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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

October 11, 2013

Dear Clean Energy Finance and Investment Authority Board of Directors:

Our next meeting of the Board of Directors will be on Friday, October 18, 2013 from 9:00 to 11:00 a.m. in the board room of Connecticut Innovations at 865 Brook Street, Rocky Hill, CT 06067.

We have a full agenda, including:

- **Green Bank Model at Work** – we have pulled together all of the information on our FY 2013 performance as it relates to our financial metrics and targets as well as the societal benefits we have achieved in terms of economic development (i.e. jobs) and environmental protection (i.e. CO_2 emission reductions). We would like to discuss these results with you. We believe Connecticut is now well positioned to tell its "Green Bank" story both locally and nationally having demonstrated that this proof of concept is working.

- **Updates from the Committees** – each committee will report out on things that they have been working on including the FY 2013 audited financial statements from the Audit, Compliance and Governance Committee. It is our hope to also bring the meeting schedule for 2014 for the committees as well as the board of directors up for discussion and approval. I believe we are now in a position to hold quarterly board meetings – and where necessary, call a special meeting.

- **Commercial and Industrial Sector Programs** – we will provide an update on the progress we have made thus far towards our quarterly targets for FY 2014 as well as recommend the approval of several C-PACE transactions.

- **Residential Sector Programs** – we will provide an update on the progress we are making towards our quarterly targets for FY 2014 as well as recommend the approval of an ARRA-SEP credit enhancement proposal to accelerate the uptake of loans and leases in the residential sector.

- **Statutory and Infrastructure Sector Programs** – we will provide an update on the progress we have made thus far towards our quarterly targets for FY 2014.

- **Institutional Sector Programs** – we will provide an update on the progress we have made thus far towards our quarterly targets for FY 2014.

- **SunShot Initiative Rooftop Solar Challenge** – over a year ago we received a $480,000 grant from the U.S. Department of Energy. The grant was to support the reduction of "soft costs" from rooftop solar PV systems in several communities across

Connecticut. You will hear a presentation of the results of the project by Selya Price of CEFIA and Mike Trahan of Solar Connecticut, and what we are doing as a follow-on to this project.

- **Other Business** – and lastly, we will propose revisions to our Sick Bank Policy as well as seek approval to move forward with providing public comment to the New York State Public Service Commission in support of NYSERDA capitalization of the New York Green Bank.

If you have any questions, comments or concerns, please feel free to contact me at any time.

Have a great weekend, and we look forward to seeing you next week.

Sincerely,

Bryan Garcia
President and CEO

AGENDA

Board of Directors of the
Clean Energy Finance and Investment Authority
865 Brook Street, Rocky Hill, CT 06067

Friday, October 18, 2013
9:00-11:00 a.m.

Staff Invited: Andy Brydges, Lucy Charpentier, Mackey Dykes, Brian Farnen, Bryan Garcia, David Goldberg, Dale Hedman, Bert Hunter, Kerry O'Neill, Selya Price, and Genevieve Sherman

1. Call to order

2. Public Comments – 5 minutes

3. Approval of meeting minutes for September 13, 2013 meeting* – 5 minutes

4. Update from the President – 5 minutes

5. Committee Updates and Recommendations* – 10 minutes

   a. Audit, Compliance and Governance Committee*
   b. Budget and Operations Committee*
   c. Deployment Committee*

6. Commercial and Industrial Sector Program Updates and Recommendations* – 20 minutes

   a. Program Updates
   b. 29 Trefoil Drive (Trumbull, CT)*
   c. 22 Waterville Road (Avon, CT)*
   d. Buonicore PSA*

7. Residential Sector Program Updates and Recommendations* – 20 minutes

   a. Program Updates
   b. ARRA Credit Enhancement Proposal*

8. Statutory and Infrastructure Sector Program Updates – 10 minutes

9. Institutional Sector Program Updates – 10 minutes

10. SunShot Initiative Rooftop Solar Challenge Presentation – CT's Sun Rise New England: Open for Business Project – 30 minutes

11. Other Business* – 5 minutes
    a. Sick Bank Policy Revisions*
    b. Support of the New York Green Bank*

12. Adjourn

*Denotes item requiring Board action

Join the meeting online at https://www4.gotomeeting.com/join/344681935

Dial +1 (630) 869-1014 Access Code: 344-681-935

Next Regular Meeting: Friday, November 15, 2013
Clean Energy Finance and Investment Authority, 865 Brook Street, Rocky Hill, CT

RESOLUTIONS

Board of Directors of the
Clean Energy Finance and Investment Authority
865 Brook Street, Rocky Hill, CT 06067

Friday, October 18, 2013
9:00-11:00 a.m.

Staff Invited: Andy Brydges, Lucy Charpentier, Mackey Dykes, Brian Farnen, Bryan Garcia, David Goldberg, Dale Hedman, Bert Hunter, Kerry O'Neill, Selya Price, and Genevieve Sherman

1. Call to order

2. Public Comments – 5 minutes

3. Approval of meeting minutes for September 13, 2013 meeting* – 5 minutes

Resolution #1

Motion to approve the minutes of the Board of Directors meeting for September 13, 2013. Second. Discussion. Vote.

4. Update from the President – 5 minutes

5. Committee Updates and Recommendations* – 10 minutes

Resolution #2

Motion to approve the regular meeting schedule of the Board of Directors, Audit, Compliance and Governance Committee, Budget and Operations Committee, and Deployment Committee for 2014 for the Clean Energy Finance and Investment Authority. Second, Discussion. Vote.

a. Audit, Compliance and Governance Committee*
b. Budget and Operations Committee*
c. Deployment Committee*

6. Commercial and Industrial Sector Program Updates and Recommendations* – 20 minutes

a. Program Updates

b. 29 Trefoil Drive (Trumbull, CT)*

Resolution #3

WHEREAS, Pursuant to Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the “Act”), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy (“C-PACE”);

WHEREAS, the CEFIA Board of Directors has approved a $40,000,000 C-PACE construction and term loan program; and

WHEREAS, CEFIA seeks to provide a $1,001,298 construction and term loan under the C-PACE program to ISCT Real Estate LLC, the property owner of 29 Trefoil Drive, Trumbull, CT (the "Loan"), to finance the construction of specified clean energy measures in line with the State’s Comprehensive Energy Strategy and CEFIA’s Strategic Plan;

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute and deliver the Loan in an amount not to be greater than one hundred ten percent of the Loan amount with terms and conditions consistent with the memorandum submitted to the Board of Directors dated October 11, 2013, and as he or she shall deem to be in the interests of CEFIA and the ratepayers no later than 90 days from October 18, 2013;

RESOLVED, that before executing the Loan, the President of CEFIA and any other duly authorized officer of CEFIA shall receive confirmation that the C-PACE transaction meets the statutory obligations of the Act, including but not limited to the savings to investment ratio and lender consent requirements; and

RESOLVED, that the proper CEFIA officers are authorized and empowered to do all other acts and execute and deliver all other documents and instruments as they shall deem necessary and desirable to effect the above-mentioned legal instrument.

c. 22 Waterville Road (Avon, CT)*’

Resolution #4

WHEREAS, Pursuant to Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the “Act”), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy (“C-PACE”);

WHEREAS, the CEFIA Board of Directors has approved a $40,000,000 C-PACE construction and term loan program;

WHEREAS, CEFIA seeks to provide a $419,346 construction and (potentially) term loan under the C-PACE program to Sweetland Realty, LLC, the property owner of 22 Waterville Road, Avon, CT to finance the installation and upgrades of energy efficiency measures in line with the State's Draft Comprehensive Energy Strategy and CEFIA's Strategic Plan;

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute and deliver Loan in an amount not to be greater than one hundred and ten percent of the Loan amount with terms and conditions consistent with the memorandum submitted to the Board of Directors on October 29, 2013, and as he or she shall deem to be in the interests of CEFIA and the ratepayers no later than 90 days from October 18, 2013;

RESOLVED, that before executing the Loan, the President of CEFIA and any other duly authorized officer of CEFIA shall receive confirmation that the C-PACE transaction meets the statutory obligations of the Act, including but not limited to the savings to investment ratio and lender consent requirements; and

RESOLVED, that the proper CEFIA officers are authorized and empowered to do all other acts and execute and deliver all other documents and instruments as they shall deem necessary and desirable to effect the above-mentioned legal instrument.

d. Buonicore Partners Revised PSA

Resolution #5

WHEREAS, Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the "Act"), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

WHEREAS, as statewide program administrator for the C-PACE program, CEFIA is required, amongst other things, to evaluate the Savings to Investment Ratio ("SIR")for individual projects;

WHEREAS, CEFIA seeks to amend PSA #1732 to retain Buonicore Partners to serve at Technical Administrator for the C-PACE program to evaluate the SIR for individual projects, work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program;

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute an amended PSA between Buonicore Partners and CEFIA with terms and conditions materially consistent with CEFIA's standard form of PSA to increase the PSA amount by $400,000 for a new not to exceed amount of $668,312.50, exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing.

7. Residential Sector Program Updates and Recommendations* – 20 minutes

a. Program Updates
b. ARRA Credit Enhancement Proposal*

Resolution #6

RESOLVED, that funding for loan loss reserves, interest rate buydowns and third party insurance products ("Credit Enhancements") through the use of repurposed American Recovery and Reinvestment Act State Energy Program (ARRA-SEP) program funds be approved for CEFIA's Cozy Home Loans, Smart-E Loans, CT Solar Loan, and CT Solar Lease programs (the "Programs") in amounts materially consistent with the Memorandum presented to the Board of Directors dated October 18, 2013.

RESOLVED, that additional ARRA-SEP funds are approved for the Programs in the not-to-exceed set forth below:

a. $304,667 for Smart-E Loans;
b. $405,311 for CT Solar Loan; and
c. $641,643 for CT Solar Lease.

RESOLVED, that the President of CEFIA; and any other duly authorized officer of CEFIA, is authorized to use their best discretion to utilize the most effective use of the entirety of the Credit Enhancements in amounts not to exceed:

a. $410,000 for Cozy Home Loans;
b. $2,804,667 for Smart-E Loans;
c. $705,311 for CT Solar Loan;
d. $4,141,643 for CT Solar Lease; and
e. $300,000 for a to-be-developed CHIF product which will be brought back to the Board of Directors for review and final approval at a later date within fiscal year 2014.

RESOLVED, that the President of CEFIA; and any other duly authorized officer of CEFIA, is authorized to execute and deliver, any contract or other legal instrument necessary to effect the Credit Enhancements on such terms and conditions consistent with current executed legal documents and as he or she shall deem to be in the interests of CEFIA and the ratepayers no later than six months from the date of this resolution; and

RESOLVED, that the proper CEFIA officers are authorized and empowered to do all other acts and execute and deliver all other documents as they shall deem necessary and desirable to effect the above-mentioned legal instrument.

8. Statutory and Infrastructure Sector Program Updates – 10 minutes

9. Institutional Sector Program Updates – 10 minutes

10. SunShot Initiative Rooftop Solar Challenge Presentation – CT's Sun Rise New England: Open for Business Project – 30 minutes

11. Other Business* – 5 minutes
    a. Sick Bank Policy Revisions*

<u>Resolution #7</u>

WHEREAS, the CEFIA Handbook Sick Leave Bank Policy requires that employees exhaust vacation, personal and compensatory leave prior to withdrawing leave from the CI/CEFIA Sick Leave Bank;

WHEREAS, in order to recruit and retain qualified employees, we would like to be able to offer an attractive benefit package including the opportunity to be paid in the event of a qualifying illness or injury, and there is no cost to the agency;

NOW, therefore be it:

RESOLVED, that the Board approves that the CEFIA Handbook can be revised as follows:

The CEFIA Sick Leave Bank is a pool of sick days that has been established by employees of CEFIA who have made a donation of their accumulated sick days. The Bank is available to members to draw up to ten (10) eight- hour sick days per year in the unfortunate event that they experience a qualified illness or injury.

Sick Leave Bank members will receive benefits in the form of paid sick leave if all of the following requirements are met:

- the member has a medical condition that prevents them from working that has been verified by a Medical Certificate OR a member's immediate family member has a medical condition that has been verified by a Medical Certificate and requires the Sick Leave Bank member's care.
- the member has been out on approved medical leave (paid or unpaid) as described above for at least two consecutive weeks.
- the member has exhausted all of their sick[~~, vacation, personal leave and compensatory~~] time
- the member has not been disciplined for an absence-related reason for the past 12 months
- the member has completed a Sick Leave Bank Withdrawal Request Form and it has been approved by human resources

b. Support of the New York Green Bank

<u>Resolution #8</u>

WHEREAS, Governor Cuomo announced that he seeks to create a New York Green Bank for the purposes of transforming the state's clean energy economy by supporting the widespread flow of private sector funds to enable a self-sustaining clean energy system;

WHEREAS, the New York State Energy Research and Development Authority (NYSERDA) issued a petition to the New York State Public Service Commission on September 9, 2013 requesting that $165.6 million in uncommitted funds be repurposed to capitalize the New York Green Bank (NYGB);

WHEREAS, the Clean Energy Finance and Investment Authority (CEFIA) has been working with the staff of NYSERDA and the NYGB to provide advice on developing and organizing a green bank and its products given experiences from Connecticut; and

WHEREAS, CEFIA envisions working with the NYGB in the future to design and implement financing products that benefit Connecticut in collaboration with New York to provide easier access to affordable private capital;

NOW, therefore be it:

RESOLVED, that the Board of Directors authorizes the President to draft public comments on behalf of the Board of Directors of CEFIA that are reviewed and approved by the Chair of the Board of Directors, and submitted to the New York State Public Service Commission before the October 28, 2013 due date.

12. Adjourn

*Denotes item requiring Board action

Join the meeting online at https://www4.gotomeeting.com/join/344681935

Dial +1 (630) 869-1014 Access Code: 344-681-935

Next Regular Meeting: Friday, November 15, 2013
Clean Energy Finance and Investment Authority, 865 Brook Street, Rocky Hill, CT

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #1

Call to Order

October 18, 2013

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #2

Public Comments

October 18, 2013

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #3

Approval of Meeting Minutes of September 13, 2013

October 18, 2013

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #4

Update from the President

October 18, 2013

Update from the President
FY 2013 Results

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **180-(40)-20 Rule** – in one year, CEFIA has attracted $180 million of private capital investment while putting $40 million of CEFIA capital at risk – $20 million of which will be returned to CEFIA because it is in the form of loans and leases and not grants…yielding a 9:1 leverage ratio, deploying nearly 30 MW of clean energy, and putting $220 million into the clean energy economy in CT.
- **1,200 Up and 250,000 Down** – based on the deployment of clean energy in FY 2013, about 1,200 jobs are estimated to have been created in one year and 250,000 tons of CO2 emissions reduced over the life of the projects. With the additional private capital attracted into Connecticut (i.e. SL2, Smart-E, etc.) that has yet to be expended, we estimate that an additional 1,800 jobs will be created and 240,000 tons of CO2 emissions reduced.
- **"Green Bank" Model Works** – in comparison to the CCEF results of $155 million of private capital investment putting $170 million of CCEF capital at risk - $15 million of which will be returned to CEFIA…yielded a 1:1 leverage ratio, deploying 35 MW of clean energy and putting $325 million into the clean energy economy in CT in over a decade…CEFIA is "doing more with less and faster!"

Update from the President
FY 2013 Results (cont'd)

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

	Comprehensive Plan Targets (through 2014)	Statutory and Infrastructure Sector	Residential Sector	Commercial and Industrial Sector	Institutional Sector	Total Achieved from Sectors (FY 2013)
CEFIA Capital at Risk	$45,300,000	$19,225,331	$15,510,000	$3,943,106	$2,900,000	$41,578,437
Private Capital Attracted	$186,600,000	$97,975,225	$73,300,000	-	$10,000,000	$181,275,225
Clean Energy Deployed (MW)	51.1	26.7	-	0.1	-	26.8
Annual Energy Saves (kMMBtu)	180	-	-	9	-	9
# of Loans/Installs	5,283	1,155	-	5	-	1,160

Sector	Subsidies	Credit Enhancements	Loans and Leases	Total
Statutory and Infrastructure	$13,425,331	$0	$5,800,000	$19,225,331
Residential	$0	$6,410,000	$9,100,000	$15,510,000
Commercial and Industrial	$250,000	$0	$3,693,106	$3,943,106
Institutional	$0	$0	$2,900,000	$2,900,000
Total	$13,675,331	$6,410,000	$21,493,106	$41,578,437
Percent of Total	33%	15%	52%	

$$\frac{\$181 \text{ million}}{\$20 \text{ million}} = 9:1 \text{ leverage ratio}$$

$$\frac{\$181 \text{ million}}{\$14 \text{ million}} = 13:1 \text{ leverage ratio}$$

Update from the President
Next Steps

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **Green Bank Academy** – work with the Coalition for Green Capital and the Brookings Institute to help other states pursue green bank strategies versus the conventional subsidy model
- **Communications** – identify opportunities to tell the Connecticut “Green Bank” story locally and nationally in the press and at events…we are leading the “Green Bank” movement and now we have the results to attest to it
- **Talking Points** – CEFIA staff has created talking points and PowerPoint slides as tools to support the communications efforts

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #5

Committee Updates and Recommendations

October 18, 2013

Committee Updates

- Audit Compliance and Governance Committee
- Budget and Operations Committee
- Deployment Committee

Committee Updates
Proposed 2014 Schedule of Meetings

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2014 Total	2013 Total
BOD			x			x			x			x	**4**	12
ACG				x						x			**2**	2
B&O					x	x							**2**	4
DC	x	x			x		x			x	x		**6**	5
Total	**1**	**1**	**1**	**1**	**2**	**2**	**1**	**0**	**1**	**2**	**1**	**1**	**14**	23

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #6a

Commercial and Industrial Sector Programs

October 18, 2013

Commercial and Industrial Programs
FY 2014 Q1 Targets and Progress

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

Installed Capacity (MW) and Energy Saved (MMBtu)

Program	Targets	Progress	Total FY 2014
C-PACE	0.5 / 10,000	0.5 / 9,559	5.0 / 100,000
CEBS	-	-	-
Total	0.5 / 10,000	0.5 / 9,559	5.0 / 100,000

Projects and Funding

Program	Targets	Progress	Total FY 2014
Projects	9	6	59
Funding	$4,750,000	$5,910,164	$40,000,000

Commercial and Industrial Sector
Observations

- The commercial and industrial sector is progressing as planned.
- C-PACE financing has been leveraged by the solar industry to bid competitively in the ZREC auctions ; these projects will help meet FY 2014 targets for renewable energy.
- 50% of projects in the pipeline are energy efficiency, so we anticipate continuing to meet or exceed FY 2014 targets.
- It is going to become more and more difficult to achieve the scale in FY 2014 targets due to the increase staff time spent on managing closed transactions. C-PACE is likely going to need more personnel to turn the growing pipeline into loan transactions.
- The Q1 and Q2 marketing effort underway with 12 C-PACE municipalities is continuing to develop our pipeline.

C-PACE
Where are we?

- 64 towns on board – 70% of the CT market eligible
- 200+ contractors trained
- 14 qualified capital providers
- $7M in closed transactions of $13.4M in approved transactions
- $3.5M possible for October Board & Deployment Committee meetings
- Selling down $6.7M in closed transactions
- Goal is to approve $20M by year end and close on $10M

Deal Status
(April-September 2013)

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

	Project Type	Estimated Annual Savings	Installed Capacity	Amount Financed	Financing Terms	Building Size
Closed						
41 Walnut Street	Renewable	221 MMBtu/yr	55 kW	$145,000	5.5% for 20 years	34,500 sqft
542 Westport Ave (Lighting and Solar)	Energy Efficiency	429 MMBtu/yr	100kW	$559,952	4.5% for 15 years	50,000 sqft
1841 Broad Street	Renewable	491 MMBtu/yr	100 kW	$325,000	5.5% for 20 years	40,000 sqft
100 Roscommon	Both	3,339 MMBtu/yr	260 kW	$2,513,915	5.5% for 20 years	81,368 sqft
86 Hopmeadow	Energy Efficiency	1,021 MMBtu/yr	--	$674,566	5.5% for 18 years	42,456 sqft
855 Main Street	Energy Efficiency	6,650 MMBtu/yr	--	$1,992,683	5.5% for 20 years	100,000 sqft
Bushnell Theatre	Energy Efficiency	777 MMBtu/yr	--	$384,000	5% for 20 years	139,000 sqft
ID Products	Energy Efficiency	714 MMBtu/yr	--	$107,566	5.5% for 15 years	15,846 sqft
228 Route 81	Renewable	275 MMBtu/yr	71 kW	$259,000	5.5% for 20 years	20,000 sqft
CLOSED TOTAL		**13,642 MMBtu/yr**	**415 kW**	**$6,961,681**		**523,170 sqft**
Approved						
Bridgeport International Academy	Energy Efficiency	836 MMBtu/yr	--	$410,000	5.5% for 15 years	55,000 sqft
Danbury YMCA	Energy Efficiency	929 MMBtu/yr	--	$87,938	5.5% for 20 years	17,107 sqft
290 Pratt	Energy Efficiency	7,123 MMBtu/yr	--	$1,990,000	5.5% for 20 years	459,292 sqft
80 Lamberton	Both	5,965 MMBtu/yr	300 kW	$3,090,444	5.5% for 20 years	165,000 sqft
Larsen Ace Hardware	Renewable	188 MMBtu/yr	45 kW	$153,300	5.5% for 20 years	25,000 sqft
Signature Advertising	Renewable	467 MMBtu/yr	122 kW	$378,000	5.5% for 20 years	50,000 sqft
NPB Assets Norwich	Renewable	367 MMBtu/yr	150 kW	$350,000	5.5% for 20 years	50,000 sqft
APPROVED TOTAL		**15,508 MMBtu/yr**	**617 kW**	**$6,459,682**		**771,399 sqft**
CLOSED AND APPROVED TOTAL		**29,150 MMBtu/yr**	**1,032 kW**	**$13,421,363**		**1,294,569 sqft**

Sell-Down of Transactions

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- Sell-Down Process
  - Solicit bids from Capital Providers through "sealed bid" process (3 month process)
    - July 31 - Initial Offering Notice
    - Aug 19 - Opened Data Room & Provided Bid Instructions
    - Sep 18 - Indicative Bid Date
    - Oct 11 - Final Bid Date
    - Oct 23 - Winning Bidder Selected
    - **<u>Nov 1 - Closing Date</u>**
- Offering (assuming all close)
  - 8 Transactions
  - $6.7 million
- Final Bidders (4)
  - Deutsche Bank, Hannon Armstrong, Clean Fund, and Brookfield
- Bottom Line: Very Well Received; Excellent Staff Work Product

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #6b

22 Waterville Road, Avon

October 18, 2013

22 Waterville Road (Avon)
Ratepayer Payback

- $419, 346 Energy Efficiency Project
- Projected savings are **33,056,660kBTU** versus **$419,346** of ratepayer funds at risk.
- Ratepayer funds will be paid back in one of the following ways
  - (a) through a take-out by a private capital provider at the end of construction (project completion);
  - (b) subsequently, when the loan is sold down to a private capital provider; or
  - (c) through receipt of funds from the City of Southington as it collects the C-PACE benefit assessment from the property owner.

REDACTED

CEFIA cash flow

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

CEFIA Pro Forma

Project Basics		*Cash Flows*	
Amount Financed	$419,346	Date	CEFIA $
Construction Period (years)	0.42	Nov 2013	$419,346
Term (years)	14	Apr 2014	$8,736
		Jul 2014	$43,341
Construction Financing Rate	5.00%	Jul 2015	$43,341
Term Financing Rate	5.50%	Jul 2016	$43,341
		Jul 2017	$43,341
Construction Interest Payment (bullet)	$8,736	Jul 2018	$43,341
Yearly Debt Service Payments (made semi-annually)	$43,341	Jul 2019	$43,341
		Jul 2020	$43,341
		Jul 2021	$43,341
		Jul 2022	$43,341
		Jul 2023	$43,341
		Jul 2024	$43,341
		Jul 2025	$43,341
		Jul 2026	$43,341
		Jul 2027	$43,341
		Jul 2028	$0
		Jul 2029	$0
		Jul 2030	$0
		Jul 2031	$0
		Jul 2032	$0
		Jul 2033	$0

REDACTED

22 Waterville Road (Avon)
Terms and Conditions

- $419,346 construction loan with interest rate of 1.75% over the Prime Rate, or 5%, and the term loan will be set at a fixed 5.5% over the 14-year term.
- $ 419,346 loan against a property valued at **REDACTED**, then the loan-to-value ratio for **REDACTED**
- DSCR is **REDACTED**.

22 Waterville Road (Avon)
The Five W's

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **What are you trying to do?**
  - Receive approval for $419,346 construction and (potentially) term loan under the C-PACE program to Sweetland Realty, LLC. to finance the construction of specified of a renewable energy system
- **When are you doing it by?**
  - Project to commence Fall 2013.
- **Why are we doing it?**
  - Approval will allow CEFIA to finance this C-PACE transaction, prime the pump of C-PACE projects and build momentum in the market, but it would also – for an interim period – potentially provide term financing for these projects until CEFIA manages to sell off all or most of its loan positions in the C-PACE transactions.

22 Waterville Road (Avon)

The Five W's

- **Who is it for?**
  - The end-users of the project include both 22 Waterville Road, and the building's tenant Women's Health USA.
- **Where are we doing it?**
  - 22 Waterville Road, Avon CT

REDACTED

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #6c

29 Trefoil Drive, Trumbull

October 18, 2013

29 Trefoil Drive (Trumbull)
Ratepayer Payback

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- $1,001,298 Solar PV & Energy Efficiency Project
- Projected savings are **6,837 MWh** versus **$1,001,298** of ratepayer funds at risk.
- Ratepayer funds will be paid back in one of the following ways
  - (a) through a take-out by a private capital provider at the end of construction (project completion);
  - (b) subsequently, when the loan is sold down to a private capital provider; or
  - (c) through receipt of funds from the City of Middletown as it collects the C-PACE benefit assessment from the property owner.

REDACTED

CEFIA cash flow

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

Project Basics		*Cash Flows*	
		Date	CEFIA $
Amount Financed	$1,001,298		
Construction Period (years)	0.25	Sep 2013	$1,001,298
Term (years)	20	Dec 2013	$13,768
		Jan 2014	$83,171
Construction Financing Rate	5.50%	Jan 2015	$83,171
Term Financing Rate	5.50%	Jan 2016	$83,171
		Jan 2017	$83,171
Construction Interest Payment (bullet)	$13,768	Jan 2018	$83,171
Yearly Debt Service Payments (made semi-annually)	$83,171	Jan 2019	$83,171
		Jan 2020	$83,171
		Jan 2021	$83,171
		Jan 2022	$83,171
		Jan 2023	$83,171
		Jan 2024	$83,171
		Jan 2025	$83,171
		Jan 2026	$83,171
		Jan 2027	$83,171
		Jan 2028	$83,171
		Jan 2029	$83,171
		Jan 2030	$83,171
		Jan 2031	$83,171
		Jan 2032	$83,171
		Jan 2033	$83,171

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

REDACTED

29 Trefoil Drive (Trumbull)
Terms and Conditions

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- $ 1,001,298 construction loan with interest rate of 1.75% over the Prime Rate, or 5%, and the term loan will be set at a fixed 5.5% over the 20-year term.
- **REDACTED** LTV based on appraised value of **REDACTED** and including C-PACE assessment as well as the value of the energy improvements.
- DSCR of **REDACTED** Over $91,678 in annual savings in expected

29 Trefoil Drive (Trumbull)
The Five W's

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **What are you trying to do?**
  - Receive approval for $ 1,001,298 construction and (potentially) term loan under the C-PACE program to ICST Real Estate, LLC to finance the construction of specified clean energy and energy efficiency measures
- **When are you doing it by?**
  - Project to commence Fall 2013
- **Why are we doing it?**
  - Approval will allow CEFIA to finance this C-PACE transaction, prime the pump of C-PACE projects and build momentum in the market, but it would also – for an interim period – potentially provide term financing for these projects until CEFIA manages to sell off all or most of its loan positions in the C-PACE transactions.

29 Trefoil Drive (Trumbull)

The Five W's

- **Who is it for?**
  - The end-users of the project and ICST Real Estate, LLC.
- **Where are we doing it?**
  - 29 Trefoil Dr, Trumbull

REDACTED

C-PACE Technical Underwriter
Buonicore Partners

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- CEFIA Board of Directors approved expansion of technical underwriting PSA with Buonicore Partners
- Increase PSA amount an additional $400,000 from $268,313 for a total of $668,313 – not $400,000
- Modify resolution so we can pursue PSA extension with Buonicore Partners

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #7

Residential Sector Programs

October 18, 2013

Residential Programs
FY 2014 Q1 Targets and Progress

Installed Capacity (MW) and Energy Saved (MMBtu)

Program	Targets	Progress	Total FY 2014
Smart-E and Cozy	TBD / 2,600	0.1 / 144	TBD / 37,600
Solar Lease	1.3 / 380	0.0 / 0.0	5.7 / 2,260
Solar Loan	0.2 / n/a	0.1 / n/a	0.9 / n/a
Total	1.5 / 2,980	0.2 / 144	6.6 / 39,860

Projects and Funding

Program	Targets	Progress	Total FY 2014
Projects	358	33	2,598
Funding	$2,002,000	$519,451	$8,929,000

REFERENCES
Note – the reason there is a downtick in Q4 for the solar lease is because there is a winter lag..

Residential Sector
Observations

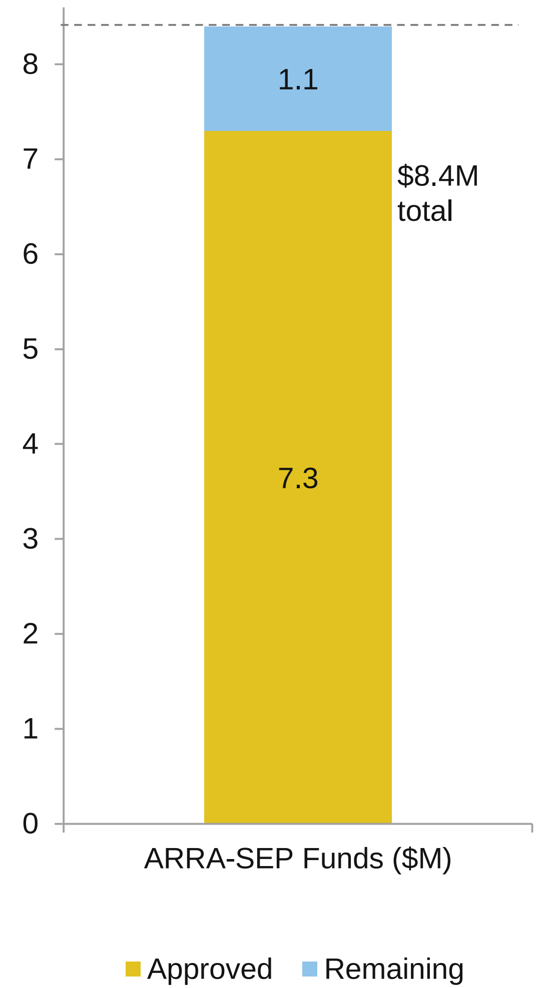
- **Operationalizing 4 products is taking time–** both internally and with our partners (lenders/originators and contractors); requiring numerous new procedures to be developed and refined
  - Liberty and Union stretched Smart-E processes for reporting and IRB processing
  - Lease has proven quite complex to operationalize; getting ready to launch Lease/Solar Hot Water on 11/1
  - Contractor engagement and re-training is time consuming, but showing early dividends (increased repeat Smart-E projects; trained solar installers on various solar financing options); Working Capital product w/ Webster Bank launched last week (1st lender)
- **Laying the groundwork for increased marketing–** late Oct-Feb
  - Special offers in place: 6 months free interest for Smart-E, 1st 3 months lease payments free
  - GoSolarCT campaign and web portal launched, support solar financing; online ads launch next week, Connecticut Magazine ads (Nov/Feb)
  - Smart-E zip-code lookup for lender/branch and contractor coming to website in advance of mid-Nov online marketing push, 4 30 sec. videos available for specific upgrades
- **Energize Norwich going strong–** 110 committed contracts for gas conversions; 5 financed to date, but market feedback is availability of financing has been key to increased contracts

Residential Sector
Where are we?

- **Smart-E**
  - 9 Lenders now taking applications, statewide coverage with Liberty/Union now live
  - 43 projects submitted for tech. approval to date, 31 loans closed at 6 lenders
    - Avg. loan size of $13,100, ~ 50/50 Solar PV/gas conversions & HVAC
  - 114 eligible contractors:
    - 27 contractors submitted projects (24% of eligible, up from 17% last month), 11 with multiple projects (10% of eligible, up from 3% last month)
- **CT Solar Lease**
  - 9 PV Contractors eligible to offer lease, 4 in process
  - 59 apps to date : 40 (pre-)/approved, 18 declined (31%), 1 withdrawn
- **CT Solar Loan**
  - 25 apps to date, 10 loans closed/funded, ~$28K avg. loan, add'l 6 (pre-)/approved, 9 declined (36%), 14 eligible contractors
- **Cozy Home Loan**
  - 12 applications, all declined; 28 eligible contractors – focusing on re-training

Residential Sector
ARRA-SEP

- Staff seeks approval to deploy the remaining $1.1M of ARRA-SEP funding, and flexibility for the amounts already- and to-be- approved:
  - Within not-to-exceed amounts for each program; and,
  - Within DOE guidelines: across Loan Loss Reserves, Interest Rate Buy-downs, and Third Party Insurance for each program:
    - Solar Lease, not to exceed $4,141,643
    - Solar Loan, not to exceed $705,311
    - Smart-E, not to exceed $2,804,667
    - Cozy Home Loan, not to exceed $410,000
- **Flexibility will allow staff to target funds where they will drive the most deployment**



Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #8

Statutory and Infrastructure Sector Programs

October 18, 2013

Statutory and Infrastructure Programs
FY 2014 Q1 Targets and Progress

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Installed Capacity (MW)

Program	Targets	Progress	Total FY 2014
RSIP	2.0	2.6	12
CHP and AD	-	-	6
Grid and Infrastructure	-	-	-
Total	2.0	2.6	18

Projects and Funding

Program	Targets	Progress	Total FY 2014
Projects	285	374	1,717
Funding	$2,500,000	$3,260,364	$16,250,000

REFERENCES
Expecting to double again in FY 2014. Will work with DEEP to perform a LEAN process for inspectors to manage volume.

Statutory and Infrastructure Sector
Observations

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **RSIP targets exceed for the quarter**
  - Received more submitted applications for leases and PPAs than homeowner purchases (172 vs. 153)
  - Step 3 nearing completion – process to set Step 4 incentives has begun
- **AD:**
  - Executed the Ansonia AD Term Sheet for a not-to-exceed subordinate loan for $4.5 million
  - Reviewing preliminary application from Supreme Industries for an AD project in Southington
  - Waste Water Treatment Plant AD workshop November 5, 2013
- **Grid and Infrastructure:**
  - Still pursuing a micro-grid project in Windsor with Distributed Sun.

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #9

Institutional Sector Programs

October 18, 2013

Institutional Programs
FY 2014 Q1 Targets and Progress

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

Installed Capacity (MW) and Energy Saved (MMBtu)

Program	Targets	Progress	Total FY 2014
Campus Efficiency Now	0.0 / 1,250	0.0 / 1,966	0.0 / 5,000
Solar Lease	0.5 / 0	0.0 / 0	2.0 / 0
Total	0.5 / 1,250	0.0 / 1,966	2.0 / 5,000

Projects and Funding

Program	Targets	Progress	Total FY 2014
Projects	7	1	30.0
Funding	$565,000	$191,294	$2,260,000

Institutional Sector
Observations

- **Expect Campus Efficiency Now pipeline to exceed FY2014 MMBtu goals**
- **Initial interest from one municipal solar lease project**
  - Requesting modification of existing underwriting criteria to accommodate:
    - Groundmounted
    - 650 kW (i.e. >350kW)
  - MW goals dependent on application process for obtaining ZRECs
- **Goals did not include LBE projects**
  - LBE Status:

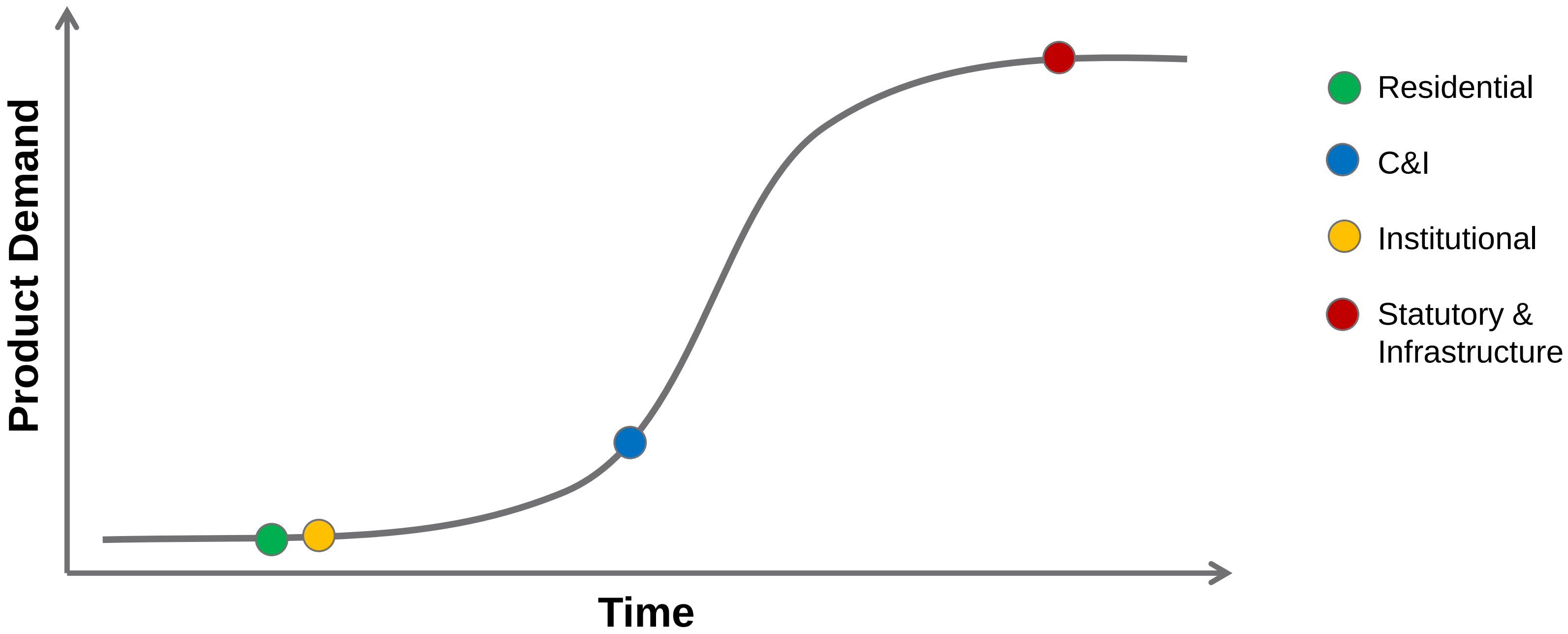
Host	Estimated Project Cost	Est. Annual Utility Savings
CT Valley Hospital	$25-$30m	$1.6m
Dept. of Corrections (8 of 19 CIs)	$50-$75m	$3.3m
Dept. of Motor Vehicles	~$3m	~$200k
City of Bristol	~$12m	~$900k
Total (4 projects)	**$90-$120 million**	**$6 million**

Targets and Progress for Q1 of FY 2014
MW Deployed / MMBtu Saved by Sector

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Quarters	Commercial & Industrial	Residential	Statutory & Infrastructure	Institutional	Total FY 2014 Target
Q1 FY 2014 Targets	0.5 / 10,000	1.5 / 2,980	2.0 / n/a	0.5 / 1,250	**4.5 / 14,230**
Q1 FY 2014 Progress	0.5 / 9,559	0.2 / 144	2.6 / n/a	0.0 / 1,966	**3.3 / 11,669**
FY 2014 Total	**5.0 / 100,000**	**6.6 / 39,860**	**18.0 / n/a**	**2.0 / 5,000**	**31.6 / 144,860**
FY 2014 Progress Left to Achieve	**4.5 / 90,500**	**6.4 / 39,500**	**15.4**	**1.5 / 3,000**	**28.3 / 133,000**

Sector Status Overview
Product Demand over Time



CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #10

SunShot Initiative Rooftop Solar Challenge

October 18, 2013

Competitive Solicitations
Leveraging State Funds for Federal Funds

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **Competitive Federal Grants** – continue to compete for and win federal grants to bring "race to the top" funds to Connecticut

Project	Federal Agency	CEFIA Administrator	Other Administrator	Total
EECBG*	DOE	$4,200,000	-	$4,200,000
SunShot Initiative – Round 1**	DOE	$480,000	-	$480,000
Energy Innovation Fund***	HUD	-	$2,625,000	$2,625,000
SunShot Initiative - SEEDS****	DOE	-	$1,800,000	$1,800,000
SunShot Initiative – Round 2	DOE	$462,000	$1,038,000	$1,500,000
		$5,142,000	**$5,463,000**	**$10,605,000**

REFERENCE
* - Energy Efficiency Conservation Block Grant supported the Neighbor to Neighbor Energy Challenge. The project involved 14 cities and towns throughout Connecticut (2011-2013)
** - SunRise New England – Open for Business is a grant to lower soft costs, including permitting, siting, and financing. The project involved 12 cities and towns throughout Connecticut (2012-2013)
*** - HUD's Energy Innovation Fund provided a grant in the amount of $5.25 million to Winn-LISC to support a financial innovation project called the Multifamily Energy Loan Fund which will support projects in Massachusetts through the MassCEC, New York through NYCEEC, and Connecticut through CEFIA and CHFA.
**** - Through a project called "The Influence of Novel Behavioral Strategies in Promoting the Diffusion of Solar Energy," a SEEDS grant through the SunShot Initiative, Yale University, New York University, and SmartPower will experiment with Solarize Connecticut to understand its effectiveness, cost effectiveness, persistence, and other attributes (2013-2015)

Goals

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Attract and deploy capital to finance the clean energy goals for Connecticut

Develop and implement strategies that bring down the cost of clean energy in order to make it more accessible and affordable to consumers

Reduce reliance on grants, rebates and other subsidies and move towards innovative low-cost financing of clean energy deployment

SunShot Initiative Rooftop Solar Challenge
Goals and Action Areas

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- **The SunShot Initiative goal:** Reduce costs by 75% by the end of the decade (2020) to enable scaled deployment of solar energy.

- **The Rooftop Solar Challenge goal:** Make adoption of residential and commercial rooftop solar PV easier, faster, and cheaper for homeowners and businesses by streamlining, standardizing and digitizing administrative processes associated with installation.

- **Project action areas include:**

  Permitting — Planning and zoning
  Financing — Interconnection, net metering

SunShot
U.S. Department of Energy

SunShot Project Highlight

Financing the Solar Movement: Bank on Connecticut's Approach

Through the SunShot Rooftop Solar Challenge, the Connecticut Clean Energy Finance and Investment Authority is pioneering innovative financing methods for PV systems.

SunShot Initiative Rooftop Solar Challenge

22 Teams Won Awards – Round 1

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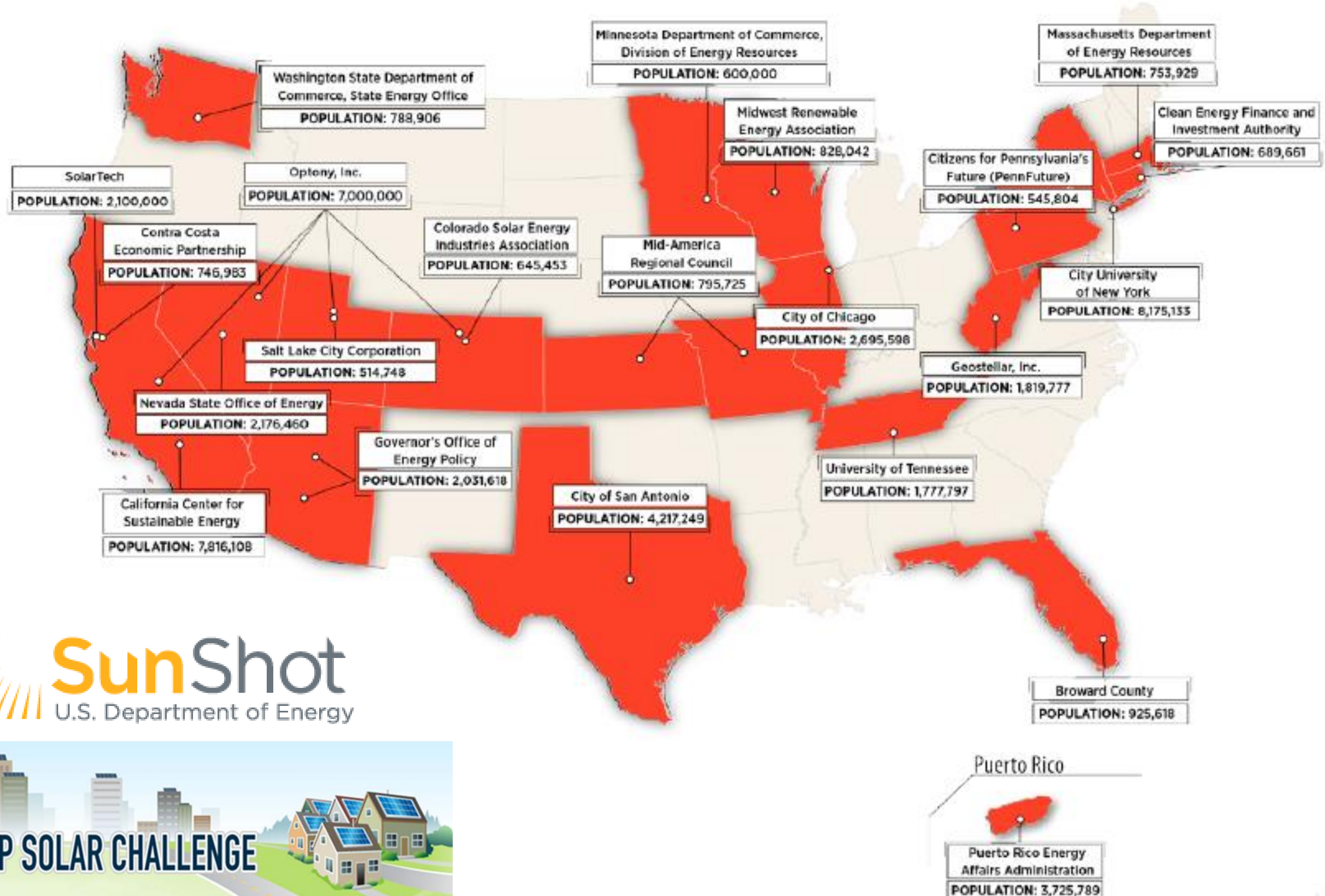


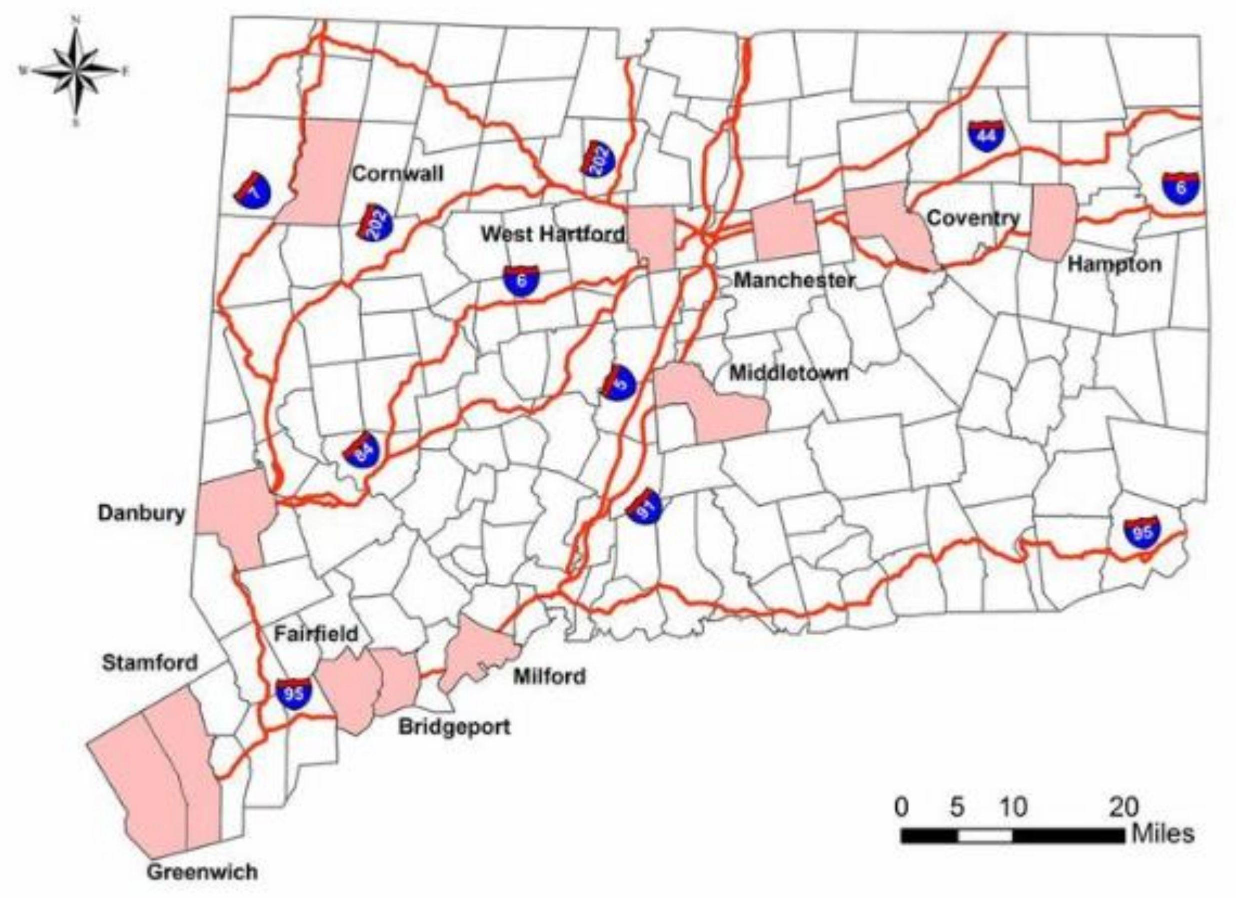
SunShot
U.S. Department of Energy

ROOFTOP SOLAR CHALLENGE

SunShot Initiative Rooftop Solar Challenge
Participants

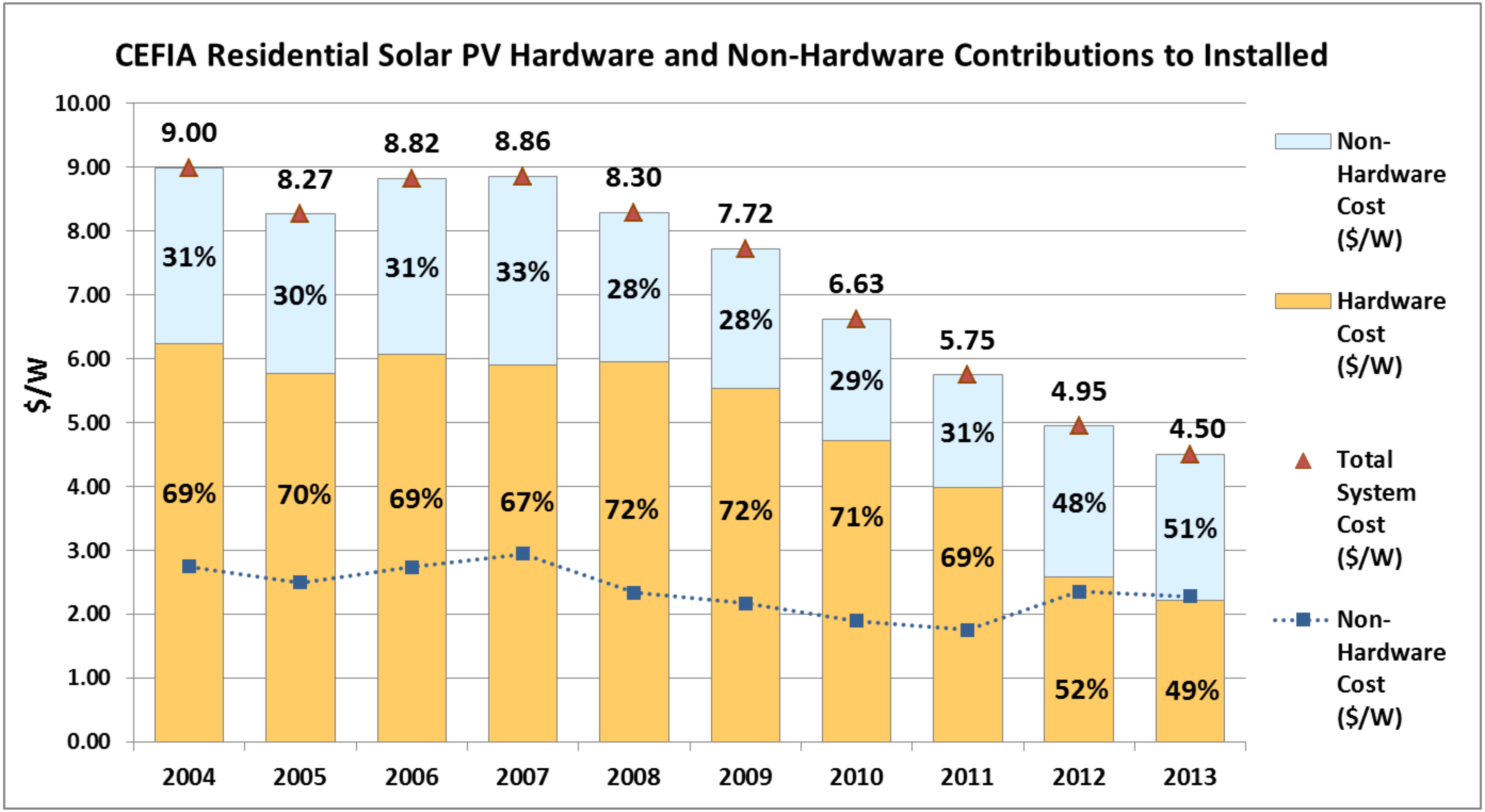
CEFIA, Solar Connecticut, Yale University, UConn, Simply Civic, CL&P, UI, DEEP, solar PV installers, Richard Dziadul, other expert consultants, many other contributors

- Bridgeport
- Cornwall
- Coventry
- Danbury
- Fairfield
- Greenwich
- Hampton
- Manchester
- Middletown
- Milford
- Stamford
- West Hartford



SunShot Initiative Rooftop Solar Challenge

CT Residential PV Costs (2004-2013)



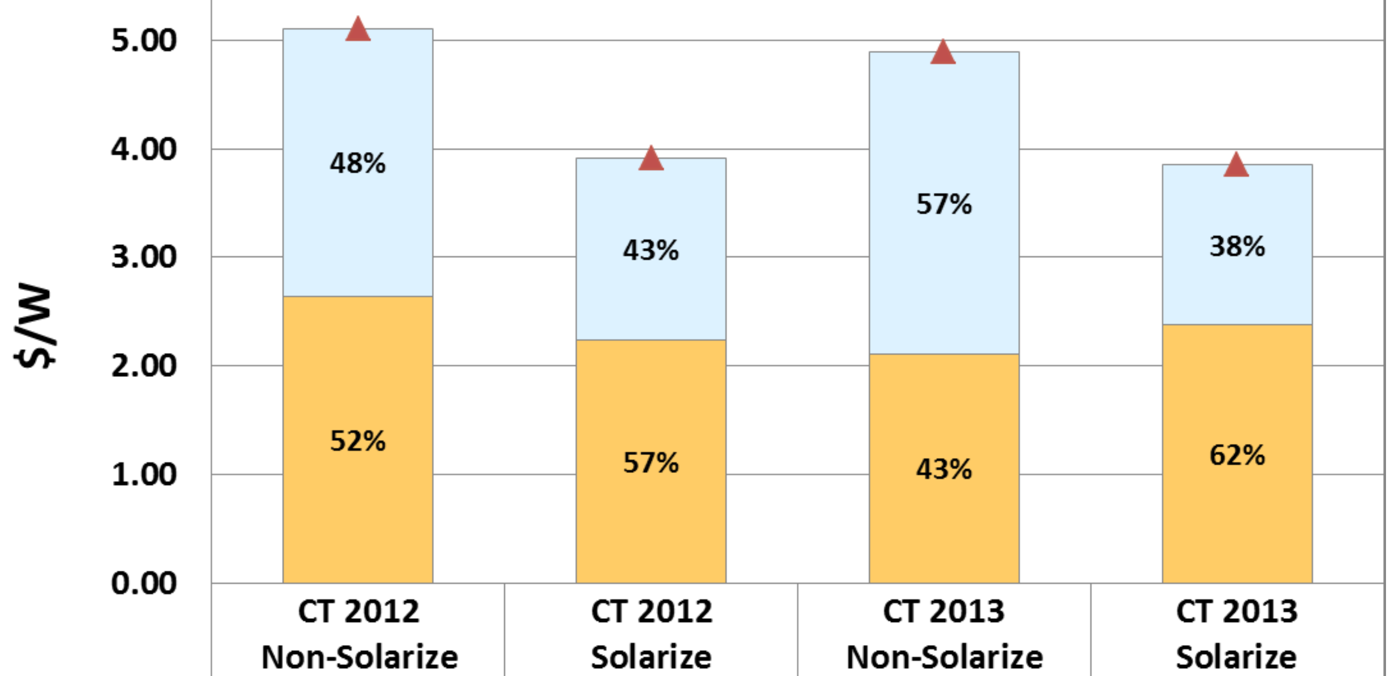
SunShot Initiative Rooftop Solar Challenge

Solarize CT – $1/W Cost Reduction

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

CT Residential Solar PV Non-Solarize vs Solarize Installation Costs

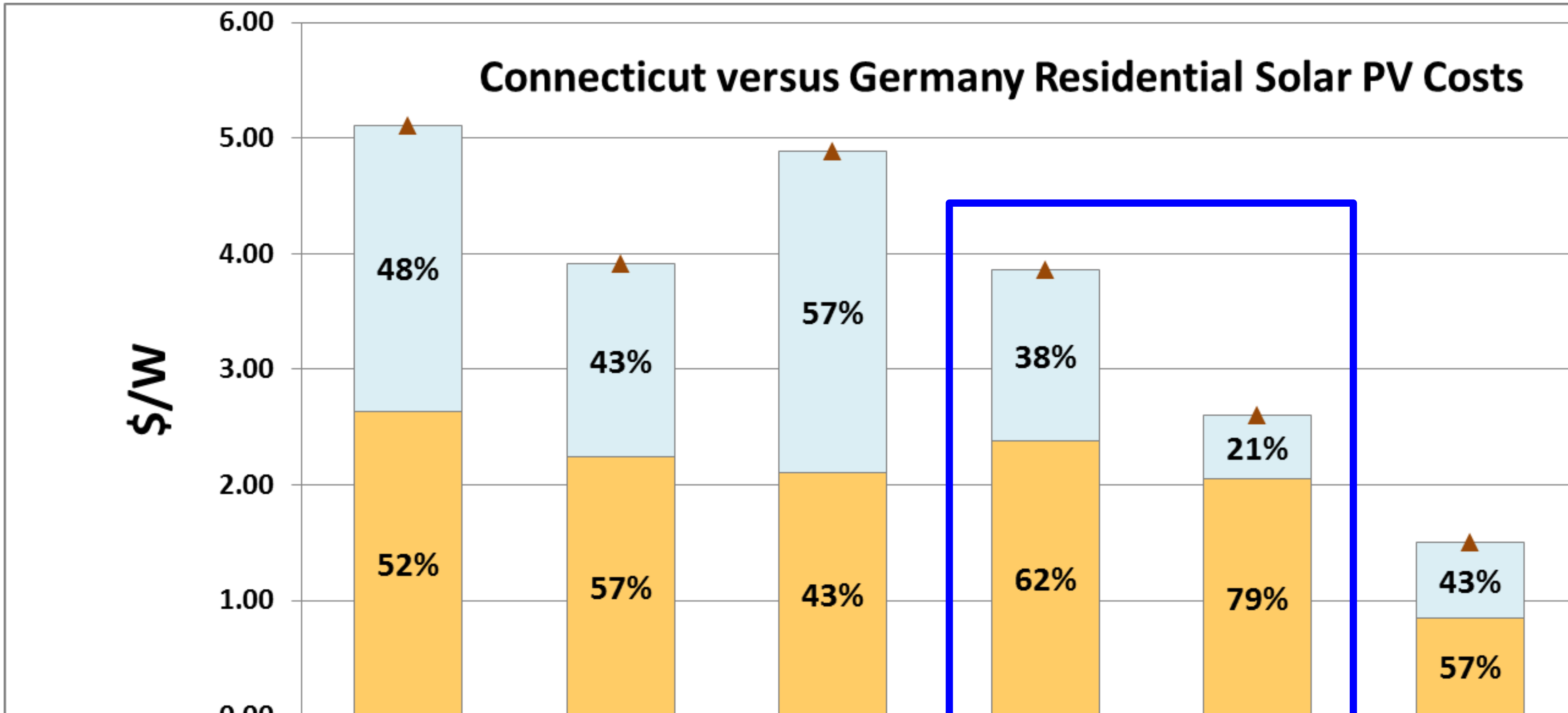
Note: CEFIA Non-Solarize total system costs are elevated by $0.09/W due to certain third-party owned systems having higher than average prices



	CT 2012 Non-Solarize	CT 2012 Solarize	CT 2013 Non-Solarize	CT 2013 Solarize
Non-Hardware Cost ($/W)	2.46	1.67	2.78	1.48
Hardware Cost ($/W)	2.64	2.24	2.11	2.38
Total System Cost ($/W)	5.11	3.91	4.89	3.86

SunShot Initiative Rooftop Solar Challenge

CT vs Germany Residential PV Costs



	CT 2012 Non-Solarize	CT 2012 Solarize	CT 2013 Non-Solarize	CT 2013 Solarize	Germany 2012	SunShot 2020 Target
Soft Cost	2.47	1.67	2.78	1.48	0.55	0.65
Hardware Cost	2.64	2.24	2.11	2.38	2.05	0.85
▲ Total Cost	5.11	3.91	4.89	3.86	2.60	1.50

SunShot Initiative Rooftop Solar Challenge

Streamlining Municipal Permitting

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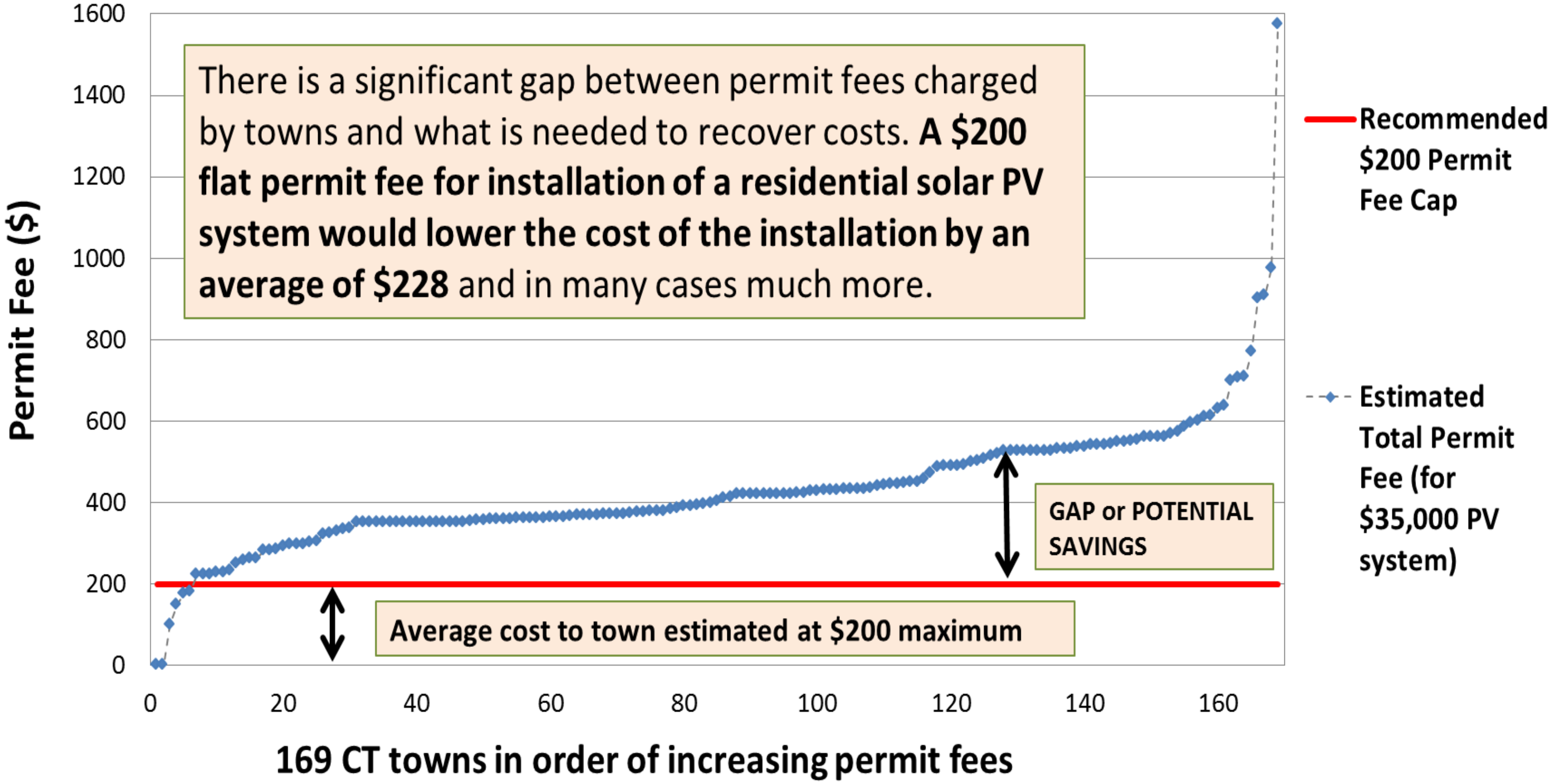
Number of Departments Requiring Approval
(R= residential, C= commercial)

Town	1	2	3	4	5	6	7
Bridgeport							R/C
Cornwall		R/C					
Coventry	R/C						
Danbury			R/C				
Fairfield			R/C				
Greenwich					R	C	
Hampton		R/C					
Manchester		R	C				
Middletown	R/C						
Milford	R	C					
Stamford				R			C
West Hartford		R/C					

Reduce the number of approvals required for solar PV permitting.

SunShot Initiative Rooftop Solar Challenge
Reducing Permit Fees

Residential Solar PV Customers are Paying Excessive Permitting Fees



Solar Connecticut
Initiatives and Contributions

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

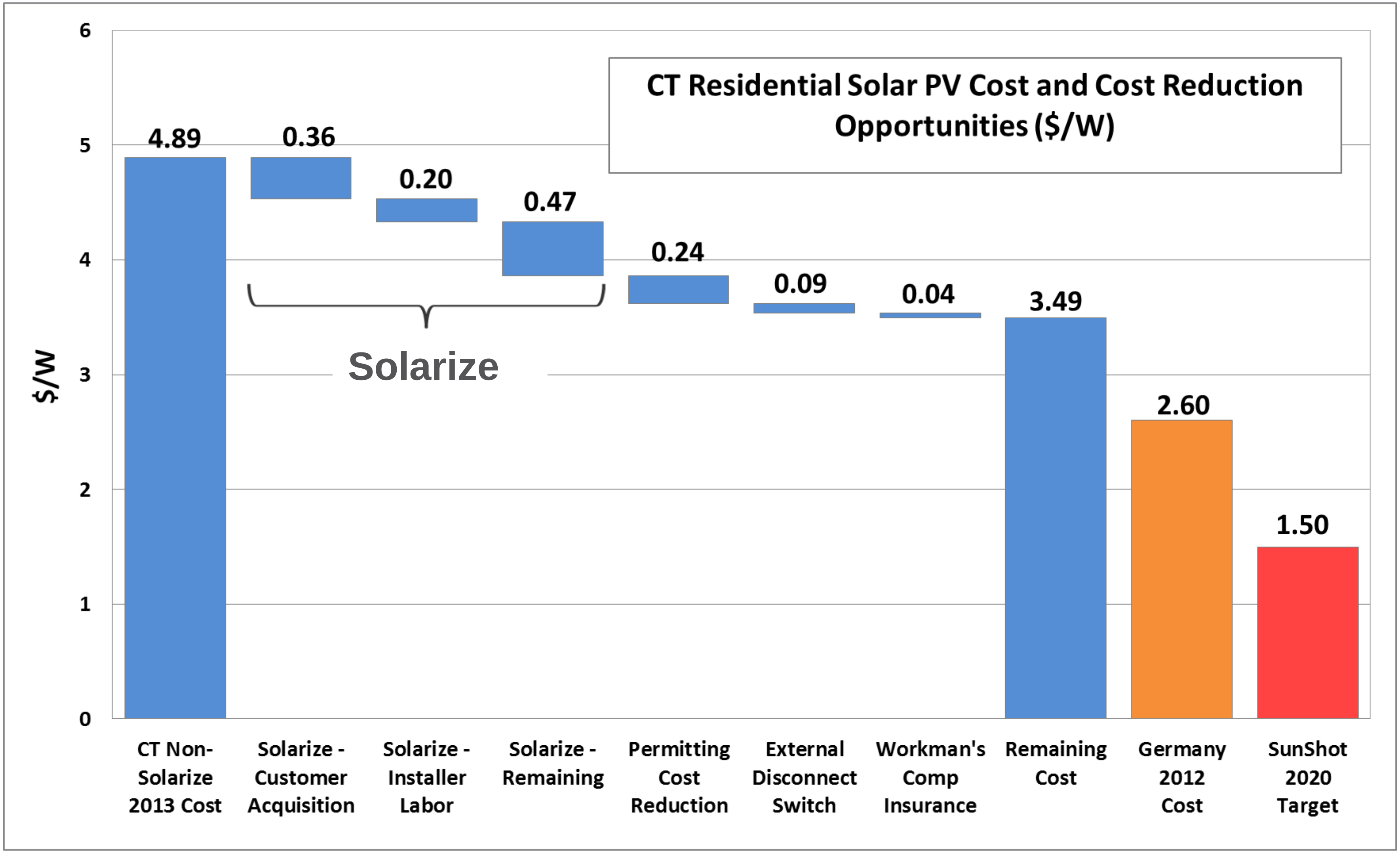
- **Leadership with CEFIA** on Rooftop Solar Challenge I and upcoming Rooftop Solar Challenge Round II project
- **Legislative efforts**
  - Enacted mandate of commercial property tax waiver
  - Proposed mandate of permit fee waiver or flat, cost recovery fee with cap for Class I RE projects, with $200 cap for residential solar
- **Engaging insurance companies** to lower workman's compensation insurance and other installer insurance costs
- **Establishing member group buying program**
- **Broadening market** - Community Solar, Solar Gardens
- **Inquiry with PURA** regarding utility external disconnect switch (UEDS) requirement

SunShot Initiative Rooftop Solar Challenge
Key Recommendations

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **Implement permitting improvements** using the **CT Rooftop Solar PV Permitting Guide** which includes tools and recommendations for streamlining all aspects of permitting (e.g., the standardized solar PV permit application, online permitting, eliminating unnecessary structural reviews by professional engineers)
- **Reduce/eliminate P&Z barriers** such as height and setback restrictions through a model solar-friendly ordinance and outreach
- **Work with Solar CT to maintain an online municipal rating system** which provides a scorecard measuring each municipality's solar-readiness
- **Legislative recommendations:** (1) Mandate permit fee waiver/cap, (2) Building code updates - allow municipalities to adopt model stretch building code; add provisions for "solar-ready" construction, (3) Enact solar access laws, (4) Allow electronic wet stamps
- **Improve interconnection guidelines:** Reconsider the UEDS requirement; improve fee structures for systems over 10kW; require all CT utilities to adopt the guidelines
- **Reduce workman's compensation insurance** and other installer insurance costs
- **Work with the state to offer free solar PV training** for building officials

SunShot Initiative Rooftop Solar Challenge
CT Residential PV Cost Reduction



SunShot Initiative Rooftop Solar Challenge

PV Soft Cost Reduction Opportunities

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

RESIDENTIAL Solar PV Cost	Cost	Reduced Cost	Savings - LOW	Savings - HIGH	Decision-Maker
Permitting Fee	$442	$200	$242	$1600	Town, State *
Online Permitting			$250	$250	Town, Installer
Permitting – Structural Review by Professional Engineer	$1000	$500	$500	$1000	Town, State *
Other Permitting Improvements			$200	$400	Town, Installer
Interconnection – Utility External Disconnect Switch	$600	$0	$600	$600	PURA, utilities
UI – 2nd meter ($500); waive witness test if <10kW ($100)	$600	$0	$0 for CL&P	$500 for UI	UI, PURA
Workman's Compensation			$300	$500	Insurance Cos., State*
Total Estimated Savings ($)			**$2092**	**$4850**	
Total Estim. Savings ($/W)			**$0.30/W**	**$0.69/W**	

$4.89/W minus $1/W Solarize savings minus savings above = $3.59 - $3.20/W

SunShot Initiative Rooftop Solar Challenge
Next Steps

CLEAN ENERGY
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New England Solar Cost-Reduction Partnership: Led by CESA, with state agencies from CT, MA, VT, RI, NH, the solar industry and other partners, municipalities including Bridgeport, Middletown, and Manchester

Solar PV System in Manchester, CT, Courtesy of Real Goods Solar

- **Conduct outreach in Connecticut**
- **Collaborate to refine tools and recommendations**
- **Pilot and implement tools and practices**
- **Work on state-level and 2014 legislative recommendations**
- **Implement Solarize community outreach model more widely**
- **Track progress and report to DOE**

ROUND 2 KICK-OFF HELD OCTOBER 1

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #11

Other Business

October 18, 2013

Other Business

- **Sick Leave Bank Policy –** employees can donate sick time into a bank to be used by themselves and/or their colleagues – recruitment and retention tool. Modification of the policy to not require employee to have to exhaust vacation, personal time, and compensatory time prior to accessing sick bank – only exhaust sick time.

- **New York Green Bank –** NYSERDA submitted a petition into the NYPSC to repurpose $166 million of uncommitted funds to capitalize the NYGB. Soliciting public comments. CEFIA to provide comments in support of capitalization as well as acknowledge areas it believes will be challenging for implementation and administration and areas of opportunity for Connecticut and New York to work together.

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #12

Adjourn

October 18, 2013

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY
Board of Directors
Draft Minutes – Regular Meeting
Friday, September 13, 2013

A regular meeting of the Board of Directors of the **Clean Energy Finance and Investment Authority (the "CEFIA")** was held on September 13, 2013 at the office of Connecticut Innovations, 865 Brook Street, Rocky Hill, CT.

1. **Call to Order**: Daniel Esty, Vice Chairperson of CEFIA, called the meeting to order at 9:05 a.m. Board members participating: Mun Choi (by phone); Daniel Esty, Vice Chairperson of CEFIA and Commissioner of the Department of Energy and Environmental Protection ("DEEP"); Bettina Ferguson, State Treasurer's office; Norma Glover; Reed Hundt (by phone); John Harrity; and Matthew Ranelli.

Members Absent: Catherine Smith, Chairperson of CEFIA and Commissioner of the Department of Economic and Community Development; Tom Flynn; and Patricia Wrice.

Staff Attending: Jessica Bailey, George Bellas, Andy Brydges, Mackey Dykes, Brian Farnen, Bryan Garcia, David Goldberg, Dale Hedman, Bert Hunter, Shelly Mondo, Kerry O'Neill, Cheryl Samuels and Kim Stevenson.

Other Attending: Denise Farrell (by phone).

2. **Public Comments:**

There were no public comments.

3. **Approval of Minutes of Meeting of July 19, 2013:**

Mr. Esty asked the Board to consider the minutes from the July 19, 2013 meeting.

> **Upon a motion made by Mr. Harrity, seconded by Ms. Glover, the Board members voted in favor of adopting the minutes from the July 19, 2013 meeting as presented (Ms. Ferguson abstained from the vote, and Mr. Ranelli was not present for the vote).**

4. Update from the President:

Mr. Garcia discussed the meeting with the Japanese delegation who visited Connecticut to discuss combined heat and power and fuel cell technology deployment. He mentioned that the delegation was organized by Fuel Cell Energy and they visited the Bridgeport fuel cell project. He provided a brief update on the Bridgeport fuel cell project, noting that the project should be completed by the end of this year or beginning of next year. Mr. Garcia indicated that discussions were held with the delegation about exchanging information and technology and the possibility of bringing residential fuel cells from Japan to Connecticut while working with Connecticut companies to export their technologies to Japan.

Mr. Garcia provided an update on the green bank movement and commended Reed Hundt for the work that the Coalition for Green Capital is doing around the country. He mentioned that Connecticut is sharing information with other states that are very interested in what CEFIA is doing. The Board discussed the importance of sharing and exchanging information and products with other states.

Mr. Garcia spoke about the senior staff retreat recently held offsite to discuss the progress made, successes, accomplishments and challenges. He noted that there was consistent recognition from the group that the green bank accomplishments are built around the proof of concepts playing out, the growth with businesses and jobs as a result of the green bank, and the things that could not be accomplished without the green bank.

In response to a question, Mr. Hundt spoke about green banks on a national level. He talked about the advantages of creating economies of scale by many states offering similar products. Mr. Hundt discussed financial institutions proving to the federal government how products work and address energy problems. He explained how a federal program, for example a U.S. green bank, could work by lending low-cost and long-term debt to states and noted that the burden of capitalizing green banks can be shifted from the ratepayer to the federal government. The importance of creating economies of scale, standardizing products and data and de-risking investments in clean energy were noted as critical components to achieving lowest costs. Several Board members questioned whether it is realistic for the federal government to get involved given the current stalemate of circumstances in Washington, D.C., and expressed the importance of continuing to try to attract more private capital.

5. Commercial and Industrial Sector Program Updates and Recommendations for Approval:

a. Program Updates

Ms. Bailey provided an update on C-PACE. She mentioned that 57 towns have opted in to be C-PACE districts, which represents about 63 percent of the Connecticut market eligible. She indicated that 200 contractors have been trained. Currently, 14 capital providers are qualified to participate in the program. Ms. Bailey stated that $6,700,000 in C-PACE transactions have been closed of the $13,800,000 transactions approved. It is anticipated that $6,700,000 in closed transactions will be sold down to capital providers participating in the program. Ms. Bailey described some of the changes to the program, including rate adjustments, instituting a closing fee and assessing budget and human resource needs. She discussed the pipeline of projects and the breakout by project type. The Board asked staff to track the types of jobs created and the other opportunities created as a result of the C-PACE Program.

Ms. Bailey explained the process of selling down the transactions. She noted that sealed bids are being solicited from capital providers. Final bids are due October 11 and the winning bidder will be selected on or about October 23.

Mr. Hunter attributed the success of the C-PACE program to many things, including having the right people run the program, developing the appropriate framework and structure for the program, having a funding warehouse approved by the Board earlier in the year and negotiating and finalizing documentation. The Board noted the importance of sharing information about CEFIA’s successes with the state legislators. A suggestion was made to host a green bank workshop to share data. Mr. Goldberg explained some of the efforts currently being done to help educate the legislators and keep them abreast.

b. Buonicore PSA

Ms. Bailey discussed the recommendation to expand the personal services contract with Buonicore to perform the technical underwriting for the program. She explained the important role Buonicore plays with reviewing each of the transactions, training contractors, providing support for the capital providers, providing technical expertise, etc.

Upon a motion made by Ms. Glover, seconded by Mr. Harrity, the Board members voted unanimously in favor of adopting the following resolution authorizing an amendment to the personal service agreement with Buonicore Partners:

WHEREAS, Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the “Act”), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy (“C-PACE”);

WHEREAS, as statewide program administrator for the C-PACE program, CEFIA is required, amongst other things, to evaluate the Savings to Investment Ratio (“SIR”)for individual projects; and

WHEREAS, CEFIA seeks to amend PSA #1732 to retain Buonicore Partners to serve as Technical Administrator for the C-PACE program to evaluate the SIR for individual projects, work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program.

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute an amended PSA between Buonicore Partners and CEFIA with terms and conditions materially consistent with CEFIA's standard form of PSA in an amount not to exceed $400,000, exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing.

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c. Warehouse Expansion:

Mr. Hunter explained that in February 2013, the Board approved funding of up to $20,000,000 as a funding warehouse for the C-PACE program. He noted that the program is working as planned, and there is growing activity on the demand side. As result of the growing demand, staff recommends expanding the funding capacity for more transactions. Mr. Hunter stated that staff recommends expanding the funding warehouse capacity to $40,000,000 as a result of the increased activity in the program.

In response to a question about lender consent, Ms. Bailey indicated that consent has been obtained on approximately 8 transactions. A suggestion was made to ensure to capture the success with the lenders' consent as a best practice, which can be attributed in part to the significant analysis provided and the statutory provision that limits foreclosure. Mr. Hunter reviewed the transactions approved to date and the pipeline of transactions.

Upon a motion made by Ms. Glover, seconded by Mr. Ranelli, the Board members voted unanimously in favor of adopting the following resolution authorizing an expansion of the funding warehouse for C-PACE:

WHEREAS, Section 99 of Public Act 11-80 "An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future" (the "Act"), CEFIA is directed to, amongst other things, to develop separate programs to finance and otherwise support clean energy investment in residential, municipal, small business and larger commercial projects and such others as the authority may determine;

WHEREAS, Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly (the "Act"), CEFIA is directed to, amongst other things, to establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE") and CEFIA established the C-PACE program;

WHEREAS, the Board of Directors previously passed resolutions authorizing the establishment of a $20 million construction and term loan facility in support of the C-PACE program to fund C-PACE transactions approved by staff, the Deployment Committee and the Board of Directors (the "C-PACE Warehouse Facility") and CEFIA established the C-PACE Warehouse Facility and has used the facility to approve $14 million in C-PACE projects;

WHEREAS, CEFIA staff requests the Board of Directors approve an increase in the C-PACE Warehouse Facility to $40 million to accommodate the anticipated needs of the C-PACE program; and

WHEREAS, staff's request for an increase in the C-PACE Warehouse Facility is consistent with CEFIA's comprehensive plan and budget for FY 2014 with respect to anticipated budget investments for the C-PACE program and other program requirements.

NOW, therefore be it:

RESOLVED, that CEFIA's Board of Directors authorizes an increase in the C-PACE Warehouse Facility to $40 million in support of the C-PACE Program, to fund up to $40 million in C-PACE transactions; and

RESOLVED, that the Board of Directors directs staff to sell such funded C-PACE transactions to private capital providers in order to continually restore funding capacity for the C-PACE program on an ongoing basis.

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6. Statutory and Infrastructure Section Program Updates and Recommendations:

a. Program Updates

Mr. Hedman provided an update on the Residential Solar Investment Program. He indicated CEFIA is at approximately 80 percent of the goal for rebates and approximately 3 megawatts of 3.8 megawatts have been approved. With respect to the performance based incentives ("PBI"), CEFIA is at approximately 50 percent of the goal with about 1.3 megawatts of 2.8 megawatts approved. Mr. Hedman stated that the goals should be reached for both the rebates and PBIs by the end of the year. He mentioned that staff will make recommendations for step 4 incentives in the November or December meeting. Mr. Hedman reviewed the average system costs.

He noted that since the inception of the program, over 1,700 applications representing about 12 megawatts have been approved. Total incentives of over $18,300,000 have been approved. The Board suggested that staff use fun facts and key words to tell the success stories of the green bank. Staff was encouraged to talk about the programs that are not working and make recommendations on redeploying funds from the programs that are not as successful to the programs that are successful.

b. Ansonia Anaerobic Digester Project

Mr. Hedman discussed the request for a loan of up to $4,500,000 for the City of Ansonia Anaerobic Digestion Project, a 1.55 megawatt food waste anaerobic digestion facility at the City of Ansonia's waste water treatment plant and transfer station. Mr. Hedman stated that the estimated facility costs are $20,000,000, and the primary project revenue sources include a 25-year power purchase agreement with the City of Ansonia and tipping fees for food waste. He reviewed the key terms of the loan and noted that certain aspects of the project are still being developed. In response to a question, Mr. Hedman explained how the power is produced. When asked about utilizing a fuel cell for the project, Mr. Hedman indicated that this is not the right feedstock for a fuel cell.

Upon a motion made by Ms. Glover, seconded by Mr. Ranelli, the Board members voted unanimously in favor of adopting the following resolution regarding funding for the City of Ansonia Anaerobic Digestion Project, Ansonia:

RESOLVED:

(1) that the Clean Energy Finance and Investment Authority (CEFIA) has determined that funding for City of Ansonia Anaerobic Digestion Project (Project), is consistent with CEFIA's Comprehensive Plan and in the interests of ratepayers, and that the term sheet dated September 6, 2013 be approved for the Project in an amount not-to-exceed Four Million Five Hundred Thousand Dollars ($4,500,000.00) (Loan);

(2) the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute and deliver, not later than June 30, 2014, any contract or other legal instrument necessary to effect the Loan on such terms and conditions materially consistent with the Term Sheet dated September 6, 2013 between CEFIA and Greenpoint Energy Partners (Ansonia) LLC; and

(3) that the proper CEFIA officers are authorized and empowered to do all other acts and execute and deliver all other documents as they shall deem necessary and desirable to effect the above-mentioned legal instrument.

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7. <u>Residential Sector Program Updates</u>:

Ms. O'Neill provided an update on the Residential Sector programs. She indicated that staff has focused on launching the CT Solar Lease Program, getting Smart-E lenders on board, training solar PV installers on the financing options and operationalizing all products. Under the Smart-E Program, Ms. O'Neill indicated that 17 loans have closed, and the average loan size is approximately $10,000. The loans have primarily been for solar PV and natural gas conversions. Ms. O'Neill mentioned that 99 contractors have been trained to date. An update was provided on the CT Solar Lease Program, noting that 5 PV contractors are eligible to offer the leases, and others are in the process of becoming eligible, representing approximately 70 percent of the market. To date, approximately 34 applications have been received. Under the Solar Loan Program, 4 loans have closed. There are 6 eligible contractors with many more in the process of becoming eligible. Ms. O'Neill mentioned that more marketing is necessary for the Cozy Home Loan Program. She indicated that it is anticipated that the Solar Hot Water Lease Program will be launched in October.

Mr. Hunter and Ms. O'Neill spoke about the various financing and program options available to customers. It was noted that a lot of education has been done and staff will continue to provide education about the options available. Staff reviewed and compared the differences between the Smart-E Loan, CT Solar Loan and CT Solar Lease programs.

8. <u>Institutional Sector Program Updates</u>:

Mr. Brydges reported on the Lead by Example Program. He mentioned that CEFIA is working closely with DEEP. Mr. Brydges noted the opportunities at the various state agencies. He spoke about the importance of standardizing the process for proposal development and data reporting. Mr. Esty indicated that after discussing the financing options further with the Office of Policy and Management, CEFIA is encouraged to seek other funding rather than funding through state bonds. Mr. Brydges provided an update on the Campus Efficiency Now Program. He noted that the program has not realized as much progress as had been anticipated, and C-PACE may be a better option for some of the projects. Mr. Brydges indicated that staff has received some feedback that the desired projects are larger than the program can accommodate. He mentioned that to date one project under the program has closed.

Mr. Brydges stated that an internal task force has been formed to develop an evaluation, measurement and verification process. A Request for Qualification has been released to hire a contractor. Mr. Brydges mentioned that CEFIA is statutorily mandated to perform an evaluation of the residential solar investment program every two years beginning January 1, 2014.

9. <u>Other Business—Executive Session</u>:

The Board was asked to go into executive session to discuss personnel matters.

Upon a motion made by Ms. Glover, seconded by Mr. Ranelli, the Board voted unanimously in favor of going into executive session at 10:47 a.m. to discuss personnel matters. Mr. Garcia, Mr. Dykes and Mr. Hunter were invited to remain.

The executive session ended at 11:12 a.m., and the regular meeting was immediately reconvened.

Upon a motion made by Ms. Glover, seconded by Mr. Ranelli, the Board members voted unanimously in favor of adopting the following resolution approving revisions to the officer-level career series:

RESOLVED, that the Board of Directors of the Clean Energy Finance and Investment Authority ("CEFIA") pursuant to Article III of the CEFIA Bylaws, approves the revisions to the officer-level career series for the Executive Vice President and Chief Investment Officer.

Upon a motion made by Ms. Glover, seconded by Mr. Harrity, the Board members voted in favor of adopting the following resolution approving revisions to the director-level career series and position description for the Director of Commercial and Industrial Programs (Ms. Ferguson abstained from the vote):

RESOLVED, that the Board of Directors of the Clean Energy Finance and Investment Authority ("CEFIA") pursuant to Section VII of the CEFIA Operating Procedures, approves the revisions to the director-level career series and position description for the Director of Commercial and Industrial Programs.

Upon a motion made by Ms. Glover, seconded by Mr. Harrity, the Board members voted in favor of adopting the following resolution approving revisions to the officer-level career series and position description for the General Counsel and Chief Legal Officer and the appointment of Brian Farnen as an officer of CEFIA (Ms. Ferguson abstained from the vote):

RESOLVED, that the Board of Directors of the Clean Energy Finance and Investment Authority ("CEFIA") pursuant to Article III of the CEFIA Bylaws, approves the revisions to the officer-level career series and position description for the General Counsel and Chief Legal Officer (General Counsel) and authorizes the appointment of Brian Farnen as an officer of CEFIA for the position of General Counsel.

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10. **Adjournment**: Upon a motion made by Ms. Glover, seconded by Mr. Harrity, the Board members voted unanimously in favor of adjourning the September 13, 2013 meeting at 11:14 a.m.

Respectfully submitted,

Daniel Esty, Vice Chairperson

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: Board of Directors of the Clean Energy Finance and Investment Authority

From: Bryan Garcia (President and CEO), Bert Hunter (EVP and CIO), Mackey Dykes (Chief of Staff)

Cc Jessica Bailey (Director of Commercial and Industrial Programs), Andy Brydges (Director of Institutional Programs), Brian Farnen (General Counsel and Chief Legal Officer), Dale Hedman (Director of Statutory and Infrastructure Programs), and Kerry O'Neill (Director of Residential Programs)

Date: October 11, 2013

Re: Connecticut's "Green Bank" at Work – FY 2013 Results

Overview

As part of our preparation for the FY 2014 budget, we assessed CEFIA's performance in FY 2013 in accordance with the targets outlined in our two-year Comprehensive Plan. We established targets as an organization through calendar year 2014 across each of the four (4) programmatic sectors (i.e. statutory and infrastructure, residential, commercial and industrial, and institutional) and noted the results we achieved in FY 2013 – see Table 1.

Table 1. FY 2013 Results Compared to the Two-Year Comprehensive Plan Targets

	Comprehensive Plan Targets (through 2014)	**Statutory and Infrastructure Sector**	**Residential Sector**	**Commercial and Industrial Sector**	**Institutional Sector**	**Total Achieved from Sectors** (FY 2013)
CEFIA Capital at Risk	$45,300,000	$19,225,331	$15,510,000	$3,943,106	$2,900,000	$41,578,437
Private Capital Attracted	$186,600,000	$97,975,225	$73,300,000	-	$10,000,000	$181,275,225
Clean Energy Deployed (MW)	51.1	26.7	-	0.1	-	26.8
Annual Energy Saves (kMMBtu)	180	-	-	9	-	9
# of Loans/Installs	5,283	1,155	-	5	-	1,160

These results were presented to and discussed with the CEFIA Board of Directors in June 2013. Of the $181.3 million of private capital attracted towards clean energy deployment in Connecticut, CEFIA put $41.6 million of its capital at risk – for a total of over $220 million of capital being invested in clean energy in Connecticut as a result of FY 2013 activities. Of the $41.6 million of CEFIA capital at risk, over 50% of those funds (i.e. $21.5 million) were in the form of loans and leases not grants – see Table 2. This means that CEFIA expects these funds to be returned over time (i.e. ratepayer payback) as debt service payments are received.

Table 2. Total and Percentage of CEFIA Capital at Risk in Subsidies, Credit Enhancements, and Loans and Leases from FY 2013 Activities

Sector	Subsidies	Credit Enhancements	Loans and Leases	Total
Statutory and Infrastructure	$13,425,331	$0	$5,800,000	$19,225,331
Residential	$0	$6,410,000	$9,100,000	$15,510,000
Commercial and Industrial	$250,000	$0	$3,693,106	$3,943,106
Institutional	$0	$0	$2,900,000	$2,900,000
Total	$13,675,331	$6,410,000	$21,493,106	$41,578,437
Percent of Total	**33%**	**15%**	**52%**	

From a "big picture" perspective, the following are key financial metrics resulting from FY 2013 activities:

- **Private Capital Attracted** – attracted over $180 million of private capital investment in clean energy in Connecticut;

- **CEFIA Funds at Risk** – of the over $40 million of CEFIA funds at risk, over $20 million is expected to be returned (i.e. ratepayer payback) over time in debt service payments;

- **Leverage Ratio** – every $1.00 of CEFIA capital put at risk attracted between $4.50 to $9.00 of private capital depending upon debt service repayment performance;

- **Deployment** – nearly 30 MW of clean renewable energy was deployed and 9,000 MMBtu of energy will be saved per year; and

- **Benchmark** – in comparison, the CCEF attracted $155 million of private capital investment in clean energy in Connecticut while putting over $170 million of its capital at risk. Only $15 million of the CCEF capital at risk was in the form of leases and is expected to be returned over time. Therefore, CCEF's model yielded a $1.00:$1.00 leverage ratio while deploying 35 MW of clean energy in over a decade.

CEFIA's results are impressive not only with respect to the financial targets CEFIA has established in its two-year Comprehensive Plan, but also in comparison to the results achieved by the CCEF over a decade. This means that CEFIA has demonstrated that the "green bank" model is working in Connecticut. It is doing more with less and faster!

In order to determine the societal benefits of economic development (i.e. jobs) and environmental protection (i.e. CO_2 emissions avoided) resulting from CEFIA's FY 2013 activities, we felt it was important to estimate these benefits in order to better communicate the full "green bank" story beyond the financial results. The rest of this memo summarizes our estimates of the jobs created and the global warming emission reductions achieved as a result of FY 2013 activities.

Economic Development Benefits – Jobs

CEFIA's enabling of over $220 million of capital investments in clean energy deployment has significant economic development implications. Recognizing that some of this investment has occurred already (i.e. $120 million), while some of it is yet to be invested (i.e. $100 million), we have calculated both "Realized Job Gains" and "Future Job Gains" resulting from FY 2013 activities. In other words, just because funds may have been invested or attracted, it doesn't mean that they have been expended or deployed (i.e. many projects are still in pre- or early construction phases).

Realized Job Gains

"Realized Job Gains" result from capital that has been expended – projects that are either in construction or have been commissioned and are in service. There are several programs and projects that have realized job gains in Connecticut in FY 2013, including:

- **Residential Solar Investment Program** (RSIP) – $36.9 million of capital has been invested in residential rooftop solar PV in Connecticut, leading to the deployment of 8.2 MW;
- **Combined Heat and Power** (CHP) – $9.5 million of capital has been invested in CHP in Connecticut, leading to the deployment of 3.7 MW; and
- **Dominion Bridgeport Fuel Cell Park** (DBFCP) – over $70.0 million has been invested in a utility-scale fuel cell park in Connecticut, leading to the deployment of 14.8 MW.

To determine the realized job gains from the RSIP and CHP programs, CEFIA staff used formulas for direct jobs and multipliers for indirect and induced jobs from a study conducted by Navigant Consulting[1] in conjunction with professional judgment[2] – see Table 3.

Table 3. Estimate of the Direct, Indirect, and Induced Jobs Realized from the RSIP and CHP Programs

Program	Direct Job Years per $1MM Invested	Indirect-Induced Job Multiplier	Indirect-Induced Job Years per $1MM Invested	Total Jobs Created per $1MM Invested	Investment Amount ($MM)	Direct Jobs	Indirect-Induced Jobs	Total Jobs
RSIP	5.9	1.6	9.5	15.4	$36.9	218	351	568
CHP	6.2	1.6	9.9	16.1	$9.5	59	94	153
Total					**$46.4**	**277**	**445**	**722**

To determine the realized job gains from the DBFCP project, we used the estimates provided by Fuel Cell Energy for direct jobs by job type and the multiplier of 2.3 for indirect and induced jobs from the Navigant Study – see Table 4.

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[1] These jobs estimates are based on multipliers determined as a result of work performed by Navigant Consulting for the *Connecticut Renewable Energy and Energy Efficiency Economy Baseline Study* completed in March 2009 and subsequently updated in 2010. This Navigant Study was an independent, third party analysis of Connecticut's clean energy economy. Data was acquired as a result of primary research. Navigant performed a census of over 300 companies, institutions, and organizations identified as active players in Connecticut's renewable energy and energy efficiency economy. Seventy four (74) key renewable energy and energy efficiency companies were interviewed; 95 additional key companies were researched in detail. All renewable companies in Connecticut were identified and analyzed. Key energy efficiency companies were identified and analyzed, with the overall market size estimated by extrapolation. Company interviews included questions about customers, supply chain, number of jobs, corresponding salaries, and revenue. Detailed interview questionnaires are available in the Methodology section of the Baseline Study, pages 58-81 - http://www.ctcleanenergy.com/Portals/0/Phase%201%20Deliverable%20Final%20Full.pdf.

[2] The estimate for CHP jobs created is a professional estimate, made by CEFIA staff, and based on the Navigant Study findings.

Table 4. Estimate of the Direct, Indirect, and Induced Jobs Realized from the DBFCP Project

Type of Job	Direct Jobs	Indirect-Induced Jobs	Total Jobs
Construction and Installation	14	31	45
Service and Operations	5	11	16
Manufacturing	94	216	310
Replacement Manufacturing	13	29	41
Interconnection	10	24	34
Total	**135**	**311**	**446**

Therefore, as a result of investing nearly $120 million in the RSIP and CHP programs and the DBFC project, nearly 1,200 direct, indirect and induced jobs were created in FY 2013 – over 400 direct jobs and 750 indirect and induced jobs – see Table 5.

Table 5. Realized Jobs from the RSIP and CHP Programs and DBFC Project

Program or Project	Direct Jobs	Indirect and Induced Jobs	Total Jobs
Residential Solar Investment Program	218	351	568
Combined Heat and Power Program	59	94	153
Dominion Bridgeport Fuel Cell Park	135	311	446
Total	**412**	**756**	**1,168**

Future Job Gains

"Future Job Gains" are calculated based on capital that has been attracted to support clean energy in Connecticut, but has not yet been expended – programs or projects have been approved by the CEFIA Board of Directors, but are not yet in construction or commissioned and in-service. There are several programs and projects that will result in future job gains in Connecticut as a result of FY 2013 activities, including:

- **<u>Solar Lease 2</u>** – $61.1 million of capital, including:
  - $46.1 million to be invested in residential solar PV projects, leading to the deployment of an estimated 10.2 MW;
  - $10.0 million to be invested in commercial solar PV projects, leading to the deployment of an estimated 3.8 MW; and
  - $5.0 million to be invested in residential solar hot water system projects, leading to the saving of an estimated 4,600 MMBtu of energy.

- **<u>Solar Loan</u>** – $1.5 million to be invested in residential solar PV projects, leading to the deployment of an estimated 330 kW; and

- **<u>Smart-E Loan</u>** – $36.2 million of capital, including:
  - An estimate of $18.1 million to be invested in residential solar PV, leading to the deployment of an estimated 4.0 MW; and
  - An estimate of $18.1 million to be invested in residential energy efficiency, leading to the saving of energy, which has yet to be estimated.

To determine the future job gains from these financing programs, CEFIA staff used formulas for direct jobs and multipliers for indirect and induced jobs from the Navigant Consulting study – see Table 6.

Table 6. Estimate of the Direct, Indirect, and Induced Jobs Future Job Gains from the Solar Lease, Solar Loan, and Smart-E Loan Programs

Program	Direct Job Years per $1MM Invested	Indirect-Induced Job Multiplier	Indirect-Induced Job Years per $1MM Invested	Total Jobs Created per $1MM Invested	Investment Amount ($MM)	Direct Jobs	Indirect-Induced Jobs	Total Jobs
Solar Lease 2 – Residential Solar PV	5.9	1.6	9.5	15.4	$46.1	272	438	710
Solar Lease 2 – Commercial Solar PV	3.4	1.6	5.4	8.8	$10.0	34	54	88
Solar Lease 2 – Residential SHWS	7.6	1.6	12.2	19.8	$5.0	38	61	99
Solar Loan – Residential Solar PV	5.9	1.6	9.5	15.4	$1.5	9	14	23
Smart-E Loan – Residential Solar PV	5.9	1.6	9.5	15.4	$18.1	107	172	279
Smart-E Loan – Residential EE	12.9	1.6	20.6	33.5	$18.1	233	373	606
Total					**$98.8**	**693**	**1,112**	**1,805**

As a result of the investments that are to be made in the future from about $100 million of capital available through the Solar Lease 2, Solar Loan, and Smart-E Loan products, over 1,800 direct, indirect and induced jobs will be created.

Realized and Future Job Gains

As a result of FY 2013 activities, the following is a breakdown of the estimated realized and future job gains – see Table 7.

Table 7. Estimate of the Realized and Future Job Gains from FY 2013 Activities

Estimated Job Gains	Direct Jobs	Indirect and Induced Jobs	Total Jobs
Realized Job Gains	412	756	1,168
Future Job Gains	693	1,112	1,805
Total Job Gains	**1,105**	**1,868**	**2,973**

Of the $220 million of CEFIA and private capital invested and to be invested as a result of FY 2013 activities, nearly 3,000 jobs will have been created – over 1,100 of which are direct. CEFIA expects that nearly 100 of those direct jobs are in manufacturing.

Environmental Protection Benefits – Lifetime CO2 Emission Reductions

The investment of over $220 million of capital in clean energy deployment has significant environmental protection implications as well, in terms of avoided greenhouse gas emissions that would otherwise contribute to global climate change. Recognizing that some of this investment has already occurred in the many projects that have been deployed around the state, while some of it is yet to be invested, we calculated “Realized CO_2 Emission Reductions” and “Future CO_2 Emission Reductions” resulting from FY 2013 activities.

Realized CO_2 Emission Reductions

"Realized CO_2 Emission Reductions" are the result of capital that has been expended – projects are either in construction or have been commissioned and are in service. There are several programs and projects that have realized CO_2 emission reductions in Connecticut in FY 2013, including the Residential Solar Investment Program, Combined Heat and Power Program, and Dominion Bridgeport Fuel Cell Park that were discussed above.

To determine the realized CO_2 emission reductions from these programs and projects CEFIA staff used marginal emission rates from ISO New England in combination with the emissions of each clean energy technology being deployed – see Table 8.[3]

Table 8. Realized CO2 Emission Reductions from the RSIP and CHP Programs and DBFC Project

Program or Project	**MW Deployed** (MW)	**Lifetime Generation** (MWh)	**CO2 Emissions Avoided over Lifetime** (TCO2)
Residential Solar Investment Program	8.2	194,844	101,027
Combined Heat and Power Program[4]	3.7	410,000	68,000-96,000
Dominion Fuel Cell Park	14.8	1,182,600	85,739
Total	**26.7**	**1,787,444**	**234,766-282,766**

As a result of investing nearly $120 million in the RSIP and CHP programs and the DBFC project, and deploying over 26 MW of clean energy generation, about 250,000 tons of CO_2 emissions will be avoided over the life of the projects as a result of FY 2013 activities. These in-state clean renewable energy projects will also provide local emission reductions of SO_2 and NO_x by displacing generating units operating on the margins.

Future CO_2 Emission Reductions

[3] All emissions reductions from renewable energy projects are determined using ISO-New England information, because that is where the energy will be displaced. This produces results that may be significantly different from emissions savings based on a comparison to national averages. In addition, the generation characteristics of each technology have an impact on the emissions reduction that can be expected. Solar-powered systems will produce only during the daylight hours, which normally coincide with the peak demand period for the utilities. The generating fleet during this time may include peaking plants and reserve plants, which will have lower efficiencies than the "baseload" plants which run 24 hours per day. Consequently, emissions are higher, and the renewable energy systems look better by comparison. The calculations are based on the results of the 2007 New England Marginal Emission Rate Analysis (http://www.iso-ne.com/genrtion_resrcs/reports/emission/2007_mea_report.pdf). The appropriate marginal emissions rates for Connecticut are used to determine the net avoided emissions for each of the technologies evaluated.

a. PV systems are analyzed using the average of the Marginal Emission Rates (in Lbs/MWh) for "On-Peak Ozone Season" and "On-Peak Non-Ozone Season". The underlying assumptions are that PV systems will be operating primarily during the on-peak periods, and that their output in the five months of the "Ozone Season" (May – September) is about the same as in the seven months of the "Non-Ozone Season."
b. Fuel cells are also evaluated using the "Annual Average (all hours) Marginal Emission Rates", because they are expected to produce power continually as "base load" generators. Fuel Cell emissions assume that 50% of the thermal output ("waste heat") is used to displace natural gas used for heating. This is conservative, since 50% thermal utilization is the minimum standard for CCEF's acceptance of a fuel cell project.

[4] To determine the exact avoided CO_2 we need to know what the CHP system is displacing (i.e. boiler, grid, etc.), as well as the efficiencies, in order to determine the existing CO_2 emissions and then do the calculation to get the avoided emissions. For general purposes a typical 3.7 MW system operating on natural gas would generate about 13,000 tons of CO2 annually and 195,000 Tons over its 15-year life. Typically avoiding 35-50% CO_2 overall from the existing infrastructure. Not factoring in the utility transmission and distribution losses.

"Future CO_2 Emission Reductions" are the result of capital that has been attracted to support clean energy in Connecticut, but has not yet been expended – programs or projects have been approved by the CEFIA Board of Directors, but that are not yet in construction or commissioned and in-service, including the Solar Lease 2, Solar Loan, and Smart-E Loan programs discussed previously.

To determine the future CO2 emission reductions that will result from these financing programs, CEFIA staff used marginal emission rates from ISO New England in combination with the emissions of each clean energy technology – see Table 9.

Table 9. Estimate of Future CO_2 Emission Reductions from the Solar Lease 2, Solar Loan, and Smart-E Loan Programs

Program or Project	Estimated MW Deployed (MW)	Estimated Lifetime Generation (MWh)	Estimated Lifetime Energy Saved (MMBtu)	Estimated CO2 Emissions Avoided over Lifetime (TCO2)
Solar Lease 2	14.0	332,661	92,000[5]	186,609
Solar Loan	0.4	9,505	-	4,928
Smart-E Loan	4.0	95,046	-[6]	49,281
Total	**18.4**	**437,212**	**92,000**	**240,818**

As result of investments that are to be made from about $100 million through the Solar Lease 2, Solar Loan, and Smart-E Loan products, over 240,000 tons of CO2 emissions will be reduced over the life of the projects.

Realized and Future CO2 Emission Reductions

As a result of CEFIA's FY 2013 activities, the following summarizes the estimated realized and future CO2 emission reductions – see Table 10.

Table 10. Estimate of the Realized and Future CO2 Emission Reductions from FY 2013 Activities

	CO2 Emission Reductions (TCO2)
Realized CO2 Emission Reductions	234,766-282,766
Future CO2 Emission Reductions	240,818
Total Realized and Future Emission Reductions	**475,584-523,584**

Of the $220 million of CEFIA and private capital invested and to be invested from our FY 2013 activities, approximately 500,000 tons of CO2 emissions will be avoided over the life of the projects.

Key Talking Points

Based on the results from FY 2013 activities, the following are key talking points that CEFIA will be using in the coming months:

[5] Assumes 60% of SHWS displacing oil and 40% displacing electricity. SHWS displacing oil avoids 298 pounds of CO2 emissions per MMBtu saved and 320 pounds of CO2 emissions per MMBtu for displacing electricity.

[6] Estimates for energy efficiency were not calculated. CEFIA is still determining average energy savings per project, which is data that is not readily available given the diversity of energy efficiency measures being taken up by Connecticut households.

1. **180-(40)-20 Rule** – in one year, CEFIA has attracted $180 million of private capital investment while putting only $40 million of CEFIA funds at risk – $20 million of which will be returned to CEFIA because it is in the form of loans and leases, and not grants…yielding a 9:1 leverage ratio, deploying approximately 30 MW of clean energy, and putting $220 million into the clean energy economy in Connecticut.

2. **1,200 Up and 250,000 Down** – from the CEFIA projects that have been completed in the past year, about 1,200 jobs have already been realized and 250,000 tons of CO2 emissions will be avoided over the life of the already completed projects. When the rest of the capital is put to work and additional projects come on line, an additional 1,800 jobs will be created and 240,000 tons of CO2 emissions will be avoided over the life of those projects.

3. **"Green Bank Model" Works** – the model of "doing more with less and at a faster pace" is working. The CCEF subsidy model, over the decade of the 2000s, attracted $155 million of private capital investment while putting $170 million of CCEF funds at risk, ultimately yielding a 1:1 leverage ratio because only $15 million of the investment will be returned over time in the form of leases. The CEFIA "green bank model" has achieved a leverage ratio and rate of deployment almost an order of magnitude better than the CCEF subsidy model.

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

BOARD OF DIRECTORS

REGULAR MEETING SCHEDULE FOR 2014

The following is a list of dates and times for **regular meetings** of the Clean Energy Finance and Investment Authority's Board of Directors through 2014.

- March 21, 2014 – Regular Meeting from 9:00 to 11:00 a.m.
- June 20, 2014 – Regular Meeting from 9:00 to 11:00 a.m.
- September 19, 2014 – Regular Meeting from 9:00 to 11:00 a.m.
- December 19, 2014 – Regular Meeting from 9:00 to 11:00 a.m.

Should a **special meeting** need to be convened for the CEFIA Board of Directors to review staff proposals or to address other issues that arise, a meeting will be scheduled accordingly.

All regular and special meetings will take place at the:

Clean Energy Finance and Investment Authority
845 Brook Street, Building #2
Albert Pope Board Room
Rocky Hill, CT 06067

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

AUDIT, COMPLIANCE AND GOVERNANCE COMMITTEE
REGULAR MEETING SCHEDULE FOR 2014

The following is a list of dates and times for regular meetings of the Clean Energy Finance and Investment Authority's Audit, Compliance and Governance Committee through 2014.

- Wednesday, April 15, 2014 – Regular Meeting from 1:00pm - 2:00pm
- Wednesday, October 15, 2014 – Regular Meeting from 1:00pm - 2:00pm

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
845 Brook Street, Building #2
Albert Pope Board Room
Rocky Hill, CT 06067

CEFIA BUDGET AND OPERATIONS COMMITTEE 2014 REGULAR MEETING SCHEDULE

The following is a list of dates and times for regular meetings of the Clean Energy Finance and Investment Authority's Budget and Operations Committee through **2014**.

- Friday, May 16, 2014 – Regular Meeting from 2:00 to 3:30 p.m.
- Monday, June 9, 2014 – Regular Meeting from 2:00 to 3:30 p.m.

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
845 Brook Street, Building #2
Albert Pope Board Room
Rocky Hill, CT 06067

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

REGULAR DEPLOYMENT COMMITTEE 2014 MEETING SCHEDULE

The following is a list of dates and times for regular meetings of the Clean Energy Finance and Investment Authority's Deployment Committee through **2014**.

- Thursday, January 9, 2014 – Regular Meeting from 2:00pm – 3:00pm
- Thursday, February 13, 2014 – Regular Meeting from 2:00pm – 3:00pm
- Thursday, May 15, 2014 – Regular Meeting from 2:00pm – 3:00pm
- Thursday, July 17, 2014 – Regular Meeting from 2:00pm – 3:00pm
- Thursday, October 16, 2014 – Regular Meeting from 2:00pm – 3:00pm
- Thursday, November 6, 2014 – Regular Meeting from 2:00pm – 3:00pm

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
845 Brook Street, Building #2
Albert Pope Board Room
Rocky Hill, CT 06067

[redacted]

InSports: A C-PACE Project in Trumbull, CT

Address	29 Trefoil Drive, Trumbull, CT			
Owner	ICST Real Estate, LLC			
Proposed Assessment	$1,001,298			
Term (*years*)	20			
Term Remaining (*months*)	Pending construction completion			
Annual Interest Rate	5.5%			
Annual C-PACE Assessment	$83,171			
Savings-to-Investment Ratio	1.10			
Average Debt-Service Coverage Ratio	[redacted]			
Loan-to-Value Ratio	[redacted]			
Proposed Energy Savings		EE	RE	Total
	Per year	47,853 kWh	294,000 kWh	341,853 kWh
	Over term of loan	0.957 MWh	5,880 MWh	6,837 MWh
Estimated Cost Savings	Per year	$12,833	$78,844	$91,678
	Life Cycle	$256,663	$1,576,896	$1,833,569
Location	Town of Trumbull			
Type of Building	Industrial			
Year of Build	2001			
Building Size (*sf*)	108,000			
Year Acquired by Current Owner	2013			
As-Is Appraised Value	[redacted]			
Status of Mortgage Lender Consent	[redacted]			
Proposed Project Description	252 kW photovoltaic system; efficient lighting upgrades			
Est. Date of Construction Completion	Pending closing			
Current Status	Awaiting Board of Directors approval			
Energy Contractors	[redacted]			
Additional Comments				

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[redacted]

22 Waterville Road: A C-PACE Project in Avon, CT

Address	22 Waterville Road, Avon, CT			
Owner	Sweetland Realty, LLC			
Proposed Assessment	$419,346			
Term (*years*)	14			
Term Remaining (*months*)	Pending Construction Completion			
Annual Interest Rate	5.5%			
Annual C-PACE Assessment	$43,341			
Savings-to-Investment Ratio	1.02			
Average Debt-Service Coverage Ratio	[redacted]			
Loan-to-Value Ratio	[redacted]			
Proposed Energy Savings		EE	RE	Total
	Per year	2,361,190kBTU	N/A	2,361,190kBTU
	Over term of loan	33,056,660kBTU	N/A	33,056,660kBTU
Estimated Cost Savings	Per year	$44,419	N/A	$44,419
	Life Cycle	$666,291	N/A	$666,291
Location	Avon, CT			
Type of Building	Office - Large (>50,000 SF)			
Year of Build	1985			
Building Size (*sf*)	53,577			
Year Acquired by Current Owner	1997			
As-Is Assessed Value	[redacted]			
Status of Mortgage Lender Consent	[redacted]			
Proposed Project Description	▪ Install new Direct Digital Controls (DDC) on heat pump system ▪ Lighting upgrade ▪ Replace fresh air rooftop units ▪ Replace boiler with condensing type ▪ Replace cooling tower			
Est. Date of Construction Completion	November 30, 2013			
Current Status	Pending Board of Directors Approval			
Energy Contractor	[redacted]			

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: CEFIA Board of Directors

From: Genevieve Sherman

Date: October 11, 2013

Re: Request for approval to enter into up to $668,312.50 PSA with Buonicore Partners to serve as Technical Administrator of the C-PACE program ($400,000 in new authority)

The previous resolution approved by the Board on this PSA erroneously capped the amended agreement with Buonicore Partners at $400,000, inclusive of all past payments. The intent was to allow for an <u>additional</u> $400,000 on a go-forward basis. The edits to the resolution are included below, followed by a new resolution for the Board to adopt.

Edits here:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute an amended PSA between Buonicore Partners and CEFIA with terms and conditions materially consistent with CEFIA's standard form of PSA **to increase the PSA amount by $400,000** ~~in an amount~~ for a new not to exceed **amount of $668,312.50** ~~$400,000~~, exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing.

New version to adopt:

RESOLUTIONS

WHEREAS, Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the "Act"), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

WHEREAS, as statewide program administrator for the C-PACE program, CEFIA is required, amongst other things, to evaluate the Savings to Investment Ratio ("SIR")for individual projects;

WHEREAS, CEFIA seeks to amend PSA #1732 to retain Buonicore Partners to serve at Technical Administrator for the C-PACE program to evaluate the SIR for individual projects, work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program;

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute an amended PSA between Buonicore Partners and CEFIA with terms and conditions materially consistent with CEFIA's standard form of PSA to increase the PSA amount by $400,000 for a new not to exceed amount of $668,312.50, exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing.

Submitted by: Bryan Garcia, President and CEO, Bert Hunter, EVP and CIO and Genevieve Sherman, Senior Manager Commercial and Industrial PACE

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: CEFIA Board of Directors

From: Jessica Bailey

Date: September 6, 2013

Re: Request for approval to enter into up to $400,000 PSA with Buonicore Partners to serve as Technical Administrator of the C-PACE program

---

SUMMARY

Selected through a competitive RFQ process, Buonicore Partners became the Technical Administrator of CEFIA's C-PACE program in November 2012. The role has involved Buonicore Partners in many aspects of designing the C-PACE program to date.

Since launching, the C-PACE program has approved 17 projects, totaling nearly $14M in its first 9 months. With this early programmatic success, we have exhausted the original professional service agreement (PSA) 1732 with Buonicore in the amount of the $268,312.50. This memo requests Board approval to amend this PSA that will govern the next phase of CEFIA's partnership with Buonicore in an amount not to exceed $400,000 which, based on an anticipated transaction flow over the next several months should be sufficient for a period of approximately 6 months or 50 projects. The funding from this PSA would come out of the FY13 approved budget for the C-PACE program.

BACKGROUND

In the 2012 Special Session, Connecticut passed legislation that gives property owners access to a new form of financing for building energy upgrades. Commercial and Industrial Property Assessed Clean Energy (C-PACE)[1] is an innovative financing program that allows Connecticut building owners to access cleaner, cheaper, and more reliable energy. Hundreds of millions of dollars in energy upgrades are possible in Connecticut and C-PACE enables property owners to access the private capital necessary to finance these upgrades.

[1] C-PACE is a tax-lien financing program that allows interested property owners to finance qualifying energy efficiency and renewable energy improvements on their properties through an additional charge ("assessment") on their property tax. Similar to a sewer tax assessment, capital provided under the C-PACE program is secured by a lien on the owner's property tax bill. Property owners pay the improvements back over time, based on the voluntary assessment placed on the property tax bill. The PACE lien takes first priority over mortgage-holders, and the repayment obligation transfers automatically to the next property owner if the property is sold. Because the payment is tied to the property tax, a secure payment stream, low interest capital can be raised from the private sector with no government financing required. This arrangement spreads the cost of clean energy improvements – such as energy efficient boilers, upgraded insulation, new windows, or solar installations – over the expected life of the measure.

The policy identifies CEFIA as the statewide administrator of C-PACE. To assist CEFIA in administering the program, we released a competitive RFQ to qualified firms on September 24, 2012. The RFQ was released on CEFIA's website and directly to about 40 qualified submitters. As described in the RFQ, the selected Technical Administrator works closely with CEFIA to, among other things, work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program.

BUONICORE PARTNERS

A Connecticut-based consortium of businesses including Buonicore Partners, Celtic Energy and Sustainable Real Estate Solutions[2] won the RFQ and has been ably serving as CEFIA's Technical Administrator since November 2012. Combined, the consortium has a collection of rich experience, including the founding of EDR, the nation's largest provider of commercial real estate property environmental due diligence information services; leading the development of standardized methodology of collection and analysis of building performance data; and providing of technical services for federal ESPC projects.

SCOPE OF WORK

As a key partner to the C-PACE team, Buonicore provides overall support for the technical underwriting process. There are 3 key functions that Buonicore and its partners provide to the C-PACE Program.

1. Data Management
2. Support to contractors and building owners
3. Third party review of proposed energy measures to qualify under the Savings to Investment Ration (SIR) >1 statutory criteria.

1. <u>Data Management</u>
   Of paramount importance to the C-PACE Program is the ability for CEFIA and its Technical Administrator to strategically manage the data, reporting and analytics across the entire program lifecycle, which consists of several critical steps including initial building application screening, energy retrofit project development, project implementation and post-implementation energy savings measurement and verification.

   To facilitate CEFIA's standardized data collection and analysis in a technically sound, fully transparent manner consistent with the industry best practice technical standards as outlined in the C-PACE Program Guidelines, SRS has created the CEFIA Data Management Platform (CDMP) to support the CPACE program and project management workflows across five primary steps:

   - Applicant Building Screening

   - Energy Audit Requirements and Project Development

[2] Sustainable Real Estate Solutions is a Connecticut Innovations portfolio company.

- Project Implementation and Commissioning

- Performance Measurement and Verification of Energy Savings

- Project Pipeline Tracking and Reporting

2. Support to contractors and building owners
   Training and supporting contractors to submit applications into the C-PACE program has been a critical – and time consuming – part of Buonicore's role in the C-PACE program. Among other things, Buonicore and its partners work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program,

3. Third party review
   Once a contractor formally applies for C-PACE financing, Buonicore is tasked with reviewing the proposed energy conservation measures. To date, they have relied on Celtic Energy as a partner to conduct the third party verification of proposed energy savings. Going forward, they will likely engage more partners on this front. With this review complete, Buonicore recommends approval to CEFIA staff on the technical merits of the proposed project.

COMPENSATION

As compensation for its support of CEFIA in administering the C-PACE program, CEFIA staff is requesting board approval to enter into an amended PSA whereby Buonicore would be paid a fee not to exceed $400,000 in base fees for a period of 6 months or 50 projects. In addition, Buonicore Partners would be paid completion fees immediately upon the closing of project financing per the following schedule:

Project Size:	**Less than $250K**	**Between $250K and $1M**	**Greater than $1M**
Solar and Single-ECM Projects:			
Base Fee	$5,000	$5,000	$5,000
Closing Fee as % of amount financed	2.0%	1.5%	1.0%
Multi-ECM Projects:			
Base Fee	$10,000	$10,000	$10,000

Closing Fee as % of amount financed	2.0%	1.5%	1.0%

These closing fees would be paid from proceeds received by CEFIA from the Borrower at closing, and would only be paid upon closing.

The Borrower would be able to wrap the closing fees into the total amount borrowed.

For example, under the proposed new PSA a review of a $300,000 solar project would pay Buonicore a total of $9,500 = $5,000 in a fixed fee and $4,500 in a closing fee to be collected by CEFIA from the Borrower.

A review of a $2,000,000 multi-measure energy conservation project would pay Buonicore a total of $30,000 = $10,000 in a fixed fee and $20,000 in a closing fee to be collected by CEFIA from the Borrower.

The not-to-exceed $400,000 PSA assumes 50 projects over the next 6 months. Assumption is 60% Multi-ECM projects (30 projects at $10,000 = $300,000) and 40% Single Measure or Solar projects (20 projects at $5,000 = $10,000).

BOARD REQUEST

This memo requests Board Approval for staff to amend the PSA with Buonicore Partners, substantially along the terms outlined above, in an amount not-to-exceed $400,000 (exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing). The PSA is materially consistent with CEFIA's standard form of PSA terms and conditions.

RESOLUTIONS

WHEREAS, Section 157 of Public Act No. 12-2 of the June 12, 2012 Special Session of the Connecticut General Assembly and as amended (the "Act"), CEFIA is directed to, amongst other things, establish a commercial sustainable energy program for Connecticut, known as Commercial Property Assessed Clean Energy ("C-PACE");

WHEREAS, as statewide program administrator for the C-PACE program, CEFIA is required, amongst other things, to evaluate the Savings to Investment Ratio ("SIR")for individual projects;

WHEREAS, CEFIA seeks to amend PSA #1732 to retain Buonicore Partners to serve at Technical Administrator for the C-PACE program to evaluate the SIR for individual projects, work with property owners through the application, audit, capital sourcing, and construction phases; approve and deny applications; assist in qualifying contractors and capital providers as needed; assist property owners in sourcing capital providers and contractors; and various other substantive tasks to assist with the successful administration of the program;

NOW, therefore be it:

RESOLVED, that the President of CEFIA and any other duly authorized officer of CEFIA, is authorized to execute an amended PSA between Buonicore Partners and CEFIA with terms and conditions materially consistent with CEFIA's standard form of PSA in an amount not to exceed $400,000, exclusive of closing fees that will be collected by CEFIA from the Borrower upon closing.

Submitted by: Bryan Garcia, President and CEO, Bert Hunter, EVP and CIO and Jessica Bailey, Director Commercial and Industrial PACE

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: Board of Directors

From: Bert Hunter, EVP and Chief Investment Officer; Brian Farnen Chief Legal Officer; Kerry O'Neill, Director of Residential Programs and Alexandra Lieberman, Senior Manager, Clean Energy Finance

CC: Bryan Garcia, President and CEO; Mackey Dykes, Chief of Staff

Date: October 11, 2013

Re: ARRA-SEP Update and Staff Proposal: CEFIA Residential Programs

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The purpose of this memo is to update CEFIA's Board of Directors on CEFIA's use of approved and proposed use of remaining American Recovery and Reinvestment Act State Energy Program (ARRA-SEP) funds. The Deployment Committee has already approved $7,264,667 of these funds during FYs 2012 and 2013. Staff seeks approval for (1) deploying the remaining $1,096,953 in ARRA funds and (2) additional flexibility to deploy the funds within each residential product line to drive capital sourcing and product deployment as effectively and capital-efficiently as possible.

In FY 2013, CEFIA staff developed four residential products, which will utilize approximately $8,361,620 of ARRA-SEP funds across a mix of Loan Loss Reserves ("LLR"), Interest Rate Buydowns ("IRB"), and Third Party Insurance Products ("TPI").

These programs, once fully invested will total almost $90M in investment in clean energy in Connecticut. The ability to allocate ARRA funds flexibly within each program will enable staff to use the ARRA funds in the most effective way possible – allowing staff to respond and adapt to challenges and barriers to deployment quickly – as we scale up in the coming months. Such flexibility will also expedite the drawdown of ARRA funds.

The table below shows the programmatic breakdown of ARRA funds across and within current residential programs. An asterisk means the amount has already been approved by the Deployment Committee:

Product	Target consumer / Measures	Total Capital Available	Terms to consumer	Targeted ARRA Credit Enhancements	
				Total Not-to-Exceed Enhancements	Approximate Split – LLR/IRB/TPI
Cozy Home Loan	• Low-to moderate-income homeowners (1-4 unit) • ≥640 FICO • ≤45% DTI • EE or RE	<u>$2.5M Available</u> - All private / non-CEFIA	• $50,000 Max • 10 year term • 5.99%	$410,000	$360,000 LLR* $50,000 IRB*
Smart-E Loan	• 1-4 unit homeowners • ≥680 or ≥640 FICO[1] • ≤43-45% DTI[1] • EE or RE [1] At lender's option	<u>~$28M Available</u> - All private / non-CEFIA	• $25,000 Max • 5-, 7-, 10-, or 12-year terms • 4.49%, 4.99%, 5.99%, or 6.99%, respectively (not to exceed rates, could be lower)	$2,804,667	$2,310,000 LLR* $190,000 IRB* $304,667 IRB $150,000 TPI
Solar Loan	• 1-4 unit homeowners • ≥640 FICO • ≤45% DTI • Solar only	<u>~$5M Available</u> - ~$4M private / non-CEFIA (*still in negotiations*)	• 15 year term • 6.49% with ITC prepayment • 9.99% without ITC prepayment	$705,311	$300,000 LLR* $405,311IRB
Solar Lease	• 1-4 unit homeowners • ≥640 FICO • ≤45% DTI • PV or SHW only	<u>$60M Available for residential and commercial (approx. $50M available for residential PV and SHW systems)</u> - $50M private / non-CEFIA	• 20 year term (PV) • 15 year term (SHW) • Escalating (2.9% per year) or non-Escalating options	$4,141,613	$3,500,000 LLR* $641,613 IRB
CHIF (still in development, but was selected via Innovation RFP)	• TBD	<u>TBD</u>	• TBD	$300,000	$300,000 LLR

Product details:

Cozy Home Loan

The Cozy Home Loan is a credit enhancement program that uses repurposed ARRA-SEP funds as a loan loss reserve and interest rate buy down to attract $2.5 million of private capital from Community Development Financial Institutions (i.e., Opportunity Finance Network) and community banks. The product, administered by the Housing Development Fund (HDF), provides 10-year loans for technologies that are consistent with the goals of Connecticut's Comprehensive Energy Strategy – including oil-to-gas conversions, high-efficiency HVAC, insulation, and renewable energy measures – to households below 80% of area median income in the Fairfield, Litchfield, and New Haven counties. HDF is using AFC First Financial to originate and service the loans. Having a professional, experienced servicer helps increase investor interest because it will ensure that fund operations run smoothly and payments are collected, remitted, and managed in a professional, timely manner. $410,000 of ARRA-SEP credit enhancements were approved by the Deployment Committee on November 30, 2012.

Use of IRB funds

The IRB will be used to support interest payments from HDF to the Opportunity Finance Network and other CDFIs which will provide the primary source of capital to Cozy Home Loans. This pool of funds can also be used to support HDF's internal cost of funds. The IRB funds were approved by CEFIA's Deployment Committee in November 2012 and advanced to HDF upon closing.

Use of LLR funds

The LLR funds have helped HDF attract private capital, and will be used to cover losses resulting from defaulted or delinquent loans, making the fund a more secure investment for community finance organizations. These funds are advanced only in the event of default. The LLR was approved by CEFIA's Deployment Committee in November 2012.

Smart-E Loan

The Smart-E Loan is a credit enhancement program that uses repurposed ARRA-SEP funds as a loan loss reserve and promotional interest rate buy down to attract nearly $28 million of private capital from local credit unions and community banks. The product provides low interest (i.e. 4.49-6.99%) unsecured loans at long terms (i.e. between 5 to 12 years) for technologies that are consistent with the goals of the Comprehensive Energy Strategy. This program is one of CEFIA's marquee residential programs because it enables the financing of the entire range of clean energy measures, and allows a diverse and dynamic group of local and regional lenders to participate in financing clean energy upgrades (presently 9 lenders effectively covering 100% of the state through 137 branches). A total of $2,500,000 of ARRA-SEP credit enhancements for Smart-E was approved by the Deployment Committee on November 30, 2012 (amended April 30, 2013). Staff is requesting the ability to use an additional $304,667 flexibly between IRBs, the program LLR, and developing a TPI product.

Use of IRB funds

The IRB will be used to support interest payments from CEFIA to participating Smart-E lenders for promotional purposes in driving customer demand. A variety of offers may be used including no interest payments for 1st six months and a buy-down of the interest rate for the entire loan term if multiple eligible measures are installed. The use of $190,000 for promotional IRBs was approved by the Deployment Committee at the April 30, 2013 meeting, and staff requests additional flexibility to, for instance, create promotions to drive volume as the program rolls out or increase the LLR amount as we attract new lenders.

Use of LLR funds

The LLR pool and innovative credit enhancement structure has enabled CEFIA to attract nine local and regional lenders (and counting) into our Smart-E program. The general program structure and the use of LLR funds were approved by the Deployment Committee at the November 30, 2012 meeting. Most, if not all, of the lenders have had no previous experience lending specifically for renewable energy or energy efficiency and the LLR has been a key selling point in enabling them to offer low rates and maturities in excess of five years for what the institutions view and process as unsecured loans. The financing agreements CEFIA signs with each lender allow lenders to cover up to 7.5% of losses from loans in their portfolio[1], after taking an initial 1.5% loss on their portfolios.

As a testament to the program design, the below shows a sampling of some participating lenders' unsecured products, which have markedly higher interest rate and shorter term than a Smart-E loan:

Participating Smart-E Lender	**Product**	**Term**	**Rate**
Nutmeg Federal Credit Union	Personal Loans	1-5 year terms available	"As low as" 7.99%
Core Plus Federal Credit Union	Lifestyle Loans	5 years	7.24-14.24%
Thomaston Savings Bank	Personal Loans	1-5 year terms available	6.9-10.9%

Use of Third Party Insurance Funds

CEFIA staff intends to use a small portion of the ARRA funds allocated to the Smart-E product for a third party energy savings guarantee pilot. Third-party loan insurance is a financial arrangement whereby a third party bears some portion or all of a loss on a specific portfolio. This would likely involve CEFIA purchasing an insurance policy from a specialty insurer against losses on a portfolio of residential clean energy loans up to a fixed percentage (the stop loss) of the sum of all the original loan amounts. Staff envisions designing a program and structuring a RFP for a provider in early 2014, depending on how the product ramps.

Solar Loan

The CT Solar Loan is a loan program that uses repurposed ARRA-SEP funds as a loan loss reserve and interest rate buydown, and debt from CEFIA approved by the Board of Directors to leverage private capital to provide 15-year secured loans at 6.49% interest rate for homeowners interested in owning solar PV systems.

Solar is a long-lived asset, producing benefits for 25 years, and in order to make the cash flow proposition appealing to homeowners, the term of the financing product must extend past the 10

[1] The financing agreement allows lenders to cover up to 15% of loan losses for loans with credit scores between 640-680, however, CEFIA expects lenders will not make many loans in this bucket.

year mark to be competitive with current electricity rates, especially in the case of the solar loan because the MACRS tax benefit is unavailable in residential applications. The structure of the Loan fund, utilizing the ARRA enhancements described below, allows the solar loan to stretch over 15 years, 60% of the estimated life of the 25 system.

CEFIA is in the process of raising $4-4.5M of private capital to fund the loan pool, and the flexibility with an IRB or some additional LLR will help us close funding more quickly. Additionally, the ability to offer promotions to the end customer will help us build the pipeline, making the fund even more attractive and less risky to potential investors.

The Deployment Committee approved a $300,000 LLR on November 30, 2012. Staff is requesting an additional $405,311 to use flexibly between an LLR and investor and consumer IRBs.

Use of IRB funds

Long term, unrated instruments have been universally unappealing to capital providers, especially in our current low-rate environment. This is due to the opportunity cost of their funds – rates are at historic lows and by all accounts are likely to increase in the future. So capital providers are loath to put their money into a long term vehicle where they might miss the ability to take advantage of a higher interest rate environment (so-called interest rate risk). This is a risk ineffectively addressed by a LLR. Therefore, CEFIA's subordinated debt and interest rate buydown to senior lenders plays a key role not only because it brings down the weighted cost of capital but also because it provides a term extension, improving cash flows for homeowners. For the loan, CEFIA staff is currently in discussions with at least three likely senior lenders into the structure and contemplates three tracks, subject to negotiations:

- Approximately $1M of 15-year CEFIA capital, for which CEFIA will utilize ARRA funds to buy down the interest rate from 5% to 2.5%
- Approximately $2.5M of participation for two senior lenders, at 15 years offered at a maximum of [in negotiation] %, which CEFIA will buy down to [in negotiation] %
- Approximately $1.5M of participation for 10 years offered at a maximum of [in negotiation]%, which CEFIA may buy down to [in negotiation] % through the use of the ARRA IRB funds.

CEFIA's board approved $2,200,000 of CEFIA subordinate investment into the Solar Loan fund in November 2012, and the full CEFIA board increased the amount of total CEFIA debt investment to $5,000,000 in July 2013 with an expectation that private capital (noted above) would reduce CEFIA exposure to approximately $1,000,000.

The inclusion of an IRB is a central point of negotiation as we approach new types of senior lenders, including foundations, family offices, and crowd sourcing. For instance, CEFIA is currently in discussions with a family office that cannot go past 10 years in final maturity, so an IRB to a second potential senior lender, a foundation, and to the subordinated debt (CEFIA) makes a 15 year piece more accessible and improves the overall cash flows of the fund and to the homeowners. Additionally, structuring the fund with multiple lenders that have varying appetites for maturities allows CEFIA to increase our leverage at the same time that we are introducing new sources of capital to the solar asset class.

Beyond the internal structuring, the Solar Loan product has seen a 21% increase in pipeline in just one week from reducing the effective rate by reducing the upfront loan fee. Staff would like the flexibility to offer small interest rate promotions for the Solar Loan to the customer to drive volume if necessary.

Use of LLR funds

CEFIA expects to allocate enough ARRA-SEP funds for a LLR to support cash flows to the fund, offering a 6% cushion to lenders to the fund. This will help mitigate the risk of default, and increase senior lenders' comfort with the structure. CEFIA's Deployment Committee approved funds for the LLR in November 2012.

Solar Lease

The CT Solar Lease II uses repurposed ARRA-SEP funds as a loan loss reserve and interest rate buydown, and debt and equity from CEFIA. CEFIA's participation in the lease structure was approved by the Board of Directors to attract $50 million of private capital from a tax equity investor and a syndicate of local lenders to provide homeowners with FICO scores of 640 and above with a no upfront financing option for residential solar PV and solar hot water system deployment.

The structure of the fund enables the Lease to stretch out 20 years for PV, 80% of the estimated 25-year useful life of the equipment. For Solar Hot Water, the term of the lease stretches 15 years, or about 60% of the estimated 25-year useful life of the equipment.

The Board of Directors approved $3,500,000 for a Lease Loss Reserve, in addition to CEFIA's debt and equity contribution, for the Solar Lease on February 15, 2013. Staff is requesting an additional $641,643 to use as an internal IRB.

Use of IRB funds

CEFIA has targeted a return of 5.25%, matching the 15 year (with two year build) rate to the senior note. This rate does not compensate for any risk associated with the additional five years of long-tailed rate increase, or our subordinated position. CEFIA will use ARRA funds to buy down the rate of its CEFIA capital, based on the present value of CEFIA's money for the life of the products (assuming a 2-year build cost for the Solar Lease). CEFIA, as a "Green Bank" with directives that include maximizing the amount of clean energy deployed and public:private leverage, does not have the same sensitivity to interest rate risk as a private capital provider. The effect is that CEFIA is able to expand the pool of funds available at a lower overall cost to taxpayers and ratepayers.

Use of LLR funds

The LLR will support payments from delinquent or defaulted lease systems. The ability to support cash flows helped CEFIA de-risk the structure for US Bank, CEFIA's tax equity provider, was one of the driving factors enabling CEFIA to leverage the fund – and increase the amount of funding available to CT residents by bringing in additional private capital.

CONCLUSION

CEFIA has created ambitious residential programming and goals for almost $90M of residential deployment in the coming fiscal years. Added flexibility, within the guidelines above, gives the residential and finance teams the ability to more quickly attract and deploy capital in the residential sector.

Staff requests flexibility to deploy ARRA-SEP funds within each product to drive capital sourcing and product deployment as effectively and capital-efficiently as possible. To recap, the not-to-exceed, and the additional amounts, requested are:

Product	Not-to-Exceed ARRA-SEP Amount	Already-Approved	Additional Requested
Cozy Home Loan	$410,000	$410,000	$0
Smart-E Loan	$2,804,667	$2,500,000	$304,667
Solar Loan	$705,311	$300,000	$405,311
Solar Lease	$4,141,643	$3,500,00	$641,643
CHIF Product (TBD)	$300,000	$300,000*	$0
Total	**$8,361,620**	**$7,010,000**	**$1,351,620**

*to be approved upon development

RESOLUTION

RESOLVED, that funding for loan loss reserves, interest rate buydowns and third party insurance products (“Credit Enhancements”) through the use of repurposed American Recovery and Reinvestment Act State Energy Program (“ARRA-SEP”) program funds be approved for CEFIA’s Cozy Home Loans, Smart-E Loans, CT Solar Loan, and CT Solar Lease programs (the “Programs”) in amounts materially consistent with the Memorandum presented to the Board of Directors dated October 18, 2013.

RESOLVED, that additional ARRA-SEP funds are approved for the Programs in the not-to-exceed set forth below:

a. $304,667 for Smart-E Loans;
b. $405,311 for CT Solar Loan; and
c. $641,643 for CT Solar Lease.

RESOLVED, that the President of CEFIA; and any other duly authorized officer of CEFIA, is authorized to use their best discretion to utilize the most effective use of the entirety of the Credit Enhancements in amounts not to exceed:

a. $410,000 for Cozy Home Loans;
b. $2,804,667 for Smart-E Loans;
c. $705,311 for CT Solar Loan;
d. $4,141,643 for CT Solar Lease; and
e. $300,000 for a to-be-developed CHIF product which will be brought back to the Board of Directors for review and final approval at a later date within fiscal year 2014.

RESOLVED, that the President of CEFIA; and any other duly authorized officer of CEFIA, is authorized to execute and deliver, any contract or other legal instrument necessary to effect the Credit Enhancements on such terms and conditions consistent with current executed legal documents and as he or she shall deem to be in the interests of CEFIA and the ratepayers no later than six months from the date of this resolution; and

RESOLVED, that the proper CEFIA officers are authorized and empowered to do all other acts and execute and deliver all other documents as they shall deem necessary and desirable to effect the above-mentioned legal instrument.

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Market Watch Report

Residential Solar Investment Program

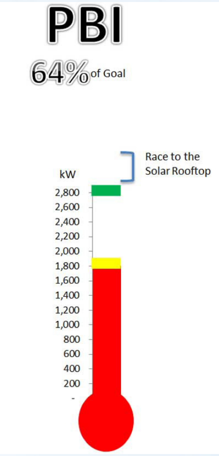
Program Data as of September 27, 2013

Executive Summary

EPBB vs. PBI Update Edition:

- For the first time under the RSIP, PBI applications are outpacing EPBB applications, such that PBI projects now make up nearly 38% of all installations under Step 3 of the program
- Accelerated PBI growth is happening despite higher prices, as PBI projects are being installed at a 12% premium to EPBB projects on a dollar per Watt basis
- In addition, due to the Solarize effect of a number of very competitively priced EPBB projects reaching the incentive cap of 35% of total installed costs, the overall incentive level per Watt is even more strongly tilted in favor of EPBB installations, coming in 18% less expensive from a ratepayer perspective

Race to the Rooftop



The **YELLOW BAR** at 1,800 kW represents a point in time when CEFIA staff will make a recommendation on the Step 4 funding and incentive level to the Deployment Committee for consideration. The **GREEN BAR** at 2,800 kW represents a point in time when the Deployment Committee and CEFIA staff will propose Step 4 funding and incentive level to the Board of Directors for consideration and approval.

	Rebate Step 3	PBI Step 3	Total	Average
Applications Received	456	278	734	
Applications Approved	452	273	725	
Applications In Progress	123	23	146	
Applications Completed	131	36	167	
Total Cost	$13,879,846	$8,865,478	$22,745,323	
Total kW STC	3,206.2	1,805.7	5,011.9	
Average System Size kW STC	7.1	6.6		6.9
Cost / kW STC	$4,329	$4,910		$4,538
Average Total Cost	$30,708	$32,474		$31,373
Total Incentive Amount	$3,740,487	$2,573,268	$6,313,755	
Incentive / kW STC	$1,167	$1,425		$1,260
ZREC Equivalent Incentive Price	$0.077	$0.087		
Rooftop Solar Capacity Remaining	593.8 kW	994.3 kW	1,588.1 kW	

Applications Received – the total number of applications submitted by installers and received by CEFIA through PowerClerk.

Applications Approved – the total number of applications received and approved by CEFIA staff for project incentives.

Applications In Progress – the total number of projects that have received 60% in upfront incentives for delivery of materials to the site.

Applications Completed – the total number of projects that have received 100% in incentives after inspection and completion of the project.

ZREC Equivalent Incentive Price - Given the total system cost, total incentive and total capacity (stc) of all Approved applications, the ZREC Equivalent Price is determined by calculating the net present ZREC Equivalent Price from a 15 years stream of payments that equals net present value of CEFIA's incentive.

Note: Solarize kWs are now included in the pricing data.

About the Clean Energy Finance and Investment Authority

CEFIA was established by Connecticut's General Assembly on July 1, 2011 as a part of Public Act 11-80. This new quasi-public agency supersedes the former Connecticut Clean Energy Fund. CEFIA's mission is to help ensure Connecticut's energy security and community prosperity by realizing its environmental and economic opportunities through clean energy finance and investments. As the nation's first full-scale clean energy finance authority, CEFIA will leverage public and private funds to drive investment and scale-up clean energy deployment in Connecticut.

Historical Program Data (Previous Steps)

Combined Fully Subscribed Steps	Rebate	PBI	Total	Average
Applications Received	777	320	1,097	
Applications Approved	777	320	1,097	
Applications In Progress	95	60	155	
Applications Completed	679	217	896	
Total Cost	$24,844,798	$10,877,951	$35,722,749	
Total kW STC	5,456.1	2,285.4	7,741.5	
Average System Size kW STC	7.0	7.1		7.1
Cost / kW STC	$4,554	$4,760		$4,614
Average Total Cost	$31,975	$33,994		$32,564
Total Incentive Amount	$8,706,127	$4,207,441	$12,913,568	
Incentive / kW STC	$1,596	$1,841		$1,668
ZREC Equivalent Incentive Price	$0.105	$0.113		

Based on estimated lifetime system production at the current installed cost of top residential solar PV installers in Connecticut, and incorporating financing charges, RSIP projects now represent an average levelized cost of solar energy of about $0.238 / kWh. Of that total, CEFIA's support accounts for about $0.068 / kWh.

Estimated Environmental Benefits based upon all Approved Applications

Lifetime CO_2 Reduction	Lifetime NO_x Reduction	Lifetime SO_2 Reduction	Annual Cars off the Road	Equivalent Acres of Trees Planted
314,253,574 lbs.	142,429 lbs.	130,308 lbs.	1,046	2,095

Estimated Economic Development and Jobs Benefits based upon all Approved Applications[1]

Direct Jobs Created	Indirect and Induced Jobs	Total Jobs Created
345	555	900

1
- Direct jobs are jobs created in CT that are directly related to manufacturing and system assembly in CT, as well as installation of the PV systems.
- Indirect jobs are jobs created at CT suppliers in order to meet demand resulting from the new systems coming on line. An example would be increased employment associated with metal bending or wiring supplied to integrate and install the units.
- Induced jobs are jobs generated by spending from households that benefit from the additional wages and business income they earn through all of the direct and indirect activity. An example would be increased employment at a local restaurant, because installers are working overtime, have extra income and don't have time to eat at home.

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

A Message from the President and CEO

The U.S. Department of Energy (DOE) SunShot Initiative Rooftop Solar Challenge provided funding support for the “Sun Rise New England – Open for Business” project (the Project), giving Connecticut an opportunity to explore where non-hardware or “soft costs” can be reduced for rooftop solar photovoltaic (PV) installation. This Project supports Governor Malloy’s clean energy goals to deploy “cleaner, cheaper, and more reliable sources of energy.” He has challenged us to “do more with less…and faster!”

As this final project report highlights, working with the Project partners, we were able to discover several areas where we can reduce these “soft costs” – by streamlining permitting, planning and zoning, and interconnection rules and processes, reducing customer acquisition costs, and increasing access to financing. As a result of the Project, we also saw a 113% increase in our DOE “solar metrics” progress score. By continuing to lower overall installed costs of rooftop solar PV and reducing market barriers, we can make clean energy more accessible and affordable to household, business, and institutional consumers.

Over this past year and a half, the Clean Energy Finance and Investment Authority (CEFIA) and its partners have achieved the following results:

- **Deployment** – we doubled the deployment of residential rooftop solar PV over what had been done from 2000 through 2011 – an additional 13 MW on top of the existing 13 MW. We have a statutory goal of 30 MW of deployment by 2022, which we expect to meet seven years ahead of schedule in 2015. We have begun to work with Geostellar, a DOE SunShot Initiative Incubator award recipient, to chart out Connecticut’s residential rooftop solar PV potential – and we believe that it is economical at the gigawatt scale.
- **Leverage** – as a result of installed cost reductions of some 15% over this past year from $5.20/W to $4.50/W, and a reduction in the proportion of ratepayer incentives being offered per project from 50% of the total installed costs to 25%, nearly $65 million of investment has gone into residential solar PV using $20 million of ratepayer resources at a ratio of over three to one. As we continue to transition the market away from being driven by subsidies and towards easier access to affordable private capital, we will continue to increase our ratepayer leverage and realize our statewide potential.
- **Financing** – with our “green bank” focus we created the first public-private partnership including a $60 million fund with a tax equity investor and syndicate of debt providers to offer customers a lease product called the Connecticut Solar Lease whose repayment is cheaper than the price a customer would have paid for their electricity and will ultimately replenish ratepayer funds contributed to CEFIA. We also offer a 5, 7, 10, and 12-year maturity term, low interest unsecured loan called the Smart-E Loan in partnership with

local credit unions and community banks, as well as a 15-year unsecured loan called the Connecticut Solar Loan. We figured out how Commercial Property Assessed Clean Energy (C-PACE) can be used for commercial rooftop solar PV to reduce the level of subsidy needed in the state's zero emissions renewable energy credit reverse auction to enable a solar PV project to better compete and move forward as a result of low interest rates and longer maturity terms.

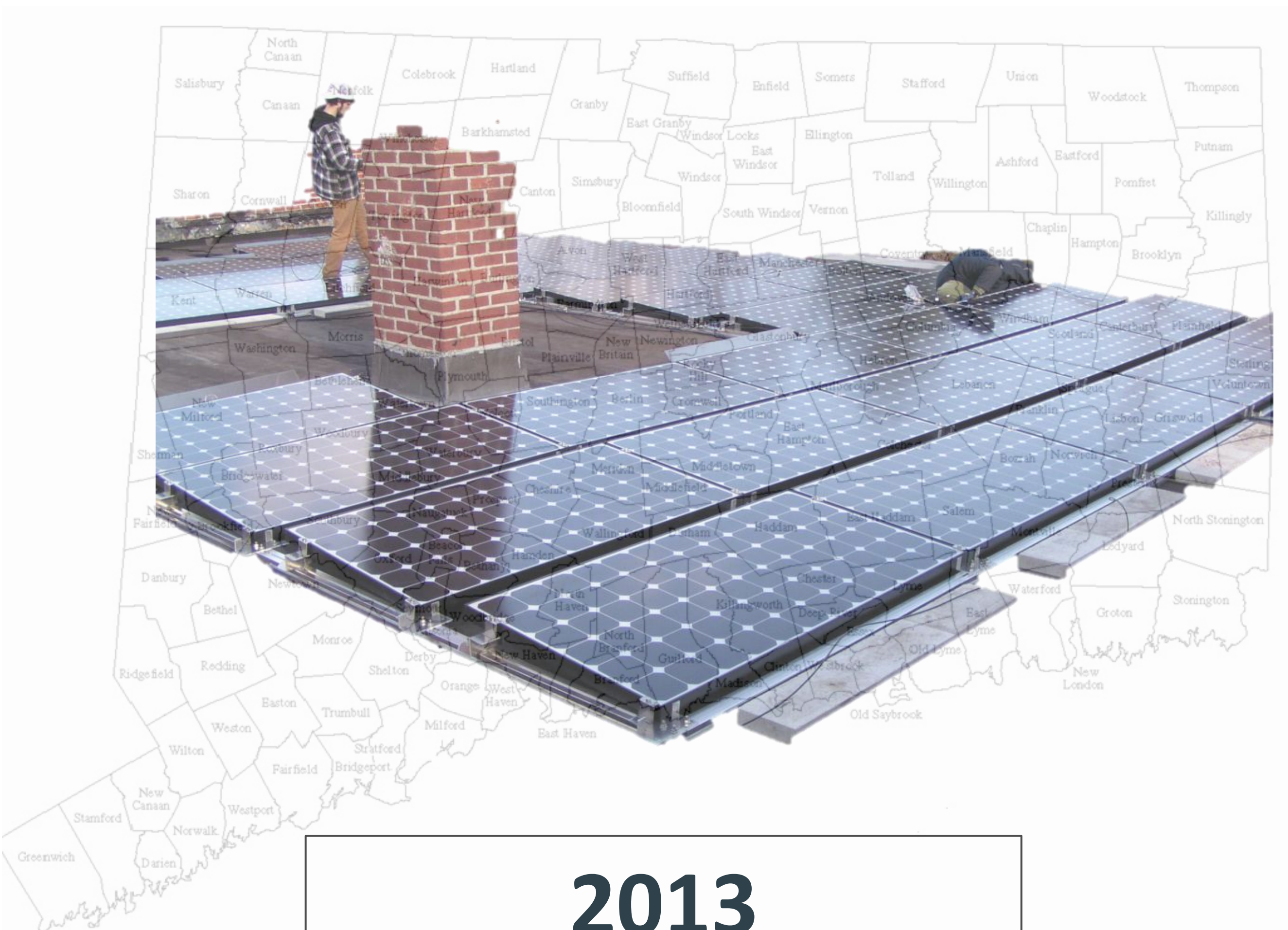
As a result of Governor Malloy's imperative for Connecticut's "green bank" to "do more with less…and faster," since we began the Project we have not only attracted an investment of $125 million in residential rooftop solar PV which will lead to about 30 MW of deployment, but in the process we have created nearly 1,000 jobs in a year-and-a-half and are reducing over 150,000 tons of carbon dioxide emissions over the life of the installed residential rooftop solar PV systems.

Sun Rise New England – Open for Business has enabled Connecticut to see the true potential of the rooftop solar PV market. Our focus now is to continue to work with the industry to drive down "soft costs" not only in Connecticut, but throughout the New England region so that we can meet the goals of providing cleaner, cheaper and more reliable sources of energy for Connecticut ratepayers, while also creating jobs and supporting local economic development in our communities.

Bryan Garcia
President and CEO

SUN RISE NEW ENGLAND - OPEN FOR BUSINESS

CONNECTICUT'S ROOFTOP SOLAR CHALLENGE



2013

FINAL PROJECT REPORT

EXECUTIVE SUMMARY

United States Department of Energy

SunShot Initiative Rooftop Solar Challenge

Prepared by Connecticut's

Sun Rise New England - Open for Business Team

October 10, 2013

www.energizect.com/sunriseNE

CLEAN ENERGY
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Executive Summary

The U.S. Department of Energy (DOE) SunShot Initiative is a collaborative national effort targeting a 75% reduction in installed solar technology system costs by 2020. Achieving this level of cost reduction would enable scaled deployment of solar energy systems across the country. The U.S. DOE SunShot Initiative Rooftop Solar Challenge provided funding and resources to regional awardees to address highly varying, time-intensive and costly administrative processes required to finance and install residential and commercial rooftop solar photovoltaic (PV) systems. Improving these processes will result in the reduction of non-hardware or "soft costs" and the elimination of market barriers that are becoming increasingly significant as solar PV hardware costs continue to fall. Connecticut's Sun Rise New England – Open for Business team was one of twenty-two teams working to streamline permitting, planning and zoning, and interconnection rules and processes, and increase access to financing for rooftop solar PV.

The Connecticut (CT) project team, led by the Clean Energy Finance and Investment Authority (CEFIA), achieved a 113% increase in the overall DOE Solar Metrics score reflecting improvements in the action areas indicated in Table 1. This work was supported by almost $482,000 of funding from the U.S. Department of Energy (DOE) as well as a documented team in-kind contribution of $175,746 for work performed between February 15, 2012 and February 14, 2013.

Table 1: Connecticut Project DOE Solar Metrics Scores

DOE Solar Metrics Action Area	Score 2011	Score 2013	% Increase
Permitting Process	47	269	427%
Interconnection Process	88	93	6%
Enabling Financing Options	55	125	127%
Siting, Planning and Zoning	8	30	275%
NNEC: Net Metering	85	85	0
NNEC: Interconnection	0	0	0
Installed PV Capacity and PV Costs	0	0	0
Total	283	602	113%

Project team members and other collaborators included 12 participating CT jurisdictions - Bridgeport, Cornwall, Coventry, Danbury, Fairfield, Greenwich, Hampton, Manchester, Middletown, Milford, Stamford, West Hartford), Solar Connecticut, Yale University, the University of Connecticut, Simply Civic, CT's two major utilities – Connecticut Light & Power (CL&P) and United Illuminating Co. (UI), the Department of Energy and Environmental Protection (DEEP), several project team consultants with valuable expertise, and many other individuals and organizations. See the Acknowledgements – Project Contributors section of this report for a complete list.

To better understand the opportunity for solar PV soft cost reduction, the project team followed three complementary approaches: (1) Collection and analysis of required DOE Solar Metrics data encompassing all Rooftop Solar Challenge topic areas to assess the status of processes and rules primarily at the local/ jurisdiction and utility levels, (2) Bottom up estimating of soft cost reduction opportunities to identify low hanging fruit as well as to compare with numbers provided by national lab analyses and analysis of CEFIA data, and (3) Review of existing research on non-hardware or soft costs for solar PV conducted by U.S. national labs, and analysis of and comparison with CEFIA incentive program data, in particular recent CT residential solar PV installation data. The biggest takeaways from the analysis efforts were as follows:

- Soft costs for solar PV installation are significant and over time could be reduced to levels that allow total installed costs to approach Germany costs (low due to dramatically reduced soft costs). Further hardware and soft cost reductions will be needed to reach DOE's 2020 target of $1.50/W. The largest reductions in total residential solar PV installation costs in CT seen to date result from Solarize customer aggregation campaigns launched in 2012, achieving over $1/W cost reductions versus non-

Solarize (2012 and preliminary 2013 data). Two thirds of Solarize cost reductions result from reduced soft costs. Solarize 2013 data reflects a \$3.86/W total installed cost, with only 38% due to soft costs. See Table 2 below for a comparison of total, hardware and soft costs in Connecticut and Germany.

Table 2: Connecticut Residential Solar PV Hardware and Non-Hardware Costs versus Germany Costs and SunShot Initiative Target for 2020

Summary of Analysis on Residential Solar PV System Component Costs - all costs in this table are **average costs in \$/W** unless shown as a %	**CT CEFIA 2012 Data**	**CT CEFIA 2012 Data Non-Solarize**	**CT CEFIA 2012 Data Solarize**	**CT CEFIA 2013 Data**	**CT CEFIA 2013 Data Non-Solarize**	**CT CEFIA 2013 Data Solarize**	**Germany LBNL Survey; BNEF; Langen 2011**	**U.S. SunShot Initiative 2020 Target**
Total Cost	4.95	5.11	3.91	4.50	4.89	3.86	3.00	1.50
Hardware Cost	2.59	2.64	2.24	2.22	2.11	2.38	2.38	0.85
Non-Hardware/ Soft Cost	2.36	2.47	1.67	2.28	2.78	1.48	0.62	0.65
Hardware Cost %	52%	52%	57%	49%	43%	62%	79%	57%
Non-hardware/ Soft Cost %	48%	48%	43%	51%	57%	38%	21%	43%

- Further work can be done to obtain better resolution on solar PV cost components. CEFIA could improve definition and collection of solar PV cost data requested of installers through CEFIA's Residential Solar Investment Program (RSIP), through which CT installers apply for residential solar PV installation incentives. Non-residential solar PV installations are now incentivized through CT's utility administered Zero Emissions Renewable Energy Credit (ZREC) Program, which began in 2012 (detailed cost component data was not being collected for this program).
- Large soft cost reduction opportunities exist in customer acquisition, installer overhead and labor, permitting, and interconnection costs on the order of 20-25% in aggregate in the near term. Examples of specific cost reduction opportunities are as follows:
  - **Permitting** – The project team estimated the permitting cost savings opportunity to be \$1900 for an average-sized residential solar PV system in CT in 2012 (7kW, \$35,000), which translates to \$0.24/W.
  - **Customer acquisition** – Acquiring customers has been shown by national lab studies and verification by CT installers to be a significant cost, on the order of \$0.67/W (industry average) or \$0.50/W (CT installer estimate). The project team estimates that this cost was reduced to \$0.14/W for solar PV systems installed through the Solarize Program.
  - **Installer overhead and labor, and other balance of system costs** – The CT Solarize Program has achieved over \$1/W in cost reductions over non-Solarize solar PV systems. A portion of this cost, roughly \$0.35/W, is attributable to customer acquisition cost reduction. The rest, as well as further cost reduction potential through Solarize and more generally, is thought to reflect installer overhead and labor savings, as well as remaining balance of system costs.
  - **Interconnection** – The project team worked with CL&P and UI to explore opportunities for cost reductions and process improvements. A cost reduction example was UI removing the need for the additional equipment and installer labor cost associated with installation of a second meter needed for net metering, estimated at \$500 for a residential installation. Two examples of process streamlining are: (1) CL&P developing and implementing an online interconnection application, and (2) CL&P and UI waiving the annual proof of insurance requirement for solar PV

systems 10kW and smaller. Additional cost reductions and process improvements have been suggested by installers including reduction of interconnection fees for systems over 10kW in size, and adoption of online processes by both utilities (thus far CL&P is online). More details on these suggested improvements are provided in the respective section of this report. Along with improvement opportunities, this report also acknowledges developments and improvements which CL&P and UI have made pro-actively including process improvements that have streamlined interconnection turn-around times. A specific example is CL&P's waiving of witness tests for installers after the first three installations.

Data collected during the study through surveys, questionnaires, emails, and in person and phone interviews, along with research on best practices in various topic areas informed the project team's development of tools and recommendations for improving practices in Connecticut. While some of these recommendations will clearly bring about cost reductions, and while the ultimate goal of the SunShot Initiative is to achieve dramatic cost reductions, some process, legal, and regulatory improvements don't have immediate or easily measured impacts on cost reduction, but are critical to removing barriers to broad deployment of solar energy.

The following are observations and recommendations pertaining to improvements that can be made in the permitting, building codes, planning and zoning and financing arenas, at the local and state levels, some impacting costs and some having impact in removal of barriers to solar PV deployment. The body of the report provides more information about each the following topics, generally organized in terms of local/jurisdictional level recommendations versus state level recommendations.

- **Permitting** – Some argue that permitting costs are not a significant soft cost. The experience of our project team is that permitting costs can in fact be significant and that the most easily quantified permitting cost, the permit fee, can by itself be quite high (reaching over $1500 in at least one CT jurisdiction). Secondly, some jurisdiction processes are so burdensome as to require a lot of extra man-hours spent on acquiring a permit. A Clean Power Finance survey of 273 installers representing 12 states found that 36% of installers avoid jurisdictions with particularly challenging permitting processes.[1] An installer avoiding bringing solar PV to a jurisdiction due to difficult permitting is the ultimate COST to customers and the industry. There was input from two to three individuals during the study who recommended that the state of Connecticut adopt a state-level permitting system; this certainly sounds efficient, though this idea would require further research. In the meantime, it makes sense to develop tools and measures which standardize and streamline current permitting processes. Standard tools and consistent practices across the state would make it easier to adopt state-level permitting in the future.
- **Building Codes** – Connecticut's State Building Code includes many model codes within it including the model 2009 International Energy Conservation Code (IECC) which provides energy efficiency requirements for new construction. More can be done with respect to codes by adopting the 2012 IECC and by making improvements to CT's building code where appropriate to include a specification for "solar-ready" construction, as has been done in California and Minnesota. Lastly, where the state is not yet ready to adopt a stricter building code, jurisdictions should be enabled to do so locally through enactment of a model stretch code as has been done in Massachusetts.

[1] www.cleanpowerfinance.com/about-us/media-center/press-release/more-than-a-third-of-u-s-solar-installers-say-permitting-requirements-limit-growth and "Nationwide Analysis of Solar Permitting and the Implications for Soft Costs," James Tong, Senior Director, Clean Power Finance, Dec.2012, solarpermit.org/media/upfiles/CPF-DOE_Permitting_Study_Dec2012_Final.pdf.

- **Planning and Zoning (P&Z)** – Though most local permitting is not hindered by planning and zoning requirements, P&Z review should not be required for standard residential and small scale non-residential rooftop solar PV installations. This best practice should be formalized as part of a model permitting process and/or solar PV ordinance adopted by CT jurisdictions. In CT, much work can be done to provide solar access protections for future solar PV customers and those who have already installed solar PV. The first step is to adopt a state level solar access law to protect a constituent's right for access to sunlight, which can be impeded by neighboring structures and trees, as well as the right to install solar PV, which can be impeded by private and local government restrictions.
- **Financing** – CEFIA has made great strides in developing and launching new financing products for residential and non-residential clean energy deployment and solar PV installation in particular. Innovative financing will make solar PV accessible to more customers, bring in affordable private capital to help CT's clean energy industry grow, and help CEFIA and the industry shift away from ratepayer subsidies.

Other developments in CT related to this project are as follows:

- Legislation passed in 2013 now mandates that jurisdictions waive commercial property tax assessments on solar PV equipment. Without this tax waiver, the economic benefits of installing solar PV on a commercial property were at jeopardy. Other significant legislative developments included passing of enhanced virtual net metering rules, enhanced C-PACE provisions, and many other provisions reflecting strong support for clean energy deployment. See section 5.3 of this report for brief summaries and links to major public acts adopted in CT's 2013 legislative session, following on the landmark legislation, PA-1180, passed in 2011, also referenced in the report.
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- University of Connecticut project team members produced an analysis on solar PV adoption patterns utilizing sophisticated map-based spatial analysis methodology. This analysis will inform Connecticut stakeholder understanding of factors spatially associated with adoption of solar PV.

Though the above overview highlights a few significant findings and results, please see the Table of Contents to assist you in finding more detailed information on specific topics addressed by this project.

The project team understands that the topics addressed in this report are in many cases complex and nuanced and may require further understanding. **We welcome any corrections, feedback, information and insights you are able to provide. Please contact us by email at: sunshot@ctcleanenergy.com.**

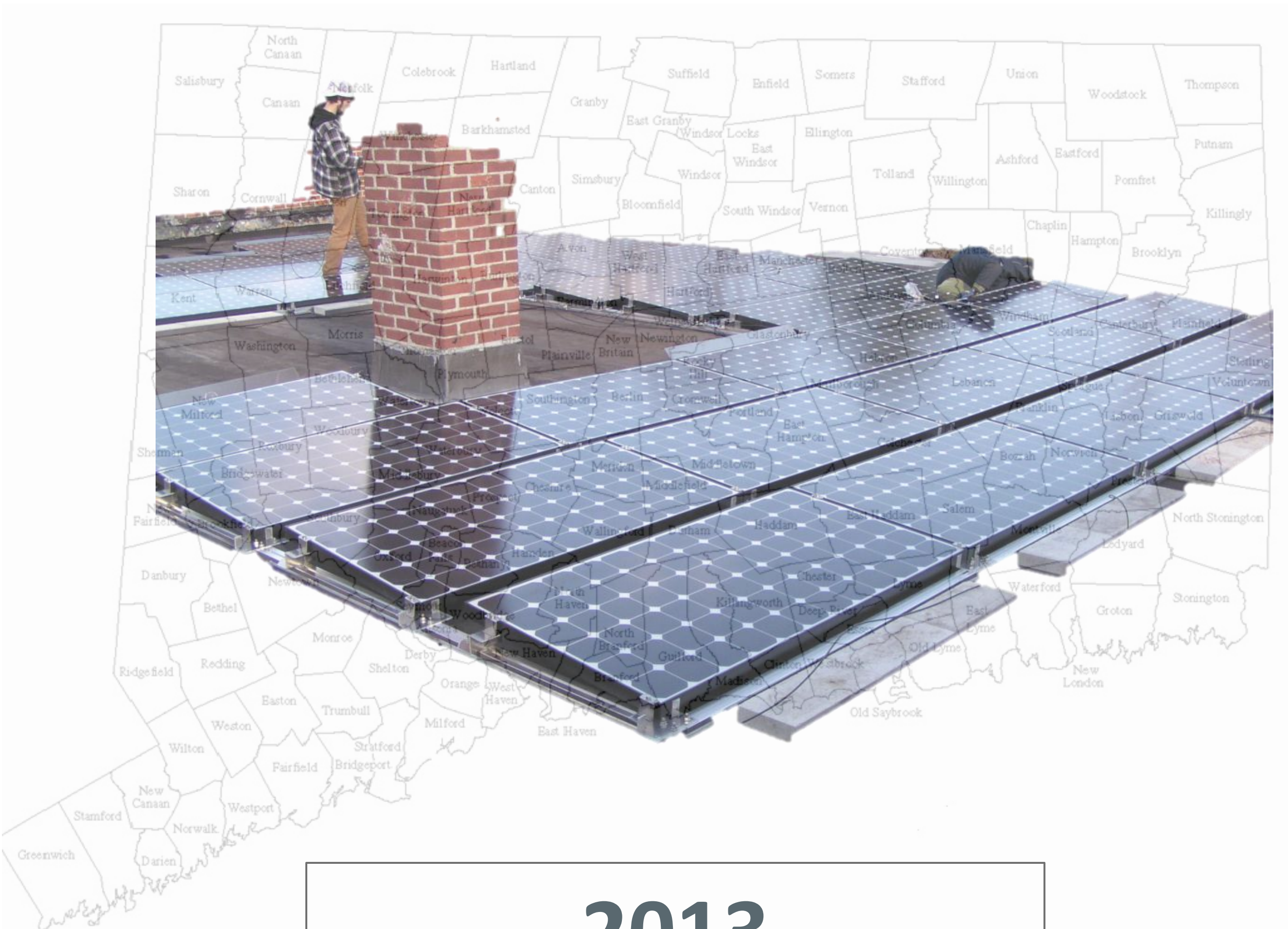
Regarding websites for accessing further information, please note:

- This Project Report, a CT Permitting Guide and associated stand-alone documents and templates are provided at the following website: **www.energizeCT.com/sunriseNE.**
- CEFIA-specific organizational information is provided on the CEFIA website: **www.ctcleanenergy.com.**

All of Connecticut's energy related program and resource information is now provided on the EnergizeCT platform, which we encourage you to access at www.energizeCT.com.

SUN RISE NEW ENGLAND - OPEN FOR BUSINESS

CONNECTICUT'S ROOFTOP SOLAR CHALLENGE



2013

FINAL PROJECT REPORT

United States Department of Energy

SunShot Initiative Rooftop Solar Challenge

Prepared by Connecticut's

Sun Rise New England - Open for Business Team

October 15, 2013

www.energizect.com/sunriseNE

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Executive Summary

The U.S. Department of Energy (DOE) SunShot Initiative is a collaborative national effort targeting a 75% reduction in installed solar technology system costs by 2020. Achieving this level of cost reduction would enable scaled deployment of solar energy systems across the country. The U.S. DOE SunShot Initiative Rooftop Solar Challenge provided funding and resources to regional awardees to address highly varying, time-intensive and costly administrative processes required to finance and install residential and commercial rooftop solar photovoltaic (PV) systems. Improving these processes will result in the reduction of non-hardware or "soft costs" and the elimination of market barriers that are becoming increasingly significant as solar PV hardware costs continue to fall. Connecticut's Sun Rise New England – Open for Business team was one of twenty-two teams working to streamline permitting, planning and zoning, and interconnection rules and processes, and increase access to financing for rooftop solar PV.

The Connecticut (CT) project team, led by the Clean Energy Finance and Investment Authority (CEFIA), achieved a 113% increase in the overall DOE Solar Metrics score reflecting improvements in the action areas indicated in Table 1. This work was supported by almost $482,000 of funding from the U.S. Department of Energy (DOE) as well as a documented team in-kind contribution of $175,746 for work performed between February 15, 2012 and February 14, 2013.

Table 1: Connecticut Project DOE Solar Metrics Scores

DOE Solar Metrics Action Area	Score 2011	Score 2013	% Increase
Permitting Process	47	269	427%
Interconnection Process	88	93	6%
Enabling Financing Options	55	125	127%
Siting, Planning and Zoning	8	30	275%
NNEC: Net Metering	85	85	0
NNEC: Interconnection	0	0	0
Installed PV Capacity and PV Costs	0	0	0
Total	283	602	113%

Project team members and other collaborators included 12 participating CT jurisdictions - Bridgeport, Cornwall, Coventry, Danbury, Fairfield, Greenwich, Hampton, Manchester, Middletown, Milford, Stamford, West Hartford), Solar Connecticut, Yale University, the University of Connecticut, Simply Civic, CT's two major utilities – Connecticut Light & Power (CL&P) and United Illuminating Co. (UI), the Department of Energy and Environmental Protection (DEEP), several project team consultants with valuable expertise, and many other individuals and organizations. See the Acknowledgements – Project Contributors section of this report for a complete list.

To better understand the opportunity for solar PV soft cost reduction, the project team followed three complementary approaches: (1) Collection and analysis of required DOE Solar Metrics data encompassing all Rooftop Solar Challenge topic areas to assess the status of processes and rules primarily at the local/ jurisdiction and utility levels, (2) Bottom up estimating of soft cost reduction opportunities to identify low hanging fruit as well as to compare with numbers provided by national lab analyses and analysis of CEFIA data, and (3) Review of existing research on non-hardware or soft costs for solar PV conducted by U.S. national labs, and analysis of and comparison with CEFIA incentive program data, in particular recent CT residential solar PV installation data. The biggest takeaways from the analysis efforts were as follows:

- Soft costs for solar PV installation are significant and over time could be reduced to levels that allow total installed costs to approach Germany costs (low due to dramatically reduced soft costs). Further hardware and soft cost reductions will be needed to reach DOE's 2020 target of $1.50/W. The largest reductions in total residential solar PV installation costs in CT seen to date result from Solarize customer aggregation campaigns launched in 2012, achieving over $1/W cost reductions versus non-

Solarize (2012 and preliminary 2013 data). Two thirds of Solarize cost reductions result from reduced soft costs. Solarize 2013 data reflects a $3.86/W total installed cost, with only 38% due to soft costs. See Table 2 below for a comparison of total, hardware and soft costs in Connecticut and Germany.

Table 2: Connecticut Residential Solar PV Hardware and Non-Hardware Costs versus Germany Costs and SunShot Initiative Target for 2020

Summary of Analysis on Residential Solar PV System Component Costs - all costs in this table are **average costs in $/W** unless shown as a %	**CT CEFIA 2012 Data**	**CT CEFIA 2012 Data Non-Solarize**	**CT CEFIA 2012 Data Solarize**	**CT CEFIA 2013 Data**	**CT CEFIA 2013 Data Non-Solarize**	**CT CEFIA 2013 Data Solarize**	**Germany LBNL Survey; BNEF; Langen 2011**	**U.S. SunShot Initiative 2020 Target**
Total Cost	4.95	5.11	3.91	4.50	4.89	3.86	3.00	1.50
Hardware Cost	2.59	2.64	2.24	2.22	2.11	2.38	2.38	0.85
Non-Hardware/ Soft Cost	2.36	2.47	1.67	2.28	2.78	1.48	0.62	0.65
Hardware Cost %	52%	52%	57%	49%	43%	62%	79%	57%
Non-hardware/ Soft Cost %	48%	48%	43%	51%	57%	38%	21%	43%

- Further work can be done to obtain better resolution on solar PV cost components. CEFIA could improve definition and collection of solar PV cost data requested of installers through CEFIA's Residential Solar Investment Program (RSIP), through which CT installers apply for residential solar PV installation incentives. Non-residential solar PV installations are now incentivized through CT's utility administered Zero Emissions Renewable Energy Credit (ZREC) Program, which began in 2012 (detailed cost component data was not being collected for this program).

- Large soft cost reduction opportunities exist in customer acquisition, installer overhead and labor, permitting, and interconnection costs on the order of 20-25% in aggregate in the near term. Examples of specific cost reduction opportunities are as follows:

  - **Permitting** – The project team estimated the permitting cost savings opportunity to be $1900 for an average-sized residential solar PV system in CT in 2012 (7kW, $35,000), which translates to $0.24/W.

  - **Customer acquisition** – Acquiring customers has been shown by national lab studies and verification by CT installers to be a significant cost, on the order of $0.67/W (industry average) or $0.50/W (CT installer estimate). The project team estimates that this cost was reduced to $0.14/W for solar PV systems installed through the Solarize Program.

  - **Installer overhead and labor, and other balance of system costs** – The CT Solarize Program has achieved over $1/W in cost reductions over non-Solarize solar PV systems. A portion of this cost, roughly $0.35/W, is attributable to customer acquisition cost reduction. The rest, as well as further cost reduction potential through Solarize and more generally, is thought to reflect installer overhead and labor savings, as well as remaining balance of system costs.

  - **Interconnection** – **In the area of interconnection,** the project team worked with CL&P and UI, as well as surveyed installers, to identify opportunities for cost reductions and process improvements. A cost reduction example implemented in 2013 was UI removing the need for the additional equipment and installer labor cost associated with installation of a second meter for net metering, estimated at $500 for a residential installation. Three other examples of process streamlining that have been implemented are: (1) CL&P offering an online interconnection application, (2) CL&P and UI waiving the annual proof of insurance requirement for solar PV systems 10kW and smaller, and (3) CL&P waiving witness tests for installers after the first few installations. Other potential cost reductions and process improvements include: (1) Reduction of interconnection fees for systems over 10kW in size, (2) Adoption of online processes by both utilities - CL&P is already online, and (3) Reconsideration of the utility external disconnect switch requirement. More details on these potential improvements are provided in the respective section of this report. Along with improvement opportunities, this report acknowledges improvements which CL&P and UI have already made pro-actively to streamline interconnection and reduce application turn-around times.

Data collected during the study through surveys, questionnaires, emails, and in person and phone interviews, along with research on best practices informed the project team's development of tools and recommendations for improving practices in Connecticut. While some of these recommendations will clearly bring about cost reductions, and while the ultimate goal of the SunShot Initiative is to achieve dramatic cost reductions, some process, legal, and regulatory improvements don't have immediate or easily measured impacts on cost reduction, but are critical to removing barriers to broad deployment of solar energy.

The following are observations and recommendations pertaining to improvements that can be made in the permitting, building codes, planning and zoning and financing arenas, at the local and state levels, some impacting costs and some having impact in removal of barriers to solar PV deployment. The body of the report provides more information about each the following topics, generally organized in terms of local/jurisdictional level recommendations versus state level recommendations.

- **<u>Permitting</u>** – Some argue that permitting costs are not a significant soft cost. The experience of our project team is that permitting costs can in fact be significant and that the most easily quantified permitting cost, the permit fee, can by itself be quite high (reaching over $1500 in at least one CT jurisdiction). Secondly, some jurisdiction processes are so burdensome as to require a lot of extra man-hours spent on acquiring a permit. A Clean Power Finance survey of 273 installers representing 12 states found that 36% of installers avoid jurisdictions with particularly challenging permitting processes.[1] An installer avoiding bringing solar PV to a jurisdiction due to difficult permitting is the ultimate COST to customers and the industry. There was input from two to three individuals during the study who recommended that the state of Connecticut adopt a state-level permitting system; this certainly sounds efficient, though this idea would require further research. In the meantime, it makes sense to develop tools and measures which standardize and streamline current permitting processes. Standard tools and consistent practices across the state would make it easier to adopt state-level permitting in the future.

- **<u>Building Codes</u>** – Connecticut's State Building Code includes many model codes within it including the model 2009 International Energy Conservation Code (IECC) which provides energy efficiency requirements for new construction. More can be done with respect to codes by adopting the 2012 IECC and by making improvements to CT's building code where appropriate to include a specification for "solar-ready" construction, as has been done in California and Minnesota. Lastly, where the state is not yet ready to adopt a stricter building code, jurisdictions should be enabled to do so locally through enactment of a model stretch code as has been done in Massachusetts.

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[1] www.cleanpowerfinance.com/about-us/media-center/press-release/more-than-a-third-of-u-s-solar-installers-say-permitting-requirements-limit-growth and "Nationwide Analysis of Solar Permitting and the Implications for Soft Costs," James Tong, Senior Director, Clean Power Finance, Dec.2012, solarpermit.org/media/upfiles/CPF-DOE_Permitting_Study_Dec2012_Final.pdf.

- **<u>Planning and Zoning (P&Z)</u>** – Though most local permitting is not hindered by planning and zoning requirements, P&Z review should not be required for standard residential and small scale non-residential rooftop solar PV installations. This best practice should be formalized as part of a model permitting process and/or solar PV ordinance adopted by CT jurisdictions. In CT, much work can be done to provide solar access protections for future solar PV customers and those who have already installed solar PV. The first step is to adopt a state level solar access law to protect a constituent's right for access to sunlight, which can be impeded by neighboring structures and trees, as well as the right to install solar PV, which can be impeded by private and local government restrictions.
- **<u>Financing</u>** – CEFIA has made great strides in developing and launching new financing products for residential and non-residential clean energy deployment and solar PV installation in particular. Innovative financing will make solar PV accessible to more customers, bring in affordable private capital to help CT's clean energy industry grow, and help CEFIA and the industry shift away from ratepayer subsidies.

Other developments in CT related to this project are as follows:

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Acknowledgment and Disclaimer

This material is based upon work supported by the U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge under award number DE-EE0005688 issued to the Sun Rise New England - Open for Business team, led by Connecticut's Clean Energy Finance and Investment Authority (CEFIA).

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The material provided in this project report is not intended to replace or supplant existing state or federal codes or regulations. There are no warranties associated with the use of this information. Some of this material, which is/was believed to be accurate at the time of publication, may no longer be accurate, current, or comply with existing codes and regulations. Neither the authors nor any other organizations or individuals who have contributed to this project report are accountable for the use or misuse of information obtained herein. The views expressed in this report are not necessarily the views of the entire project team, the state of Connecticut nor contributors of information to the project and report.

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ROOFTOP SOLAR CHALLENGE

Acknowledgment – Project Contributors

First, a big thank you to the following twelve participating municipalities who contributed tremendously to this project. Leaders and staff from these towns assisted in the process of applying for the funding award; provided vision, input and guidance before and during the project; responded to long surveys and numerous follow-up inquiries; patiently answered emails and phone calls; made time for meetings, interviews and conference calls; and most of all shared in our enthusiasm to pave the way for increased deployment of solar energy in their towns and throughout Connecticut's 169 jurisdictions.

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1.0 SunShot Initiative

The U.S. Department of Energy (DOE) SunShot Initiative is a collaborative national effort to dramatically reduce the costs of solar energy, making it cost-competitive with other forms of energy by the end of the decade.

Under the SunShot Initiative, DOE invests in competitive research and development for solar technologies that promise to transform the way we generate, store and utilize energy. To make solar energy more accessible and affordable, SunShot aggressively drives innovation by investing in private companies, academia, and national laboratories, targeting a 75% reduction in installed solar technology system costs by 2020. Achieving this level of cost reduction would enable scaled deployment of solar energy systems across the country, enabling solar technology-generated electricity (from photovoltaic and concentrating solar technologies together) to meet 14% of U.S. electricity needs by 2030.

SunShot Initiative advancements will ultimately benefit everyone by:

- Providing clean, low-cost energy for home owners, communities, businesses, and government;
- Enhancing America's global technology leadership through advanced solar energy technologies and smart grid innovation;
- Creating U.S. jobs through domestic solar manufacturing, distribution, and installation; and
- Reducing greenhouse gas emissions and protecting the environment.

Learn more about SunShot and DOE's efforts to expand deployment of clean, inexpensive solar energy by visiting eere.energy.gov/solar/sunshot. For an in-depth assessment of the potential for solar technologies to meet a significant share of electricity demand in the United States during the next several decades, see the SunShot Vision Study report, eere.energy.gov/solar/sunshot/vision_study.html.

2.0 Rooftop Solar Challenge

The U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge provides funding and resources to regional awardees to address highly varying, time-intensive and costly administrative processes required to finance and install residential and commercial rooftop solar photovoltaic (PV) systems. Improving these administrative processes will result in the reduction of non-hardware or "soft costs" and the elimination of market barriers that are becoming increasingly significant as solar PV hardware costs continue to fall.

Twenty-two Rooftop Solar Challenge teams from across the country are working to streamline permitting processes, update planning and zoning regulations, improve standards and processes for connecting solar energy systems to the electric grid, and increase access to financing for rooftop solar PV. The teams bring together municipal, county, and state officials, regulatory entities, private industry, universities, local utilities, and other regional stakeholders to clear a path for rapid expansion of solar energy and serve as models for other communities across the nation.

Learn more about the Rooftop Solar Challenge at: eere.energy.gov/solarchallenge. Learn more about Connecticut's Sun Rise New England – Open for Business project and access project deliverables at: energizect.com/sunrisene.

3.0 Sun Rise New England – Open for Business

3.1 Connecticut Context

Table 3. Highest U.S. Retail Electricity Prices

Average Retail Price of Electricity - All Sectors, April 2013 (¢/ kWh)	
Hawaii	33.33
Alaska	16.91
Connecticut	**15.50**
Vermont	14.73
New Hampshire	14.38
New York	14.38

Although Connecticut ranks the fifth lowest in energy use per capita in the United States, it has one of the highest retail electricity rates in the United States at 15.50 cents per kilowatt-hour (kWh) across sectors, and $17.40 cents per kWh for the residential sector, as of April 2013.[2] Scaled deployment of clean energy including solar energy is part of Connecticut's strategy to put the state on a path to a cheaper, cleaner and more reliable energy future.[3] Electricity produced from solar energy will contribute to reducing energy costs, increasing energy reliability and security, reducing greenhouse gas emissions, and meeting the State's renewable portfolio standard to meet 27 percent of retail electricity load with renewable energy by 2020.[4]

3.2 Benefits of Solar Energy

Environmental Benefits

The majority of Connecticut's electricity is produced from natural gas and nuclear energy.[5] Although natural gas and nuclear based electricity generation technologies produce lower emissions than technologies based on other petroleum fuels and coal, solar energy provides a zero emissions alternative (or near zero on a life cycle basis).[6] On average, for every residential solar PV system installed in Connecticut, the U.S. avoids 3.5 tons of greenhouse gas emissions each year. Over the lifetime of a typical system, over 87 tons of carbon dioxide (CO_2) will be offset. The lifetime impact of

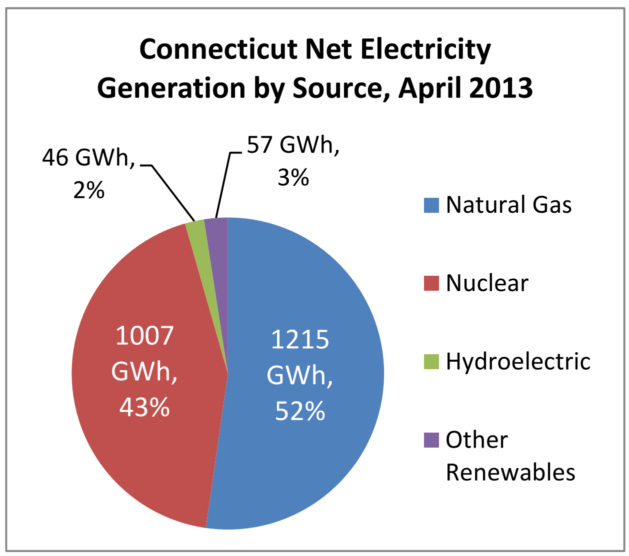

Figure 1: CT Net Electricity Generation by Source

[2] U.S. Department of Energy, Energy Information Administration (EIA) April 2013: eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a; eia.gov/state/?sid=CT

[3] The Department of Energy and Environmental Protection (DEEP) developed and issued in 2013 the first-ever Comprehensive Energy Strategy for the State of Connecticut: ct.gov/deep/cwp/view.asp?a=4405&q=500752&deepNav_GID=2121%20

[4] ct.gov/pura/cwp/view.asp?a=3354&q=415186

[5] www.eia.gov/state/?sid=CT

[6] Lifecycle Greenhouse Gas Emissions from Electricity Generation, January 2013: nrel.gov/docs/fy13osti/57187.pdf or nrel.gov/analysis/sustain_lca_results.html

approximately 9.3 MW of residential solar PV capacity (1325 projects) installed under CEFIA's current incentive program (March 2012 – June 2013), is avoided emissions of over 115 thousand tons of CO_2, 52 tons of nitrous oxides (NO_x) and 48 tons of sulfur dioxide (SO_2).

Economic Benefits

In addition to the environmental benefits of installing solar PV there are significant economic benefits resulting from widespread adoption of solar PV in Connecticut. Increased deployment of solar PV creates direct, indirect and induced jobs. Connecticut's 9.3 MW of residential solar PV capacity installed between March 2012 and June 2013 is estimated to result in 255 new direct jobs, and 410 indirect and induced jobs, for a total of 665 new jobs.

Another economic benefit of solar energy is that it provides a hedge against volatility and increases in fossil fuel prices. Though natural gas prices have recently been relatively low, solar energy systems rely on a free, limitless fuel source so that payments for electricity generated from a solar PV system are known and can be fixed over 20 years or other fixed period of time.

Solar energy increases Connecticut's energy security through diversity, reliability and independence. Securing Connecticut's energy supply has become increasingly important given losses estimated at $2-4 billion each year on power outages and quality issues.[7]

As population increases in the Northeast United States, the demand for electricity, particularly peak energy, will increase as well. Solar PV generates electricity during parts of the day at or around the times when energy demands are at their highest. Power plants built just for meeting peak electricity demand are very expensive.

Some of the benefits of solar energy systems are attributable to the fact that residential and commercial solar PV systems usually provide distributed generation, at or near the point of use. For example, distributed solar PV avoids transmission line losses which translate to avoided cost. Additionally, solar energy and other distributed generation help relieve electric grid congestion and as mentioned previously, the cost of adding new power plants to the grid.

Energy expenditures in 2012 were estimated to account for between 9% and 78% of homeowner after tax income, depending on income bracket.[8] Providing a stable, low cost source of energy will increase residents' disposable income and the competitiveness of Connecticut businesses. For many homeowners and businesses, just having a known cost is very helpful for budgeting expenses, and solar being a free fuel source frees system owners from the unknown and escalating fuel costs.

A benefit of residential solar PV systems in addition to the electricity cost savings to the system owner is that they increase home selling prices. An analysis based on data in California, the most mature market in the United States, conducted by the Lawrence Berkeley National Laboratory and San Diego State University quantified the benefits in terms of the prices paid for solar PV systems:[9]

[7] "Clean Energy Tops Agenda in Connecticut," William Pentland, Forbes Online (11/09/2010). forbes.com/sites/williampentland/2010/11/09/microgrids

[8] "Energy Cost Impacts on American Families, 2001-2012," American Coalition for Clean Coal Electricity. americaspower.org/sites/default/files/Energy_Cost_Impacts_2012_FINAL.pdf

[9] "An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California," Ben Hoen, Ryan Wiser, Peter Cappers and Mark Thayer, Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division, and San Diego State University, April 2011, eetd.lbl.gov/ea/emp/reports/lbnl-4476e.pdf.

> The effects range, on average, from approximately $3.9 to $6.4 per installed watt (DC) of PV, with most coalescing near $5.5/watt, which corresponds to a home sales price premium of approximately $17,000 for a relatively new 3,100 watt PV system (the average size of PV systems in the study). These average sales price premiums appear to be comparable to the investment that homeowners have made to install PV systems in California, which from 2001 through 2009 averaged approximately $5/watt (DC), and homeowners with PV also benefit from electricity cost savings after PV system installation and prior to home sale.

Another study based on California data, conducted by University of California San Diego and University of California Los Angeles researchers, estimates that a home with a solar PV system will sell for 3-4% more than a comparable home without solar PV.[10] The sales price premium is larger in communities with more registered Prius hybrid vehicles and a greater share of college graduates, and in environmentalist communities where there is a community approval aspect to being green.

Finally, net metering rules in Connecticut have improved over time, allowing owners to better capture the benefit of the electricity generated by their solar PV systems. Virtual net metering, described in the Interconnection section, section 13.5 of this Report, was adopted in 2011 in Public Act 11-80. Expanded virtual net metering provisions enacted in Public Act 13-298 in Connecticut's 2013 legislative session will increase this value even further. Virtual Net Metering was expanded to state agencies and agricultural customers in addition to municipalities, increased the maximum installation size from 2MW up to 3MW, allows for class III resources such as cogeneration, and allows customers connected to a micro-grid to share credits with up to ten non-state or municipal critical facilities (e. g. hospitals, police and fire stations, and municipal centers).[11] For a link to the text of the legislation, see the section 5.3 of this Report, Connecticut's 2013 Legislative Session – Support for Clean Energy.

Quantifying Community-Level Benefits

An analysis conducted by AECOM for Sunrun evaluated the economic and fiscal implications of streamlining local government permitting for installing solar PV systems on residences in California between 2012 and 2020. The AECOM report [12] presents the following findings:

- Under the streamlined permitting regime presented by the Sunrun report, which results in a 75% reduction in local permitting costs, California homeowners are projected to install an additional 132,000 systems overall, a 13% increase relative to the baseline market projection.
- AECOM's analysis estimates that the incremental growth and the additional savings that result from permitting reform would contribute nearly $5.1 billion to the California state economy between 2012 and 2020. AECOM's modeling indicates that approximately 3,900 full-time jobs would be generated by this economic contribution.

A specific analysis would need to be conducted to quantify similar benefits for Connecticut taking into account differences in state and local laws and other factors. However, this benefits analysis done for

[10] "Understanding the Solar Home Price Premium: Electricity Generation and 'Green' Social Status," Samuel Dastrup, Joshua Graff Zivin, Dora Costa, and Matthew Kahn. European Economic Review 56 (2012): 961-973. works.bepress.com/josh_graffzivin/37.

[11] An Act Concerning Implementation of Connecticut's Comprehensive Energy Strategy. House Bill 6360, Public Act 13-298, cga.ct.gov/2013/ACT/PA/2013PA-00298-R00HB-06360-PA.htm

[12] Economic and Fiscal Impact Analysis of Residential Solar Permitting Reform. July 2011. AECOM. sunrunhome.com/download_file/view/415/189/

California indicates that streamlining solar PV permitting results in increased solar PV adoption which in turn benefits local and state economies.

3.3 The Clean Energy Finance and Investment Authority

The Clean Energy Finance and Investment Authority (CEFIA),[13] the successor organization to the Connecticut Clean Energy Fund (CCEF), was created by the Connecticut Legislature through Public Act No. 11-80 (PA 11-80), effective July 1, 2011.[14] As the nation's first green bank, CEFIA invests its resources in an array of enterprises, initiatives and projects aimed to attract and deploy capital to finance the clean energy goals of Connecticut, develop and implement strategies that lower the cost of clean energy to make it more accessible and affordable to consumers and reduce reliance on grants, rebates and other subsidies, and move toward innovative low-cost financing of clean energy deployment. CEFIA led the Sun Rise New England – Open for Business[15] team in applying to the U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge to bring efforts and resources to bear on reducing rooftop solar PV installation costs and market barriers in Connecticut.

3.4 Sun Rise New England – Open for Business Project Accomplishments

Connecticut's Sun Rise New England – Open for Business team was one of 22 teams nationwide to win an award under the Rooftop Solar Challenge Program.[16] The Connecticut team received almost $482,000 of funding from the U.S. Department of Energy (DOE), spent during the project period spanning February 15, 2012 through February 14, 2013, and with a documented in-kind contribution totaling $175,746 during the official project period.

The following is a summary of project activities and accomplishments (with more details provided in relevant sections of this project report, and in the Connecticut Rooftop Solar PV Permitting Guide):

- Conducted data collection, research and analysis on rooftop solar PV non-hardware or soft costs and market barriers including those associated with permitting, planning and zoning, interconnection, and financing. Data collection was conducted with 12 partner communities, Connecticut's two major utility companies, and numerous solar PV installers. The focus of data collection was on DOE Solar Metrics data, though the project team conducting additional data collection as needed to understand issues pertaining to solar PV soft costs.
- Produced this report summarizing research, findings and recommendations on permitting, planning and zoning, interconnection, innovative financing, solar PV soft cost analysis and market drivers.
- Provided permitting improvement recommendations to participating CT jurisdictions. See section 8.0 of this report.
- Project partner Simply Civic developed and implemented an affordable online permitting system and conducted outreach to provide demonstrations of the system throughout Connecticut. See section 8.8, Online Permitting.
- Performed data collection, research and analysis, and drafting of legislation mandating waived or flat permit fees capped at $200. The proposed legislation did not get a hearing in the 2013 legislative session but automatically is put on the list for consideration in 2014. Additionally, the

[13] ctcleanenergy.com, then click on "About"

[14] An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future, cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm

[15] energizect.com/SunRiseNE

[16] eere.energy.gov/solarchallenge

work on the proposed legislation allowed the team to write an informed recommendation for voluntary municipal permit fee reduction. See sections 7.2 and 8.3.

- Developed and implemented an online, map-based rating system comparing Connecticut communities in terms of solar friendliness/readiness. The map is to be updated to incorporate additional variables as more tools and measures are implemented, including those found in the CT Rooftop Solar PV Permitting Guide. See section 8.9 of this report for more information.
- Developed a CT Standardized Solar PV Permit Application Package provided in the CT Rooftop Solar PV Permitting Guide.
- Developed a model solar PV ordinance for Connecticut jurisdictions provided in the CT Rooftop Solar PV Permitting Guide.
- Developed and deployed innovative financing models, programs and products for the Connecticut solar PV and clean energy market, to expand access to affordable capital and reduce dependency on ratepayer funds. See section 14.0 on financing.
- Established a network of municipal, state, industry, utility, university, regional, federal and other stakeholders aligned to continue efforts toward reduction of solar PV costs, elimination of market barriers and scaled deployment of solar PV
- Produced a Connecticut Rooftop Solar PV Permitting Guide, carried out and funded by CEFIA after the official project period, including and expanding on tools and measures developed during the Rooftop Solar Challenge Project period. Contents of the Guide include the Connecticut Standardized Solar PV Permit Application Package, a summary of permitting recommendations for CT jurisdictions, detailed guidance and resources on streamlining solar PV permit review and inspection, information about online permitting systems, an example solar PV inspection checklist, a model solar PV ordinance for Connecticut jurisdictions, a checklist for earning CT Clean Energy Communities Program points as a result of permitting improvements, and a subdivision site design worksheet. For a complete list, see section 8.6 titled **Connecticut Rooftop Solar PV Permitting Guide✷** in this report and the Permitting Guide tab on the Sun Rise New England - Open for Business website.

Questions about the Sun Rise New England – Open for Business project may be directed to sunshot@ctcleanenergy.com.

3.5 Sun Rise New England Partner Communities

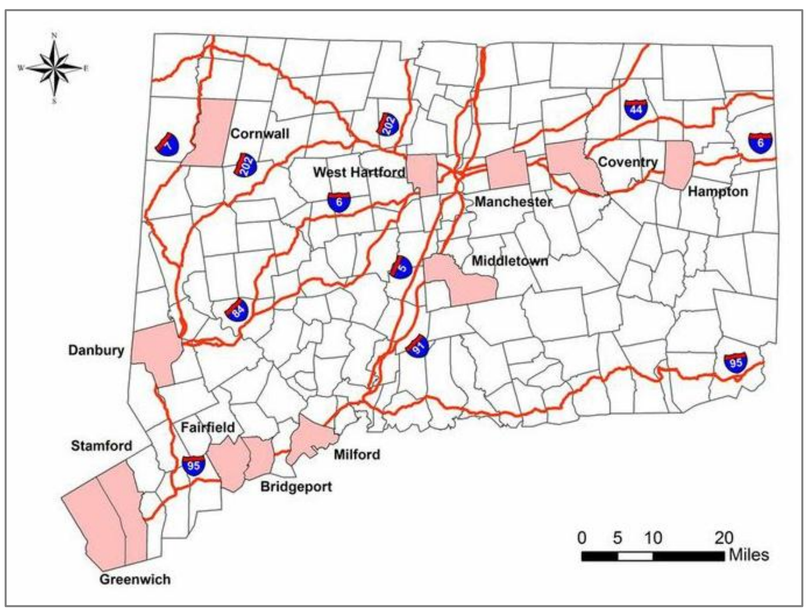

Figure 2: Sun Rise New England Participating CT Jurisdictions

Connecticut may be a relatively small state but its 169 municipalities operate under a diverse set of rules, regulations and permitting processes that makes it challenging for those doing business across the state, including solar PV installers. Bringing consistency and improvements to these processes will ultimately attract more solar PV installation and other business to Connecticut communities. Twelve communities were asked to participate in this project, providing a range of characteristics and strengths:

- A strong record in terms of number of installations and capacity installed per capita and/or strong clean energy leadership in other ways such as through the CT Clean Energy Communities (CEC) Program and/or a clean energy task force. All 12 towns earned a municipal solar PV system through success as CEC participants in the original version of the Program.[17] A new version of the CEC Program has been launched, so community commitments are in the process of being renewed.
- Diversity in terms of representing large and small populations, community types (i.e. urban, suburban, rural), income levels and the two major utility service territories (i.e., Connecticut Light and Power and United Illuminating service territories).

Table 4: Sun Rise New England Partner Communities in Connecticut (as of 4/40/13)

				Non-Residential		Residential				
Rooftop Solar Challenge Community	Population (CERC 2011)	Number of Households (CERC 2011)	Community Type	# Projects	Total Capacity (kW)	# Projects	Total Capacity (kW)	Household Penetration	Total # Projects	Total Capacity (kW)
Bridgeport	146,824	52,261	Urban	5	382	7	39	0.01%	12	421
Cornwall	1,429	643	Rural	1	9	12	93	1.87%	13	102
Coventry	12,572	4,738	Rural	1	76	28	191	0.59%	29	268
Danbury	82,409	29,508	Urban	5	1271	34	229	0.12%	39	1500
Fairfield	59,625	20,556	Suburban	5	621	125	912	0.61%	130	1533
Greenwich	61,983	23,382	Suburban	4	218	37	199	0.16%	41	417
Hampton	1,890	768	Rural	2	19	15	87	1.95%	17	106
Manchester	59,175	25,194	Suburban	5	416	27	181	0.11%	32	597
Middletown	48,041	20,233	Suburban	7	565	43	224	0.21%	50	789
Milford	52,894	21,910	Suburban	2	370	70	447	0.32%	72	816
Stamford	124,908	48,288	Urban	8	1139	39	227	0.08%	47	1366
West Hartford	63,649	25,513	Suburban	6	351	45	266	0.18%	51	617
Totals	**715,399**	**272,994**		**50**	**5429**	**482**	**3094**	**0.18%**	**533**	**8532**

Table 4 represents CEFIA/CCEF residential and non-residential solar PV incentive program data for the 12 participating Sun Rise New England towns from 2004 through 2013. CEFIA's current residential solar PV incentive program is called the Residential Solar Investment Program (RSIP), launched in March 2012. Non-residential installations are captured primarily from 2004-2011, after which only 4 non-residential installations were included in the CEFIA dataset for these 12 communities. CEFIA's non-residential solar incentive programs were primarily replaced by the competitive Zero Emission Renewable Energy Credit (ZREC) Program, administered by CT's two large utility companies.

Projects competitively selected through the ZREC Program which may be in service by the end of 2013 in the above 12 municipalities include the following: a 297 kW commercial project in Fairfield, four projects (three commercial, one industrial) in Manchester totaling 1.1 MW, two commercial projects in Stamford totaling 327 kW, and two commercial projects in West Hartford totaling 634 kW. These nine projects together total 2.4MW.

This report also presents total committed solar PV installation capacity for the 2012 ZREC solicitation, namely 45 MW to be installed by the end of 2013 (see section 5.1 titled "Installed Solar PV Capacity in Connecticut").

[17] All 12 have had their municipal solar PV system installed except for Danbury whose system is yet to be installed.

The following are a few observations about the data in the above table:

- Each participating town has at least one non-residential installation consisting of a CT Clean Energy Communities Program municipal installation, except for Danbury who has earned a PV system but has not yet installed it.
- Fairfield has the most projects installed and the highest installed capacity of the participating towns. Fairfield is also participating in the Solarize Program, which has been very impactful in deployment of record amounts of solar PV in Solarize communities as well as significant cost reductions.
- The two smallest towns, Cornwall and Hampton, reached the highest residential household penetration rates of the 12. Note that the town of Durham (with a population of 7416 in 2011) achieved the highest residential solar PV market penetration rate in Connecticut as of May 2013, reaching over 5% household penetration as a result of its successful Solarize Program.

More information about each of the 12 participating towns including clean energy commitments, permitting best practices and recommendations for permitting improvements are provided in town-specific summaries in Appendix I.

4.0 Soft Cost Reduction Opportunity in the United States and Connecticut

The goal of the Rooftop Solar Challenge Program (RSC) is to reduce soft costs and eliminate market barriers associated with installation of rooftop solar PV. The U.S. Department of Energy identifies the areas of permitting, planning and zoning, interconnection and financing as key areas for process improvements and cost reductions.

During the course of Connecticut's RSC efforts, several approaches informed understanding of soft cost reduction opportunities. A large portion of the Sun Rise New England project efforts were focused on collecting and analyzing data defined by DOE Solar Metrics requirements for the 12 participating communities, then developing and implementing recommendations and tools to address opportunities for improvements. Three approaches undertaken during the project to understand soft costs are listed below, including the collection of DOE Solar Metrics data already mentioned.

1. Collect data and conduct research and analysis related to Solar Metrics questions defined and required by DOE.
2. Identify specific cost savings opportunities in the various action areas using a bottom-up approach similar to the Sunrun analysis.
3. Survey the latest literature summarizing research and analysis conducted on soft costs nationwide, analyze

Table 5: DOE Solar Metrics Action Areas and Scoring

ACTION AREA	POINTS
Permitting Process	**460**
Application	110
Information Access	60
Process Time	110
Fee	30
Model Process	30
Inspection	80
Communication w/ Utility	40
Interconnection Process	**110**
Application	40
Information Access	20
Process Time	20
Inspection	30
Interconnection Standard	**100**
Net Metering Standard	**100**
Financing Options	**150**
Third Party Ownership (or equivalent)	90
Direct Finance Options	25
Community Solar	15
Other	20
Planning and Zoning	**80**
Solar Rights and Access	54
Zoning	20
New Construction	6
TOTAL POINTS POSSIBLE	**1000**

Connecticut solar PV installation data collected through CCEF/CEFIA incentive programs and use this information to inform other approaches.

4.1 DOE Solar Metrics Data

Approach one involved collecting answers to DOE Solar Metrics questions on all action areas. This included permitting and planning and zoning data from 12 towns participating in the project, and interconnection process data for utilities. In addition, the project team collected information from solar PV installers on permitting, planning and zoning, and interconnection processes to obtain insight on how to improve processes and requirements in these areas. Table 5 shows the Solar Metrics action areas and point allocations provided by DOE to guide the targeting of improvements. The permitting process for rooftop solar PV is emphasized as a key area of needed improvement, representing 460 out of the total 1000 DOE points possible. DOE Solar Metrics permitting questions were verified by a Lawrence Berkeley National Laboratory (LBNL) analysis published in April 2013 to provide a meaningful measure of jurisdiction-level permitting scores.[18]

The overall DOE Solar Metrics score for Connecticut improved from 283 to 602 points, an increase of 113%, with the biggest increases coming from permitting process improvements, planning and zoning, and development and launch of financing options. The permitting and planning and zoning areas started out with the lowest scores, whereas CT's interconnection process score was already high relative to the maximum number of points.

Table 6: Connecticut Project DOE Solar Metrics Scores

DOE Solar Metrics Action Area	Score 2011	Score 2013	% Increase
Permitting Process	47	269	427%
Interconnection Process	88	93	6%
Enabling Financing Options	55	125	127%
Siting, Planning and Zoning	8	30	275%
NNEC: Net Metering	85	85	0
NNEC: Interconnection	0	0	0
Installed PV Capacity and PV Costs	0	0	0
Total	283	602	113%

Note that there are process areas and soft cost components not included in the DOE action areas, for example customer acquisition, which is known to contribute significantly to soft costs. Also note that while some action areas may not seem as relevant to cost reduction, they may be impactful in enabling solar PV deployment by reducing or eliminating market barriers. An example may be solar rights and access which could impact adoption of solar PV as well as solar PV performance after installation. Permitting both contributes to soft costs and poses a market barrier. A Clean Power Finance survey of 273 installers representing 12 states found that 36% of installers avoid jurisdictions with particularly challenging permitting processes.[19]

4.2 Bottom-up Estimates of Soft Cost Reduction Opportunities

A second approach involved adding up specific opportunities for cost reductions that were identified during the project through a bottom-up approach. For example, interviews with municipalities, utilities

[18] Wiser, Ryan H, and Dong, Changgui. "The Impact of City-level Permitting Processes on Residential Photovoltaic Installation Prices and Development Times: An Empirical Analysis of Solar Systems in California Cities," 2013. emp.lbl.gov/reports/re.

[19] www.cleanpowerfinance.com/about-us/media-center/press-release/more-than-a-third-of-u-s-solar-installers-say-permitting-requirements-limit-growth and "Nationwide Analysis of Solar Permitting and the Implications for Soft Costs," James Tong, Senior Director, Clean Power Finance, Dec.2012, solarpermit.org/media/upfiles/CPF-DOE_Permitting_Study_Dec2012_Final.pdf.

and solar PV installers helped the team focus extra efforts on a few opportunities that could be targeted. Examples of specific cost reduction opportunities are as follows:

- **Permit fee reductions** were approached both by preparing a legislative proposal for a state-level mandate and by providing an informed recommendation to jurisdictions on a better permit fee structure for solar PV. An analysis of permit fee data throughout Connecticut and permitting recommendations provided by the project team are detailed in the section 7.2, Rooftop Solar PV Permitting – Opportunities for Improvement. On average, reducing permit fees to a flat fee of $200 for an average-sized residential solar PV system would result in $228 in savings for a solar PV installation. In the highest permit fee towns, the savings could be as high as $1400 or more. The project team developed an online map presenting information about jurisdiction adoption of solar-friendly policies, programs and practices such as Commercial Property Assessed Clean Energy (C-PACE) adoption, Solarize Program participation, and implementation of permit fee waivers and reductions. Jurisdictions are thus encouraged to adopt measures that make them solar-ready, whereby they can attract more business to their communities.
- Another permitting cost reduction example was to provide all Connecticut communities **access to affordable online permitting**, which can simplify the work of municipal staff, save installers' time and expense in travel time, and help streamline the permitting process generally, especially if used in combination with a standardized solar PV permit application. Simply Civic, the project team's partner in offering an online permitting solution for Connecticut towns, estimates savings of at least $250 on an average for a residential solar PV installation as a result of using online permitting. See section 8.8 of this report on online permitting for information about a number of online permitting solutions which Connecticut towns are using.
- A third example of an interconnection cost reduction opportunity that was identified during the project was **elimination of the need for a second meter for net metering of electricity produced by a PV system**. United Illuminating shared this information with the project team during one of our interviews. By the writing of this project report, UI had already found a solution to eliminate the need for this additional equipment. This additional equipment had added approximately $500 to the cost of each solar PV installation, consisting of $270 for the additional meter plus additional installer labor. What had been required was an update or upgrade to a billing system which can be a complex undertaking for a large company serving many customers.
- In the 2013 legislative session, CEFIA leadership worked with the Connecticut legislature to achieve a **property tax exemption for commercial and industrial class I renewable energy projects**. This exemption was critical to ensuring economic viability of commercial clean energy systems. Without the exemption, the cash flow benefit which makes solar PV and other clean energy system adoption feasible would be offset by commercial property taxes on the equipment. A property tax waiver had already been in place for residential solar PV systems; residents are required to file paperwork once with their jurisdiction to obtain the waiver.

In Figure 3 below, individual cost reduction opportunities such as presented in the above list are identified or consolidated with other reduction opportunities in the same category to show the impact of a combination of cost reductions.

Starting with a 2013 Connecticut residential solar PV installation cost of $4.89/W (includes only projects not participating in the Solarize Program -- described further below), the combined impact of the cost reductions shown is a reduction of $1.40/W, bringing the cost down to $3.49/W. Germany installed cost of $3/W in 2011 is shown for comparison next to the reduced CT cost[20]. More discussion comparing U.S., CT, and Germany residential solar PV installation costs is presented in subsequent sections of this report

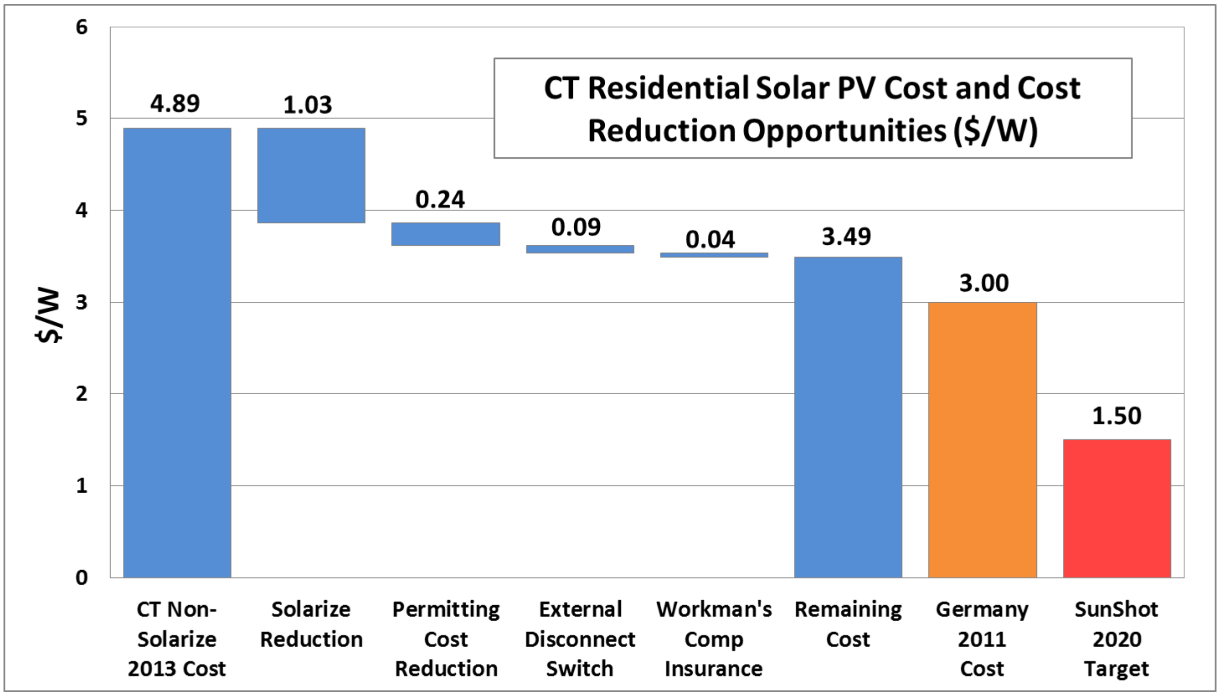

Figure 3: CT Residential Solar PV Cost and Cost Reduction Opportunities ($/W)

The cost reduction areas presented in Figure 3 are described as follows.

The CT Solarize Program, launched in the Summer of 2012, is a group purchasing program that has resulted in approximately $1/W in soft cost savings which can be attributed to savings in customer acquisition ($0.36/W), as well as installer labor ($0.20/W), installer overhead and other installation costs that can be spread out over a larger volume of systems being installed in one Solarize community.

Permitting improvements were estimated to add up to almost $1700 for an average residential solar PV installation in Connecticut (7kW in year 2012) amounting to cost savings of $0.24/W. This included potential permitting cost savings resulting from the following: eliminating unnecessary professional engineering/structural reviews; streamlining permit application submission, review, inspection and approval through process improvements and tools such as a standardized solar PV permit application package; and, online permitting. To get another reference point on permitting costs, a Sunrun analysis estimated local permitting costs in California for a 5kW system to be $2516 per installation (or $0.50/W) and potential permitting cost savings to be $1900 per installation or $0.38/W.[21] The sunrun number included some customer acquisition costs for sales and marketing ($440 of potential savings out of $520). Removing the customer acquisition portion of the cost savings from the Sunrun estimate results in an estimated permitting cost savings potential of $1460 for a 5kW system, or $0.29/W, higher but similar to the CT project team estimate of $0.24/W.

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[20] Germany cost dropped to $2.60/W in 2012. Chris Nelda writing for GreenTechMedia, "Can US Solar PV Costs Keep Falling?" August 16, 2013. www.greentechmedia.com/articles/read/can-u.s.-solar-pv-costs-keep-falling.

[21] Economic and Fiscal Impact Analysis of Residential Solar Permitting Reform. July 2011. AECOM. www.sunrunhome.com/download_file/view/415/189/

Another reference point on permitting costs is an LBNL analysis published in April 2013 which concludes that those California cities with the most favorable permitting processes are found to reduce average residential PV system prices by $0.27-$0.77/W and shorten development times by around 24 days, compared to cities with the most onerous permitting practices. In this analysis, LBNL controlled for confounding factors impacting system costs (e.g., system size, cost of living and education level) to attempt to isolate the effect of favorable permitting processes. LBNL notes that the measured effect on system costs was significant while the results were less robust but evident for project development times.[22]

In the area of interconnection, the project team worked with CL&P and UI, as well as surveyed installers, to identify opportunities for cost reductions and process improvements. A cost reduction example implemented in 2013 was UI removing the need for the additional equipment and installer labor cost associated with installation of a second meter for net metering, estimated at $500 for a residential installation. Three other examples of process streamlining that have been implemented are: (1) CL&P offering an online interconnection application, (2) CL&P and UI waiving the annual proof of insurance requirement for solar PV systems 10kW and smaller, and (3) CL&P waiving witness tests for installers after the first few installations. Other potential cost reductions and process improvements include: (1) Reduction of interconnection fees for systems over 10kW in size, (2) Adoption of online processes by both utilities - CL&P is already online, and (3) Reconsideration of the utility external disconnect switch requirement. More details on these potential improvements are provided in the respective section of this report. Along with improvement opportunities, this report acknowledges improvements which CL&P and UI have already made pro-actively to streamline interconnection and reduce application turn-around times.

Another soft cost savings opportunity, identified by the solar industry, is the high cost of insurance, one example being **workmen's compensation insurance which could potentially be reduced by $300.**

4.3 Overview of U.S. and Germany Soft Cost Analyses and Comparison to Connecticut Non-Solarize and Solarize Data

Approach three to better understanding soft costs consisted of review of research and analysis led by national laboratory (e.g., NREL, LBNL) and other researchers to better understand contributions to solar PV installation costs, categorized in terms of hardware and non-hardware (soft) costs. These analyses are based on survey data and/or rely on bottom-up cost modeling. As solar PV hardware cost components have become better understood and as PV module prices have decreased significantly over recent years and have started to stabilize, more attention has been focused on better identifying and reducing soft costs. The reviewed literature and analyses provided a framework for understanding soft costs in the global, U.S. and Connecticut contexts, especially for reference in analyzing Connecticut solar PV data collected to date and for informing future data collection strategies.

Table 7 summarizes recent analyses on U.S. residential solar PV installation cost and cost components conducted by the National Renewable Energy Laboratory (NREL), Lawrence Berkeley National Laboratory (LBNL), and the Sun Rise New England project team (using CEFIA residential solar PV incentive program data), alongside SunShot Initiative 2020 targets and an estimate of residential solar PV costs in Germany. In recent analyses, U.S. hardware and non-hardware costs have each contributed approximately 50% to total system costs. The cost component categories provided by

[22] Wiser, Ryan H, and Dong, Changgui. "The Impact of City-level Permitting Processes on Residential Photovoltaic Installation Prices and Development Times: An Empirical Analysis of Solar Systems in California Cities," 2013. emp.lbl.gov/reports/re

recent NREL analyses were used to compare data across sources to the extent possible. Germany 2011 installed cost of $3.00/W from an LBNL study was used here as the study breaks the cost out into components. The installed cost in Germany is estimated to have dropped further, to $2.60/W in 2012.[23]

Table 7: Summary of Analyses on Residential Solar PV Components by U.S. National Labs; Analysis of CEFIA CT Solar PV data; and Comparison to Germany Solar PV costs and the SunShot Initiative target.

Summary of Analysis on Residential Solar PV System Component Costs - all costs in this table are **average costs in $/W** unless shown as a %	**U.S. NREL/ LBNL Survey & Analysis (1)**	**U.S. NREL Goodrich Cost Model (2)**	**U.S. NREL/ Goodrich/ LBNL Cost Model (3)**	**U.S. LBNL/ NREL Data Composite (4)**	**CT CEFIA 2012 Data**	**CT CEFIA 2012 Data Non-Solarize**	**CT CEFIA 2012 Data Solarize**	**CT CEFIA 2013 Data**	**CT CEFIA 2013 Data Non-Solarize**	**CT CEFIA 2013 Data Solarize**	**Germany LBNL Survey; BNEF; Langen (4)**	**SunShot Initiative U.S. 2020 Target**
Publication Year	2012	2011	Nov-2012	2013							2012	
Data Year	2010	2010	Q4 2011	2011, 2010	2012	2012	2012	2013	2013	2013	2011, 2010	
Total Cost	**6.60**	**5.71**	**4.39**	**6.19**	**4.95**	**5.11**	**3.91**	**4.50**	**4.89**	**3.86**	**3.00**	**1.50**
Hardware Cost	**3.28**	**3.03**	**2.04**	**2.85**	**2.59**	**2.64**	**2.24**	**2.22**	**2.11**	**2.38**	**2.38**	**0.85**
Module		2.17	1.15	1.83	1.80	1.88	1.30	1.44	1.43	1.47		
Inverter		0.40	0.43	0.55	0.67	0.66	0.78	0.66	0.59	0.77		
Wiring	3.28	0.46	0.46	0.47							2.38	
Mounting hardware												
Monitoring equipment					0.11	0.11	0.17	0.12	0.10	0.14		
Non-Hardware/ Soft Cost	**3.32**	**2.68**	**2.35**	**3.34**	**2.36**	**2.47**	**1.67**	**2.28**	**2.78**	**1.48**	**0.62**	**0.65**
Soft Cost Component Subtotal - customer acquisition, PII, installation labor, etc	1.71	1.08		1.73	1.79	1.78	1.40	1.69	1.73	1.25	0.36	
Customer Acquisition	0.67			0.69	0.50	0.50	0.14	0.50	0.50	0.14	0.07	
Permitting, Inspection, Interconnection (PII) Fees and Costs Subtotal	0.22			0.24	0.23	0.19	0.41	0.23	0.18	0.29	0.03	
PII Labor	0.13			0.15	0.11	0.08	0.21	0.12	0.08	0.15	0.03	
Interconnection Fee		0.17			0.03	0.03	0.07	0.03	0.03	0.05		
Permit Fee	0.09			0.09	0.09	0.08	0.13	0.08	0.07	0.09	0.00	
Installation Labor	0.59	0.63		0.59	0.91	0.94	0.72	0.83	0.91	0.71	0.23	
Labor for arranging third party financing	0.02											
Engineering and Design Cost					0.15	0.15	0.14	0.13	0.14	0.12		
Sales tax	0.21	0.29		0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Balance of System (BOS) costs*	1.60	1.60		1.61	0.57	0.69	0.27	0.59	1.05	0.23	0.26	
Hardware Cost %	**50%**	**53%**	**47%**	**46%**	**52%**	**52%**	**57%**	**49%**	**43%**	**62%**	**79%**	**57%**
Non-hardware/ Soft Cost %	**50%**	**47%**	**53%**	**54%**	**48%**	**48%**	**43%**	**51%**	**57%**	**38%**	**21%**	**43%**

[23] Germany cost dropped to $2.60/W in 2012. Chris Nelda writing for GreenTechMedia, "Can US Solar PV Costs Keep Falling?" August 16, 2013. www.greentechmedia.com/articles/read/can-u.s.-solar-pv-costs-keep-falling.

The following are four analyses referenced in Table 7 (in parentheses in the heading of each column):

(1) Kristen Ardani (*), Galen Barbose (**), Robert Margolis (*), Ryan Wiser (**), David Feldman (*), and Sean Ong (*). *Benchmarking Non-Hardware Balance of System (Soft) Costs for U.S. Photovoltaic Systems Using a Data-Driven Analysis from PV Installer Survey Results*, National Renewable Energy Laboratory (*-NREL) and Lawrence Berkeley National Laboratory (**-LBNL), Report DOE/GO-10212-3834, November 2012, www.nrel.gov/docs/fy13osti/56806.pdf.

(2) Alan Goodrich, Ted James, and Michael Woodhouse. *Residential, Commercial, and Utility-Scale Photovoltaic (PV) System Prices in the United States: Current Drivers and Cost-Reduction Opportunities,* NREL, Report TP-6A20-53347, February 2012, www.nrel.gov/docs/fy12osti/53347.pdf.

(3) David Feldman, Galen L Barbose, Robert Margolis, Ryan H Wiser, Naïm Darghouth, and Alan Goodrich. *Photovoltaic (PV) Pricing Trends: Historical, Recent, and Near-Term Projections,* 2012. www.nrel.gov/docs/fy13osti/56776.pdf.

(4) Joachim Seel, Galen Barbose, and Ryan Wiser. *Why Are Residential PV Prices in Germany So Much Lower Than in the United States? A Scoping Analysis,* LBNL, Presentation, February 2013 Revision (with updated data on installation labor requirements). emp.lbl.gov/sites/all/files/german-us-pv-price-ppt.pdf

Benchmarking Residential Solar PV Cost Components

The NREL analysis published in 2012, source (1) above, was based on a 2010 survey of U.S. installers, with results presented in the leftmost column of data in Table 7. The survey was aimed at obtaining granularity on solar PV soft cost components.

Sources (2) and (3) rely on solar PV bottom-up cost modeling by NREL (Goodrich et al) to estimate U.S. solar PV cost components. A comparison of two sets of residential solar PV data from Goodrich, one based on 2010 data and one based on Q4 2011 data (both in Table 7) indicate that module costs declined significantly, approximately $1/W, during this time period, and that the module (or the corresponding hardware) cost decline accounted for about three-quarters of the 23% overall installed cost decline. As a result of the hardware cost decline, the hardware cost contribution decreased from 53% to 47% of installed cost, while the soft cost contribution increased from 47% to 53%. This example illustrates the increasing importance of soft costs as hardware costs have declined.

Source (4) provides a composite of U.S. 2010 and 2011 solar PV cost component data including data from sources (1) through (3) to compare against Germany 2010 cost component data.

Figure 4 presents consolidated data from source (4) and adds further resolution on installer overhead and installer profit using percentages provided by Goodrich et al in source (2). Figure 4 is based on a $6.19/W system.

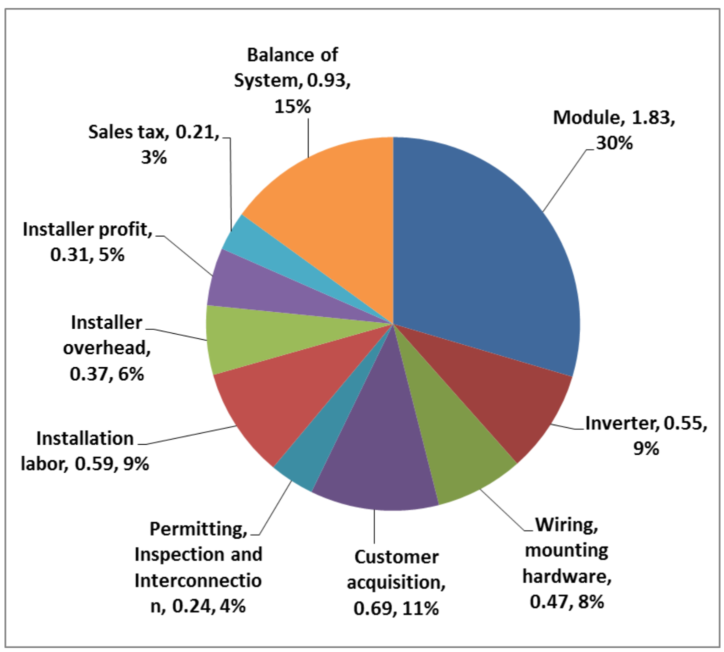


Figure 4: U.S. Residential Solar PV Cost Components (LBNL/NREL composite 2010-2011 data)

What is CEFIA's breakout of Connecticut residential solar PV cost components? CEFIA collects data for the following cost components through its residential solar PV incentive program application system: module, inverter, monitoring device, permitting fee, interconnection fee, municipal inspections, utility inspections, engineering and design (assumed to be labor), installation labor, and balance of system (BOS).

For the analyses of the CEFIA data done for this report, the permitting fee, interconnection fee and the municipal and utility inspections costs are combined into a cost category called permitting, inspection and interconnection (PII) costs.

The CEFIA data does not ask for separate data on wiring and racking costs. CEFIA's calculation for hardware cost in this report thus includes: module, inverter and monitoring device. Installers may have reported wiring and racking costs as part of the module cost or as part of the BOS cost. Therefore the BOS cost might include both non-hardware as well as some soft cost contributions.

Figure 5 shows CEFIA's CT data for 2012 cost components collected from installer incentive applications. Figure 6 shows what the CT 2012 cost components would be using the U.S. composite cost component percentages benchmarked in Figure 4.

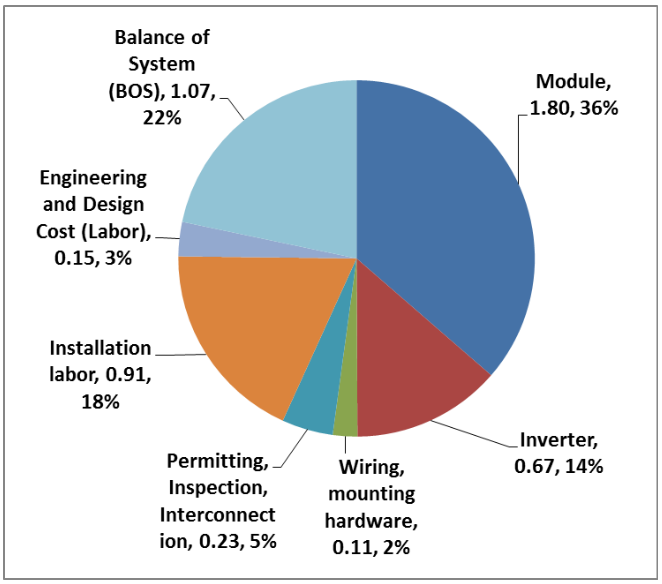


Figure 6: CEFIA CT 2012 Residential Solar PV Cost Components

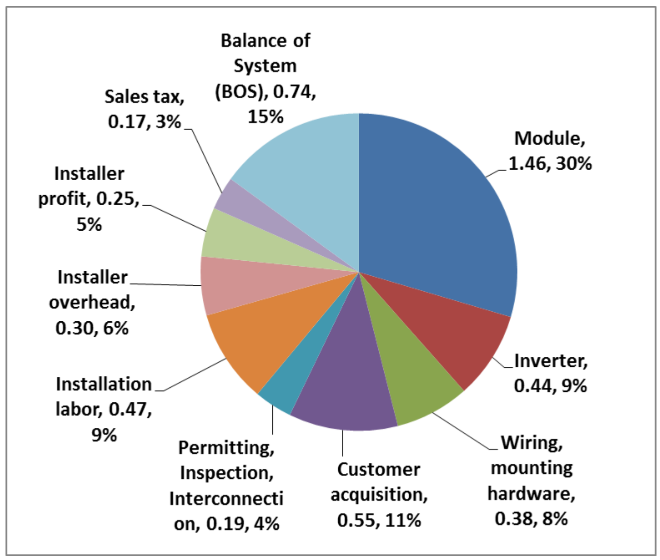


Figure 5: CT 2012 Residential Solar PV Cost Components using U.S. Composite Data Percentages

Comparing Figures 5 and 6 illustrate how soft cost component datasets may reflect lack of resolution or uncertainty on some cost components. For example, the CEFIA raw data in Figure 5 suggests that installation labor is 18% of the installed cost. Figure 6 shows that the U.S. benchmark data attributes only 9% to installation labor. Combining installation labor, installer overhead and installer profit from Figure 6 get us to 20%, indicating that the CEFIA "installation labor" raw data point could possibly include other cost contributions such as installer overhead and/or profit.

Customer acquisition cost in CT is estimated by speaking to installers to be $0.50/W, though this data point is not captured by the CEFIA incentive program dataset and therefore is assumed to be part of the Balance of System (BOS) cost of $1.07/W. The $0.50/W estimate is comparable to the $0.55/W number attributed to customer acquisition by using the U.S. composite benchmark in Figure 6.

Solarize versus Non-Solarize

In Connecticut, the Solarize Program has had a tremendous impact on reducing solar PV installation costs, so the CEFIA data presented in Table 7 presents combined CEFIA data, as well as non-Solarize and Solarize installations separated out for 2012 and 2013 data. Solarize installations in 2012 were $1.20/W or 23% lower in cost than non-solarize installations, with about one-third of this cost difference due to lower hardware (i.e., module) costs and about two-thirds or $0.80/W due to lower soft costs. In 2012, soft costs for solarize installations were lower, 43% of installed cost, as compared to soft costs for non-solarize installations, 48% of installed cost.

In preliminary 2013 data (from May 2013), solarize installations are $1.03/W or 21% lower in cost than non-solarize installations, with soft costs accounting for a $1.30/W cost reduction and hardware costs contributing a $0.27/cost *increase* for solarize versus non-solarize installations in 2013. Soft costs for solarize installations were 38% of installed cost in 2013, as compared to 57% for non-solarize installations.

The soft cost components accounting for lower Solarize installation costs in 2012 are as follows: customer acquisition cost, installation labor, engineering and design cost, and balance of system (BOS) costs. BOS costs include installer overhead, profit, supply chain and other costs. Note that BOS costs in the CEFIA data may include some hardware costs such as wiring and racking for which there is no category in the CEFIA data. Installers may have reported these additional hardware costs either in the module cost number or in the reported BOS cost number. For example, racking and wiring would be roughly comparable in magnitude to the cost of an inverter, which could possibly account for some or a large part of the $0.46/W BOS cost difference between non-solarize and solarize installations in 2012, and possibly some of the BOS cost difference of $0.83/W in 2013.

Soft Costs in Germany versus Connecticut

Connecticut's Solarize Program has had the effect of reducing soft costs to an estimated 38% of system cost according to preliminary 2013 data. In Germany, where total installation costs are lower than in the United States, soft costs may contribute to as low as 21% of total installation cost. Table 7 allows for comparison of installed costs in Germany as compared to in the United States and in particular to Connecticut 2013 Solarize installation data. Installed costs in Germany are lower primarily due to soft costs in the following categories: customer acquisition; installation labor; permitting, inspection and interconnection (or PII); and other balance of system costs.

Note that the LBNL survey data on soft costs in Germany shown in Table 7 are low end estimates in several categories and could be higher than what is reported by LBNL. For examples:

- The LBNL survey estimated customer acquisition costs in Germany to be $0.07/W versus the $0.69/W for the U.S. per the NREL survey (or $0.50/W as reported by CT installers). A previous study by Langen, cited in the LBNL report, estimated U.S. and Germany customer acquisition costs to be higher, at $1.1/W for the U.S. and $0.4/W for Germany. The cost differences between the U.S. and Germany numbers, however, are similar at $0.62/W for both sets of comparisons.
- LBNL/NREL PII estimates are $0.24/W for the U.S and $0.03/W for Germany. Langen estimates PII at $0.80/W in the U.S. and $0.10/W in Germany, so the Langen estimates are higher for both, and suggest a bigger gap between U.S. and Germany PII costs.
- Installation labor in the U.S. is $0.59/W according to LBNL/NREL survey data and is estimated to be $0.23/W in Germany based on an LBNL survey. An EuPD study cited in the LBNL report

estimated Germany installation labor at $0.42/W, still lower than in the U.S. but with a smaller difference. The estimate of $0.23/W for installation labor provided by Germany installers reflects 39 hours of installation time in Germany versus an average of 75 hours per system needed by U.S. installers.

Improving Data Definition and Collection

As stated previously, the last cost component category in Table 7, identified as balance of system (BOS) cost, may include some hardware as well as some soft cost and thus introduces uncertainty into this analysis. Collaborators from the Yale team surveyed a small sample of solar PV installers and verified that some installers are including racking and wiring cost contributions with module (and therefore hardware) costs and in some cases with balance of system costs.

Further resolution on Connecticut residential solar PV cost components may be obtained by improving how cost component data is defined and collected through incentive program applications and/or by conducting a survey of Connecticut installers, similar to NREL's nationwide installer survey.

NREL and CEFIA Soft Cost Comparison

Comparing the NREL soft cost survey data to CEFIA data is not straightforward given differences in the cost component variables used and uncertainty in both sets of data. In the NREL data, surveyed soft costs amounted to about half of total soft costs, with the remaining soft costs still needing to be resolved, including installer overhead, profit, financing costs (non-labor), and other soft costs represented in Table 7 as Balance of System (BOS) costs. For the CEFIA data, BOS costs may include additional installer labor not captured by cost component categories in CEFIA's dataset and possibly some hardware costs such as wiring and racking as stated previously. Therefore, better data definition and collection is needed to obtain complete soft cost component breakouts.

Regardless of the differences in soft cost component categories as well as uncertainties in the data, some comparison can still be made for permitting, inspection and interconnection (or collectively, PII) data. Shown in Table 8, total PII costs represented in the NREL analysis are about $0.22/W for 2010 data and are $0.23/W in both CEFIA's 2012 and 2013 datasets. (Interestingly, Solarize installations appear to have higher PII costs than non-Solarize in CEFIA's 2012 and 2013 dataset, though there are uncertainties in the accuracy of the data and the 2013 data is still preliminary from May 2013). Table 8 provides a third comparison with estimated PII numbers based on known Connecticut permitting and interconnection fees, as compared to CEFIA data reported by installers through the incentive program.

Table 8: Residential Solar PV Permitting, Inspection and Interconnection (PII) Cost Estimate Comparison

Fees/Costs ($/W)	U.S. 2010 data NREL/ LBNL survey	CEFIA 2012 data	Known/ Estimated Cost in CT	Comments
Permit fee	0.09	0.09	0.063	Based on a $442 average permit fee in CT for a $35,000, 7kW system
Interconnection fee	Not specified	0.03	0.014	Based on a $100 interconnection fee for a system of size < 10kW
Permitting, inspection and interconnection (PII) labor	0.13	0.11	0.18	NREL number represents PII labor. CEFIA number includes municipal and utility inspection costs but not permit preparation and submittal, which NREL analysis estimates to be $.07/W. Estimated CT cost is thus 0.11+.07=.18
Total	**0.22**	**0.23**	**0.26**	**Estimated CT cost based on NREL and CEFIA data is about $0.26/W**

As with soft cost component data in general, CEFIA PII data definition and collection could be improved. For example, it was discovered that some installers were reporting higher permit fees than others for similar sized systems in the same town. Some installers may have been including related costs such as permit preparation and labor as part of the reported permit fee cost. The data uncertainties prompted the team to collect permit fee data directly from all 169 CT jurisdictions to obtain a dataset that would inform a permit fee recommendation to the CT legislature. See section 7.2 of this report for details.

CEFIA Hardware and Non-hardware Cost Data

Table 9 and Figure 7 present CEFIA data collected through residential solar PV incentive programs from 2004-2013, including the current RSIP starting in March 2012. Residential solar PV hardware and non-hardware costs are presented by year, with non-solarize and solarize data broken out in 2012 and 2013.

Table 9: CEFIA Residential Solar PV Hardware and Non-Hardware Cost Data (2004-preliminary 2013 data)

Year; Non-Solarize vs Solarize	System Size (kW)	Total System Cost ($/W)	PV Module Cost ($/W)	Inverter Cost ($/W)	Hardware Cost ($/W)	Non-Hardware Cost ($/W)	% Hardware	% Non-Hardware	% Module Cost	Installed Capacity (kW)	# Projects Installed
2004	4.23	9.00	4.80	1.45	6.25	2.75	69%	31%	53%	13	3
2005	4.23	8.27	4.86	0.91	5.77	2.50	70%	30%	59%	266	63
2006	4.59	8.82	5.19	0.89	6.08	2.74	69%	31%	59%	496	108
2007	5.66	8.86	5.12	0.79	5.91	2.95	67%	33%	58%	1,229	217
2008	6.56	8.30	5.22	0.73	5.95	2.34	72%	28%	63%	3,140	479
2009	7.14	7.72	4.92	0.62	5.54	2.18	72%	28%	64%	3,355	470
2010	7.27	6.63	4.02	0.70	4.73	1.90	71%	29%	61%	3,178	437
2011	7.13	5.75	3.25	0.74	3.99	1.76	69%	31%	56%	1,568	220
2012	**7.00**	**4.95**	**1.80**	**0.67**	**2.59**	**2.36**	**52%**	**48%**	**36%**	**5,709**	**816**
2012 Non-Solarize	6.93	5.11	1.88	0.66	2.64	2.46	52%	48%	37%	4,864	702
2012 Solarize	7.42	3.91	1.30	0.78	2.24	1.67	57%	43%	33%	845	114
2013	**7.18**	**4.50**	**1.44**	**0.66**	**2.22**	**2.28**	**49%**	**51%**	**32%**	**3,362**	**468**
2013 Non-Solarize	6.88	4.89	1.43	0.59	2.11	2.78	43%	57%	29%	1,968	286
2013 Solarize	7.66	3.86	1.47	0.77	2.38	1.48	62%	38%	38%	1,395	182
										22,316	**3,281**

The following are observations about the CEFIA data in Table 9 and Figure 7:

1. Average system sizes have increased from 2004 to 2013, with the average system size in 2012 being 7kW.
2. Average total system costs have decreased from 2004 to 2013, most sharply between 2007 and 2011, with the average system cost in 2012 down to $4.95/W, or $34,650 for a 7kW system.
3. Average solar PV module costs decreased overall from 2004 to 2013, though costs increased slightly between 2005 and 2008 possibly due to the polysilicon shortage during these years. In 2013, module costs are beginning to flatten out/ stabilize.
4. Average hardware costs and total system costs have declined steadily from 2004-2013 following the decline in module costs.
5. Average inverter costs have stayed about the same after decreasing from 2004 to 2005 and have become a greater share of hardware as well as total costs as module costs have declined.
6. Average hardware costs have declined steadily from 2004-2013 following the decline in module costs.

7. Average soft costs have only decreased slightly and have increased in some years including from 2011 to 2012.
8. In terms of percent hardware versus soft cost contributions from 2004-2011, hardware has been roughly 70% and soft costs have been roughly 30% of installed costs. In 2012, this ratio changed to 52% hardware and 48% soft costs. Preliminary data for 2013 is similar, with 49% hardware and 51% soft costs.

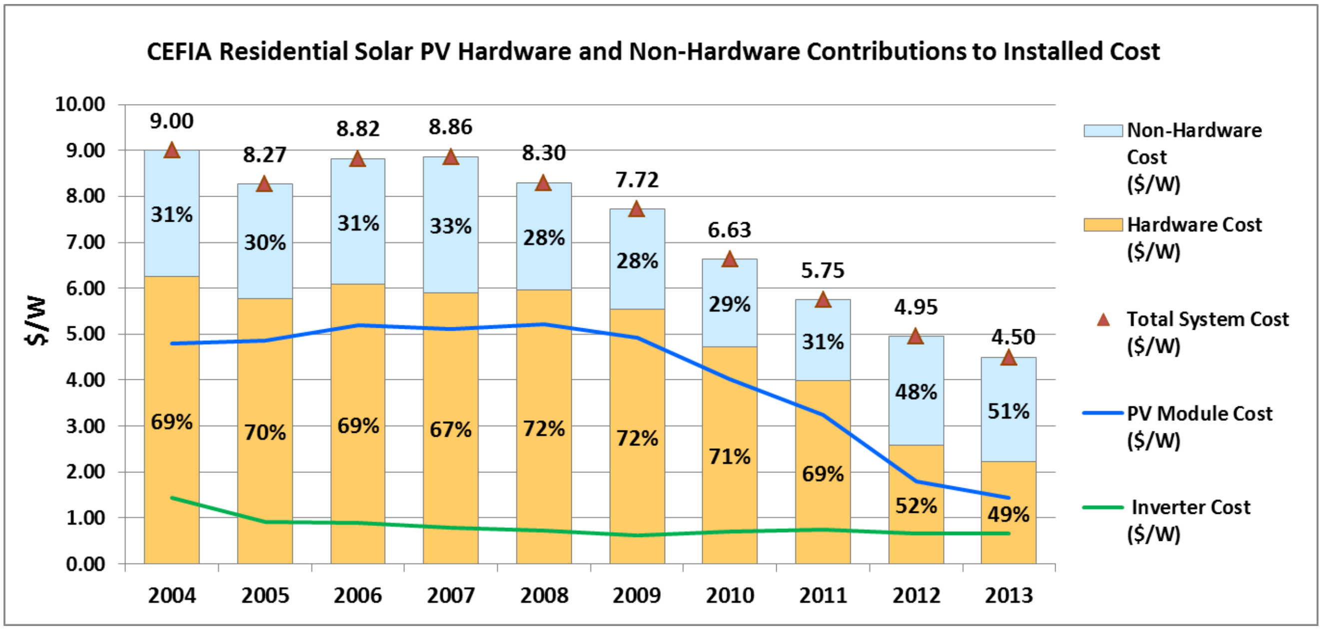


Figure 7: CEFIA Residential Solar PV Hardware and Non-Hardware Contributions to Installed Cost (2004-2013)

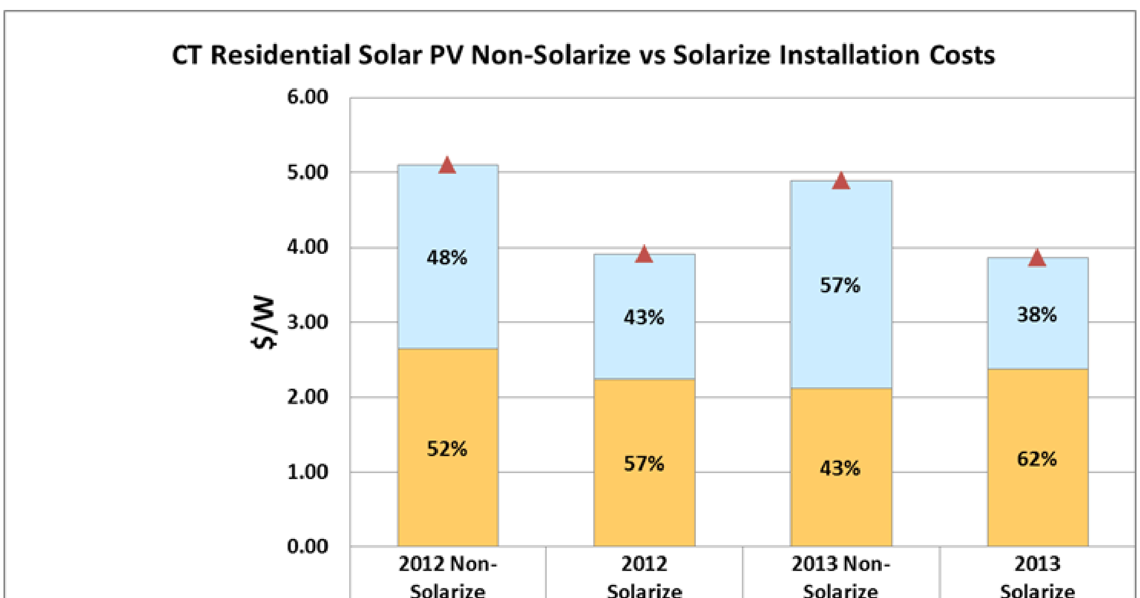
Of note in Table 9 and Figure 7 is the steep drop in module costs from 2011 to 2012 and the change in percent hardware versus non-hardware from 70/30 from 2004-2011, closer to 50/50 from 2012 onwards. The 50/50 split applies to 2012 and 2013 CEFIA data, but not the Solarize subset of data for which soft costs are lower than 50%. Note that the word “cost” is used throughout this discussion though cost may be more correctly referred to as “price,” which is what is being paid for the systems by customers, through installers.

Solarize Program Impact on Soft Costs

CEFIA data point to a dramatic reduction in solar PV installation cost for installations deployed through the Solarize Program. Figure 8 shows the difference in overall costs as well as the differences in percent hardware and non-hardware costs for year 2012 and preliminary 2013 data. The following are some observations about the data:

- Total system costs are clearly higher for non-Solarize versus Solarize installations, \$5.11/W versus \$3.91/W in 2012 (a 23% reduction), and \$4.89/W versus \$3.86/W in 2013 (a 21% reduction).
- With respect to percent hardware versus percent non-hardware cost, Solarize installations reached \$1.67/W in soft costs in 2012 or 43% of total system cost, and reached \$1.48/W in soft costs in 2013 or 38% of the total system cost, significantly lower than for non-Solarize installations with soft costs at 48% in 2012 and 57% in 2013.

- The percent reduction in soft costs in 2012 for non-Solarize ($2.46/W) versus Solarize ($1.67/W) installations was 32%. For preliminary 2013 data, non-Solarize soft costs ($2.78) were almost twice as high as solarize soft costs ($1.48), representing a 47% reduction.
- **In 2012, two thirds or $0.80/W of the difference of $1.20 between non-solarize and solarize installation costs ($5.11/W versus $3.91/W) could be attributed to a reduction in soft costs.** In 2013, soft cost reductions were 126% of the difference of $1.03/W between non-Solarize and Solarize installations costs ($4.89/W versus $3.86/W), while hardware costs for solarize installations in 2013 are actually higher by 26% as compared to non-Solarize installations. Note that 2013 data are preliminary, only include CEFIA data through May 10, 2013 and should be re-analyzed with a complete 2013 dataset. The numbers presented here for partial year 2013 data may not yet be providing a complete picture. Note also that the Solarize Program allows customers to select and pay extra for adders such as the use of PV modules made in the U.S., so it will be important to assess the impact of adders on Solarize costs.
- Contributions to the solarize versus non-solarize cost reduction include reduced customer acquisition cost (from about $0.50/W estimated by CT installers to about $0.14/W) and likely include reductions in installer labor, overhead, profit, and other costs which may be amortized over a large number of installations. As stated previously, it is estimated that soft costs account for 2/3 of the difference in 2012 costs between non-Solarize and Solarize installations. See section 15.0 of this report for further information about the CT Solarize Program and program impacts. The exact non-Solarize versus Solarize numbers presented in this section versus section 15.0 may differ slightly due to the date the CEFIA data was accessed for each analysis.
- Lastly, for data through May 2013, the cut-off for what was included in this analysis, non-Solarize data may be inflated by approximately $0.15/W as compared to Solarize data due to a higher number of non-Solarize third party owned systems which are higher priced.



	2012 Non-Solarize	2012 Solarize	2013 Non-Solarize	2013 Solarize
Non-Hardware Cost ($/W)	2.46	1.67	2.78	1.48
Hardware Cost ($/W)	2.64	2.24	2.11	2.38
Total System Cost ($/W)	5.11	3.91	4.89	3.86

Figure 8: CEFIA Non-Solarize versus Solarize Hardware, Non-Hardware and Total System Costs (2012-2013)

5.0 Scaling up Solar PV Deployment in Connecticut

5.1 Installed Solar PV Capacity in Connecticut

Public Act 11-80 specifies ambitious targets for deployment of solar energy, including a target to install 30 MW of new residential solar PV by the end of 2022.[24]

Connecticut residential solar PV deployment has increased dramatically over the past two and a half years, as a result of clear and ambitious policy goals, effectively designed and well-managed incentive and financing programs and a tremendously effective Solarize campaign (now in its third phase).

As of June 28, 2013, the end of CEFIA's 2013 fiscal year, approximately 9.3 MW of additional solar PV (1325 projects) had been installed through CEFIA's Residential Solar Investment Program (RSIP) since its inception in March 2012. This additional 9.3 MW brings CEFIA's total to 23.3 MW of residential solar PV capacity (3430 projects) installed with support of CEFIA/CCEF administered ratepayer funds since 2004.

Figure 9 illustrates the ramp up of residential solar PV installations in 2012 along with decreasing costs and decreasing reliance on ratepayer funds. The ratepayer contribution to the cost of a residential solar PV system in Connecticut has dropped from approximately half of the cost historically to about one-third of the cost starting in 2011.

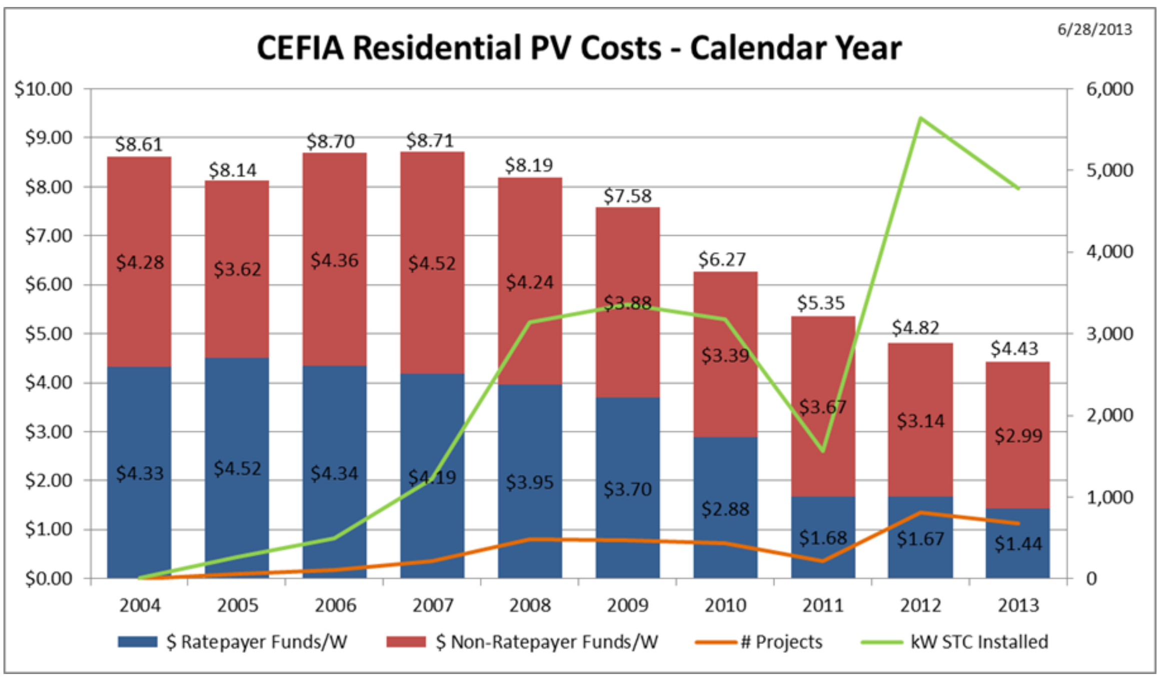


Figure 9: CEFIA Residential Solar PV System Costs Declining, Installation Volume Increasing, Ratepayer Cost Contributions Decreasing (2004-2013)

[24] Public Act 11-80, cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm, and Conn. Gen. Stat. § 16-245n require CEFIA to establish a residential solar investment program that will result in a minimum of 30 MW of new residential solar PV installations in the state by the end of 2022.

How much non-residential solar PV has been installed in Connecticut? Starting in 2001 and phasing out in 2011-2013, CCEF/CEFIA provided rebates for the installation of 254 commercial solar PV projects amounting to 23.6 MW of installed capacity through incentives programs such as the On-Site Distributed Generation (OSDG) Program. As of June 30, 2013, CEFIA's database included only a handful of commercial solar PV installations in 2012-2013, with 19 commercial installations completed in 2012 and one in 2013.

Incentives for commercial and industrial solar PV installations are now provided through the ZREC Program administered by Connecticut Light and Power (CL&P) and United Illuminating (UI). The 2012 ZREC auction resulted in commitments for approximately 26 MW of commercial and industrial solar PV installations expected on-line by the end of 2013.

For more information about the ZREC Program, see section 14.10 of this report, and the CL&P and UI websites.[25] Note also that the Commercial Property Assessed Clean Energy (C-PACE) Program provides a financing vehicle for adoption of clean energy including solar PV. For more information about C-PACE, see section 14 of this report on financing, as well as www.c-pace.com.

Adding up CCEF/CEFIA residential and non-residential solar PV installation data through June 2013, estimated CEFIA solar PV installation data from July-December 2013, and ZREC Program commitments to date provides for an estimated 82.3 MW in cumulative installed solar PV capacity in Connecticut (see Table 10).

Table 10: Estimate of CT Cumulative Solar PV Capacity Installed and Committed through 2013 (MW)

Residential and Non-residential Solar PV Installation Data Sources	CT cumulative installed solar PV capacity – 2013 (MW)
CCEF/CEFIA residential solar PV data (2004- June 2013)[26]	23.3
CEFIA residential solar PV data – estimated capacity (July-December 2013)	7
CCEF/CEFIA non-residential installation data (primarily 2001-2011, a few installations completed in 2012-2013)	23.6
ZREC Program 2012 – CL&P commitments for commercial and industrial solar PV (expected on-line in 2013)	21.0
ZREC Program 2012 – UI commitments for commercial and industrial solar PV (expected on-line in 2013)	5.1
Small ZREC Program 2013 – UI commitments for commercial and industrial solar PV (expected on-line in 2013, possibly 2014)	2.3
Total	**82.3**

[25] www.cl-p.com/Home/SaveEnergy/GoingGreen/Renewable_Energy_Credits/ and for UI: UI LREC/ZREC link and UI Small ZREC link

[26] Approximately 9.3 MW contributed from RSIP Program from March 2012-June 2013.

5.2 Solar PV Adoption Patterns

Project team members Marcello Graziano and William Waite from the University of Connecticut School of Business' Connecticut Center for Economic Analysis conducted a spatial distribution analysis to gain insight on patterns of adoption and adoption per capita for solar PV in Connecticut as spatially associated with factors such as community type (e.g., urban, suburban, rural), housing density (a proxy for multi-family versus single family homes), ownership structure (density of renters), and income (median household income levels).

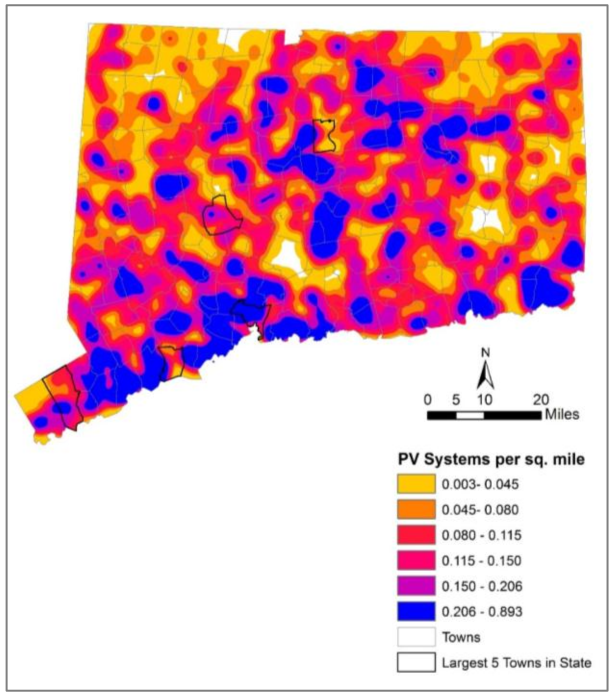


Figure 10: Cumulative Residential Solar PV Installations per Square Mile (with data grouped into quintiles)

Spatial distribution analysis has been well established in geography and other disciplines since the 1960s[27] and has recently come into use in crime analysis, epidemiology and other fields, in particular a type of spatial analysis called hotspot analysis.

A summary and excerpts from the analysis, "Rooftop Solar Adoption Pattern 2004-2012: Hotspots and Density Analysis," is provided here along with a link to the full report.[28] The data used in this analysis were residential solar PV data collected by CCEF/CEFIA through its incentive programs. The analysis used ArcGIS 10.1 and built-in modules for calculating, displaying and testing the results. The present analysis represents the first step towards a larger research effort and will be incorporated as part of a doctoral thesis by the authors. The thesis title is "Adoption of Diffused Renewable Energy Technologies: Patterns and Drivers of Residential Photovoltaic Systems in Connecticut, 2005-2013."The study relied on two methodological approaches, focusing primarily on the second:

1. Kernel Density Analysis (KDA) which is an interpolation technique that forecasts the spatial distribution of point-features over a specified surface using actual observations points; and
2. Hot Spot Analysis or Getis-Ord Gi* Statistics (GOG) which uses census block group[29] data to identify hotspots where higher (lower) values cluster non-randomly.

KDA uses actual observation points to simulate what the distribution would be in those areas where no observation points occur. The final result is a surface where the density of observation points is shown, with higher values where the observation points cluster together. Figure 10 shows dark areas where there are the most residential solar PV installations per square mile. The darkest areas represent areas of 0.206-0.893 installations per square mile. This first map, however, is misleading as each breakpoint

[27] Hagerstrand, T. "Innovation diffucision as a spatial process," 1968. cabdirect.org/abstracts/19691800901.html
[28] Full UConn report: ccea.uconn.edu/studies/SpatialStatisticsAnalysis-Hotspots_20130728release.pdf
[29] Block Groups (BGs) are statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people, and are used to present data and control block numbering. A block group consists of clusters of blocks within the same census tract that have the same first digit of their four-digit census block number. For example, blocks 3001, 3002, 3003,… ,3999 in census tract 1210.02 belong to BG 3 in that census tract. www.census.gov/geo/reference/gtc/gtc_bg.html

(or change in color) in the data contains 16.67% of the total observations.

Figure 11 shows the same data but with the breakpoints (or changes in color) set at regular intervals each spanning a range of 0.15 in value. The darkest areas have PV system density of 0.75-0.9 solar PV systems per square mile, almost one system per square mile.

Figure 12 highlights the pattern of adoption across the state with most solar PV systems occurring along the Connecticut River corridor and along the coast around but outside larger urban areas. Milford, for example, has high solar PV installation density according to this map.

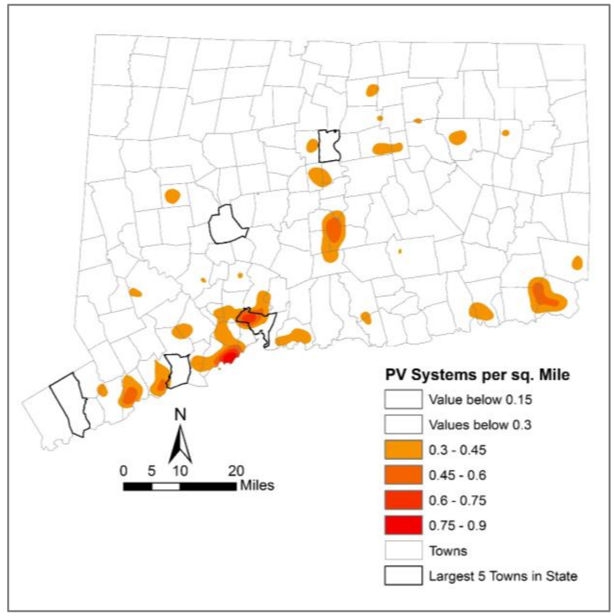


Figure 11: Cumulative Residential Solar PV Installation Data per Square Mile (same-sized data display intervals)

An advantage of KDA lies in the use of actual observed values rather than aggregated data. A disadvantage is that it does not weight or normalize results in terms of population, income, population density or any other socioeconomic variable. Due to this limitation, the UConn analysts used the GOG methodology for the rest of the analysis, allowing for identification of weighted concentrations of solar adoption as well as clusters of concentrated areas of PV adoption.

In GOG analysis, the data are aggregated, in this case by census block groups and weighted by population (number of rooftop solar PV systems per thousand residents). The block groups are then analyzed to identify statistically significant clustering among block groups of solar PV adoption data. Positive statistical values (with GiZScore > 1.96) represent clusters of block groups with high adoption (in terms of adoption per thousand people). The reddest colored polygons show the "hotspots" with the highest value clusters or concentrations of solar PV adoption. This spatial representation of solar PV adoption provides another perspective not evident from the KDA spatial analysis.

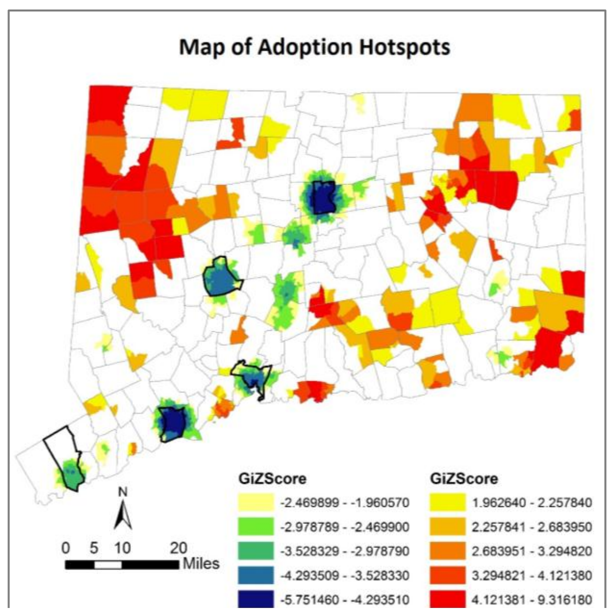


Figure 12: Residential Solar PV Adoption Map with Data Aggregated by Census Block Groups and Weighted by Population

What can be inferred from Figure 12 is that lower per capita adoption rates cluster together around Connecticut's urban or most developed areas, with low adoption rates decaying towards the suburbs. The pattern is similar for the five largest urban areas in CT around the cities of Bridgeport, Hartford, New Haven, Stamford and Waterbury. Higher per capita adoption rates cluster together in rural areas in the northwestern and eastern portions of the state, with a few pockets in lower, central Connecticut. In the urban, developed areas of the state, *low solar PV adoption* relative to population is spatially associated with housing density (high housing density, a proxy for more multi-family versus single family homes), ownership structure (high density of renters versus owners), and income (low median household income levels).

Figure 13 shows patterns of solar PV adoption associated with income levels. *Solar PV adoption hotspots* (weighted for population) are spatially associated with areas that have low housing density, low density of renters, and median household income in the third and fourth quintiles of income (higher income levels but not necessary the highest levels). The last observation about income levels suggests that once a certain income level is reached, the ability to adopt solar PV is there and then the decision to adopt depends on other factors. If solar PV can be made more accessible to all income levels, homeowners that are not necessarily at the highest income level may be just as or even more likely to adopt PV.

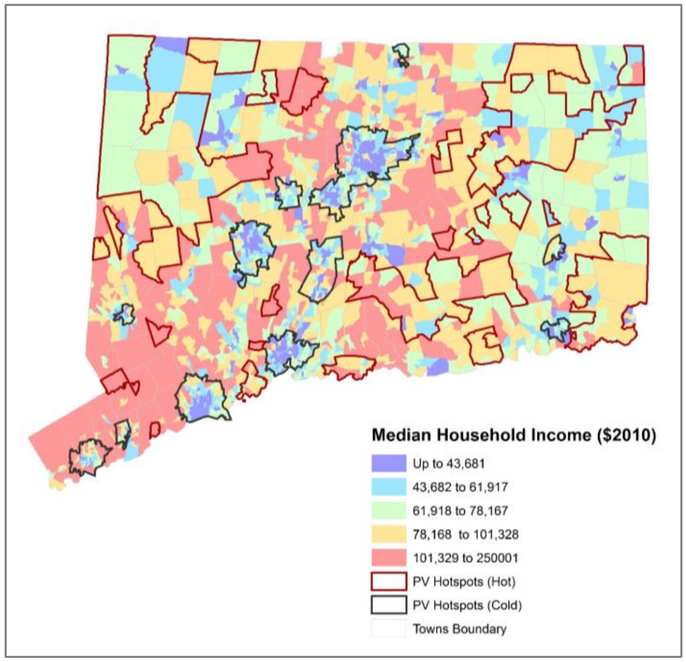


Figure 13: Residential Solar PV Adoption Associated with Higher Income Levels but the Highest Income Levels are not the Highest Adopters

There are many factors impacting solar PV adoption. An example of a factor in the multi-family sector is the ability to submeter for a building with tenants. A case study of a relatively high income all-rental building at 360 State Street in New Haven includes discussion of submetering considerations.[30] In 2011, a multiagency federal task force issued a report recommending submetering in building design and retrofits wherever there is economic justification.[31]

The lower adoption rates associated with high housing density areas (which likely include more multi-family housing), as well as areas with higher density of renters, points to the importance of policy, legislative and program strategies in supporting solar PV adoption.

5.3 Connecticut's 2013 Legislative Session – Support for Clean Energy

Connecticut's 2013 legislative session resulted in significant new laws and enhancements to existing laws providing another year of landmark legislative support for clean energy deployment, both energy efficiency and renewable energy. Building on the landmark Public Act 11-80 legislation passed in 2011, this year's session has been hailed as another milestone in terms of impactful policy and legislative support for the industry. For example, Public Act 13-61 provides for a property tax exemption for commercial and industrial systems, mentioned earlier in this report as being critical to ensuring economic viability of these systems, especially as these installations are now supported by C-PACE financing. Without the exemption, the cash flow benefit from avoided electricity costs which makes solar PV and other clean energy system adoption feasible would be offset by property taxes. Residential property tax exemption for clean energy systems has already been law.

The following are links to and highlights of 2013 legislative developments impact clean energy

[30] "Building-Related Renewable Energy and the Case of 360 State Street," Sara C. Bronin, UConn - School of Law, Nov.27, 2012, Vanderbilt Law Review, Vol. 65, No. 6, 2012. papers.ssrn.com/sol3/papers.cfm?abstract_id=2181635
[31] NAT'L SCI. & TECH. COUNCIL COMM. ON TECH., SUBCOMM. ON BLDGS. TECH. RESEARCH & DEV., SUBMETERING OF BUILDING ENERGY AND WATER USAGE, at x, 15 (2011).

deployment, along with a link to Public Act 11-80 from 2011 for reference. Summaries of the below public acts may be accessed from the CT Office of Legislative Research: www.cga.ct.gov/olr/olrpasums.asp or www.cga.ct.gov/olr/sitesearch.asp.

Table 11: 2013 Legislative Developments Supporting Deployment of Clean Energy (plus reference to PA 11-80)

2011 Legislative Session	
An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future. Senate Bill 1243, Public Act 11-80. (cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm, and www.murthalaw.com/publications/918-summary-public-act-number-11-80-act-concerning-establishment-of)	• Creation of Department of Energy and Environmental Protection (DEEP). Requires DEEP to develop a comprehensive State Energy Plan and establishes a variety of new programs to promote clean energy and energy efficiency. • Creation of Clean Energy Finance & Investment Authority (CEFIA)
2013 Legislative Session	
An Act Concerning Property Tax Exemptions for Class I Renewable Energy Sources. Substitute Senate Bill No. 203, Public Act No. 13-61. (cga.ct.gov/2013/ACT/PA/2013PA-00061-R00SB-00203-PA.htm)	• Property Tax Exemption – Mandatory commercial and industrial property tax exemption for Class I renewable energy sources.
An Act Concerning the Commercial Property Assessed Clean Energy Program. House Bill 6472, Public Act 13-116. (cga.ct.gov/2013/act/pa/2013PA-00116-R00HB-06472-PA.htm)	• C-PACE Enhancements – Benefit assessment during construction, foreclosure impacts in arrears and benefit assessment on property, mortgage holder consent, and district heating and cooling.
An Act Concerning Implementation of Connecticut's Comprehensive Energy Strategy. House Bill 6360, Public Act 13-298. (cga.ct.gov/2013/ACT/PA/2013PA-00298-R00HB-06360-PA.htm)	• On Bill Repayment – Residential sector financing tool for "clean energy," for which CEFIA is the statewide administrator. Also allows for financing of healthy home measures (e.g., asbestos removal). • Energize CT – Adaptation of the Solarize model to fuel conversions, heating equipment replacement, and energy efficiency in partnership with DEEP and utilities. • Renewable Energy and Efficient Energy Finance Program – $18 million of bond funds and collaboration between DEEP, DECD, and State Treasurer to provide grants, investments and loans for clean energy. • Expansion of Virtual Net Metering (v.n.m.) to state agencies and agricultural customers in addition to municipalities, increases max size from 2MW up to 3MW, allows for class III

	resources such as cogeneration, allows customers connected to a micro-grid to share credits with up to ten non-state or municipal critical facilities (e. g. hospitals, police and fire stations, and municipal centers).
An Act Concerning Connecticut's Clean Energy Goals. S.B. 1138, Public Act 13-303. (cga.ct.gov/2013/act/pa/2013PA-00303-R00SB-01138-PA.htm)	• Alternative Compliance Payments – Redirects ACP from CEFIA back to the ratepayers to alleviate ZREC-LREC long-term costs. Provides consideration for large scale resource inclusion in RPS.

6.0 Project Data Collection and Methodology

CEFIA and its project partners collected and analyzed data based on U.S. DOE Solar Metrics questions pertaining to rooftop solar PV soft costs and market barriers, permitting, planning and zoning regulations, interconnection, and financing.

At the outset of the project, each jurisdiction designated an official point of contact who identified the appropriate municipal officials to survey or interview for each topic area. CEFIA and CBEY then contacted those individuals by phone and email to initiate data collection and schedule interviews.

Several different types of survey instruments and questionnaires were developed primarily based on DOE Solar Metrics questions, including an online Qualtrics survey implemented by Yale University to collect permitting data. The team also created various fillable forms and email questionnaires to collect data electronically. Interviews were conducted in person and by phone to collect follow-up permitting data (where clarity was needed or where omissions were made) and planning and zoning information from jurisdictions. The project team collected data from both jurisdictions and solar PV installers to better understand processes and opportunities for improvement associated with permitting, planning and zoning and interconnection for solar PV. Information on interconnection was collected through several in person meetings with the utility companies, conducted by Yale and CEFIA. Additional information was obtained via research on websites, attendance at webinars and conferences, reading the latest reports on soft cost related topics, and by consulting with experts in person and by phone. Later in the project, the team collected additional data from each jurisdiction including indicators of a jurisdiction's solar-readiness for display on an online rating system and map.

The data collection, analysis and related research provided the information need by the project team to identify best practices and opportunities for improvements, and develop recommendations for business process improvements on the local, utility and state levels. The recommended tools and measures are designed to make solar PV installation easier, faster and cheaper in order to make solar PV accessible to more CT residents and business owners and remove market barriers to widespread adoption of solar PV in Connecticut.

Solutions in Place: Simply Civic

Simply Civic provides a simple, fast and affordable online permitting solution for all of a jurisdiction's permitting needs. The system is now being piloted across the country and in Connecticut allowing the company to refine and improve the permitting system. Simply Civic is free to all Connecticut jurisdictions until December 2014 and at an affordable rate in 2015 and beyond.

7.0 Permitting Processes in Connecticut

7.1 Summary of Findings and Conclusions

Improving permitting processes in Connecticut jurisdictions can help to reduce costs for solar PV installers, homeowners, business owners and jurisdictions, and will increase economic activity. Jurisdictions in Connecticut have a diverse set of requirements and processes for rooftop solar PV permitting.

The Sun Rise New England team has identified opportunities for improvement in the following aspects of the permitting process:

1. Information availability
2. Application submission
3. Review and inspection requirements
4. Permit fees

Inefficiencies in each of these areas increase the time taken to approve permits resulting in a slower, cumbersome and costly permitting process. In addition, confusion resulting from inconsistent requirements across the state adds to the difficulties encountered by installers seeking permits for both residential and commercial installations.

7.2 Rooftop Solar PV Permitting – Opportunities for Improvement

Information Availability

Incomplete permit applications from installers are among the most time consuming and frustrating problems facing permitting departments (usually the building department). Although it is the installers' responsibility to submit complete applications, it is often difficult for installers to determine what documents and processes are required for solar PV permits. Complete permit application packages reduce the time building department staff must spend on each permit application. Issues include:

- *Lack of Information availability online*—Although many Connecticut jurisdictions post online information pertaining to general permitting processes (including application forms, submission requirements, and contact information), not one of the 12 participating jurisdictions posts solar PV specific permitting information on their websites. Thus installers have no way of determining which applications and documentation are required for rooftop solar PV permitting.
- *Inconsistent requirements*—Each jurisdiction in Connecticut has its own requirements, guidelines and permitting process. This lack of consistency across Connecticut causes confusion among installers and can lead to missing information in permit applications, or unwillingness to conduct business in certain cities and towns.

Application Submission

The process of submitting an application for solar PV installations can be labor intensive and confusing for installers working in Connecticut. In addition to unclear permitting requirements, installers are often required to make multiple trips to jurisdictions, submit numerous documents and move applications between several departments in order to obtain approval. Installers across the state have reported these application submission issues:

- *In-person Submission*—Although many jurisdictions enable installers to obtain applications online, only five of the 12 participating jurisdictions surveyed allow permit submission online or via e-mail. Requiring installers to travel just to submit an application in-person results in unnecessary time and money spent by installers, ultimately costing money to the jurisdiction's constituent who is adopting solar.
- *Notarized Documents*—Notarizing documents is time consuming, requires additional travel and is an unnecessary extra step in obtaining a permit for solar PV installation.

- *Numerous Department Approvals and Sign-off Sheets*—Some jurisdictions require numerous departmental approvals and signatures for rooftop solar PV installations. Of the jurisdictions surveyed, the average number of departments requiring approvals was 3 for residential and commercial projects. Some jurisdictions require seven or more approvals in order to obtain a permit. Requiring many approvals delays decisions on permit requests and requires more work on the part of the jurisdiction to process permits. The table below shows our 12 partner towns and the number of residential (R) and Commercial (C) approvals required for each.

Table 12: Number of Departments Requiring Approval for One Solar PV Permit Application

Number of Departments Requiring Approval

Multiple approvals for a single installation result in additional time and cost for solar PV installers, as well as a more complex and time-consuming process for municipal staff. R refers to residential and C for commercial. Coventry, Middletown and Milford (residential) require approval from only one department, a best practice.

Town	1	2	3	4	5	6	7
Bridgeport							R/C
Cornwall		R/C					
Coventry	R/C						
Danbury			R/C				
Fairfield			R/C				
Greenwich					R	C	
Hampton		R/C					
Manchester		R	C				
Middletown	R/C						
Milford	R	C					
Stamford				R			C
West Hartford		R/C					

Permit Review and Inspection Requirements

Permit application review and inspection of the solar PV systems can be arduous and take up more time than necessary. The biggest factors that slow down this process are:

- *Unnecessary reviews:* Reviews conducted by professional engineers and requiring an engineering stamp of approval can be costly, time-consuming and should not be required on every installation, just those that really require it.

- *Unnecessary Inspections:* Rooftop solar PV systems are sometimes subject to additional and unnecessary inspections due to lack of familiarity or training to know what is most critical to inspect for.

- *Appointment windows:* Eight out of the twelve jurisdictions surveyed schedule inspections during 30 minute up to four hour time windows. Coordinating these long windows with installers and homeowners can be difficult and time consuming.

- *Multiple Inspection trips required:* Multiple inspection appointments scattered throughout an installation add more time that an installer, homeowner, and inspector must coordinate.

Table 13: Inspection Practices - Specific Appointments versus Windows of Time Appointments; Single versus Multiple Inspection Appointments

Town	Specific Appt Time	Window of Time	Single Inspection Appt (Comprehensive, or Specific as noted)	Multiple Inspection Appts[32]
Bridgeport		R/C		R/C
Cornwall	R/C		R (roof penetration pre-install)	C
Coventry		R/C	R/C	
Danbury		R/C		R/C
Fairfield		R/C		R/C
Greenwich		R/C		R/C
Hampton	R/C		R/C	
Manchester		R/C	R/C	
Middletown		R/C	R/C	
Milford	R/C		R/C (structural/ building final)	
Stamford		R/C		R/C
West Hartford		R/C	R/C[33]	

Inspection Best Practices: Hampton, Milford and Middletown

Hampton, Milford and Middletown make inspections easier for installers and customers of both residential and commercial solar PV systems by requiring a single instead of multiple inspections and by scheduling specific inspection appointment times instead of a window of time that can be as long as four hours.

Time Required to Secure a Rooftop Solar PV Permit

Best practices reduce the man-hours required to obtain a permit. Appendix III, question eight captures installers' estimates for what they consider to be fast, average and slow permit process times in CT in terms of man-hours required to secure a solar PV permit (excluding travel time). Residential permit process times in CT range from 10 minutes up to "hours and days," and commercial process times range from 10 minutes up to 30 hours. This data helps target a lean processing time of 10 minutes, certainly for straightforward applications.

Permit Fees

Detailed research on solar PV permit fees for this project, over and above DOE Solar Metrics data collection, focused primarily on residential permit fees, though many of the findings and recommendations translate to commercial permit fees as well. For example, the recommendation to waive or reduce fees to cost-recovery based flat fees is applicable to commercial systems, just with higher numbers involved. Currently, most jurisdictions

[32] See Appendix II, question 48, for more details on number and types of inspections (electrical rough-in, electrical final, roof penetration pre-install, structural/building final) for each of the 12 participating jurisdictions.
[33] West Hartford requires multiple inspection types for commercial systems but does all the inspections in one trip.

in CT use a value-based fee structure for calculating permit fees for both residential and commercial solar PV systems.

Permitting fees for residential rooftop solar PV across CT's 169 jurisdictions range from $0 (Manchester and Bridgeport) to approximately $1575, and average $428 for an average sized 7kW, $35,000 residential system in 2012. Fees are higher for costlier systems even though a municipality's work involved in permitting a residential system does not increase significantly with system cost or size. Jurisdictions charging high permit fees for residential solar PV installations may be collecting payments much higher than actual municipal processing expenses. Installers not familiar with a specific town's fee structure may underestimate the fee when providing an estimate to a customer. Constituents may not know that their jurisdiction is making it more difficult to go solar by charging an excessive fee and increasing the overall price they need to pay for their solar PV system.

Figure 14 illustrates the variation in residential solar PV permit fees across CT's 169 jurisdictions in comparison to a recommended $200 flat fee, representing municipal processing costs including permit application review and inspection that is estimated to be less than $200 on average.[34] A flat $200 permit fee for residential solar PV would for the majority of Connecticut jurisdictions save constituents a considerable amount on installation costs. If permit fees were waived or a flat fee no greater than $200 was adopted, CT residents could save on average $228 per installation and over $1300 in jurisdictions with the highest fees.

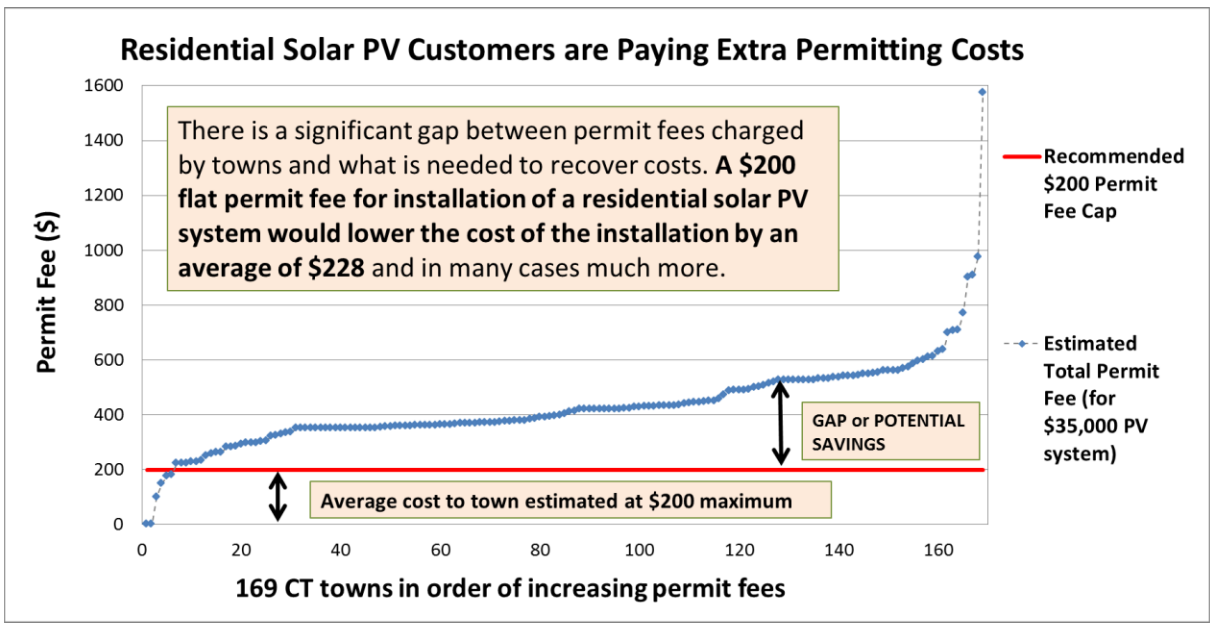


Figure 14: Residential Solar PV Customers are Paying Permit Fees In Excess of Estimated Processing Costs

[34] The cost to a CT jurisdiction for reviewing a solar PV permit application and conducting an inspection was estimated by collecting data directly from jurisdictions on the amount of time required for various aspects of the permit processing, multiplying these time estimates by maximum state of CT labor rates, and adding in travel costs and maximum overhead charges. Based on these calculations, the cost to a jurisdiction was conservatively estimated to be $100-150. A flat fee of no more than $200 is anticipated to cover a jurisdiction's costs.

The following CT jurisdictions have waived fees or adopted a flat permit fee for solar PV and in some cases clean energy systems more broadly:

- Bridgeport and Manchester have waived permit fees for all class I renewable energy systems[35]
- Bethany adopted a $150 flat fee and Chester adopted a $100 flat fee for residential solar PV systems as part of their participation in the Connecticut Solar Challenge[36]
- Durham has a $204.16 flat fee for residential solar PV systems
- Windham reduced its fee by 50% for residential installations put in place by CTech Solar through the Solarize Program.

How do permit fees impact deployment of residential solar PV in CT jurisdictions? CEFIA analysis done for this project of CT solar PV installation and permit fee data indicates that there is a relationship between permit fees and number of installations per capita, in particular, a moderate inverse or negative correlation. Towns with higher permit fees are more likely to have fewer solar PV installations per capita than those with lower fees. Towns with higher numbers of solar PV installations per capita are more likely to have lower permit fees. As more towns waive or adopt lower, flat fees, this correlation will likely bear out more strongly.

In summary, the team identified the following ways jurisdictions increase the cost and difficulty of obtaining a rooftop solar PV permit:

- *Value-based fee structure*: Using the valuation-based method of calculating fees can result in high, unpredictable permitting fees.
- *Payment in-person:* Requiring payment of permit fees in-person adds time and cost for installers, increasing cost of installation.
- *Permit fees for public buildings:* Some jurisdictions require permit fees for public buildings including schools and municipal buildings. These fees are an unnecessary cost to installers.

Permit Fee Best Practice: Manchester and Bridgeport

Manchester waived its permit fee for all Class I renewable projects in March of 2012. In December 2012, Bridgeport waived permit fees for Class I renewable energy projects (outside of supporting construction such as “footings and foundations”).

[35] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."
[36] ctsolarchallenge.com

Figure 15: "Go SOLAR Chester!" Signage for the CT Solar Challenge, Courtesy of Michael Phillips

8.0 Rooftop Solar PV Permitting Recommendations for Jurisdictions

Connecticut's Sun Rise New England team, led by CEFIA, has identified some of the best rooftop solar PV permitting practices in Connecticut and nationwide.[37]

8.1 Make Information Available

- **Bring Permitting Online:** Make information and resources pertaining to your solar PV permitting process and fee available and easily accessible via your jurisdiction website. Use online permitting software (please see "Adopt Online Permitting" in section 8.2).
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[38] Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[39] See West Hartford's websites for examples.[40]

[37] These recommendations are also included in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ and as a stand-alone document in the Permitting Guide tab of the Sun Rise New England – Open for Business website.

[38] energizect.com/SunriseNE and more generally, energizect.com

[39] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[40] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

- **Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

8.2 Streamline Permit Application Submission

- **Adopt the Standardized Solar PV Permit Application:** Clarify requirements and increase consistency across jurisdictions by adopting a standardized rooftop solar PV permit application package as provided in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE on the Sun Rise New England webpage.[41] Incorporate the standardized application into online permitting.
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[42] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and *submit* permit application materials through your website, by email, or by regular mail. This change saves installers time-intensive and costly trips to jurisdiction offices.

8.3 Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[43] If not a full waiver, consider a low or flat fee based on cost recovery instead of a value-based fee structure that may not accurately reflect the cost of solar PV permit review and inspection. Research in CT indicates that it should cost no more than $200, usually less, for a town to permit a small-scale (generally residential) rooftop solar PV installation. Streamlining processes can help further reduce costs to jurisdictions so that the fee more than covers a jurisdiction's cost. For examples, Bridgeport and Manchester waive permit fees for all class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by regular mail to save driving time and cost.

8.4 Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[44]
- **Remove Excessive Reviews**. Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

[41] energizect.com/SunriseNE

[42] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[43] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[44] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Waive Building Permit Requirement for Approved Designs** - The ordinance should waive the building permit requirement for certain pre-approved or basic solar models, such as flush-mounted solar panels and/or panels that do not exceed certain size or weight limitations. This waiver could be formulated to be stricter for solar collectors installed in high-wind zones.
- **Simplify the Inspection Process.** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of multiple inspections. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, especially residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[45] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

8.5 Formalize Best Practices

- **Adopt a Solar Friendly Ordinance** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.

8.6 Connecticut Rooftop Solar PV Permitting Guide

The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ provides all solar PV stakeholders with a straightforward and efficient solar photovoltaic (PV) permitting process. By adopting the recommendations and tools offered, jurisdictions can reduce their administrative costs, lower installation costs for solar PV installers and property owners, ,and enhance opportunities for state and local solar PV markets to grow. Reducing soft costs makes solar energy more affordable, helping to put solar photovoltaic (PV) systems on more Connecticut rooftops.

The GUIDE ✷ highlights effective rooftop solar PV permitting practices, focusing on the following areas:

- Information availability
- Permit application forms and instructions
- Review and inspection requirements
- Permit fees
- Formalizing solar-friendly practices

[45] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

The complete guide along with stand-alone forms and templates (allowing for modification and implementation) are available in the Permitting Guide tab of the Sunrise New England – Open for Business website.[46]

The contents of the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✹ are as follows:

8.7 Model Solar PV Ordinance for Jurisdictions

The Connecticut Rooftop Solar PV Permitting Guide ✹ includes a model solar-friendly ordinance which includes key elements of a streamlined permitting process for solar PV installation. The ordinance may be adjusted for suitability to each town and is also provided as a stand-alone document in the Permitting Guide tab on the Sunrise New England – Open for Business website.[47]

[46] www.energizect.com/sunrisene
[47] www.energizect.com/sunrisene

8.8 Online Permitting

An online permitting system saves resources, time and money. Ideally, online permitting software should be able to:

- Handle rooftop solar PV permitting as well as other types of permitting.
- Provide download options for the Connecticut Standardized Solar PV Permit Application Package
- Include an upload option for completed permit applications.
- Offer an interactive workflow for inspections, notifications and next steps.
- Display approval-status information.
- Provide downloadable approval documents.
- Be user friendly, with clear instructions on how to use the system.
- Allow online payments for jurisdictions that still require a permit fee for Class 1 renewables.

Online permitting systems bring efficiency to permitting processes across jurisdictions. Consistency and transparency allow installers and municipalities to handle higher volumes of permit requests, and enable the state of Connecticut to meet its goal of scaling up solar PV deployment.

The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers examples of online permitting systems in place or being developed for use in Connecticut and across the country. These include Simply Civic, ViewPermit, CityView and CRW Systems Trakit. Featured here is Simply Civic, one of the Connecticut project partners.

In June 2012, Simply Civic, was awarded funding under the U.S. Department of Energy SunShot Incubator Program to develop a software designed to reduce the solar PV soft costs arising from administrative processes at the municipal level.

Simply Civic provides jurisdictions with a simple, fast and affordable online permitting solution for solar PV (and other types of permitting). The online platform allows permit applicants and building department staff to seamlessly collaborate during the permit application, review and approval processes. Benefits to municipal staff and installers include reduction or elimination of phone calls, emails and the travelling expenses incurred when in-person visits are required to submit, review, and sometimes resubmit paperwork. Additionally, Simply Civic stores and tracks permit applications, easing staff workloads.

Simply Civic is a Sun Rise New England Project partner, contributing to the project team's goal of making online permitting an option for any of Connecticut's 169 municipalities, including those with limited resources. The Simply Civic platform is available free of charge to Connecticut jurisdictions during an extended pilot period. It is also being piloted in other states.

8.9 Solar-Ready Municipality Rating Map – Is Your Town Open for Business?

The Sun Rise New England team created a clickable map of CT jurisdictions presenting information for each jurisdiction that allows installers and solar PV customers to see how the jurisdiction is rated in terms of solar-readiness or solar-friendliness. Version one of the map captures the following variables, to be expanded to include indicators for endorsement of the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷, adoption of the CT Standardized Solar PV Permit Application Package and other tools and measures and tools contained in the Guide.

The variables currently captured in this version are as follows:

- Total Installed Capacity (kW)
- Town Population
- Website
- Rooftop Solar Challenge participant: *YES/NO*
- Solarize participant
- CT Clean Energy Communities Program member: *YEAR*
- Opted into C-PACE: *YES/NO*
- Online permitting system: *YES/NO*
- Solar-friendly residential permitting fee or structure

Below is the town of Durham's scorecard as an example.

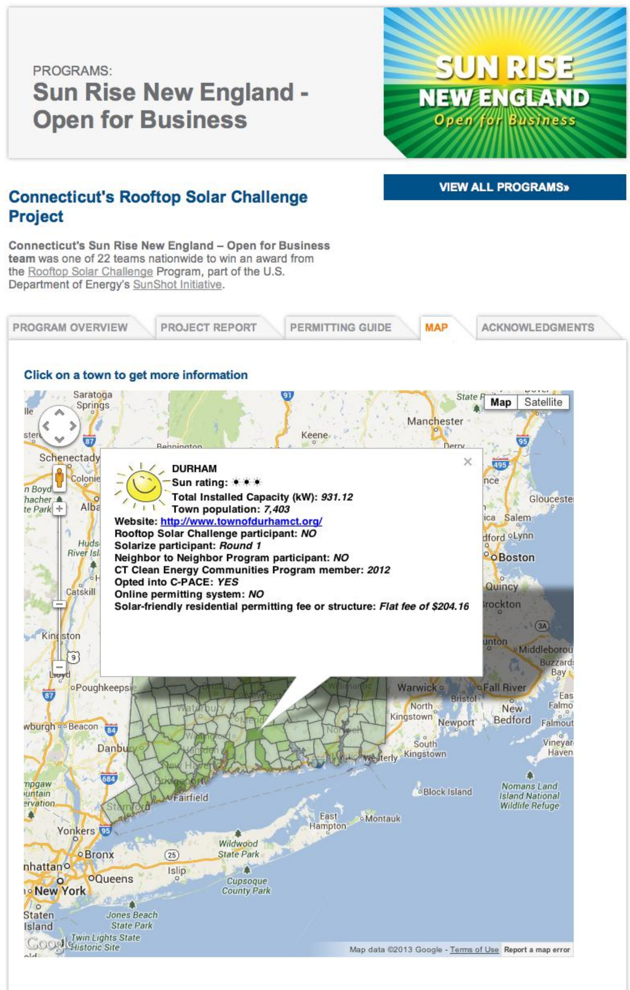


Figure 17: Sun Rise New England – Open for Business Website, Solar-Ready Municipality Rating Map

DURHAM
Sun rating: ☀☀☀
Total Installed Capacity (kW): *931.12*
Town population: *7,403*
Website: http://www.townofdurhamct.org/
Rooftop Solar Challenge participant: *NO*
Solarize participant: *Phase 1*
CT Clean Energy Communities Program member: *2012*
Opted into C-PACE: *YES*
Online permitting system: *NO*
Solar-friendly residential permitting fee or structure: *Flat fee of $204.16*

Figure 16: Sun Rise New England – Open for Business Website Solar-Readiness Rating for the Town of Durham

Figure 18: New Haven Lighthouse Solar PV Installation, Courtesy of Ross Solar Group

9.0 Permitting Recommendations for the State of Connecticut

As presented above, there are a number of ways jurisdictions can streamline the permitting process for rooftop solar PV, reducing the time and expense necessary for installation. The State of Connecticut can play an important role in streamlining these processes.

9.1 Waived Fee or Flat Fee Based on Cost-Recovery Fee Structure with a Cap

The majority of Connecticut jurisdictions do not have a cap on solar permitting fees and instead calculate the permitting fee based on the value of the solar PV system. In order to give installers more certainty when creating project budgets and to ensure a reasonable permitting fee, the Sun Rise New England team recommends that the State legislate a flat, cost-recovery based permit fee structure no more than a specified cap (e.g., $200 for residential solar PV) for those jurisdictions that have not already chosen to waive (or reduce) fees as enabled by Connecticut General Statutes Section 29-263.[48] Research conducted by states across the country including that done by the Connecticut project team supports implementation of a permit fee structure that allows a jurisdiction to recover costs incurred during the permitting process including application review and inspection, but not more than that cost.

A permit fee cap would motivate jurisdictions to optimize and streamline inefficient solar PV permitting processes to keep jurisdiction costs down. However, a cap alone would not bring about desired permit fee reductions. While some jurisdictions would bring their fees down to the permit fee cap, others could raise their fees up to the cap resulting in the statewide average fee remaining largely unchanged. The

[48] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

requirement of either a waived fee, or a *cost-recovery* based flat fee that complies with a cap would result in reasonable permitting fees and processes throughout the state.

In addition to adopting a permit fee waiver or a capped flat fee, each jurisdiction should be required to post its waived or flat fee amount online to increase transparency.

Legislation has been an effective means in other states such as Arizona, California and Colorado to reduce permit fees and bring about more transparency and fairness in how permit fees are calculated. The project team modeled proposed legislation for CT, and the permit fee recommendation for CT jurisdictions more generally, on elements of the laws passed in these three states:

- The California[49] and Colorado[50] legislation are very similar and have four major aspects. First, they acknowledge that there is a state-wide need for certainty regarding solar permitting fees. Second, they restrict municipalities from charging more for a solar permit than the estimated reasonable cost of providing the services. Third, they provide specific limits on the dollar amount that municipalities may charge for a roof-top solar permit ($500 for residential and $1000 for commercial systems, with justified exceptions). Fourth, the laws require municipalities to clearly identify each fee and report them to the applicant in response to the permit application. Note that the California law specifies additional fees of $15 for each kW over 15kW for residential rooftop solar energy systems, $7 for each kW between 51kW and 250kW, and $5 for every kW above 250kW for commercial rooftop solar energy systems.
- Arizona[51] has similar legislation but without a permit cap. The law states that: "any building permit for solar construction must be attributable to and defray or cover the expense of the service for which the fee or charge is assessed. A fee or charge shall not exceed the actual cost of issuing a permit, and a written, itemized list of the individual costs associated with permit fee shall be provided at the request of the permitee." Before adopting a standard permit fee, the county or municipality must hold a public hearing with at least fifteen days of public notice.

The proposed legislation for Connecticut combined aspects of the above existing legislation; it became a bill but was not given a public hearing before the end of the 2013 legislative session. The 2013 legislative session, summarized in section 5.3 of this report, was already very successful in terms of increased support for clean energy deployment, including a municipal property tax waiver for commercial and industrial properties, so perhaps the permit fee legislation will be reconsidered in 2014.

Given existing enabling legislation in CT, mentioned above, outreach to waive or reduce permit fees will continue whether it is mandated by legislation or not. This project has created a rating system and map on the Sun Rise New England - Open for Business website which tracks and presents information about which jurisdictions have adopted permit fee reductions along with other soft cost related measures and tools. Jurisdictions that are solar-friendly and "open for business" will be more likely to attract installers to their communities. See section 8.9 of this report for more information about the rating tool and map.

9.2 Mandatory permit decision deadline

The state currently requires jurisdictions to approve or deny permits within 30 days of a completed application submission. A shorter mandatory limit for solar PV permitting turnaround time will hold

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49 California Senate Bill 1222: leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120SB1222

50 Colorado Senate Bill 117: www.leg.state.co.us/CLICS/CLICS2008A/csl.nsf/fsbillcont3/1109D26989FEC52B872573D000791515?Open&file=117_enr.pdf

51 Arizona House Bill 2615: www.azleg.gov/legtext/48leg/2r/bills/hb2615s.pdf

jurisdictions accountable for delays and give installers more certainty regarding the installation schedule. Based on feedback from jurisdictions surveyed, the Sun Rise New England team suggests a 14-day decision deadline from the date of a complete application submission.

9.3 Improve the State Building Code and Allow Stretch Codes

The current State Building Code of Connecticut is found on the website of the Office of the State Building Inspector[52] and includes:

- The 2005 CT Supplement which was approved in 2005
- 2009 and 2011 amendments
- Corrections to wind load data for several towns.

The 2005 CT Supplement includes the following model national and international codes:

- 2003 International Building Code (IBC)
- 2003 International Existing Building Code (IEBC)
- 2003 International Plumbing Code (IPC)
- 2003 International Mechanical Code (IMC)
- 2003 International Residential Code (IRC)
- 2009 International Energy Conservation Code (IECC)
- 2005 National Electrical Code (National Fire Protection Association (NFPA) 70)

The current State Building Code of Connecticut is the building code by which the state and all municipalities must abide. Therefore, municipalities may not currently adopt codes that are stricter than the State Building Code. There are many jurisdictions that are making great efforts to become clean energy leaders in the state. The project team recommends that the State of Connecticut create a model "stretch-code" to enable municipalities to adopt more stringent codes that the State Building Code, if desired. A stretch energy code was added to the Massachusetts State Building Code in 2009, allowing municipalities to adopt a specified, more energy efficient alternative code.[53]

Connecticut's State Building Code should be amended include a provision for "solar ready" construction that requires new homes and non-residential buildings to be built so that roof structures and orientation are sufficient for installation of a solar PV system (aside from factors outside of construction such as adjacent buildings and trees). Other states such as Minnesota and California have adopted standards for "solar-ready" new construction.[54] [55]

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[52] www.ct.gov/dcs/cwp/view.asp?a=4447&q=521446&dcsNav

[53] MA Stretch Energy Code: mass.gov/eopss/consumer-prot-and-bus-lic/license-type/csl/stretch-energy-code-information.html

[54] Minnesota published the "Solar Ready Building Design Guidelines for Minnesota" to be used with the 2006 IBC: www.nextstep.state.mn.us/res_detail.cfm?id=4467

[55] Beginning January 1, 2014 the California Energy Commission will require all new buildings to be solar ready, www.energy.ca.gov/releases/2012_releases/2012-05-31_energy_commission_approves_more_efficient_buildings_nr.html, and energy.ca.gov/title24/2013standards/index.html

In CT's 2011 amendment to its State Building Code, Connecticut adopted the 2009 International Energy Conservation Code (IECC), which increased energy efficiency requirements for new residential and commercial construction.[56] Upgrading to the IECC 2012 would significantly enhance the energy performance of new buildings.

The text in Connecticut General Statutes sections 29-252 through 29-254 pertains to the State Building Code of Connecticut:

- **Sec. 29-252.[57] (Formerly Sec. 19-395). State Building Code: Adoption, revision and amendments. State Building Inspector: Appointment; interpretations of code. Appeal.** (a) The State Building Inspector and the Codes and Standards Committee shall, jointly, with the approval of the Commissioner of Construction Services, adopt and administer a State Building Code based on a nationally recognized model building code for the purpose of regulating the design, construction and use of buildings or structures to be erected and the alteration of buildings or structures already erected and make such amendments thereto as they, from time to time, deem necessary or desirable… The code shall be revised not later than January 1, 2005, and thereafter as deemed necessary to incorporate any subsequent revisions to the code not later than eighteen months following the date of first publication of such subsequent revisions to the code. The purpose of said Building Code shall also include, but not be limited to, promoting and ensuring that such buildings and structures are designed and constructed in such a manner as to conserve energy and, wherever practicable, facilitate the use of renewable energy resources…
- **Sec. 29-253.[58] (Formerly Sec. 19-395e). Code applicable to all municipalities. Ordinance governing demolition of hazardous building.** (a) The State Building Code, including any amendment to said code adopted by the State Building Inspector and Codes and Standards Committee, shall be the building code for all towns, cities and boroughs. (b) Nothing in this section shall prevent any town, city or borough from adopting an ordinance governing the demolition of buildings deemed to be unsafe. As used in this subsection, "unsafe building" means a building that constitutes a fire hazard or is otherwise dangerous to human life or the public welfare.
- **Sec. 29-254.[59] (Formerly Sec. 19-395g). Amendments to code. Variations and exemptions.** (a) Any town, city or borough or any interested person may propose amendments to the State Building Code,…

9.4 Allow electronic wet stamps

When jurisdictions require engineer or architect approved plans, these plans must be delivered in person because official stamps are required. The State of Connecticut does not allow these required stamps to be submitted electronically. Other states across the United States, including Pennsylvania, New York, Delaware, Maryland, and California allow electronic submission of wet stamps in order to streamline the permitting process. The Sun Rise New England team recommends the State of Connecticut allow engineer and architect stamps to be submitted electronically thus eliminating the need for installers to deliver these documents in person.

[56] ct.gov/dcs/lib/dcs/office_of_state_building_inspector_files/iecc_amendment_9-27-11.pdf
[57] www.cga.ct.gov/2011/PUB/chap541.htm#Sec29-252.htm
[58] www.cga.ct.gov/2011/PUB/chap541.htm#Sec29-253.htm
[59] www.cga.ct.gov/2011/PUB/chap541.htm#Sec29-254.htm

9.5 Education & Training

Building departments are responsible for understanding and enforcing a diverse set of codes and standards. Insufficient funding and manpower makes training extremely difficult for most jurisdictions. In order to help building officials obtain the necessary training, the Sun Rise New England team recommends that the State of Connecticut develop and offer each year several free training sessions for building officials related to rooftop solar PV and other clean energy technologies. An increased awareness and understanding of solar PV systems will help local jurisdictions eliminate any unnecessary requirements currently enforced in permitting processes. Resources can be found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ .

10.0 Planning & Zoning

10.1 Data Collection and Methods

Members of the Center for Business and Environment at Yale (CBEY) research team interviewed planning and zoning officials from each of the participating jurisdictions. The interview questions were developed with guidance from the Yale Center for Customer Insights (YCCI), and were designed to develop an organic conversation concerning the data needed for completing the DOE solar metrics questions.

At the outset of the project, each town designated an official point of contact for the study who identified the appropriate municipal officials to interview for each topic area. CEFIA and CBEY then contacted those individuals to schedule interviews, with the points of contact assisting as necessary. In addition to the primary official, interviews were also attended by the point of contact and/or other municipal staff whose presence the interviewee deemed helpful. Where scheduling permitted, interview teams consisted of at least two people, one to ask questions and one to take notes. Interviews were conducted over the phone or in person according to scheduling constraints and the preferences of those being interviewed. Interviews ranged from 30-90 minutes. Some interviews were recorded to facilitate note taking. Officials were asked to provide copies of the solar-relevant ordinances and municipal statutes discussed in the interviews. Notes taken during the interview were used to complete the planning and zoning portion of the DOE solar metrics questions.

Research also included a literature search, review of studies by the Interstate Renewable Energy Council (IREC) and the National Renewable Energy Laboratory (NREL), and review of model ordinances and best practices from other states such as California, New Jersey, New York/Long Island, Pennsylvania and Vermont.

10.2 Summary of Findings and Conclusions

On the state-level in Connecticut, there are several regulations that apply to rooftop solar PV installations:

- **Connecticut's zoning enabling act (General Statute 8-2)** enables jurisdictions to adopt regulations, and specifies that: "Such regulations may also encourage energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation."
- **CT General Statutes § 8-23 (a) and (d)** require planning commissions to prepare, amend or adopt a plan of conservation and development for the municipality, and in preparing such plan, consider energy-efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation.
- **CT General Statute 8-25(b)** governing subdivision regulations states: "The regulations shall require any person submitting a plan for a subdivision to the commission under subsection (a) of this section to demonstrate to the commission that such person has considered, in developing the plan, using passive solar energy techniques which would not significantly increase the cost of the housing to the buyer."
- **CT General Statute 7-147f** states "No application for a certificate of appropriateness for an exterior architectural feature, such as a solar energy system, designed for the utilization of renewable resources shall be denied unless the commission finds that the feature cannot be installed without substantially impairing the historic character and appearance of the district.

Interviews conducted during this project indicate that these regulations are difficult to enforce. This is likely due to statute language that is not well-defined, such as "may also encourage" and "consider," and the lack of specific guidance on and mechanisms for implementation and enforcement. Section 11.3 of this report provides more information about and recommends publicizing, enforcing and strengthening these existing regulations.

Connecticut statutes do not specifically establish a homeowner's right to install a solar PV system, nor do they guarantee access to sunlight or protect against restrictive private covenants or local government rules. By contrast, Massachusetts' legislation (M.G.L. chapter 40A §3)[60] disallows any zoning prohibitions or unreasonable regulations of solar installation except, "where necessary to protect the public health, safety or welfare." Sections 11.0-11.2 provide a recommendation for Connecticut to adopt a solar access law offering protections such as authorization to create solar easements and protection from private property and local government restrictions on installation of solar PV.

Zoning Approval Best Practice:

Zoning approval for residential rooftop solar PV installations is often granted automatically when a building permit is issued, or the PV systems must meet minimal criteria such as height restrictions. Half of the 12 participating towns do not require any zoning involvement or review to issue a permit for residential rooftop solar PV.

Summary of Municipal Survey Data

Zoning approval for residential rooftop solar PV installations is often granted automatically when a building permit is issued, or the PV systems must meet minimal criteria such as height restrictions. For example, permitting for residential rooftop solar PV in the jurisdictions of Cornwall, Greenwich, Middletown, Milford, Stamford and West Hartford either does not entail any zoning department involvement or a zoning permit is issued automatically when a building permit is issued. Bridgeport, Coventry, Danbury, Fairfield, Hampton, Manchester and New Haven have minimal zoning requirements that need to be met, namely whether the solar PV system meets height restrictions (sometimes more flexible for solar PV than for other accessory structures)[61] or whether the system is flush mounted to the roof (e.g., Fairfield). The height requirement is in some cases checked by the building department (e.g., Danbury) or by an integrated building and planning and zoning department (e.g., Manchester), so a separate zoning department review may not be needed to verify that height restrictions are met. This can result in very minimal zoning department involvement.

There is wider variation in the requirements for commercial rooftop solar PV, the requirements are stricter and more numerous, and often extra approvals and reviews are involved, sometimes with special committees or hearings. In historic or village districts, additional restrictions and reviews are common, though CT statute 7-147f, cited above, specifies that a solar PV installation

[60] M.G.L., chapter 40A § 3, malegislature.gov/Laws/GeneralLaws/PartI/TitleVII/Chapter40a/Section3: "No zoning ordinance or by-law shall prohibit or unreasonably regulate the installation of solar energy systems or the building of structures that facilitate the collection of solar energy, except where necessary to protect the public health, safety or welfare."

[61] Solar PV is usually considered an accessory structure from a zoning perspective, meaning it is secondary to the primary structure, for example a house or building.

may not be prevented from being installed unless it substantially impairs the historic character and appearance of the district. For ground or pole mount solar PV installations, there are usually zoning and other department reviews needed, for example a review to assure that the installation meets wetlands regulation requirements.

Bridgeport, Manchester and Middletown have adopted solar friendly ordinances. Bridgeport and Manchester exempt permit fees for Class I renewable energy installations. Middletown grants a 10% real-estate tax exemption for LEED certified properties through its Tax and Business Incentive Program.

The project team did not run across any municipal solar access ordinances or ordinance provisions, and believe that these provisions will need to be enabled by adoption of a state solar access law. However, Greenwich allows for “viewshed” agreements that protect property views/vistas, which have some similarity to protection of access to sunlight from being blocked by structures or trees on adjacent properties. The viewshed agreements are privately drawn contracts that are published in the town record and can be upheld in court.

Solar access agreements between commercial developers and solar PV system hosts are in use in Connecticut to protect the developer from blocking of access to sunlight which would impact the energy production of the solar PV system.

Many jurisdictions have incorporated support of clean energy adoption into their conservation and development plans, including Bridgeport, Coventry, Greenwich and New Haven, and other towns are updating their plans so that clean energy is encouraged. Several towns including Middletown and West Hartford have a clean energy task force, and Coventry has an energy conservation/ alternative energy advisory committee, providing further community-level engagement in support of clean energy.

For a tabular summary of the planning and zoning data collected from municipalities, based on DOE’s Solar Metrics questions, see Appendix IV.

Summary of Installer Survey Responses

The following are excerpts of feedback from installers in response to questions about planning and zoning. See Appendix V to view all responses. Note that a few comments pertain to other topics such as permitting or interconnection.

1. Are there towns in CT which require a planning and zoning (P&Z) permit or P&Z approval to install rooftop solar PV?

- Trumbull, Reading, Fairfield, Newtown - anything west of Highway 95
- Most towns do if you have a ground mount near setbacks or near wetlands for residential. For commercial, you never know what a town could come up with.
- No, but some towns do have a review for commercial sites that are on main streets.
- Yes, towns need more education to feel comfortable letting some things go. We in the electrical industry are used to this kind of process. Other out of state companies are not accustomed to this protocol.

2. Are you aware of any P&Z restrictions/hurdles to rooftop solar PV installation in CT towns (e.g., height restrictions, aesthetic requirements, homeowner association restrictions, restrictions in historic districts)?

- Not yet, condo associations have been slow to adopt solar.

- Historic districts and aesthetic requirements for residential, and aesthetic requirements for commercial sites.
- Some homeowners associations and historic districts have restrictions, but this is usually a minor problem and most approve installations upon review.
- Yes, all exist in one town or another. Most are not onerous except for the separate applications. Chief grievances are treating PV installs flat against the roof as potential height variations; there should be an exception if less than 5" are added or if the PV does not extend above the ridge line. Another is treating ground mounts as structures and requiring them to meet setbacks; the ground mounts should be viewed in this case as fences (if under 8 feet or so) so they can be backed neatly up to the property line. If plantings to hide the system are required, fine.

3. Are there improvements you would recommend to P&Z ordinances in CT towns to remove hurdles to rooftop solar PV installation?

- No, but we would like a better inspection process. Hanging wires are not good. We don't want solar to get a bad name from a few reckless installers.
- Does the Department of Transportation (DOT) need municipal approval to install a culvert? CEFIA projects are state level/DEEP projects. Municipalities can tag along for community awareness, but should not hold the strings.

Figure 19: Solar PV Installation in Manchester, Courtesy of Ross Solar Group

11.0 Planning and Zoning Recommendations for the State of Connecticut

Solar access is the ability of one property to continue to receive sunlight across property lines without obstruction from another's property (buildings, foliage or other impediment). For example, solar access is the right to receive sunlight upon certain building façades regardless of the presence of active or passive solar energy systems. The term "solar access" is used broadly and encompasses protections provided to solar energy systems in the form of solar easements and solar rights:[62]

- **"Solar easements"** refers to the ability of one property to continue to receive sunlight across property lines without obstruction from another's property (buildings, foliage, or other impediment) for the purpose of *assuring adequate access to direct sunlight for a solar energy system*
- **"Solar rights"** refers to *the ability to install solar energy systems on residential and commercial property that is subject to restrictions* including private restrictions (i.e., covenants, conditions, restrictions, bylaws, condominium declarations) as well as local government ordinances and building codes.

The United States has held that there is no common-law right to sunlight. This has required that specific statutory authority be established to protect the rights of solar users in terms of both their ability to install a solar energy system on their property and after that system is installed to protect their access to sunlight, so that the system remains operational.

The map in Figure 20, updated in February 2013, was accessed from the Database of State Incentives for

[62] A Comprehensive Review of Solar Access Law in the United States, Suggested Standards for a Model Statute and Ordinance, Colleen McCann Kettles, Florida Solar Energy Research and Education. Report: solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf; and Online, Narrated Presentation: www.solarabcs.org/about/publications/reports/solar-access/presentations/index.htm

Renewable Energy (DSIRE) Solar website.[63] The map shows that 40 U.S. states have solar easement provisions, solar rights provisions, or both solar easements and solar rights and/or the local option to create such provisions. Connecticut is one of a minority of U.S. states that does not have a state level solar access law. In anticipation of increased solar PV deployment in CT, CT should work to adopt solar access protections in the near term.

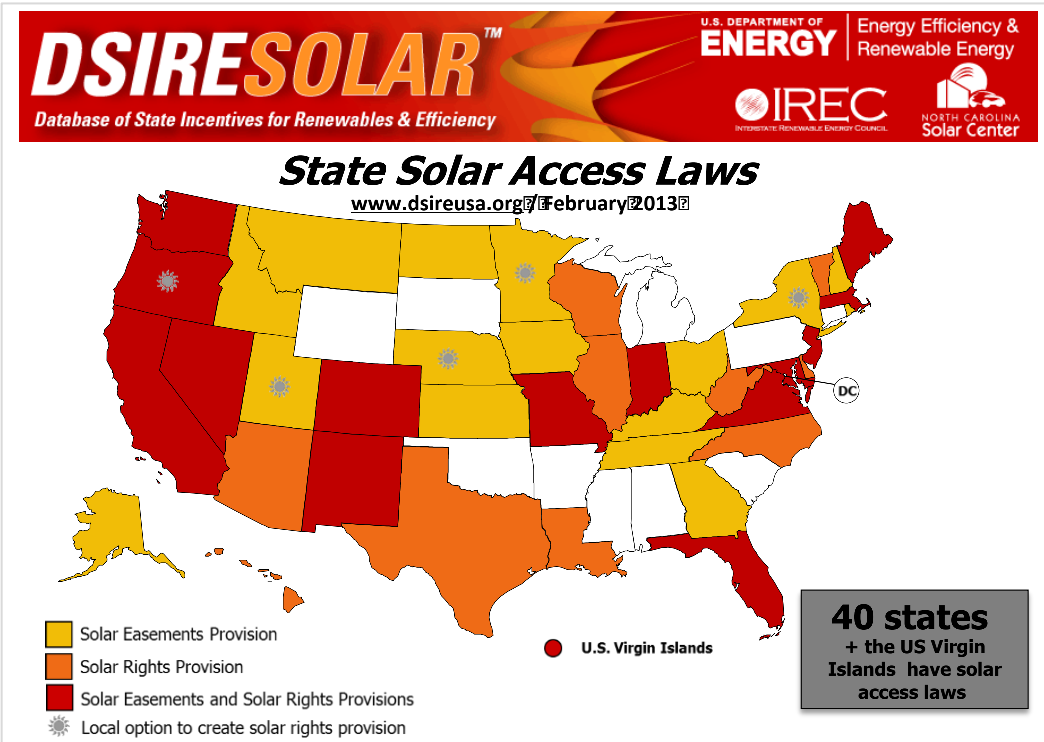

Figure 20: Map of State Solar Access Laws, DSIRE, February 2013

11.1 Adopt a Statewide Solar Access Law

A statewide solar access law would provide a uniform regulatory structure that developers and property owners could rely on to protect their investments. A state law would also support CT's goal to scale up clean energy deployment.

A model solar access law is provided in "A Comprehensive Review of Solar Access Law in the United States, Suggested Standards for a Model Statute and Ordinance,"[64] which draws from exemplary provisions in existing solar access laws in Florida, Hawaii, Massachusetts, New Jersey, New Mexico, Oregon, Wisconsin, and the Virgin Islands.

An example state law from the U.S. solar industry's most mature market is California's Solar Rights Act, which was adopted in 1978 and went into effect January 1, 1979. Its enactment contributed to California's strong policy commitment to solar energy. The California bill states: "that the use of solar energy systems will reduce the state's dependence on nonrenewable fossil fuels, supplement existing

[63] dsireusa.org/solar/solarpolicyguide/?id=19

[64] "A Comprehensive Review of Solar Access Law in the United States, Suggested Standards for a Model Statute and Ordinance, Colleen McCann Kettles," Florida Solar Energy Research and Education. Report: solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf

energy sources, and decrease the air and water pollution which results from the use of conventional energy sources. It is, therefore, the policy of the state to encourage the use of solar energy systems."[65] California's Solar Rights Act consists of the following California codes of law: California Civil Code Sections 714 and 714.1, California Civil Code Section 801, California Civil Code Section 801.5, California Government Code Section 65850.5, California Health and Safety Code Section 17959.1, California Government Code Section 66475.3, and California Government Code Section 66473.1, which collectively contribute the following key provisions:[66]

- Limits on covenants, conditions, and restrictions (CC&Rs) to Restrict Solar Installations – The Act prohibits CC&Rs, like those enforced by homeowner associations (HOAs), which would unreasonably restrict the use or installation of solar energy systems. (California Civil Code Sections 714 and 714.1).
- Solar Easements – The Act establishes the legal right to a solar easement, which protects access to sunlight across adjacent properties. (California Civil Code Section 801). It also describes the minimum requirements needed to create a solar easement. (California Civil Code Section 801.5).
- Definition of a Solar Energy System – The Act defines which solar energy systems are covered by its provisions. (California Civil Code Section 801.5).
- Limits to Local Government Restrictions on Solar Installations – The Act discourages local governments from adopting an ordinance that would unreasonably restrict the use of solar energy systems. (California Government Code Section 65850.5). It also requires local governments to use a non-discretionary permitting process for solar energy systems. (California Government Code Section 65850.5 and California Health and Safety Code Section 17959.1). Additionally, provisions of the Act require local governments seeking state-sponsored incentives for solar energy systems to demonstrate compliance with certain provisions of the Act. (California Civil Code Section 714).
- Passive Solar Opportunities in Subdivisions – The Act requires certain subdivisions to provide for future passive and natural heating and cooling opportunities to the extent feasible. (California Government Code Section 66473.1).
- Allowance for Requiring Solar Easements – The Act allows cities and counties to require by ordinance the dedication of solar easements in certain subdivision developments as a condition of tentative map approval. (California Government Code Section 66475.3).

Another law on the books in California not included above is the Solar Shade Control Act (CA Public Resources Code § 25980),[67] which provides limited protection to solar energy system owners from shading caused by trees and shrubs on adjacent properties. This law provides for the following protection for access to sunlight (note, however that even 10% shading could prevent a solar PV system from generating electricity depending on how a solar PV system is configured):[68]

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[65] "California's Solar Rights Act, A Review of the Statutes and Relevant Cases," Scott Anders, Kevin Grigsby, Carolyn Adi Kuduk, Taylor Day, Allegra Frost, Updated December 2012, Energy Policy Initiatives Center, University of San Diego School of Law, www.sandiego.edu/documents/epic/SolarRightsAct_UPDATEDec2012.pdf.
[66] Ibid.
[67] California's Solar Shade Control Act, California Public Resources Code § 25980: leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25980-25986.
[68] Ibid.

> After the installation of a solar collector, a person owning or in control of another property shall not allow a tree or shrub to be placed or, if placed, to grow on that property so as to cast a shadow greater than 10 percent of the collector absorption area upon that solar collector surface at any one time between the hours of 10am and 2pm, local standard time.

Table 14 summarizes examples of solar access laws in leading and nearby states, illustrating the types of protections that can be provided for solar energy. There is a lot of room to establish solar access protections in Connecticut, in addition to publicizing, enforcing and strengthening Connecticut's existing laws supporting clean energy deployment (described in the next section, section 11.2).

Table 14: Examples of State Solar Access Laws

Description of Law	Statute Language	Type of Solar Access Law
California – the California Solar Rights Act – authorizes creation of solar easements; limits CC&R and local government restrictions on installation of solar PV systems.	www.sandiego.edu/documents/epic/SolarRightsAct_UPDATEDec2012.pdf (all statute text starts on p.27)	Solar easements, solar rights
Rhode Island – authorizes homeowners to negotiate solar easements.	R.I. Gen. Laws § 34-40	Solar easements
New Hampshire – protects the right of homeowners to obtain solar easements.	New Hampshire Statutes § 477:49	Solar easements
Maine – authorizes the creation of solar easements.	33 M.R.S. §1401	Solar easements
Maine – prohibits municipal bylaws, zoning ordinances, and homeowners' associations from prohibiting or unreasonably restricting homeowners' right to use solar energy devices.	33 M.R.S. §1421	Solar rights
Massachusetts – local governments are authorized to promote solar energy systems through their zoning ordinances, including regulation of street layout and building size and placement. Ordinances establishing systems for solar rights permits are also authorized.	M.G.L. ch. 40A § 9B.; definition of a solar easement found in M.G.L. ch. 187 § 1A.	Solar easements, solar rights
Massachusetts – prohibits local zoning ordinances placing unreasonable restrictions on solar energy systems	M.G.L. ch. 40A § 3.	Solar rights
Massachusetts – forbids restrictive covenants (e.g., from developers, neighborhood associations) that prohibit or unreasonably restrict homeowners' right to install a solar system.	M.G.L. ch. 184 § 23C.	Solar rights
New York – provides for the creation of voluntary solar easements.	NY CLS Real Property § 335-b	Solar easements
New York – authorizes local governments to create zoning ordinances specifically for the purpose of facilitating solar access and solar energy systems	NY CLS General City § 20 (24); NY CLS Town § 263; NY CLS Vill § 7-704	Solar easements
Vermont – prohibits municipal bylaws, zoning ordinances, and nongovernmental deed restrictions from prohibiting or unreasonably restricting homeowners' right to install a rooftop solar system.	27 V.S.A. § 544; 24 V.S.A. § 2291a; 24 V.S.A. § 4413 (g)	Solar rights

11.2 Publicize, Enforce, and Strengthen Existing Connecticut Laws and Codes

Connecticut's zoning enabling act (General Statute 8-2)[69] states: "Such regulations may also encourage energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation."

CT Gen. Statutes § 8-23 (a) and (d) require planning commissions to prepare, amend or adopt a plan of conservation and development for the municipality, and in preparing such plan, consider energy-efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation.[70]

> **Sec. 8-23. Preparation, amendment or adoption of plan of conservation and development.**
>
> (a)(1) **At least once every ten years, the commission shall prepare or amend and shall adopt a plan of conservation and development for the municipality. Following adoption, the commission shall regularly review and maintain such plan.** The commission may adopt such geographical, functional or other amendments to the plan or parts of the plan, in accordance with the provisions of this section, as it deems necessary. The commission may, at any time, prepare, amend and adopt plans for the redevelopment and improvement of districts or neighborhoods which, in its judgment, contain special problems or opportunities or show a trend toward lower land values.
>
> (d) In preparing such plan, the commission or any special committee shall consider the following: (1) The community development action plan of the municipality, if any, (2) the need for affordable housing, (3) the need for protection of existing and potential public surface and ground drinking water supplies, (4) the use of cluster development and other development patterns to the extent consistent with soil types, terrain and infrastructure capacity within the municipality, (5) the state plan of conservation and development adopted pursuant to chapter 297, (6) the regional plan of conservation and development adopted pursuant to section 8-35a, (7) physical, social, economic and governmental conditions and trends, (8) the needs of the municipality including, but not limited to, human resources, education, health, housing, recreation, social services, public utilities, public protection, transportation and circulation and cultural and interpersonal communications, **(9) the objectives of energy-efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation,** and (10) protection and preservation of agriculture.

CT Gen. Statute § 8-25(b) requires subdivision development regulations to "encourage energy-efficient patterns of development and land use, the use of solar and other renewable forms of energy, and energy conservation." [71] Many towns have taken the first step by adding this language to their subdivision regulations (e.g., Fairfield, Milford). Fewer towns have long-term plans or task forces for renewable energy (e.g., Cornwall, Coventry).

> Sec. 8-25. Subdivision of land.
>
> (b) The regulations adopted under subsection (a) of this section shall also encourage energy-efficient patterns of development and land use, the use of solar and other renewable forms of energy, and energy conservation. The regulations shall require any person submitting a plan for a subdivision to the commission under subsection (a) of this section to demonstrate to the commission that such person has considered, in developing the plan, using passive solar energy techniques which would not significantly increase the cost of the housing to the buyer, after tax credits, subsidies and exemptions. As used in this subsection and section 8-2, passive solar energy techniques mean site design techniques which maximize solar heat gain, minimize heat loss and provide thermal storage within a building during the heating

[69] cga.ct.gov/2011/PUB/chap124.htm#Sec8-2.htm
[70] cga.ct.gov/2011/pub/chap126.htm - Sec8-23.htm
[71] cga.ct.gov/2011/pub/chap126.htm#Sec8-25.htm

> season and minimize heat gain and provide for natural ventilation during the cooling season. The site design techniques shall include, but not be limited to: (1) house orientation; (2) street and lot layout; (3) vegetation; (4) natural and man-made topographical features; and (5) protection of solar access within the development.

CT Gen. Statute § 8-25(b) should be strengthened. The current language only requires developers to "consider" passive solar. This is difficult to enforce, because it is hard to prove developers have not fulfilled that requirement. As a result, most towns don't enforce it. The statute would be easier to enforce if 8-25(b) were amended to *require* developers to incorporate passive solar energy techniques into their development plans rather than simply "considering" them. Language in the amendment could require developers to document their use of passive solar techniques for municipal building or planning and zoning departments when they apply for building permits. This would involve developing a more specific list of passive solar features covered by the statute. The list could make some features mandatory for all developments or provide a range of options for developers to choose from and combine. It is expected that there would be some situations where passive solar would be prohibitively costly or disadvantageous, and exceptions could be granted for projects where the developer could document a valid reason that such techniques would be inappropriate. In such cases the developer would need to provide sufficient documentation and evidence to justify an exception.

See the Solar Site Design Worksheet for a Proposed Subdivision included in the Connecticut Rooftop Solar PV Permitting Guide. The worksheet is also available as a stand-alone form in the Permitting Guide tab of the Sun Rise New England - Open for Business website. This worksheet can be used to enforce *consideration* of passive solar site design under the current law, or it could be modified to enforce *requirement* of solar site design if CT Gen. Statute § 8-25(b) is strengthened.

Require New Homes to be "Solar Ready" – In addition to strengthening the requirement to consider passive solar, amend CT Gen. Statute 8-25(b) such that new homes are "solar ready":

- Have the structural attributes and integrity capable of supporting a rooftop solar system. New homes meeting such specifications could thus be automatically certified as "solar ready," streamlining the permitting and installation process.
- Require east-west street and building orientation (typically within 30 degrees of the east-west axis) to maximize south-facing roof space ideal for collecting solar energy.
- Have landscaping that complements solar energy systems
- Have dedicated solar easements to protect access to sunlight.

CT Gen. Statute § 7-147f which limits the reasons a certificate of appropriateness can be denied to a solar energy system to features that substantially impair the historic character of the district.[72]

> Sec. 7-147f. Considerations in determining appropriateness. Solar energy systems (a) If the commission determines that the proposed erection, alteration or parking will be appropriate, it shall issue a certificate of appropriateness. In passing on appropriateness as to exterior architectural features, buildings or structures, the commission shall consider, in addition to other pertinent factors, the type and style of exterior windows, doors, light fixtures, signs, above-ground utility structures, mechanical appurtenances and the type and texture of building materials. In passing upon appropriateness as to exterior architectural features the commission shall also consider, in addition to any other pertinent factors, the historical and architectural value and significance, architectural style, scale, general design, arrangement, texture and material of the architectural features involved and the relationship thereof to the exterior architectural style and pertinent features of other buildings and structures in the immediate

[72] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm

> neighborhood. **No application for a certificate of appropriateness for an exterior architectural feature, such as a solar energy system, designed for the utilization of renewable resources shall be denied unless the commission finds that the feature cannot be installed without substantially impairing the historic character and appearance of the district.** A certificate of appropriateness for such a feature may include stipulations requiring design modifications and limitations on the location of the feature which do not significantly impair its effectiveness…

As detailed in section 9.3, Connecticut can improve its state Building Code and allow stretch codes. Related to this, one of the participating jurisdictions in this project suggested that it would be helpful if Connecticut's Building Code provided standard specifications for weight, wind lift resistance and reflectivity of solar PV systems so that municipal approval would simply be a matter of verifying that the system meets the requirements of this code. This might also require changing industry reporting standards to make such information more readily available for all solar panel models. This suggestion reflects the reality that municipalities and installers are slowed down when requirements have not been well-defined or explained and are inconsistent among jurisdictions. Some of these criteria are addressed in the CT Standardized Solar PV Permit Application, provided in the Permitting Guide tab of the SunRise New England website. This standard permit application form aims to provide clarity and consistency for installers and municipalities to take the guesswork out of what is required for solar PV permitting.

Figure 21: Solar PV Installation in Cornwall, Courtesy of Chris Lenzelec

12.0 Planning and Zoning Recommendations for Connecticut Jurisdictions

12.1 Local Policy Recommendations for Removing Zoning Barriers to Solar Energy

As of the writing of this report, Connecticut does not have any solar access laws in place, which the project team understands to be necessary to provide a legal framework for solar access protections to be adopted at the jurisdiction level. It should be verified before adopting specific provisions and recommendations below whether there is first a need for enabling state legislation or a building stretch code. This is indicated wherever likely but should be re-examined by counsel.

Provide information for those doing business in your jurisdiction about applicable existing state and local laws, regulations and codes impacting installation of solar PV, such as the existing state statutes specified above.

Adopt a solar friendly ordinance – To clarify when approvals are required and to remove barriers to the installation of solar energy systems from planning and zoning regulations and administrative procedures, adopt a solar friendly local ordinance. The following are key elements and provisions friendly to rooftop solar PV (or even broader to all solar energy systems):

- **Statement of findings** – The ordinance should begin with a "Statement of Findings" that ties it to the city's comprehensive plan or valid public policy goals.
- **Definition** – The ordinance should ideally include a broad definition of "solar collector" that includes thermal as well as electrical devices, or should be broadened as soon as feasible.
- **Exempt rooftop installations from zoning review** – Allow all rooftop solar PV installations meeting certain criteria to be exempt from zoning review during the permitting process.
- **Exempt or allow increased flexibility from zoning requirements for solar** – The ordinance should provide exemptions, increased flexibility or appropriate definitions for solar collectors with respect to height, setback, lot coverage and impervious surface limitations to the extent that these exist in a municipality's zoning code. Solar energy systems are often categorized as accessory structures, and if so, then the limitations for accessory structures should be reviewed

to determine which limitations make sense for solar PV and should apply. The following are examples of types of restrictions that solar could be exempted from or restrictions that could be made more flexible for solar energy systems:

- Height – Exemptions from height limitations often make sense such as allowing solar energy systems to exceed height limitations or by allowing for a specified additional allowance. Excluding the solar system from counting towards the overall height of the structure is also important so that a system does not result in a zoning violation.
- Setback – Stand-alone solar energy systems (e.g., ground and pole-mounted systems) should be exempt from setback requirements for other structures such as sheds. Setbacks for solar energy systems should be reduced to much smaller distances from the side or rear lot property lines.
- Lot coverage – Stand-alone solar energy systems should be excluded from counting towards lot coverage, as the contact with the ground is limited usually only to footings.
- Impervious surface[73] – Solar energy systems should be excluded from impervious surface calculations. This is significant as local zoning laws typically set maximum impervious surface or coverage percentages and municipal and state agencies have been inconsistent in determining whether solar panels should constitute an impervious surface. Solar energy systems are elevated panels that do not completely cap the ground and thereby do not prevent water absorption (important for replenishment of aquifers and to help prevent run-off, soil erosion, flooding and other environmental hazards). Exemption for solar energy systems allows for installation in areas otherwise protected by municipal land use laws that pose strict limitations on impervious surface coverage (e.g., coastal and waterfront areas, forest and conservation areas). A state law was passed in New Jersey in 2010 excluding solar energy systems from being counted as impervious surface.[74]

Also keep in mind that there is still development and innovation in solar energy technology and solar energy system design taking place, so that restrictions left in place or put in place now that do not seem to pose a barrier to deployment of solar energy could very easily become a barrier in the future. Restrictions left or put in place by a municipal ordinance may be difficult or take a long time to adjust or change in the future. Excessive restrictions could result in it being difficult or impossible for installers or customers to move forward with a solar energy installation. A reputation for a difficult permitting process or excessive restrictions can result in lost business or opportunity can be difficult to remedy.

- **Establish requirements for historic and village district installations** – Enforce CT Gen. Statute Section 7-147f and develop clear prescriptive standards that comply, such as allowing flush mounted solar panels on all existing roofs, installation of roof-mounted solar panels not visible from the street, and permitting rear yard ground mounted solar systems of limited height to be approved with only a no-cost administrative review.

[73] "Impervious surface" means any structure, surface, or improvement that reduces or prevents absorption of stormwater into land, and includes porous paving, paver blocks, gravel, crushed stone, decks, patios, elevated structures, and other similar structures, surfaces, or improvements. Increases in impervious surface area are often used to characterize and measure land use changes in the process of property development.

[74] "Solar Panels Do Not Constitute Impervious Cover Under New Law," April 2010, njzoningwatch.com/category/highlands/.

- **Implement Incentive-Based Green Building Ordinances or ordinance provisions** to award points, incentives, or bonuses (such as density bonuses) to developers who include energy efficiency features such as solar systems and solar access in their projects.
- **Allow for creation of solar easements** to protect solar PV system access to sunlight across property lines (this will need to be preceded by enactment of a state solar access law).
- **Adopt a solar access ordinance or ordinance provisions** that protect future solar access as well as access to sunlight after investment a solar energy system. There are two prevalent strategies for enhancing solar-access, each suited to addressing different development patterns. These strategies are summarized as follows, with more details provided in Appendix VI.
    - First, an ordinance may create a **permitting and recording procedure** by which a home owner who installs a solar system may obtain a permit that prevents their solar access from being impeded by later construction or vegetation growth. Such a permit can then be recorded in the local land records.
    - Second, an ordinance may create a **solar envelope** around each property. Solar envelope ordinances are a more comprehensive form of solar access protection, and preserve a property's access to sunlight even if the property owner has not yet installed a solar collector.

Consider solar access in establishing zoning and planning regulations and review processes such as height, setback, lot coverage, impervious surface, landscape requirements and building construction. For example, the following could be encouraged: roof systems that are solar ready, building limits that consider solar access, planting limited to certain height limits near property lines. CT's zoning enabling act **(CT Gen. Statute Section 8-2)**[75] states: "…regulations may also encourage energy-efficient patterns of development, the use of solar and other renewable forms of energy, and energy conservation." State law would need to be strengthened in order to say that "regulations may *require*" rather than "regulations may *encourage*" in order for zoning and planning regulations and review processes to be stricter than state law. It should be verified whether there is first a need for enabling state legislation or a building stretch code before suggested provisions are included in the local regulations.

Comply with CT Gen. Statutes § 8-23 (a) and (d)[76] which require planning commissions to prepare, amend or adopt a plan of conservation and development for the municipality, and in preparing such plan, consider energy-efficient patterns of development, the use of solar and other renewable forms of energy and energy conservation.

Comply with CT Gen. Statute Section 8-25(b) which requires subdivision development regulations to consider energy-efficient patterns of development and use of solar. Such ordinances and review processes would consider road and lot orientation, building restrictions and subdivision regulations. See Addendum - Solar Site Design Worksheet for a Proposed Subdivision in the Rooftop Solar PV Model Ordinance For Connecticut Jurisdictions. The worksheet is also available in the Permitting Guide tab of the Sun Rise New England - Open for Business website as a stand-alone form that can be modified and implemented. This worksheet can be used to enforce *consideration* of passive solar site design under the current law, or it could be modified to enforce *requirement* of solar site design if CT Gen. Statute § 8-25(b) is strengthened.

[75] cga.ct.gov/2011/PUB/chap124.htm#Sec8-2.htm
[76] cga.ct.gov/2011/pub/chap126.htm - Sec8-23.htm

Consider the recommendations offered in a report published by the Connecticut Capitol Region Council of Governments (CRCOG), "Sustainable Land Use Regulations. Assessment of Local Land Use Regulations."[77] See Par III, Assessments of Local Land Use Regulations. For each selected municipality and each topic area, the report presents in tabular form where local land use regulations:

- Pose barriers to attainment of sustainable development practices;
- Could incorporate incentives to promote sustainable development practices; and
- Have regulatory gaps or untapped opportunities to better promote sustainable development practices.

Towns participating in this Sustainable Land Use Regulation Project were Avon, Bloomfield, Ellington, Enfield, Farmington, Hartford, Manchester, Simsbury, Tolland, Vernon, Windsor, and Windsor Locks (see Figure 22).

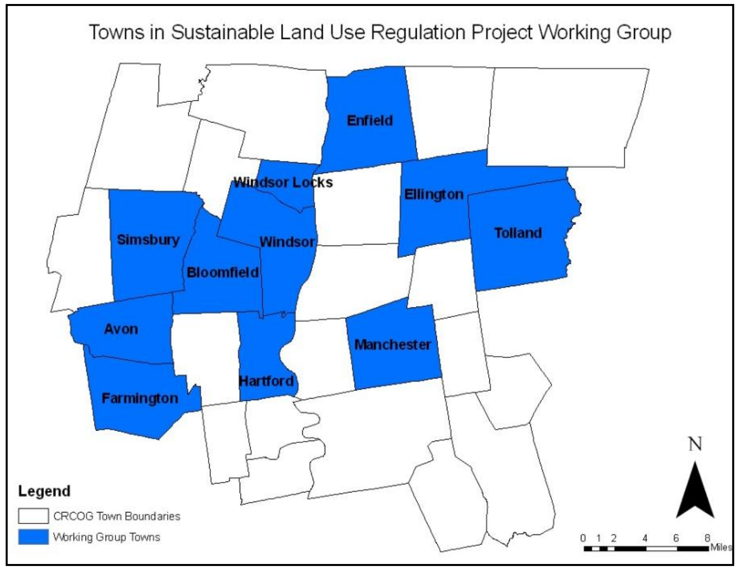

Figure 22: CT Capitol Region Council of Governments (CRCOG) Towns in Sustainable Land Use Regulation Project Working Group

77 "Sustainable Land Use Regulations. Assessment of Local Land Use Regulations," February, 2013. www.sustainableknowledgecorridor.org/site/sites/default/files/CA%20FINAL%203-4-13.pdf

13.0 Interconnection

13.1 Connecticut Context

Connecticut Light and Power Company (CL&P)[78] and The United Illuminating Company (UI)[79] are Connecticut's two major utility companies, both of which participated as partners on this project. CL&P is the state's largest utility with 1.2 million customers in 149 cities and towns. CL&P is a Northeast Utilities (NU) company. NU operates New England's largest utility system serving more than 3.6 million electric and natural gas customers in Connecticut, Massachusetts and New Hampshire. Companies that are part of NU include CL&P, NSTAR Electric & Gas, NU Transmission, Public Service of New Hampshire, Western Massachusetts Electric Company, and Yankee Gas Services Company.

Figure 23: CL&P Service Territory Map

Figure 23 shows CL&P's service territory map. The areas shaded in grey are those jurisdictions not serviced by CL&P, most of which are serviced by UI.

UI is Connecticut's second largest utility, with 325,000 residential, commercial and industrial customers in the Greater New Haven and Bridgeport areas. UI's parent company is UIL Holdings Corporation. UIL Holdings Corporation is an energy delivery company serving approximately 706,000 electric and natural gas utility customers in 66 communities across two states, Connecticut and Massachusetts. UIL Holdings is the parent company for UI, The Southern Connecticut Gas Company (SCG), Connecticut Natural Gas Corporation (CNG), and The Berkshire Gas Company (Berkshire Gas, serving natural gas customers in western Massachusetts).

Figure 24: UI Service Territory Map

The map of UI's service territory is shown in Figure 24.

As of May 15, 2013, CL&P has nearly 3300 distributed generation (DG) systems and UI has 525 systems interconnected to the grid and operating safely in Connecticut. These include solar PV systems, as well as fuel cells, combined heat and power systems, wind installations and other distributed generation.

Twelve jurisdictions participated in this project, representing the CL&P and UI territories as follows:

- **CL&P:** Cornwall, Coventry, Danbury, Greenwich, Hampton, Manchester, Middletown, Stamford, West Hartford
- **UI:** Bridgeport, Fairfield, Milford

[78] www.cl-p.com
[79] www.uil.com

In addition to CL&P and UI, Connecticut also has municipal electric distribution companies[80] including: Bozrah Light & Power, Groton Utilities, Norwich Public Utilities, South Norwalk Electric Works, and Wallingford Department of Public Utilities (DPU). There is also a Mohegan Tribal Utility Authority. A cooperative agency, the Connecticut Municipal Electric Energy Cooperative (CMEEC),[81] was formed by the state's municipal electric utilities.

The Public Utilities Regulatory Authority (PURA)[82] is statutorily charged with regulating the rates and services of Connecticut's investor owned electricity, natural gas, water and telecommunication companies and is the franchising authority for the state's cable television companies. PURA also keeps watch over competitive utility services to promote equity among the competitors while customers reap the price and quality benefits of competition and are protected from unfair business practices.

PURA replaced the former Department of Public Utility Control (DPUC) and along with the Bureau of Energy and Technology Policy, is part of the Energy Branch of Connecticut's Department of Energy and Environmental Protection (DEEP). DEEP was created in July 2011 and brings together the state's Department of Environmental Protection (DEP), the Department of Public Utility Control (DPUC) and an energy policy group that had been based at the Office of Policy and Management.

Thus, PURA regulates CL&P and UI, both investor-owned utilities, but not Connecticut's municipal utility companies. All filings submitted by CL&P and UI are processed by PURA in accordance with applicable statutes and regulations, and address issues such as: distribution, transmission and generation rates, wholesale procurement of electricity, energy efficiency, conservation and load management, cost-of-service, rate design, revenue requirements, metering accuracy, and the safety and reliability of the electric distribution system. In addition, PURA is responsible for the licensing of electric suppliers, registration of electric aggregators, and the oversight of renewable energy and renewable portfolio standards.[83]

13.2 Utility Participation in CT's Rooftop Solar Challenge

As partners on this project, CL&P and UI supported the Sun Rise New England team by explaining how interconnection of distributed generation works in Connecticut, how they work to ensure customer safety while also enabling interconnection of an ever-increasing number of distributed generation systems, what improvements they have made to their processes and their thoughts on potential areas for further improvement. CL&P and UI managers and staff were very generous with their time and explanations, providing multiple in-person interviews with CEFIA and Yale team members and sharing information to assist the team in identifying possible areas of improvement to the interconnection process, especially as it would impact solar PV installation. Requests for follow up information and review of information were always provided very promptly.

While the goal of the Sun Rise team is to identify possible areas for improvements resulting in soft cost savings for solar PV installations, the team's overall impression was that CL&P and UI are both very knowledgeable in their understanding of and support of deployment of distributed generation. While the common, PURA-approved interconnection guidelines are implemented differently in terms of administrative processes and specific practices, both utilities have impressive staff who clearly know what they are doing and are very efficient. Also, the team recognized that many improvements have been steadily implemented over the past years.

[80] www.ct.gov/pura/cwp/view.asp?a=3352&q=405244
[81] www.cmeec.com/whoiscmeec.htm
[82] www.ct.gov/pura/cwp/view.asp?a=3157&q=404410&puraNav_GID=1702
[83] www.ct.gov/pura/cwp/view.asp?a=3356&Q=405992&puraNav_GID=1702

In addition to interviews with the utility companies, CEFIA, Yale and Solar Connecticut collected installer feedback from open-ended survey questions that were emailed to solar PV installers. A summary of the feedback is provided in a later section, section 13.14, of this discussion on interconnection.

13.3 Connecticut's "Freeing the Grid"[84] Report Card

Connecticut is proud to be steadily improving its "Freeing the Grid" report card, with utilities making strong efforts in many areas to positively impact deployment of distributed generation. Connecticut's "Net Metering" grade in 2013 is an A, and has been since 2009. Connecticut also scored well on "Interconnection," with a respectable B going back to 2010, having made tremendous progress since scoring a D back in 2009. Connecticut would need to make further improvements in interconnection to make an A.

Figure 25: Connecticut's Freeing the Grid Report Card on Net Metering and Interconnection

13.4 Net Metering

Connecticut ranks among the nation's leaders with respect to net metering.[85]

Connecticut General Statute Section 16-243h86 changed the way customers who generate electricity from Class I renewable resources with a capacity of 2 MW or less are reimbursed for their net kWh production. Beginning in October 2007, instead of being paid an energy only amount for net kilowatt-hours at the end of a billing cycle, customers operating Class I renewable generation are required to bank or rollover their net kilowatt-hours to be used to offset the full retail value (i.e., delivery and generation rates) of their future electric consumption. This structure significantly increased the customer's reimbursement for the net energy produced by their system. At the end of each annualized period, the electric distribution company or electric supplier shall compensate the customer-generator for any excess kilowatt-hours generated, at the avoided cost of wholesale power.

For example, at present, CL&P's residential retail charges total about $0.16 per kWh, one of the highest in the United States, and more than double the past wholesale average energy reimbursement payment. The reimbursement mechanism established through Conn. Gen. Stat. 16-243h significantly increases the financial benefit of owning Class I renewable generation.

In Connecticut, there is no stated limit on the aggregate capacity of net-metered systems in a utility's service territory.

13.5 Virtual Net Metering

An enhancement to Connecticut's net metering law is virtual net metering, included in Connecticut Public Act No. 11-80 (PA 11-80), effective July 1, 2011.[87] Under this law, municipalities are eligible for virtual net metering, which allows them to share the billing credit among their electric accounts. For example, a town could install a solar PV system on the roof of a school and share the billing credits the system produces with a fire station. This increases the likelihood that the customer will fully utilize its credits (paid at the retail rate) during a year, and therefore not have any remaining credits at the end of the year, for which it would be paid at the wholesale rate.

[84] Freeing the Grid 2013. Best Practices in State Net Metering Policies and Interconnection Procedures, freeingthegrid.org.
[85] www.ctenergyinfo.com/dpuc_net_metering.htm
[86] www.cga.ct.gov/2011/pub/chap283.htm#Sec16-243h.htm
[87] www.cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm

The new law, PA 13-298 broadens eligibility for virtual net metering in several ways. It opens the option to state agencies and agricultural customers and increases the maximum size of the renewable resource from two up to three megawatts. It allows virtual net metering for class III resources such as cogeneration, as well as class I resources. It allows municipal and state agency customers to lease the renewable resource or enter into a long-term contract for it.[88]

The new law further enhances the value of distributed generation by allowing municipal or state accounts as well as agricultural accounts connected to a micro-grid to share their credits with up to ten non-state or municipal critical facilities (e. g. hospitals, police and fire stations, and municipal centers).

13.6 Interconnection

In December 2007, the Connecticut Department of Public Utility Control (DPUC), now PURA, approved revised interconnection guidelines [89] for distributed energy systems up to 20 megawatts (MW) in capacity. Connecticut's interconnection guidelines apply to the state's two investor-owned utilities, CL&P and UI, and are modeled on the Federal Energy Regulatory Commission's (FERC) interconnection standards for small generators.[90] [91] The most recent revision to the guidelines was made in 2010.

Connecticut's interconnection guidelines, like FERC's standards, include provisions for three levels of systems:

- **Certified Inverter:** projects 10 kW and less (application fee: $100)
- **Fast Track:** projects up to 2MW (application fee: $500)
- **Study Process:** complex projects over 2 MW (application fee: $1000 plus study fees).

Note that the interconnection guidelines include "additional process steps" for generators over 5 MW.

Connecticut's guidelines include a standard interconnection agreement and application fees that vary by system type.[92] Connecticut's guidelines differ from the federal standards in several ways:

- Connecticut customers are required to install an external disconnect switch.
- Customers must indemnify their utility against "all causes of action," including personal injury or property damage to third parties.
- Customers are required to maintain liability insurance in specified amounts based on the system's capacity.
- In addition, the utilities were required to collaboratively submit to the PURA a status report on the research and development of area network interconnection standards. This report was

[88] PA 13-298: www.cga.ct.gov/2013/ACT/PA/2013PA-00298-R00HB-06360-PA.htm

[89] Docket No. 03-01-15RE01, DPUC Investigation into the need for Interconnection Standards for Distributed Generation, December 5, 2007 (includes language from Docket No. 03-01-15 which made a decision on the EDS). www.dpuc.state.ct.us/dockhist.nsf/(Web+Main+View/All+Dockets)?OpenView&StartKey=03-01-15RE01

[90] FERC's interconnection standards are applicable to generator interconnections subject to FERC jurisdiction, whereas CT's interconnection guidelines apply to state-jurisdiction interconnections, which typically occur at the distribution level. FERC standards apply primarily to facilities that interconnect at the transmission level. However, FERC interconnection standards for small generators serve as a useful model for state-level standards. www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06R

[91] www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CT06R

[92] www.cl-p.com/generatorInter/Generator_Interconnection/ and UI website Generator_Interconnection

completed in December 2009, and the PURA reached a final decision (03-01-15RE02)[93] on the docket. The PURA has determined that the utilities can interconnect inverter-based generators (up to 50 kW) on area networks.

Connecticut's guidelines address requirements for study fees and include technical screens for each level of interconnection. Utilities and customers must follow general procedural timelines.

13.7 Interstate Comparison Table

The table on the following pages compares interconnection policies across five states as well as the 2009 IREC model interconnection procedures[94] based on application review time, application fee, insurance requirements and external disconnect switch requirements. IREC's model procedures have been used by states across the country to improve interconnection laws and policies pertaining to distributed generation. For the purposes of understanding how the DG Guidelines compared to those in other states, the team compared two New England states (Massachusetts and Maine) and the two other tri-state area states (New York and New Jersey) with the Connecticut policies. Please note that the data in these comparison tables are for research and comparison purposes and may have already or is expected to change so it is best to refer directly to relevant state websites.

The five-state comparison illustrates differences in the interconnection standards and procedures, useful but also not providing the full story, as further explained here:

- **Connecticut's interconnection standard allows up to 10 days to verify application completeness, and 15 days for application review for systems that are 10kW and less.**

  Two of the other four states have 3 and 5 day timeframes for verifying completeness, and the other four states allow only 10 days for application review. However, CL&P data shows that their median time frames are much faster than the CT guidelines require. *We thus shouldn't assume that the maximum timeframes allowed in the guidelines reflect actual timeframes.*

  CL&P's data for systems of size 10 kW and smaller, from January through June 2013, shows efficient timeframes for processing interconnection applications:

  - Out of 506 applications received, 468 have been successfully interconnected.
  - Average time to review an application for completeness is 2.5 business days, as compared to 10 days provided in the guidelines.
  - The median timeframe for application approval including net meter installation and approval to energize a project (without a witness test) is 3 business days, as compared to 15 days provided in the guidelines.
  - For systems in which a witness test is conducted, the median timeframe is 9 days.
  - Only 33 witness tests were conducted, while 435 were waived, reflecting that witness tests were done on 7% of applications for interconnection. CL&P waives the witness test for experienced installers and to those whom they have witnessed do about three successful installations.

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[93] Area networks are low voltage electrical systems served by multiple transformers located in densely populated metropolitan areas to provide large numbers of customers with highly reliable electrical service. www.dpuc.state.ct.us/dockhist.nsf/8e6fc37a54110e3e852576190052b64d/6bafa029ff9f34f78525775100510987?OpenDocument

[94] www.irecusa.org or www.irecusa.org/publications

In summary, the requirements are less stringent than the other five states but this does not imply that the Connecticut utilities use the allotted time. The impression from the interviews conducted was that the interconnection staff work quickly and efficiently, and with large workloads. Process and system improvements that help with ever-increasing workloads may be beneficial, so that efficiency can be maintained even as volumes increase. In fact, CEFIA anticipates that residential solar PV additions are expected to double in fiscal year 2013 (starting July 1, 2013) as compared to the number of systems installed in fiscal year 2012.

- **Connecticut charges a $100 application fee for systems that are 10kW and less. Maine charges $50 while the other three states do not charge fees for small systems.**

  We spoke to the CT utilities about the fee and learned two things. The $100 does not cover the utility's review cost for this size system. In addition, not charging at least a nominal fee can result in "frivolous" interconnection applications so that serious applicants may have to wait longer or their interconnection projects may be impacted by inactive projects.

- **Connecticut charges a $500 fee for fast track systems that are less than 2 MW. New York charges $350 while in the other three states the fee depends on the size of the project.**

  While some installers have expressed that this $500 fee is too high, Connecticut's flat fee would be less expensive for systems over a certain size. For example, Massachusetts charges $3/kW with a minimum of $300 and a maximum of $2500, so a system of size greater than or equal to 167 kW would cost at least $501 in MA. In CT, a system of size up to 2MW would still cost $500. It would be interesting to research further how fee amounts and structures impact aspects of deployment such as sizes of installations. A flat fee for anything less than 2 MW does not penalize larger system sizes.

  An administrative aspect to consider in adopting a fee that depends on system size is that a more complex fee can lead to more mistakes and confusion in terms of installers submitting the correct amounts. Submission of the fee is what initiates the interconnection process, so an incorrect payment could delay a project.

  Changing the tier sizes or adding a tier may help make fees more reasonable for systems that are over 10kW in size but not over a larger size cut-off, say 100kW.

- **Connecticut requires proof of insurance for systems of size 100kW and less, whereas other states waive this proof for most systems, or at least smaller systems.**

  The insurance requirement for smaller systems is satisfied by standard homeowner's insurance. CL&P has removed the requirement to renew proof of insurance annually for systems 10kW and less.

- **Connecticut's interconnection standard requires an external disconnect switch for all systems.**

  Some states do not include this requirement in their interconnection guidelines but leave it up to utility discretion, such as in Massachusetts. The project team contacted Western Massachusetts Electric Company, which is an NU company, and they do require the switch.

Table 15: Interconnection Guidelines - Comparison among Five States

IREC 2009 Model Interconnection Procedures	Connecticut CL&P and UI DG Guidelines	New Jersey	New York	Massachusetts	Maine
Inverter-Based Generating Facilities 25 kW and Less	**Inverter-Based Generating Facilities, 10 kW and Less**	**Inverter-Based Generating Facilities 10 kW and Less**	**Inverter-Based Generating Facilities 25 kW and Less**	**Single-Phase Inverter of 10 kW or Less, or Three-Phase Inverter of 25 kW or Less**	**Inverted-Based Generating Facilities 10 kW or Less**
Online application requirement **$0-20 fee** **3** days to evaluate application for completeness **7** days to review the application	**$100 fee** (plus potential study fees) **10** days to evaluate application for completeness **15** days to review the application	**$0 fee** **3** days to check application for completeness and respond to applicant via email **10** days to review the application	**$0 fee** **5** days to evaluate application for completeness **10** days to review the application	**$0 fee** (more for spot networks) **10** days to evaluate application for completeness **10** days to review the application	**$50 fee** **5** days to check application for completeness **10** days to review the application
For Generating Facilities Greater than 25 kW and Less than 2 MW	**Fast track for projects up to 2MW**	**For Generating Facilities 2 MW and Less**	**For Generating Facilities 2 MW and Less**	**For All Other Facilities**	**For Generating Facilities 2 MW and Less**
Online Application **$50 fee plus $1 per kW** of generating capacity **3** days to evaluate application for completeness **15** days to review the application	**$500 fee** plus study fee if don't qualify for fast track **10** days to evaluate application for completeness. **15** days to process application through initial screens	**$50 fee plus $1 per kW** of generating capacity **3** days to check application for completeness and respond to applicant via email. **15** days to review the application	**$350** application fee **5** days to check for completeness **15** days to review the application	**$3/kW: min. $300, max. 2,500** **10** days to evaluate application for completeness **10** days to review the application	**$50 fee plus $1 per kW** of generating capacity **5** days to evaluate application for completeness **15** days to review the application

Table 16: Interconnection Guidelines - Comparison among Five States (continued from Table 15)

IREC 2009 Model Interconnection Procedures	Connecticut: CL&P and UI DG Guidelines	New Jersey	New York	Massachusetts	Maine
Insurance Requirements	**Insurance Requirements**	**Insurance Requirements**	**Insurance Requirements**	**Insurance Requirements**	**Insurance Requirements**
No insurance required for inverter-based systems less than 1 MW	$300,000 in coverage required for systems less than 100 kW	Additional insurance is not required, unless agreed to by the applicant	Insurance not required	Insurance is not required for facilities that are less than 60 kW and eligible for Class I Net Metering	No insurance required for inverter-based systems less than 1 MW
External Disconnect Switch	**External Disconnect Switch**	**External Disconnect Switch**	**External Disconnect Switch**	**External Disconnect Switch**	**External Disconnect Switch**
Cannot be required if all the necessary conditions are met.	Required for all systems	Cannot be required if all the necessary conditions are met.	Not required for inverter-based systems less than 25 kW	Electric distribution company (EDC) discretion	Cannot be required if system complies with IEEE 1547 and UL 1741
Freeing the Grid 2012 Interconnection Grade	**Freeing the Grid 2012 Interconnection Grade**	**Freeing the Grid 2012 Interconnection Grade**	**Freeing the Grid 2012 Interconnection Grade**	**Freeing the Grid 2012 Interconnection Grade**	**Freeing the Grid 2012 Interconnection Grade**
A Standard	B	A	B	A	A

13.8 Interconnection Recommendations

The Sun Rise New England team identified the following opportunities for improvements to interconnection in Connecticut, from the perspective of facilitating interconnection of solar PV systems, and distributed generation generally. In addition, IREC has released a 2013 update to its Model Interconnection Procedures[95], a useful reference, along with consideration of best practices observed in other states and understanding what makes those practices possible, and lastly and most importantly – utility experience here in Connecticut and collaboration with other Connecticut utilities and organizations working towards common goals. Note that the CT utilities are currently participating in a FERC docket that may revise the FERC Small Generator Interconnection Procedures (SGIP); state interconnection rules including CT's are generally modeled on the FERC rules.

13.9 Recommendations for Interconnection Guidelines

Remove the annual requirement to show proof of insurance and consider waiving the insurance requirement altogether – Currently, the insurance requirement for systems up to 10kW is satisfied by standard homeowner's insurance, and CL&P has removed the requirement to renew proof of insurance annually for systems 10kW and less. This is easy to justify as there are electronic devices in houses and buildings that have been certified to be safe such as UL-certified inverters.

Consider removing the proof of insurance requirement for systems that are UL certified and are under a larger, specified size such as 100kW for which $300,000 of liability insurance is required, or alternately up to 1 MW for which $1 million of liability is required.

The customer's insurance coverage for their structures should be sufficient, and the customer should be able to decide how they wish to account for any additional risk. Waiving this insurance requirement would alleviate an administrative burden to the utility and the installer. CL&P and UI have waived the annual proof of insurance requirement for systems 10kW and smaller.

Consider replacing the 10kW with an up to 25kW certified inverter guideline – Making this adjustment would allow the majority of residential and commercial systems to take advantage of a faster process and a lower fee. Under the current tier sizes, an 11kW system would have a $500 interconnection fee just because it is over 10kW in size. On the other hand, note that states whose certified inverter guidelines extend up to 25kW generally include additional considerations in the review process, so there can be a trade-off here. Additionally, the tier sizes should be reviewed every two years or in a time period that reflects rapid developments (including system size increases) in distributed generation.

Consider reducing interconnection fees where possible:

- For inverter-based systems up to 10kW (potentially up to 25 kW), consider reducing the $100 fee if there are ways to streamline processes to reduce the cost to the utility, or ways to recapture or justify the cost.
- For systems greater than 10kW (potentially 25kW) and up to 2 MW, consider adding a tier size, for example for systems of size 25-100kW, so that systems of size 25kW-2MW are not all charged $500. It would be helpful to better understand what a cost-recovery fee would be, and if it is high, whether there are ways to streamline the process to lower costs, or understand how some utilities are able to set fee levels that do not fully recover their costs (e.g., via other benefits).

Require utility reporting of application acknowledgement, review and approval periods to PURA to assure that time periods for both utilities are reasonable. Note that reducing written, required turnaround times has the tendency to increase eligibility requirements for those submitting applications subject to those turnaround times, as many states have done, so reducing these times in the guidelines has potential cost versus benefit.

[95] www.irecusa.org/wp-content/uploads/2013-IREC-Interconnection-Model-Procedures.pdf

Reconsider necessity of the external disconnect switch requirement.

- Small inverter-based systems automatically disconnect from the grid during outages and can also be manually disconnected from the grid through other mechanisms. The EDS may be a redundant safety feature. This issue is discussed in detail in the next section, section 13.10.

13.10 External Disconnect Switch

The utility-accessible (UA) alternate current (AC) external disconnect switch (EDS) for distributed generation, including photovoltaic (PV) systems, is a hardware feature that allows a utility's employee to manually disconnect a customer-owned generator from the electricity grid. Proponents of the EDS contend that it is necessary to keep utility line workers safe when they make repairs to the electric distribution system. Opponents assert it is a redundant feature that adds cost without proving tangible benefits.[96]

Modern small commercial and residential PV systems include UL-listed[97] components that meet rigorous standards. The National Electrical Code (NEC) requires that an inverter de-energize its output upon loss of utility voltage and remain in that state until utility voltage has been restored. Modern electronic inverters are reliable, intelligent, and comprehensively tested to ensure that they do not feed back to the grid during outages.

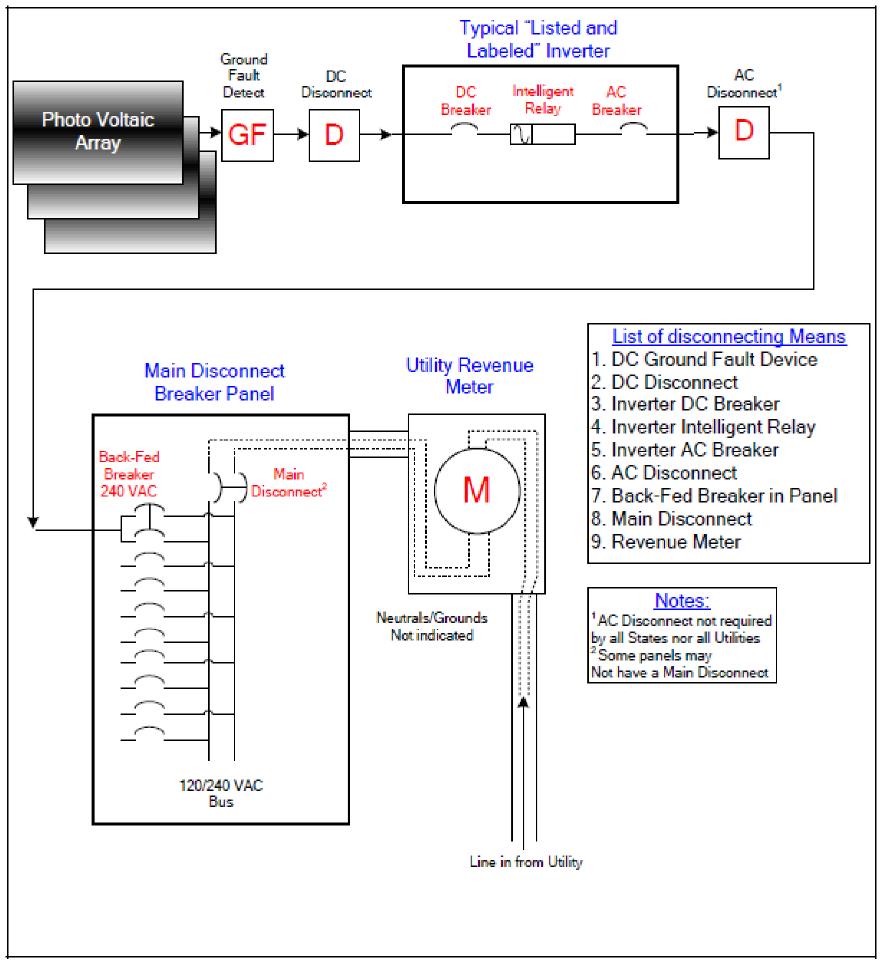


Figure 26: Utility Accessible Alternate Current External Disconnect Switch

Arguments made for why the EDS should not be required include:

- Inverters drop off-line during an outage.
- Linemen usually don't have time to use an EDS when restoring an outage.
- If there is an issue with the PV system, the DC switch can be locked or "red-tagged."
- IEEE 1547, UL 1741 and the NEC do not require an EDS.
- If the utility is allowed to require the EDS, then this should be added to the switching procedures.

[96] M.H. Coddington et al., Utility-Interconnected Photovoltaic Systems: Evaluating the Rationale for the Utility-Accessible External Disconnect Switch, National Renewable Energy Laboratory, NREL/TP-581-42675, January 2008, available at: www.nrel.gov/docs/fy08osti/42675.pdf.

[97] UL 1742 applies to inverters. Based on IEEE 1547 requirements, the UL-listed inverters for PV systems require the inverters to disconnect automatically from the grid.

Figure 26 shows that the EDS[98] or AC Disconnect for a solar PV system, as usually installed, has multiple disconnecting mechanisms serving the same purpose as an EDS.

While those focused on reducing time and cost of solar PV installation emphasize the redundancy of the EDS, utility companies express reasons why it should be maintained as a requirement. One person shared the perspective that the EDS marks the boundary between where the responsibility of the utility ends and where the responsibility of the homeowner starts. Certainly, if one thinks of the EDS as being replaced by multiple other mechanisms, from a functional perspective, then is there another clear line of demarcation, say the inverter?

Another perspective on this issue which Connecticut has to offer is that from the most recent PURA (at the time DPUC) ruling when PURA was asked by Aegis, an installation company, to remove this requirement. Aegis made the point that generators have other means of ensuring isolation and also that induction generators are incapable of starting up on their own and inadvertently energizing circuits.

The project team asked PURA about how the decision on this issue came about, and PURA shared that there was at the time considerable debate on the issue, and much thought put into a decision in favor of preserving the EDS requirement. The explanation provided in Docket No. 03-01-15RE01, DPUC Investigation into the need for Interconnection Standards for Distributed Generation, December 5, 2007, was as follows:

> **The disconnect switch is a mechanical device used to isolate the generator's electrical facilities. The disconnect switch is used to either isolate the generator from the Company's facilities for safety reasons, or to isolate the generator from the customer's facilities to enable work on the customer's facilities without de-energizing the customer's loads.** The Revised Guidelines require that an external disconnect switch be provided at the point of interconnection that is easily accessible to Company personnel that can be opened for isolation, for any generating facility rated greater than 1 kW. (Revised Guidelines, Section 3.3.2). The Existing Guidelines require a disconnect switch for all generator interconnections; therefore, the Existing Guidelines relax the disconnect switch requirement for very small generators.
>
> **In the Initial Decision, the Department concluded that the disconnect switch requirement is reasonable, and stated its belief that Company workers should have positive confirmation and control over isolation devices to ensure electrical facilities cannot be energized during maintenance.** (Initial Decision, p.5).
>
> SunEdison notes that some jurisdictions have eliminated the need for an external disconnect switch for certain types of generating facilities, notably, inverter based generation (which is commonly used for solar and wind based generators). Instead, other jurisdictions allow removal of the revenue meter as a means of disconnection. (SunEdison Written Comments, pp. 12-13).
>
> The EDCs oppose removing the disconnect switch requirement. According to the Companies, removal of the revenue meter as an alternate means of disconnection poses a substantial safety hazard. The EDCs report that they have had numerous instances of electrical flashes and broken meter socket jaws upon meter removal, presenting both safety issues for employees and property damage liability issues for the Companies. Further, the Companies state that the majority of states still require a disconnect switch. (UI Reply Brief, p.7; CL&P Brief, pp.3-4; Tr. 9/25/07, pp.130-131).
>
> The Department reaffirms its conclusions from the Initial Decision on this matter. No new facts have been presented in this case, other than that some other jurisdictions have removed the requirement, which may have the effect reducing utility worker safety to accomplish energy policy goals. The Department believes that the disconnect switch requirement is necessary for worker protection.

[98] M.H. Coddington et al., Utility-Interconnected Photovoltaic Systems: Evaluating the Rationale for the Utility-Accessible External Disconnect Switch, National Renewable Energy Laboratory, NREL/TP-581-42675, January 2008, www.nrel.gov/docs/fy08osti/42675.pdf.

With arguments for and against the disconnection switch, the team's recommendation is to reconsider the necessity of the external disconnect switch requirement; PURA would need to agree to reopen the discussion.

13.11 Utility Strengths and Best Practices

The interconnection guidelines do not establish all of the interconnection application procedures, leaving implementation processes and practices up to the utility. **The following are examples of CL&P and UI's strengths and best practices:**

- CL&P developed and currently uses an online interconnection application submission and tracking system which provides both installers and solar PV customers a convenient means to check the status of their interconnection application.
- CL&P and UI have helpful websites which provide information and documentation on interconnection requirements and processes.
- CL&P waives most witness tests for inverter based systems under 10 kW in size, typically after three successful tests with the same installer. The waived witness test results in tremendous time and cost savings. Additionally, CL&P does not charge for those witness tests it does conduct for this system size.
- CL&P shows their median times to interconnect inverter based systems of size 10kW or smaller to be very reasonable, as follows:
    - 4 days in 2012, 3 days in the 1st quarter (1Q) of 2013, and 2.5 days in the first half of 2013, as compared to 10 days as required in the interconnection guidelines
    - The median timeframe for application approval including net meter installation and approval to energize a project is 3 business days without a witness test (9 days with witness test), as compared to 15 days in the guidelines
- Both utilities have effective processes in place to coordinate with town building inspectors as to when systems have passed municipal inspection and are ready for interconnection to the grid. CL&P and UI do this process slightly differently because of the systems they have in place (CL&P is online):
    - CL&P: To handle the variation in processes for over 140 towns in CL&P's service territory in terms of notifying the utility when municipal building permits are approved, CL&P worked with the municipalities to create a common process across all of the towns. As of 10 years ago, the towns all handled permit approvals and notifications to the utility differently. CL&P worked with the towns to develop a process by which an installer submits a permit application to the town and an interconnection application to CL&P. CL&P creates a work request number which is provided to the municipal building inspector. Once the inspection is done and the permit is approved, the inspector notifies the utility using the work request number. This process saved all parties a tremendous amount of time because it was consistent and clear for all the towns. Three years ago, this process was further improved with online and electronic means put in place to handle about 90% of the requests and communications. As of one year ago, 100% of requests and communications are processed electronically.
    - UI: At a high level, UI's process in coordinating with municipalities and installers is similar and reaches the same outcome. Ultimately, the municipal inspector contacts UI via an automated telephone notification system to inform UI when the PV system has passed inspection. This information is relayed to UI's distributed generation team for next steps. The biggest differences are due to the UI process not being online or fully electronic, resulting in several process flow steps that rely on phone calls or emails. Though this process currently works very well, it does rely on incredible diligence of staff, and could be made even better in the long run with more

reliance on technology to make staff's work easier. An online or electronic system, for example, similar to what CL&P has, could be particularly helpful as the volume of DG applications such as those for solar PV systems increase.

- Installers new to Connecticut are invited to train with the utilities to help them understand the interconnection processes, saving everyone time in the long run. The utilities see themselves as shepherding installers through the interconnection process.
- Interconnection staff at both utilities are highly qualified, knowledgeable and experienced in the processes and subject matter of their roles. The staff have strong technical skills and know their jobs inside and out.
- The utilities track a lot of useful information about the systems that are installed as well as metrics pertaining to administrative processes.
- Both installers and distributed generation system customers are surveyed regularly to solicit feedback on how the utility can better provide service.

13.12 Utility Practice Recommendations

Opportunities for improvement at the utility practice level include:

- **Develop online application, and online fee payment** – This would streamline the application process and shorten the waiting period. CL&P has an online interconnection application submission and online tracking system in place. UI does not yet, but mentioned that it's something one would naturally consider. Neither company offers an online payment option for the interconnection fee. Allowing for online payment is not a simple matter primarily due to utility billing system complexities. At this time, payments can be sent in by check in the regular mail.
- **Require only a single net meter (only applied to UI who had implemented this change as of May 2013 or earlier)** – As observed by "Freeing the Grid" in their report assessing interconnection and net metering across all U.S. states, a common area of improvement for utility companies are improvements to billing systems. For example, UI until very recently required two meters for a solar PV system in order to determine "net" use because of how the existing billing system is structured. Billing systems can be expensive and arduous to change, especially with a large number of customers. The consequence of requiring an extra meter was that the solar PV customer would ultimately pay an extra $270 to the installer to cover the second meter (extra equipment) plus added installer labor cost. As of the writing of this report, UI found a solution to remove the need for two meters. This will save about $500 per system installed in UI territory.
- **Consider waiving witness tests for repeat installers for inverter based systems under 25kW (CL&P already does this for systems up to 10kW in size)** – For inverter-based systems under 25 kW, utilities could consider waiving the system witness test if they have worked with a particular installer in the past and are confident in the installer's ability to install the particular system, saving both the installer and utility time and resources, ultimately benefiting customers of distributed generation. CL&P has applied this practice already for systems up to 10kW by waiving witness tests for installers after about the third witness test conducted with an installer. Also, CL&P does not charge a witness test fee for these tests with new installers.
- **Continue to develop and enhance guidance and resources for installers to help them better understand processes and application requirements, leading to more complete applications.** As with permitting, installers providing incomplete applications is a significant source of delays. The practice of training new installers, as mentioned above, is beneficial, as would any additional tools and measures to

increase clarity in communicating process expectations and technical requirements for all review tracks.

- **Standardize procedures for systems that fail fast track screens (CL&P and UI already working on this)** – For systems that are large and/or technically complex, it would be helpful if the utilities provided as much guidance as possible to help installers understand the scope of studies needed to address the failure of certain screens. What will it take to assure that the system is consistent with safety, reliability and power quality standards? Each time the utility and installer work together on an interconnection that is complex, it would be beneficial to apply the lessons learned in an effort to continue simplifying, formalizing and communicating processes for more complex systems as effectively as possible.
- **Examine the effectiveness of the coordination between utilities and municipalities to see if it is working as intended, and correct any problems.** Take initiative to reach out to jurisdictions to optimize communication between building inspectors who are approving solar PV permits and communicating this information to the utility. CL&P has an online system in place for building inspectors to provide communications about permit approvals. UI has an automated phone system and could consider adopting an online system similar to what CL&P has implemented. The more this communication is made easy and standardized for all parties, the less delay incurred.

13.13 Recommendations for PURA

The interconnection guidelines adopted by CL&P and UI do not apply to the municipal electric companies, for which this project did not conduct research. It would be useful to know what standards, requirements and processes the municipal utilities operate by, what installers' experiences are in these towns, and whether there are any best practices.

Recommendation:

- **Encourage adoption of the interconnection guidelines by all utilities in Connecticut** – PURA could encourage adoption of the interconnection guidelines adopted by CL&P and UI by all of Connecticut's utilities. This would help standardize interconnection across all CT jurisdictions.

13.14 Data Collected -- Utility Interviews and Installer Survey Responses

CL&P Interview Highlights

- Online interconnection application, but no online payment option
- Typically a small project would only take a day or two to review
- Application approval sent by email to homeowner and installer
- Don't do utility inspection for small projects—rely on town building departments; have right to inspect but waive it after they've done a new installer 3 times; usually working with same cast of characters
- Building inspector will be able to use number to submit approval online to CL&P (handful of 144 towns don't do online system and submit by fax)
- Can check status of interconnection online using work request number and town name
- With new installer will schedule a "witness test" within 10 days, send out a technician to test to make sure inverter cuts off when there's loss of power, make sure equipment is not back-feeding, and make sure it's configured in the right way. Do this about 3 times with a new installer and then no witness tests after that. No witness test fee if system 10 kW or smaller.
- How can the interconnection process be improved? In Connecticut we need, as California has done, a system for when systems fail fast track system screens. Would help to have a defined scope of what

studies will be needed based on which screens a project fails; CL&P is working to develop this with UI.

UI Interview Highlights

- 2010 interconnection guidelines are currently in the process of being updated
- Net metering requires two separate meters, one measuring the power flowing into the house from the grid and one measuring the net export of surplus generated power to the grid.
    - There are two ways to accommodate the required second meter:
        - Have the homeowner's electrician install a second meter socket
        - Have UI install an adapter in the original socket that allows a second meter to be connected. This costs $270.00 and only works for systems of 200 amps or less.
    - The meters themselves could be wired so that a single meter could handle both inflow and outflow of power, but the UI billing system can't handle it. Hence the two-meter requirement.
- No online application but supporting documents such as site plans and insurance documents can be sent electronically.
- The installer receives an email confirming receipt of the application within three business days.
- UI never waives the right to conduct witness tests the way CL&P sometimes does. This is because UI has a much smaller territory than CL&P, so it's not such a stretch for them to personally inspect every PV system.
- UI works with the same installers (about a dozen in the area) over and over and knows them well.
- Installers should submit the application as early as possible even if it's incomplete. That way they can get help with any parts that give them difficulty. Installers who wait to the last minute make UI look bad to the customer if the customer thinks the installer submitted the application much earlier.
- Ideally UI would like to receive an application before the system is installed so any changes can be made to the plans rather than to the physical system.

Summary of Installer Survey Responses

The following is a summary of installer survey responses -- see Appendix VIII for full questions and answers. Note that some responses include comments about the permitting process, which is a municipal rather than a utility process.

- I have no issues with the process. I would like to see more representatives to keep up with the load. I suggest having the clearance desk reps assigned to certain areas
- CL&P online tracking of application status is good
- Making all processes electronic will help speed things up
- Witness test scheduling is a large time expense
- Category 2 process takes too long and is too expensive
- The entire permitting and interconnection process is time consuming and expensive, much more so with systems over 10kW.
- The utility requires a printed, mailed copy of paperwork and a check. Need faster and simpler process.
- Well run program, modest cost ($100 for 10 kW and under), inspections waived after a few passes

- The process is time consuming and expensive, much more so with system over 10kW.
- Application fees are in the $200-$500 range. Biggest expense is time for witness tests and scheduling.
- Some are advocates of removing the utility disconnect requirement (as inverters are 1741 listed). I'd leave that decision to safety studies.
- Category 2 is $500 for interconnection and $550 for witness test (both too much)
- Town inspectors have to do an online submittal in a timely manner -- this is weakest link
- Coordinating with town building inspectors is time consuming, and they usually don't know enough about electrical parts
- Main issue is building inspectors being ill prepared for the task of reviewing solar systems
- Let's build a centralized state level permitting process so we only have one inspector. Provide the municipality a token amount, say $100, to verify that the house is constructed to code. This information should be on file so that towns don't have to go to the site. Use SunShot funds to build this process and fees to installers will help maintain it.
- Implement a permitting and interconnection process as they have in Vermont.[99]

[99] www.renewableenergyworld.com/rea/news/article/2011/05/vermont-enacts-first-in-nation-solar-registration

14.0 Financing

14.1 Connecticut's Innovative Financing Mechanisms

The Clean Energy Finance and Investment Authority (CEFIA) develops numerous innovative financing mechanisms for Connecticut residents that increase affordability and accessibility of rooftop solar PV installations and increase demand while lessening dependence on ratepayer dollars by leveraging private capital. New products/programs were released in the Spring and Summer of 2013 that will enable the residential and commercial sectors to access financing for clean energy including rooftop solar PV.

14.2 Green Bank Financing Model

CEFIA was created by the Connecticut General Assembly in 2011 as the successor organization to the Connecticut Clean Energy Fund (CCEF). As the nation's first "green bank," CEFIA leverages public and private funds to drive investment and scale up clean energy deployment in Connecticut.

Green bank loans can provide lower cost financing from third-parties enabling greater access to capital for households interested in solar PV. The Rooftop Solar PV "Green Bank" Financing Model[100] allows users to stipulate financing cost assumptions as well as revenue source assumptions in order to model scenarios in a given state or region. ***This model quantitatively shows how a combination of lowered installation costs and green bank loans can lower the price paid by consumers for clean electricity to at or below the existing retail price as a result of lower cost debt in the capital structure.***

According to the model, various combinations of green bank loans lower the price of solar electricity enough to be competitive with average Connecticut electricity prices (see Table 17). The model uses the installed cost of PV, regional capacity factors (i.e., solar insolation levels), state policies and incentives, and the capital structure to determine the resulting retail cost, equity returns, and installed capacity per green bank debt.

Table 17: Retail Price ($/kWh) as a Function of Solarize Installed Cost Levels and Green Bank Loans

(*base case retail price before any green bank loans)

	% Green Bank Debt in Capital Structure				
Installed Cost ($/W)	0%	10%	20%	30%	40%
4.5	0.210*	0.187	0.163	0.140	0.117
4.0	0.174	0.154	0.133	0.112	NA
3.5	0.139	0.121	0.103	0.085	NA
3.0	0.103	0.088	0.072	0.057	NA

Other Assumptions:	
Developer Equity Return	15%
Tax Equity Return	12%
Total Leverage	40%
Commercial Debt Interest	6%
15-Year RECs	$0.030/ kWh
6-Year State Incentives	$0.225/ kWh

The shaded cells in Table 17 are those with retail price less than the average 2011 CT retail price escalated to 2013 ($0.190/ kWh). Essentially, all scenarios presented in the table, except for the case with installed cost at $4.5/W and 0% green bank debt in capital structure will result in a cost of electricity to the customer that is less than the current average retail rate.

This model can be used by any state and is publicly available via CEFIA online at www.ctcleanenergy.com/RooftopSolarPVModel.

[100] Rooftop Solar PV "Green Bank" Financing Model sponsored by CEFIA, the Coalition for Green Capital (CGC) and the Brattle Group.

14.3 Financing Programs

CEFIA is putting the Green Bank Financing Model in practice through several financing programs. The increased availability of longer term, low interest debt results in the need for fewer subsidies, energy savings that exceed debt service and greater access and affordability of rooftop solar PV to Connecticut residents.

Table 18: Roadmap to Residential Rooftop Solar PV Financing in Connecticut

Program	Type	Term (Years)	Interest Rate (%)	ARRA[101] ($MM = $ million)	CEFIA ($MM)	Private Capital ($MM)
CT Solar Lease Version 2.0	Lease	20	2.9 pa[102]	$3.5MM	$10MM	$52MM ($28MM debt, $24MM tax equity)
Smart-E Loans	Loan	5	< 4.49	$2.5MM	$0	$28MM
		7	< 4.99			
		10	< 5.99			
		12	< 6.99			
CT Solar Loan Powered By Sungage	Loan	15	6.49	$0.3MM	$1.5MM	$4.5MM
		20	7.49			
Capital Competition	Loan	20	2	$0	$1MM	TBD
Total				$6.3MM	$12.5MM	$82.5MM

CEFIA has been working to further drive down installed costs with programs such as Solarize and the Rooftop Solar Challenge, while increasing the availability of low cost financing from the private market in order to work toward making financed installations cash flow positive from the outset.

Figure 27 provides a comparison of solar financing options assuming a Solarize price of $3.50/W for a 7kW system. Based on this pricing example, the CT Solar Lease is cash flow positive from the outset (see the next section for details).

(for a 7kW system installed at Solarize price of $3.50/W)	Smart-E Loan (12yr)	CT Solar Loan	CT Solar Lease
Down Payment Required	$0	$1,263	$0
Loan Amount	$15,925	$15,150	N/A
Est. 1st Month Payment	($164)	($132) ($87 post re-amortization)	($72)
Est. 1st Month Net Cost	($58)	($27)	$34
Wealth Created (5% discount rate)	$9,720	$10,046	$5,589

Figure 27: Comparison of Financing Options

101 CEFIA is using repurposed ARRA-SEP funds as credit enhancements (i.e. loan loss reserves) for various financing programs for rooftop solar PV.

102 pa = percent annum

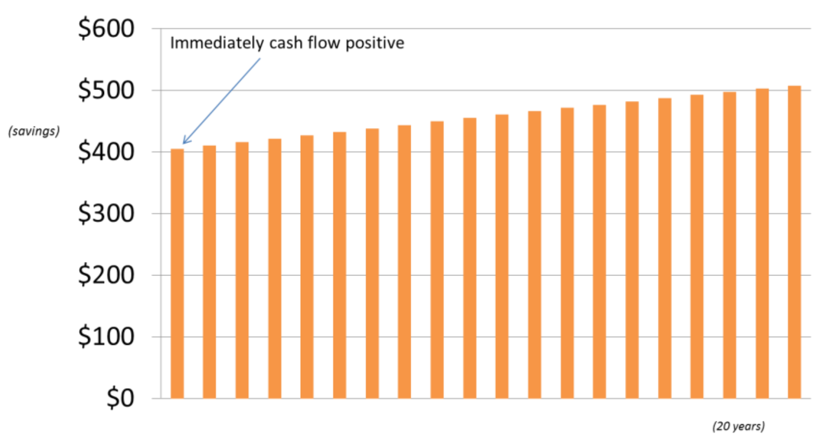
14.4 Energize Connecticut Solar Lease Version 2.0

CCEF launched the award-winning Connecticut Solar Lease (version one) in 2008 for PV systems in one to four unit owner-occupied residences in Connecticut. The program provided 855 leases to residents in just over three years demonstrating "high borrower fidelity rates."[103] Version 2.0, released July 2013, includes more private investment, including debt providers, thus lowering the overall cost of capital going into the structure and reducing reliance on ratepayer funds. It includes energy assessments and coupons for energy efficiency from solar REC revenue. These financing mechanisms will "right-size" and lower the payback period of a rooftop solar PV system and expand its data collection requirements on hardware and non-hardware costs.

Solar Lease Version 2.0 provides over $50 million in capital for an expected 1500 residential solar PV systems, 400 residential solar thermal (hot water) systems, and 40 commercial solar energy systems. The program will result in the return over time of all Connecticut ratepayer funds used to subsidize the installations, plus provide a two percent return. Twenty-year leases will be available for residential and commercial solar energy systems. Monthly payments will be based on installed cost with a 2.9 percent per annum (pa) escalation in the lease payment with an option to purchase the system at year 20. Leases with fixed rates are available for higher monthly prices. Eligibility will not include income requirements and will be available to customers with FICO scores above 640 making the product accessible to 87% of single family homes in Connecticut.

AFC First Financial will service leases including taking on all applications and maintaining data. AFC First Financial successfully partnered with CEFIA as the servicer for Solar Lease 1, and has experience with many other clean energy programs, including Pennsylvania's Keystone HELP, for energy efficiency.

Figure 28 provides an example of annual cash flow for the CT Solar Lease over a 20 year term under the Solarize price assumption of $3.50/W for a 7kW system. This lease product is immediately cash flow positive.



Term Length	20-year
Not-to-Exceed Rate	N/A
Down Payment Required	$0
Est. Monthly Payment (1st Month)	$72
Est. Monthly Savings (1st Month)	$34
Month of First Positive Cash Flow	Immediate

Figure 28: CT Solar Lease Representative Cash Flow

14.5 Energize Connecticut Smart–E Loans

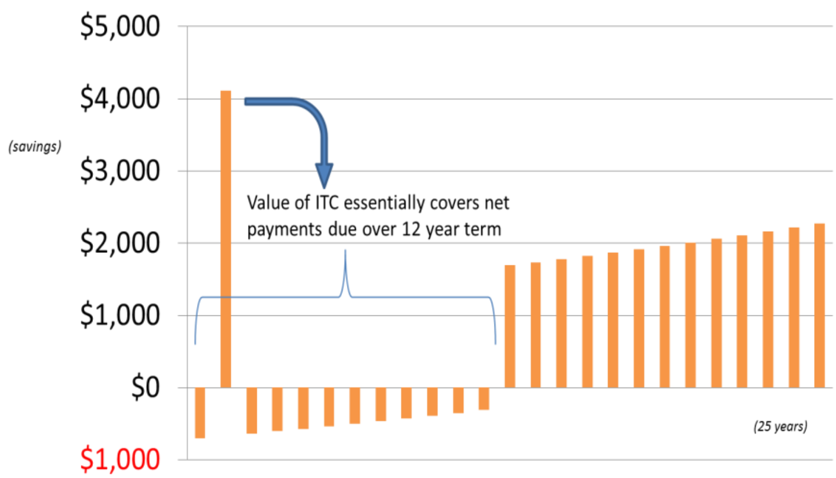
CEFIA's Smart-E Loan Program offers long-term, low-interest financing through participating lenders to help Connecticut residents access home energy upgrades, including rooftop solar PV. Affordable, simple and easy to access, Smart-E loans enable the implementation of energy upgrades that result in environmental benefits, cost savings and home improvement to Connecticut residents. Participating local credit unions and community banks are providing up to $28 million in capital for projects undertaken by contractors for energy upgrades, supported by CEFIA's $2.5M Loan Loss Reserve. Unsecured loans of up to twelve years are provided to qualifying residential

[103] Bethany Speer. Connecticut's Solar Lease Program Demonstrates High Borrower Fidelity. NREL, October 2012.

borrowers to finance comprehensive, qualifying renewable energy improvements (i.e. rooftop solar PV installations), including fuel conversion, renewable energy and efficiency measures.

The program is open to 1-4 unit owner occupied residences or rented units approved by the landlord (varies by lending institution), subject to credit approval. Residences must be serviced by The United Illuminating Company, Connecticut Light and Power, or the Connecticut Municipal Electric Energy Cooperative[104] for electric; and Southern Connecticut Gas, Connecticut Natural Gas, or Yankee Gas for gas.

Figure 29 provides an example of annual cash flow for the Smart-E Loan over a 12 year term under the Solarize price assumption of $3.50/W for a 7kW system. The value of the federal investment tax credit (ITC) essentially covers net payments due over the 12 year term.



Term Length	12-year
Not-to-Exceed Rate	6.99%
Down Payment Required	$0
Loan Amount (7 kW @ $3.50/W)	$15,925
ITC Value	$4,778
Est. Monthly Payment	($164)
Est. Net Cost (1st Month)	($58)

Figure 29: Smart-E Loan Representative Cash Flow

14.6 Energize Connecticut Solar Loan Powered By Sungage

Sungage, Inc. (Sungage) is a privately held company headquartered in Amherst, Massachusetts, and with an office in Connecticut. **Sungage developed an innovative loan structure specifically targeted at residential solar ownership.** The loan structure enables CEFIA to promote solar ownership in Connecticut with a $300,000 Loan Loss Reserve (LLR) from repurposed ARRA-SEP funds, a subordinated debt term loan component of $500,000 and a revolving loan of a maximum of $2,200,000. Homeowners with FICO scores greater than 680 are able to access the Energize Connecticut Solar Loan program and take advantage of the Investment Tax Credit (ITC), previously out of reach for those who could not afford the entire upfront cost of PV installations. The standard loan rate is 6.49%, and rises to 9.99% if the homeowner does not use the ITC to pay down the loan (Tax Credit Recapture and Reamortization, “TCRR”). The individual loan tenor is 15 years, and the homeowner can choose to extend to 20 years at any point during their loan, resulting in an additional 100 basis points (bp) or 1% added to the homeowner’s current rate.

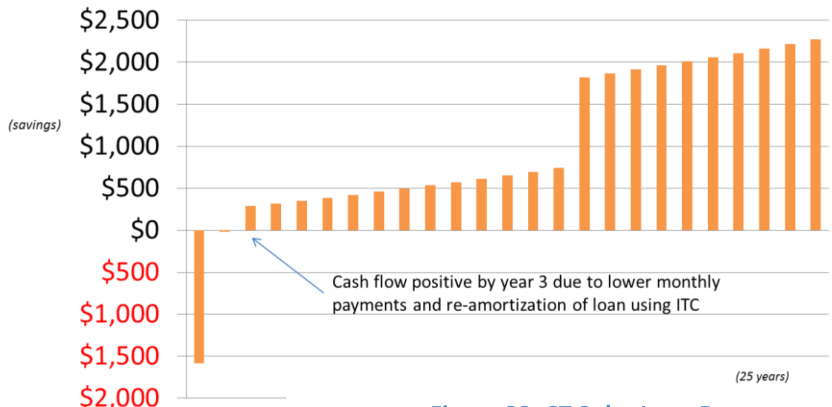
CEFIA’s LLR and subordinated debt term loan will support $4,500,000 of private capital.[105] The long-term structure (once the subordinated component reaches a “steady state”) leverages private capital to public funds at a rate of nearly 6:1. Sungage provides contractor training, financing tools and administration of the program. Funds management and loan application / administration responsibilities are handled by LeaseDimensions, an

[104] www.cmeec.com/whoiscmeec.htm

[105] The $4.5M is pending based on the participation of a proposed Senior Lender. In lieu of a Senior Lender, CEFIA invested $1,500,000 of ratepayer capital in order to jump start the program.

established major consumer loan administrator whose client list includes GE Capital, Volkswagen Credit, Coca-Cola, Hewlett-Packard and Ford Credit.

Figure 30 provides an example of annual cash flow for the CT Solar Loan over a 12 year term under the Solarize price assumption of \$3.50/W for a 7kW system. The loan is cash flow positive by year three due to lower monthly payments and re-amortization of the loan using the ITC.[106]



Term Length	15-year
Not-to-Exceed Rate	6.49%
Down Payment Required	\$1,263
Loan Amount (7 kW @ \$3.50/W)	\$15,150
ITC Value	\$4,924
Est. Monthly Payment (1st Month)	(\$132)
Est. Net Cost (1st Month)	(\$27)

Figure 30: CT Solar Loan Representative Cash Flow

For more information about these financing products, see the EnergizeCT website: www.energizect.com/residents/programs.

14.7 Capital Competition Program

CEFIA worked with the Coalition for Green Capital (CGC) to issue a Request for Proposals (RFP) for a pilot program to invest \$1 million of ratepayer funds in a 20-year low interest (e.g., 2%) loan to identify an installer, financier, or third-party that can maximize the deployment of residential rooftop solar PV per dollar of ratepayer funds at risk without the use of subsidies. CEFIA will be purchasing (and then selling) the RECs from these installations at a price that will amount to a lower subsidy than if these installations were provided with RSIP rebates. A successful pilot would encourage CEFIA to offer another RFP for \$5-10 million, to be expanded in partnership with other state or city level green banks to attract additional low cost capital.

14.8 Commercial Property Assessed Clean Energy (C-PACE) Financing

C-PACE is a finance mechanism that allows commercial, industrial and multifamily property owners to access up to 100% low-cost, fixed rate, long-term financing for energy efficiency and renewable energy improvements and repay the loan through placing a voluntary assessment on their property tax bill, similar to a water/sewer tax assessment. Property owners pay for the improvements over time (up to a period of 20 years) through this additional charge on their property tax bill and the repayment obligation transfers automatically to the next owner if the property is sold. Capital provided under the C-PACE program is secured by a lien on the property, so low-interest capital can be raised from the private sector with no government financing required. The state of Connecticut passed legislation enabling CEFIA to offer C-PACE financing. However, each jurisdiction must still opt into the C-PACE program, agree to assess, collect, remit and assign benefit assessments to CEFIA.

When low cost, long-term C-PACE debt is used to finance the costs of installing a rooftop solar PV system, lower levels of incentives are needed to make the project viable at current electric rates. For example, as shown in the table below, when 70-percent debt is assumed to finance a project that costs \$3/W, the project can be financed with a Zero Emissions Renewable Energy Credit (ZREC) price of as little as \$58/MWh while still maintaining a net

[106] Notes: (1) Assumes a dealer fee of \$750, (2) Estimated monthly payment drops to \$87 after re-amortization of ITC proceeds.

present value greater than zero. This price is significantly lower than the average clearing price from last year's auction of $135/MWh. The addition of C-PACE debt to the current level of incentives could result in more than twice the number of clean energy projects.

Table 19: Net Present Value given varying ZREC Prices

(*2012 ZREC clearing price)

REC Value	$60	$65	$75	$95	$115	$135*
Net Present Value ($)	3,702	18,124	32,546	46,968	61,391	75,813

Assumptions:

System Cost: $3/W
C-PACE Debt: 70%
Financing Term: 20 Years
Financing rate: 5.5%
Avoided Electricity Cost: $0.12 kWh

14.9 Zero Emission Renewable Energy Credit (ZREC) Program

In July 2011 the Connecticut legislature created the Zero Emission Renewable Energy Credit (ZREC) Program.[107] The program requires Connecticut's two investor owned utilities, Connecticut Light & Power (CL&P) and United Illuminating (UI), to enter into 15-year contracts through a "market-driven RFP bidding process and small tariff" with electric generation facilities larger than 100 kilowatts (kW) but not larger than one megawatt (MW) that are zero emission. Systems based on technologies such as solar, wind, hydro or other zero emission energy systems fit the bill. There is a similarly-structured Low-Emission Renewable Energy Credit (LREC) Program applicable to low-emission energy technologies such as fuel cell systems and low-emission biomass facilities. For more details, see the CL&P and UI websites.[108]

Utilities are authorized to spend up to $8 million on ZREC contracts annually. The first auction under the ZREC Program, held in 2012, was oversubscribed by a factor of 2.75, had an average price of about $135 per ZREC, and resulted in approximately 26MW of commitments for commercial and industrial solar PV installations. The statutory price cap for one ZREC in 2012 was $350. The Public Utilities Regulatory Authority (PURA) may reduce the price cap annually by 3-7%.[109]

14.10 Residential Solar Investment Program (RSIP)

CEFIA's Residential Solar Investment Program (RSIP) provides two incentive models to help customers who want to purchase or lease solar PV systems. The RSIP is currently on Step 3 of incentives which were designed to decline gradually – see Table 20.

1. *Expected Performance-Based Buy down (EPBB) Incentive*: The EPBB incentive is a rebate available to consumers who purchase a solar PV system. The EPBB provides a level of incentives for the first 5 kW and a lower level of incentives for the second 5 kW, specified in the table below. A 5% bonus is given to projects that use major system components principally manufactured in Connecticut and an additional bonus if these components are manufactured in distressed Connecticut municipalities.
2. *Performance-Based Incentive (PBI):* CEFIA's PBI is designed to allow homeowners to benefit from solar PV systems for little to no upfront cost. Under this model, an eligible third-party PV system owner owns

[107] www.cl-p.com/Home/SaveEnergy/GoingGreen/Renewable_Energy_Credits/ and for UI: UI LREC/ZREC link and UI Small ZREC link
[108] www.cl-p.com/Home/SaveEnergy/GoingGreen/Renewable_Energy_Credits/ and for UI: UI LREC/ZREC link and UI Small ZREC link
[109] Ibid

the system and enters into a contract with the homeowner. The PBI is paid to the System Owner based on actual performance over the course of six years and is used to reduce the homeowner's monthly cost. The PBI model also provides an additional bonus for projects that use major system components principally manufactured in Connecticut.

Table 20: Residential Solar Investment Program (RSIP) – Declining Incentives

Step	EPBB Incentive - first 5kW ($/W)	EPBB Incentive - second 5 kW ($/W)	PBI Incentive ($/kWh)
1	$2.45	$1.25	$0.300
2	$2.275	$1.075	$0.300
3	**$1.75**	**$0.55**	**$0.225**

As of the end of June 2013, the end of CEFIA's 2013 fiscal year, RSIP installations contributed approximately 9.3 MW and 1325 projects out of the cumulative total residential solar PV capacity of 23.3 MW (3430 projects) installed with support of CEFIA/CCEF administered ratepayer funds since 2004.

Figure 9 in Section 5.1, Installed Solar PV Capacity in Connecticut, illustrates ramping up of residential solar PV installations in 2012 along with decreasing costs and decreasing reliance on ratepayer funds. The ratepayer contribution to the cost of a residential solar PV system in Connecticut has dropped from approximately half of the cost historically to about one-third of the cost starting in 2011, and is expected to drop further.

14.11 Long Term REC Contracts

CEFIA has begun discussions with the Connecticut Public Utilities Regulatory Authority (PURA) and the public utilities or electric distribution companies (EDCs) in an effort to partner on long term REC contracts. Under the proposed agreement, the EDCs would purchase all of CEFIA's Residential Solar Investment Program (RSIP) RECs to help Connecticut realize its clean energy goals. In return, all revenues earned through the program would be given back to homeowners as vouchers to promote additional energy retrofits or for other purposes (i.e., credit enhancement on a loan). As a result of a ten year REC contract at $35/REC, a net present value of $2,316 would be generated for 7kW of residential solar PV installed.

Even with the innovative green bank financing model, states currently need some incentives to deploy rooftop solar PV until the cost of installing solar PV decreases further. The existence of incentive programs such as the ZREC Program and RSIP make rooftop solar PV projects financed through the "Green Bank" Financing Model feasible for customers at current electric rates.

15.0 Solarize Connecticut

15.1 Background

Solarize Connecticut (Solarize CT[110]) is a pilot program designed to encourage adoption of residential solar PV through a group purchasing structure that lowers costs through volume, economy of scale, peer and other effects. The Solarize CT program attracts customers by deploying a coordinated education, marketing and outreach effort, combined with a tiered pricing structure that provides increased savings to homeowners as more people in one community go solar. The more residents who sign up to install solar, the more the price decreases for everyone who participates.

[110] http://solarizect.com/

The Solarize Connecticut pilot is based on a proven residential aggregation model designed to bring down the cost of solar PV when residents sign up for a pre-selected installer's offering. Because the installer, the technology and the exact price of PV are provided upfront, and because the installed prices are very competitive and are being offered in program rounds with deadlines, residents are encouraged to make the decision to go solar.

Solarize Connecticut is a partnership between CEFIA and the non-profit organization SmartPower with support from the John Merck Fund and Putnam Family Foundation. These partners launched a pilot Phase I program in the summer of 2012 with four Connecticut towns selected through a competitive process - **Durham, Fairfield, Portland** and **Westport**.

In just five months, Solarize Connecticut drove twice as much solar adoption in the four pilot communities as those towns saw in the prior eight years. **Figure 31 illustrates the acceleration of solar PV adoption in the four Solarize Phase I communities.**[111] For example, there have been 121 solar PV installations in the town of Durham during and since the Solarize pilot, bringing Durham's total number of installed solar PV installations to 144. The installation rates in Durham, Fairfield, Westport and Portland since the Solarize pilot began are 69x, 25x, 24x and 44x the rate in the previous five years, respectively.

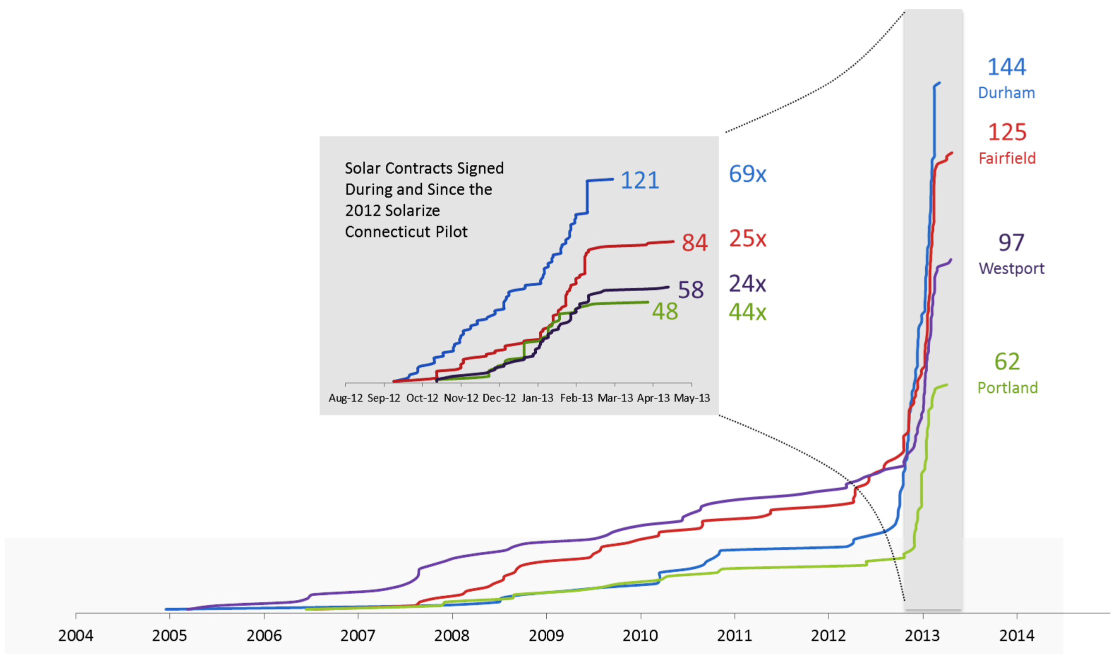


Figure 31: Dramatic Increases in Solar Contracts Signed During and Since the 2012 Solarize Connecticut Pilot in the Communities of Durham, Fairfield, Portland and Westport

[111] Graphic created by Kenneth Gillingham , Assistant Professor of Environmental & Energy Economics, Yale University, School of Forestry & Environmental Studies (2013)

All four towns reached the lowest price level available by successfully convincing enough town residents to participate. As more homeowners signed up to install solar through purchase or lease agreements, the price for everyone dropped – including those who installed systems earlier in the program before the maximum savings kicked in. All four communities ended up with average installed costs at or below $3.80/W, in comparison to pre-Solarize prices of close to $5/W. Figure 32 illustrates the decrease in installed costs resulting from Solarize.

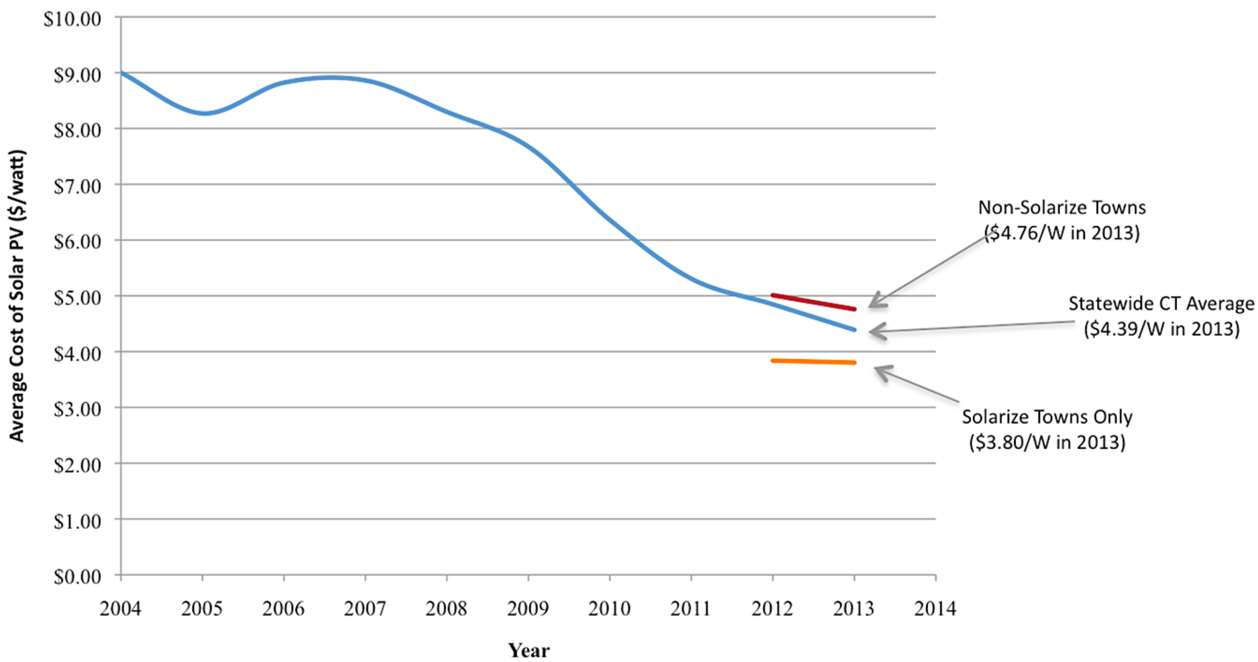


Figure 32: Decrease in Residential Solar PV Installed Cost as a Result of Solarize

15.2 Phase I Program Impacts

Results of Solarize Connecticut Phase 1 exceeded expectations. Highlights of program impacts are as follows:

- Over 2.2 MW of new solar PV capacity deployed across the four communities, close to triple what was installed in those towns during the preceding eight years.
- Nearly 300 projects were completed, representing at least a doubling in the number of homeowners "going solar" in all towns, with Durham *quintupling* its solar ownership and reaching 5.7% residential solar PV market penetration, the first town in the state to reach over 5%.
- Dramatically reduced costs for solar PV, with all towns hitting the lowest tier (Tier 5) pricing and cumulative savings of over $2.2 million on the aggregate of the solar PV installations.
- Compelling drops in customer acquisition costs, at < $90/kW from a direct program spend perspective and $135/kW "all-in" – significantly less than both the industry average of $670/kW (per NREL analysis) and local installers' estimates at $250-$500/kW.

Pre-Solarize, the average installed cost for solar PV in Connecticut was close to $5.00/W, with three of the installers chosen to serve Solarize communities in fact having average installed costs above that level. Each installer selected not only bid into the program with pricing well below the industry average, but – in partnership with their host communities – they all achieved the lowest pricing tier possible under the program. Even including "adders" (or extra costs due to steep roofs, higher-priced modules, etc.), which increased prices up to 6% above the base price quoted, all four communities ended up with average installed costs at or below

$3.80/W – representing savings of at least 20% from pre-Solarize levels, and surpassing the program goal of driving installed costs down to $4.25/W through the Solarize pilot.

15.3 Customer Acquisition

Based on initial results, we have found that community-based social marketing under a deadline-driven campaign model – together with a tiered discount approach and sufficient public support to make the process of going solar as simple as possible – can drastically reduce the costs of acquiring a solar customer (and thus contribute to lower soft costs overall). Overall, the program produced 1,500 leads and a 20% conversion rate (consistent among all installers), including generating a final customer base of whom 20% had not considered solar prior to program.[112]

Quantitatively, CEFIA committed $100,000 to support Solarize in these initial four towns, matched by grants made to SmartPower, from the John Merck Fund and the Putnam Family. Dividing that $200,000 total by the number of customers acquired, and then again by the average size of a Solarize installation, gives us the average customer acquisition cost per kilowatt of solar PV deployed (see below table). At $90/kW on a direct cost basis, Solarize has delivered a customer acquisition cost figure that is a discount of 86% from the national average of $670/kW, as reported by NREL. Even adding in estimated installers' direct marketing costs across the four towns, plus the value of CEFIA staff time, Solarize still demonstrates tremendous customer acquisition savings at $135/kW. Again, the results we achieved strongly outpaced CEFIA's goal of $190/kW for this metric.

Table 21: Solarize CT Customer Acquisition Costs

Description	Cost	Acquisition Cost / kW
CEFIA direct contribution	$100,000	$89.72
Foundations' matching grants	$100,000	
Est. installer expenditures	$30,000	$13.46
Est. value of CEFIA staff time	$72,000	$32.30
Total	$302,000	$135.48

15.4 Solarize Phase II

Building on the success of the four initial communities, the second phase of the program began in early March 2013 and includes **Bridgeport, Canton, Coventry and Mansfield/Windham** (two in partnership). Two distressed communities are participating in Phase II (Bridgeport and Windham). The towns are partnering with two experienced Solarize installers and two installers that are new to the program. CEFIA's new financing products – including the CT Solar Loan, the Smart-E Loan, and the CT Solar Lease– are available as of July 2013, before the contract signing deadline for Phase II which was extended through July 31, 2013 to give more homeowners time to benefit from these new financing products.

CEFIA's new financing options make it possible to install solar with little or no money down. The financing products are anticipated to bolster the success of the Solarize Program.

- CEFIA's new Smart-E Loan and CT Solar Loan programs provide long-term, affordable financing options designed to allow homeowners to undertake almost any measure that reduces a home's fuel or electricity usage or that increases on-site energy production from clean energy sources.
- CT Solar Lease II (a CEFIA product following and expanding on CCEF's successful solar lease version one) was launched in July 2013 and will allow more customers access to solar PV. The lease provides

[112] According to 218 responses to a post-campaign survey emailed to about 900 households in three Solarize towns

financing with a credit score requirement of 640, lower than other financing products, flexibility in payment options and allows customers to be cash flow positive from day one.

15.5 Solarize Phase III

CEFIA launched Phase 3 of Solarize Connecticut in July 2013, with the following 10 towns competitively selected: the Ashford-Chaplin-Hampton town coalition, the Easton-Redding-Trumbull Town Coalition, Greenwich, Manchester, Newtown, and West Hartford.

15.6 Solarize Choice and Solarize Express

Two new Solarize programs launched this fall 2013 are Solarize Express, a 10-week Solarize program rather than a 20-week Solarize program, and Solarize Choice which allows communities to select more than one installer with those installers offering a flat discounted base price (i.e., a not to exceed price) for solar.

Communities participating in Solarize Express include Glastonbury, Hamden, Roxbury and Stafford.

Communities participating in Solarize Choice include Cheshire, Enfield, a Columbia-Lebanon town partnership, Stamford and West Haven.

15.7 Connecticut Solar Challenge

Solarize is inspiring market innovation – private sector actors want to move ahead on Solarize without CEFIA. One installer, Aegis Solar, has already arranged a similar model, the "Connecticut Solar Challenge,"[113] with several communities (Bethany, Chester and Madison), and two other installers have inquired about running a Solarize initiative. CEFIA is discussing with these installers how best to support them on both administrative and substantive matters, outside of the structure of the formal Solarize Program and associated resources.

[113] ctsolarchallenge.com/

Appendix I
Permitting Recommendations Specific to each of the Twelve Sun Rise New England – Open for Business Partner Communities

Bridgeport

Population: 146,824
Households: 52,261
Region: Greater Bridgeport
bridgeportct.gov/

Clean Energy Commitments

- ✔ Rooftop Solar Challenge
- ✔ CPACE
- ✔ Solarize Phase Two
- ✔ CT Clean Energy Communities

Best Practices

- Permit fee waiver for Class 1 Renewables
- Applications can be submitted by email
- Solarize webpage

Solar PV Installations 2004—April 2013

7 residential projects (39 kW)

Household penetration 0.01%

5 nonresidential projects (382 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Bridgeport for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✸.

Rooftop Solar PV Permitting Recommendations for Bridgeport

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Bridgeport's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[114]

[114] energizect.com/SunriseNE and more generally, energizect.com

Constituents would also want to link to and know about local clean energy projects and activities, policies and incentives, your clean energy task force (if applicable), and successes and participation in programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, the CT Solar Challenge, and C-PACE.[115] Please check West Hartford's websites for examples.[116]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England website.[117]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[118] to enable applicants to obtain and submit solar PV permit application materials online.

Permit Fees

- **Waive Permit Fees:** Bridgeport is providing clean energy leadership in Connecticut by waiving permit fees for Class I renewable energy systems as enabled in Public Act 11-80.[119]

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[120]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone,

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[115] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[116] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[117] energizect.com/SunriseNE

[118] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[119] Section 29-263: cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[120] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

and ultimately town residents and business owners, time, money and frustration.

- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[121] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

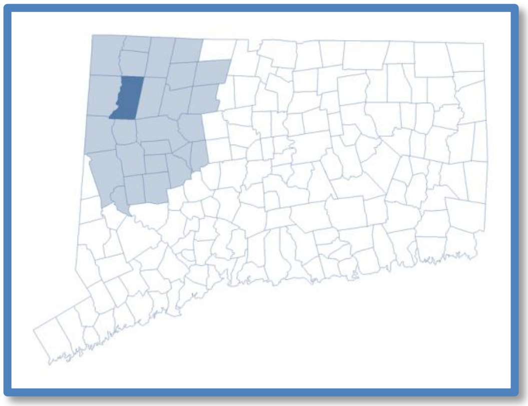
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions" found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[122]

Photo: Lighthouse, Seaside Park at sundown, Andrew Korn, flickr.com/photos/andkorn/1593016190/sizes/l/

[121] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[122] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Cornwall

Population: 1,429
Number of residential households: 643
Region: Capitol

cornwallct.org

Clean Energy Commitments

✔Rooftop Solar Challenge
CPACE
Solarize
✔CT Clean Energy Communities

Best Practices

- Applications can be submitted by mail
- Scheduled inspection times
- Quick decisions on solar PV permit
- Approved permits can be mailed to installers

Solar PV Installations 2004—April 2013

[CEFIA program data; does not include ZREC data]

12 residential projects (93 kW)

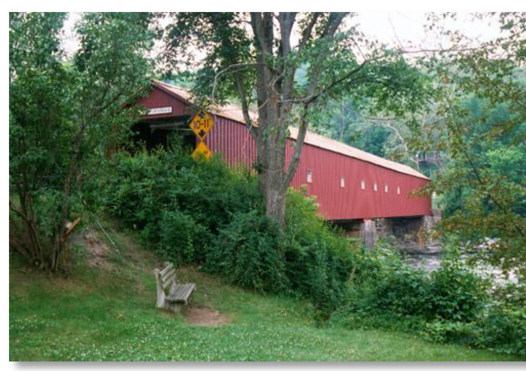
Household penetration 0.187%

1 nonresidential project (9 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Cornwall for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Cornwall



Make Information Available

- **Online Permitting:** Make sure all information pertaining to Cornwall's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[123]

[123] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[124] Cornwall residents have created a "Cornwall Energy Taskforce" website: cornwallctenergy.org. Perhaps this initiative can be linked to or integrated with the official town site.

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a CEFIA-endorsed statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE on the Sun Rise New England webpage.[125]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[126] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and submit permit application materials through your website or by email. This change saves installers time-intensive and costly trips to jurisdiction offices.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[127] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Cornwall currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[128]

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[124] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[125] energizect.com/SunriseNE

[126] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[127] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[128] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[129] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

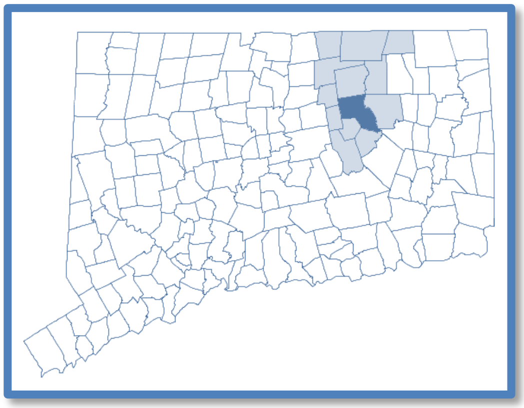
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[130]

Cornwall Covered Bridge Photo, Ray Brown ct.gov/photo/scripts/subjectbridge.asp

[129] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[130] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Coventry

Population: 12,572
Number of households: 4738
Region: Windham

coventryct.org

Clean Energy Commitments

✔Rooftop Solar Challenge
✔CPACE
✔ Solarize Phase Two
✔CT Clean Energy Communities

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Coventry for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

Best Practices

- Clean energy web information
- Online permitting system
- Online application submission and payments
- Single comprehensive inspection

Solar PV Installations 2004—April 2013

[CEFIA program data; does not include ZREC data]

28 residential projects (191 kW)

Household penetration 0.59%

1 nonresidential project (76 KW)

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Coventry

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Coventry's solar PV permitting processes are clearly posted on your town website and updated regularly. Coventry responded to our outreach indicating the use of View Permit online permitting system. Installers visiting Coventry's permit page should be able to easily access a link to the online system. See Manchester's site for a good example.[131]

[131] building.townofmanchester.org/building

- **"Clean Energy" Webpage:** Coventry has already created an "Energy Committee" webpage. Make sure to provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[132]
- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[133] Coventry could consider adopting use of this application package through ViewPermit, perhaps as forms that can be submitted as attachments through the system.
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[134] If not a full waiver, consider a low or flat fee based on cost recovery instead of a value-based fee structure that may not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.

Streamline Review and Inspection Requirements

- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** Coventry conducts a single comprehensive inspection reducing the amount of time inspectors, installers and homeowners must spend on site. Additional strategies to streamline the inspection process include:
  - Scheduling specific appointment times rather than a window of time. This saves everyone, and ultimately customers/constituents time, money and frustration.
  - Adopting the inspection checklist included in the Connecticut Rooftop Solar PV Permitting Guide ✷.

[132] energizect.com/SunriseNE and more generally, energizect.com
[133] energizect.com/SunriseNE
[134] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[135] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

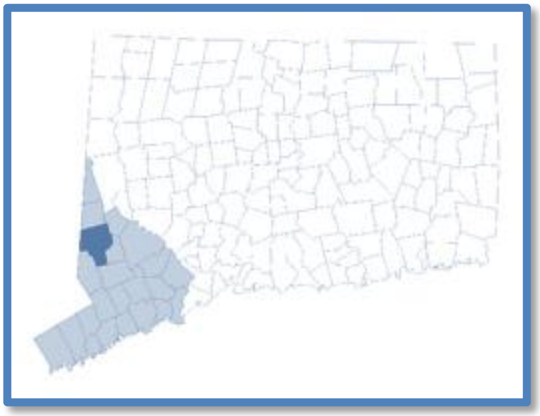
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the Connecticut Rooftop Solar PV Permitting Guide ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[136]

Photo: Visitors Center, coventryct.org/index.asp?Type=B_LOC&SEC={8F02BF33-332E-484B-94D1-40AA20648A15}

[135] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[136] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Danbury

Population: 82,409
Households: 29,508
Region: Housatonic Valley

ci.danbury.ct.us

Clean Energy Commitments

✔ Rooftop Solar Challenge
✔ CPACE
Solarize
CT Clean Energy Communities

Best Practices

- Online permitting system
- Permit fee exemption for cultural non-profits and municipal projects
- Escrow account for certified electricians to allow for quick payments

Solar PV Installations 2004—April 2013

[CEFIA program data; does not include ZREC data]

34 residential projects (229 kW)

Household penetration 0.12%

5 nonresidential projects (1271 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Danbury for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions,* found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Danbury

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Danbury's solar PV permitting processes are clearly posted on your website and updated regularly.
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[137]

[137] energizect.com/SunriseNE and more generally, energizect.com

Consider creating a webpage on Danbury's website devoted to clean energy. Provide links to your permitting information and to resources such as the Sun Rise New England and EnergizeCT websites.[138] EnergizeCT is a state initiative to provide energy-related information and resources. Constituents would also want to link to and know about local clean energy projects and activities, policies and incentives, your clean energy task force (if applicable), and successes and participation in programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, the CT Solar Challenge, and C-PACE.[139]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[140]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Online Permitting System:** Make sure entire permitting process (application acquisition, submission and payment) is enabled by the permitting system.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Danbury's solar PV permitting fees are about average for Connecticut. To make solar PV installation more affordable Danbury can encourage solar installations by waiving solar PV permit fees.[141] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Danbury currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[142]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical

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[138] energizect.com/SunriseNE and more generally, energizect.com

[139] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[140] energizect.com/SunriseNE

[141] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[142] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

- **Simplify the Inspection Process:** Danbury requires multiple inspection trips, which are scheduled during open blocks of time. The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[143] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

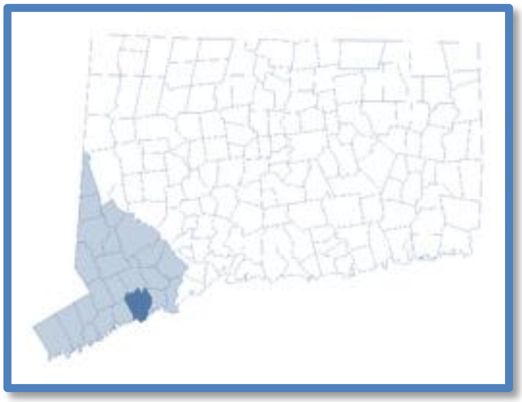
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[144]

Photo: Pond at Rogers Park, http://www.city-data.com/picfilesc/picc49809.php

[143] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[144] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Fairfield

Population: 59,625
Households: 20,556
Region: Greater Bridgeport

fairfieldct.org/

Clean Energy Commitments

- ✔ Rooftop Solar Challenge
- ✔ CPACE
- ✔ Solarize Phase One
- ✔ CT Clean Energy Communities

Best Practices

- Applications can be obtained online or by mail

Solar PV Installations 2004—April 2013

125 residential projects (912 kW)

Household penetration 0.61%

5 nonresidential projects (621 kW)

1 nonresidential ZREC project (297 kW) anticipated installed by end of 2013

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Fairfield for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Fairfield

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Fairfield's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").

- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[145]

[145] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[146] Please check West Hartford's websites for examples.[147]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[148]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[149] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and submit permit application materials through your website, by email, or by U.S. mail. This change saves installers time-intensive and costly trips to jurisdiction offices.
- **Unnecessary Copies:** Consider lifting the requirement for multiple copies of materials such as building plans.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[150] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Fairfield currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

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[146] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[147] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[148] energizect.com/SunriseNE

[149] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[150] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

Streamline Review and Inspection Requirements

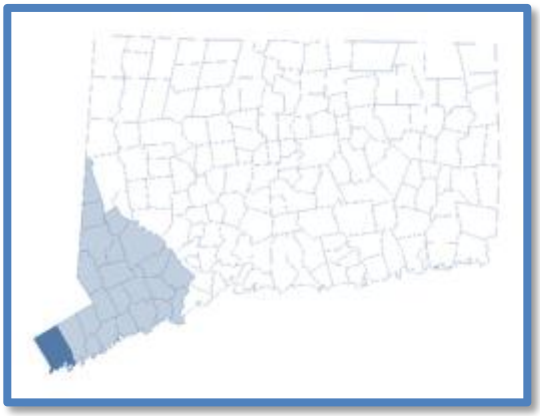
- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[151]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[152] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[153]

Photo: Sasco Beach, Fairfield CT, Creative Commons, flickr.com/photos/lvpdesign/7022744263/sizes/l/

[151] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402
[152] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.
[153] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Greenwich

Population: 61,983

Households: 23,382

Region: South Western

greenwichct.org/

Clean Energy Commitments

- ✔Rooftop Solar Challenge
- ✔CPACE
- ✔Solarize Phase Three
- ✔CT Clean Energy Communities

Best Practices

- Applications can be obtained online
- Final permits can be mailed to installers
- Green building ordinance for public buildings

Solar PV Installations 2004—April 2013

[CEFIA program data; does not include ZREC data]

37 residential projects (199 kW)

Household penetration 0.16%

4 nonresidential projects (218 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Greenwich for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.

Rooftop Solar PV Permitting Recommendations for Greenwich

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Greenwich's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[154]

[154] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[155] Please check West Hartford's websites for examples.[156]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[157]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[158] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and submit permit application materials through your website, by email, or by regular mail. This change saves installers time-intensive and costly trips to jurisdiction offices.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[159] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Greenwich currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[160]

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[155] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communitiesor ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[156] west-hartford.com/government/CleanEnergy.htm and www.westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[157] energizect.com/SunriseNE

[158] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[159] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[160] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

- **Remove Unnecessary Paperwork Requirements:** Consider removing the requirement for homeowner approvals to be notarized. Eliminate the need for particular paper types.

- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.

- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[161] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

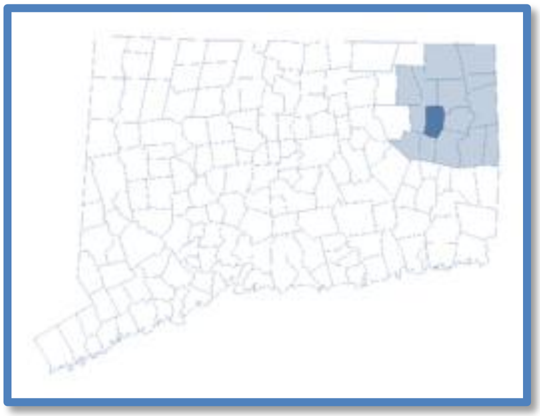
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[162]

Photo: Long Island Sound at dusk, Carl Raether, Creative Commons, flickr.com/photos/carlbock/214843728/

[161] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[162] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Hampton

Population: 1,890
Households: 768
Region: Windham

Hamptonct.org

Clean Energy Commitments

- ✔ Rooftop Solar Challenge
- CPACE
- ✔ Solarize Phase Three
- ✔ CT Clean Energy Communities

Best Practices

- Applications can be obtained online
- Applications can be submitted by mail
- Approved permits can be mailed to installers
- Scheduled inspections
- "Green Energy" webpage

Solar PV Installations 2004—April 2013

[CEFIA program data; does not include ZREC data]

15 residential projects (87 kW)

Household penetration 1.95%

2 nonresidential projects (19 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Hampton for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Permitting Recommendations for Jurisdictions,* found CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Hampton

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Hampton's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").
- **"Clean Energy" Webpage:** Hampton has a "Green Energy" webpage. Be sure to provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[163]

[163] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[164] Please check West Hartford's websites for examples.[165]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[166]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[167] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and submit permit application materials through your website, by email, or by regular mail. This change saves installers time-intensive and costly trips to jurisdiction offices.
- **Eliminate Tax Clearance Application Requirements**

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[168] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Hampton currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

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[164] Rooftop Solar Challenge, www.eere.energy.gov/solarchallenge; SunShot Initiative, www.eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, www.energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, www.c-pace.com.

[165] west-hartford.com/government/CleanEnergy.htm and www.westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[166] energizect.com/SunriseNE

[167] For examples, see: Simply Civic, simplycivic.com; City View, www.msgovern.com/software/cityview; View Permit, viewpermit.com.

[168] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[169]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[170] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

Formalize Best Practices

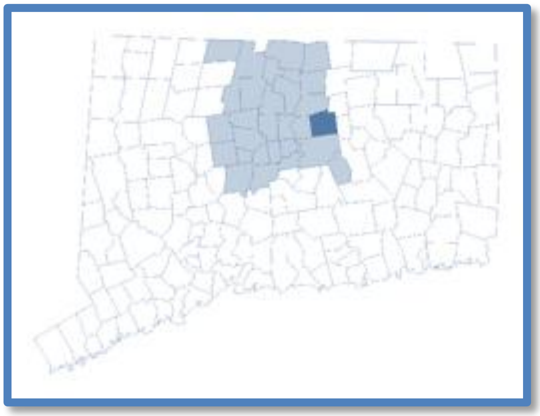
- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[171]

Photo: Goodwin Conservation Area, Don Taylor, Creative Commons, flickr.com/photos/donphoto/2076313187/sizes/l/

[169] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

[170] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[171] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Manchester

Population: 59,175

Households: 25,194

Region: Capitol

townofmanchester.org

Clean Energy Commitments

✔Rooftop Solar Challenge
✔CPACE
✔Solarize Phase Three
CT Clean Energy Communities

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Manchester for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

Best Practices

- Permit fee waiver for Class 1 renewables
- Online permitting system
- Applications can also be submitted by email and mail
- Single comprehensive inspections
- Software used to help assess need for engineering reviews

Solar PV Installations 2004—April 2013

27 residential projects (181 kW)

Household penetration .11%

5 nonresidential projects (416 kW)

4 nonresidential ZREC projects (1131 kW) anticipated installed by end of 2013

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions,* found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Manchester

Make Information Available

Online Permitting: Make sure all information pertaining to Manchester's solar PV permitting processes are clearly posted on your website and updated regularly.

- **Create a "Clean Energy" Webpage** on Manchester's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[172]

[172] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[173] Please check West Hartford's websites for examples.[174]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[175]
- **Application Submission:** Ensure that solar PV permit applications may be submitted online through View Permit in addition to email and mail.
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.

Permit Fees

- **Manchester is providing clean energy leadership in Connecticut by waiving permit fees for Class I renewable energy systems as enabled in Public Act 11-80.[176]**

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[177]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. Manchester shows a commitment to encouraging solar PV installations by using software designed to help determine when engineering inspections are required and when they can be waived.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as scheduling specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.

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[173] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[174] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[175] energizect.com/SunriseNE

[176] Section 29-263: cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[177] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[178] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

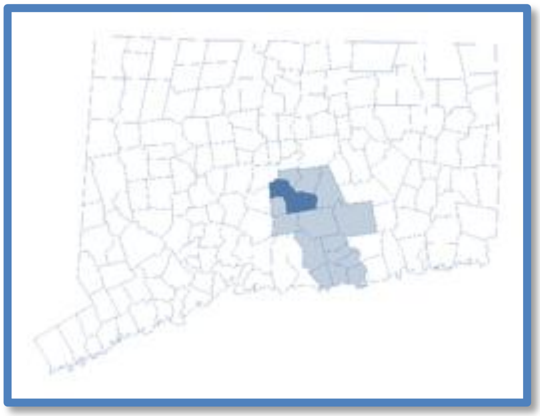
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[179]

Photo: Torii Gate, Don Rogers, , Creative Commons, flickr.com/photos/dsrogers/4758403810/

[178] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[179] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Middletown

Population: 48,041
Households: 20,233
Region: Midstate

cityofmiddletown.com

Clean Energy Commitments

✔ Rooftop Solar Challenge
✔ CPACE
Solarize
✔ CT Clean Energy Communities

Best Practices

- Single application
- Single department
- Single and scheduled inspections
- Approved permits can be mailed to installers

Solar PV Installations 2004—April 2013

43 residential projects (224 kW)

Household penetration 0.21%

7 nonresidential projects (565 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Middletown for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions,* found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✹ .

Rooftop Solar PV Permitting Recommendations for Middletown

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Middletown's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software (please see "Adopt Online Permitting" in the next section called "Streamline Permit Application Submission").
- **Create a "Clean Energy" Webpage** on Middletown's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[180]

[180] energizect.com/SunriseNE and more generally, energizect.com

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[181] Please check West Hartford's websites for examples.[182]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[183]
- **Adopt Online Permitting:** Adopt an online permitting system[184] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and submit permit application materials through your website, by email, or by regular mail. This change saves installers time-intensive and costly trips to jurisdiction offices.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[185] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Middletown currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[186]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

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[181] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[182] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[183] energizect.com/SunriseNE

[184] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.

[185] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[186] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

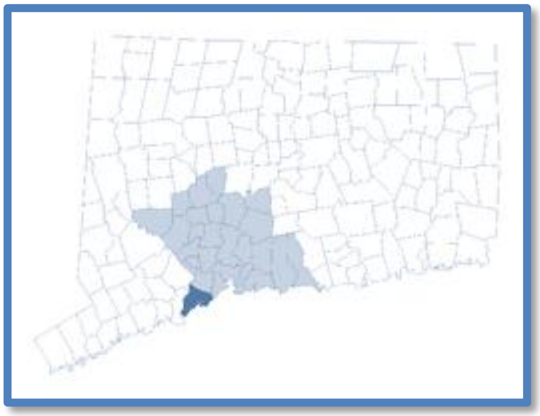
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[187] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[188]

Photo: Connecticut River, Victoria Stahl, Sun Rise New England team

[187] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.
[188] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Milford

Population: 52,894
Households: 21,910
Region: South Central CT

ci.milford.ct.us/

Clean Energy Commitments

- ✔ Rooftop Solar Challenge
- ✔ CPACE
- Solarize
- ✔ CT Clean Energy Communities

Best Practices

- Online permitting system
- Single comprehensive inspection
- Inspection schedules posted online

Solar PV Installations 2004—April 2013

70 residential projects (447 kW)

Household penetration 0.32%

2 nonresidential projects (370 kW)

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Milford for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for Milford

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Milford's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software.
- **Create a "Clean Energy" Webpage** on your jurisdiction's website. Provide links to your permitting information/webpage and to resources such as the Sun

Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[189]

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[190] Please check West Hartford's websites for examples.[191]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[192]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[193] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Milford currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[194]
- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

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[189] energizect.com/SunriseNE and more generally, energizect.com

[190] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.

[191] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

[192] energizect.com/SunriseNE

[193] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[194] Photovoltaic Online Training For Code Officials: nterlearning.org/web/guest/course-details?cid=402

- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as scheduling specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[195] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

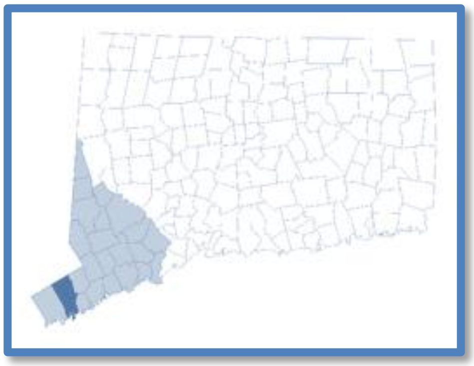
Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[196]

Photo: Walnut Beach, Jerry Angelica, Creative Commons, flickr.com/photos/jerryangelicaphotography/6213356174/

[195] ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[196] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



Stamford

Population: 124,908
Household: 48,288
Region: South Western
ci.stamford.ct.us/

Clean Energy Commitments

- ✔Rooftop Solar Challenge
- ✔CPACE
- ✔Solarize Choice
- ✔CT Clean Energy Communities

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks Stamford for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

Best Practices

- Applications can be obtained online
- Approved permits can be mailed to installers
- Trained personnel for permit process
- Same day turnaround on permit decisions
- Identification criteria for systems not requiring permits

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions,* found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✹.

Solar PV Installations 2004—April 2013

39 residential projects (227 kW)

Household penetration 0.08%

8 nonresidential projects (1139 kW)

2 nonresidential ZREC projects (327 kW) anticipated installed by end of 2013

Rooftop Solar PV Permitting Recommendations for Stamford

Make Information Available

- **Online Permitting:** Make sure all information pertaining to Stamford's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software.
- **Create a "Clean Energy" Webpage** on Stamford's website. Provide links to your permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[197]

  Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in

[197] energizect.com/SunriseNE and more generally, energizect.com

relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[198] Please check West Hartford's websites for examples.[199]

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** The Sun Rise New England team has put together a statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[200]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Adopt Online Permitting:** Adopt an online permitting system[201] to enable applicants to obtain and submit solar PV permit application materials online. Otherwise, allow installers to obtain and *submit* permit application materials through your website, by email, or by regular mail. This change saves installers time-intensive and costly trips to jurisdiction offices.
- **Eliminate Multiple copies** of materials, such as building plans.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[202] If not a full waiver, consider a low or flat fee based on cost recovery instead of the value-based fee structure Stamford currently utilizes. Value-based fee structures usually do not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by U.S. mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.

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[198] Rooftop Solar Challenge, eere.energy.gov/solarchallenge; SunShot Initiative, eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, c-pace.com.
[199] west-hartford.com/government/CleanEnergy.htm and westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php
[200] energizect.com/SunriseNE
[201] For examples, see: Simply Civic, simplycivic.com; City View, msgovern.com/software/cityview; View Permit, viewpermit.com.
[202] cga.ct.gov/2012/sup/chap541.htm - Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

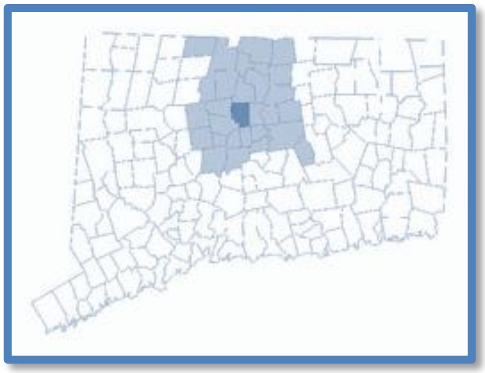
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as scheduling specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.

Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[203]

Photo: building reflection 02, Monica Arellano-Ongpin, Creative Commons, flickr.com/photos/maong/2935963878/

[203] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm



West Hartford

Population: 63,649
Number of households: 25,513
Region: Capitol

http://www.west-hartford.com/

Clean Energy Commitments

- ✔ Rooftop Solar Challenge
- ✔ CPACE
- ✔ Solarize Phase Three
- ✔ CT Clean Energy Communities

Best Practices

- Clean energy websites
- Solar PV specific application and checklist
- Online permitting system

Solar PV Installations 2004—April 2013

45 residential projects (266 kW)

Household penetration 0.18%

6 nonresidential projects (351 kW)

2 nonresidential ZREC projects (634 kW) anticipated installed by end of 2013

Connecticut's Sun Rise New England team, led by the Clean Energy Finance and Investment Authority (CEFIA), thanks West Hartford for participating in Connecticut's Rooftop Solar Challenge project, focusing on improving processes and reducing non-hardware costs associated with permitting, planning and zoning, interconnection, and increasing access to financing for rooftop solar photovoltaic (PV) systems.

In addition to our specific recommendations, please also consider the general suggestions covered in the *Rooftop Solar PV Permitting Recommendations for Jurisdictions*, found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE.

Rooftop Solar PV Permitting Recommendations for West Hartford

Make Information Available

- **Online Permitting:** Make sure all information pertaining to West Hartford's solar PV permitting processes are clearly posted on your website and updated regularly. Use online permitting software.
- **"Clean Energy" Webpage**: West Hartford sets a good example for other jurisdictions by providing information about clean energy on the jurisdiction and clean energy task force websites.[204] Make sure web visitors can easily find West Hartford's Clean Energy sites by highlighting links from your homepage. All jurisdictions are also encouraged to provide links to their

[204] https://west-hartford.com/government/CleanEnergy.htm and http://www.westhartford.org/living_here/green/west_hartford_clean_energy_task_force.php

permitting information/webpage and to resources such as the Sun Rise New England and EnergizeCT websites. EnergizeCT is a state initiative to provide energy-related information and resources.[205]

Constituents also want to know about local clean energy projects, activities, policies, incentives, your clean energy task force, and participation in relevant programs such as the Rooftop Solar Challenge, Solarize, the Clean Energy Communities Program, CT Solar Challenge, and C-PACE.[206] Again, your "West Hartford and Clean Energy" and "WH is Green" webpages exemplify the spirit of sustainability.

- **Remember to Promote** your clean energy webpage, timely programs and solar PV adoption with radio and newspaper announcements, newsletters and environmentally friendly signage.

Streamline Permit Application Submission

- **Adopt the Standard Solar PV Permit Application:** West Hartford provides leadership among Connecticut jurisdictions by developing and sharing a solar PV specific permit application/checklist. The Sun Rise New England team has put together a CEFIA-endorsed statewide standard application package for rooftop solar PV permitting, which is now offered in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ on the Sun Rise New England webpage.[207]
- **Simplify the Application Process:** Make one department responsible for the rooftop solar PV permitting process and reduce the number of steps and unnecessary requirements asked of installers.
- **Online Permitting:** Allow applicants to obtain and submit solar PV permit application materials online through your CityView portal.

Waive or Reduce Permit Fees

- **Waive or Reduce Fees:** Towns may encourage solar installations by waiving solar PV permit fees.[208] If not a full waiver, consider a low or flat fee based on cost recovery instead of a value-based fee structure that may not accurately reflect the cost of solar PV permit review and inspection. Research in Connecticut indicates that it should cost no more than $200, usually less, for a town to permit a small-scale, rooftop solar PV installation. Streamlining processes can help reduce costs to jurisdictions. For examples, Bridgeport and Manchester waive permit fees for class I renewable energy systems, and Durham has a flat fee for solar PV permits.
- **Allow for Payment Electronically or by Mail:** Allow installers to pay permit fees online, electronically, or by regular mail to save driving time and cost.

Streamline Review and Inspection Requirements

- **Train Staff:** Require jurisdiction staff involved in solar PV permitting to participate in relevant solar PV training, at minimum by accessing a free online training course comparable to the "Photovoltaic Online Training for Code Officials" offered on the National Training & Education Resource (NTER) website.[209]

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[205] www.energizect.com/SunriseNE and more generally, www.energizect.com

[206] Rooftop Solar Challenge, www.eere.energy.gov/solarchallenge; SunShot Initiative, www.eere.energy.gov/solar/sunshot; Solarize, solarizect.com; Clean Energy Communities Program, www.energizect.com/communities/programs/clean-energy-communities or ctenergydashboard.com/CEC/CECHome.aspx; CT Solar Challenge, ctsolarchallenge.com; C-PACE, www.c-pace.com.

[207] www.energizect.com/SunriseNE

[208] http://www.cga.ct.gov/2012/sup/chap541.htm#Sec29-263.htm, "(c) Any municipality may, by ordinance adopted by its legislative body, exempt Class I renewable energy source projects from payment of building permit fees imposed by the municipality."

[209] Photovoltaic Online Training For Code Officials: www.nterlearning.org/web/guest/course-details?cid=402

- **Remove Excessive Reviews**: Jurisdiction staff should identify and remove reviews that are not critical to safe and efficient operation of a proposed rooftop solar PV system. In particular, unnecessary and costly engineering reviews should be eliminated by specifying criteria and a methodology for determining when these reviews are needed.
- **Simplify the Inspection Process:** The CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷ offers resources and suggestions for improving inspection processes such as: (1) When an inspection is required, conduct a single, comprehensive inspection instead of requiring multiple appointments. (2) Schedule specific appointment times for inspections instead of windows of time. This saves everyone, and ultimately town residents and business owners, time, money and frustration.
- **Shorten Permit Approval Times:** By Connecticut law, a permitting decision must be made within 30 days.[210] However, a shorter timeframe encourages installers to do business in your jurisdiction and speeds up the time between a customer's intent to generate clean energy and their ability to do so. Consider the best practice of issuing permits in as short a time frame as possible, for example on the "same day" or "over-the-counter" for standard small-scale rooftop solar PV systems that clearly meet your jurisdiction's permit approval criteria.

Formalize Best Practices

- **Adopt Solar Friendly Ordinances** using the model elements offered in "Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions," found in the CONNECTICUT ROOFTOP SOLAR PV PERMITTING GUIDE ✷.
  - Adopting the elements of the Rooftop Solar PV Model Ordinance for Connecticut Jurisdictions removes unnecessary barriers to solar energy installation and formalizes your jurisdiction's commitment to making rooftop solar PV permitting easier and less costly for everyone.
  - Elements of the model ordinance include enforcement of existing Connecticut statutes that encourage and support deployment of solar energy systems. For example, Connecticut General Statute §7-147f limits the reasons solar energy systems are denied only to installations that substantially impair the historic character of the district. This statute puts the burden of proof on showing that the historic character of the district would be substantially impaired by a solar energy system.[211]

West Hartford Tulips, from the **West Hartford and Clean Energy** site west-hartford.com/government/CleanEnergy.htm

[210] http://www.ct.gov/dcs/cwp/view.asp?a=4218&q=305412. The 30 day permit decision time is from the State Building Code, namely the 2005 Connecticut Supplement which includes the 2009 Amendment (effective August 1, 2009) to the 2005 State Building Code. The language of the code amendment also encourages building officials to issue a permit as soon as practicable once the official is satisfied that the proposed work meets all requirements.

[211] cga.ct.gov/2001/pub/Chap097a.htm - sec7-147f.htm

Appendix II
Municipal Permitting Survey

Sun Rise New England – Open for Business Municipal Survey Data

1. Please provide the following:

Name of Municipality/Jurisdiction	Person(s) Completing the Survey	Contact Information for Person(s) Completing Survey	Date Survey Completed
Bridgeport	Ted Grabarz	Ted.grabarz@bridgeportct.gov (203) 576-8439	December 20, 2012
Cornwall	Paul Prindle	(860) 672-0711	July 3, 2012
Coventry	Joseph Callahan	jcallahan@coventryct.org	July 11, 2012
Danbury	Sean Hearty	(203) 797-4526	July 17, 2012
Fairfield	James Gilleran	(203) 256-3036	August 16, 2012
Greenwich	William Marr	(203) 622-7754	January 18, 2013
Hampton	Leslie Davis	860-455-9132	December 26, 2012
Manchester	Jim Roy	(860) 647-3110	July 20, 2012
Middletown	John Parker, Dean Lisitano, Robert Dobmeier, Ron Klattenberg	Bob.Dobmeier@MiddletownCT.Gov	August 3, 2012
Milford	Jocelyn Mathiasen	(203) 783-3374	August 20, 2012
Stamford	Rob Demarco	rdemarco@ci.stamford.ct.us	July 17, 2012
West Hartford	Tim Mikloiche, Mary Ann Basile	(860) 561-7536	July 10, 2012

2. Who are the primary contacts involved in processing permits and inspecting completed systems? Please list important contact persons, their titles, roles and contact information. (Indicate applicability to residential and/or commercial installation)

BGPT	Peter Paajanen (Building Official) (203) 576-7225
CORN	Roof mount - Paul Prindle (Building), Karen Nelson (Zoning) Ground Mounts - Building & Health district
COVE	Joseph Callahan (Building Official) (860) 742-4064 jcallahan@coventryct.org / permit review, approval and inspection. Brigit Tanganelli (Permit Tech) (860) 742-4064 btanganelli@coventryct.org / process application and information. schedules inspections
DANB	Sean Hearty (203) 256-3036
FAIRF	James Gilleran (Director of Building Department)
GRNCH	William Marr (Building Official), John Vallerie (Deputy Building Official) Building Inspection Division, DPW - Inspection and clerical staff (203) 622-7755
HAMP	John Berard (Building Official), Lesley Davis (Clerk) (860) 455-9132 building@hamptonct.org
MANC	Greg Smith
MLFD	Christine Angelica (Clerk - Building Inspection) (203) 783-3235, Tom Raucci (Chief Building Inspector) (203) 783-3235, Jocelyn Mathiasen (Director, Permitting and Land Use) (203) 783-3374
MTWN	Dean Lisitano (Electrical Inspector) - dean.lisitano@MiddletownCT.gov, John Parker (Head of Building Office) - john.parker@MiddletownCT.gov, Robert Dobmeier (Deputy Head of Building Office) - bob.dobmeier@cityofmiddletown.com
STAM	Rob Demarco (Chief Building Inspector), Dwight Carlson (Permits), Robert Bounder
W HRT	Tim Mikloiche (Senior Building Inspector & Electrical Inspector), Mary Ann Basile (Supervisor of Inspections)

3. To how many departments does an installer have to submit separate applications? (Choose "1" if one office coordinates for multiple departments. Do not count the interconnection application with a utility.) R=RESIDENTIAL and C=COMMERCIAL.

	1	2	≥ 3
BGPT			R/C
CORN		R/C	
COVE	R/C		
DANB	R		C
FAIRF		R/C	
GRNCH		R/C	
HAMP		R/C	
MANC	R	C	
MLFD	R	C	
MTWN	R/C		
STAM		R	C
W HRT	R	C	

3a. Which departments require separate application?

	Building	Electrical	Fire	Planning	Plumbing	Structural	Zoning	Other, Specify
BGPT	R/C	C					R/C	R/C Engineering Department
CORN	R/C	R/C						
COVE	R/C							
DANB	R/C	R/C						
FAIRF	R/C	R/C	C		R/C		R/C	
GRNCH	R/C						R/C	
HAMP	R/C							R/C Tax Collector
MANC	R/C	R/C	C					Building only required when Structural changes necessary
MLFD	R/C	R/C						
MTWN		R/C						
STAM	R/C	R/C	R/C	R/C	R/C	R/C	R/C	WPCA and Tax collector. Stamford does not issue permits unless homeowner can prove they paid these
W HRT	R/C	R/C						Only Electrical if no Roof improvements needed

3b. Which additional documentation is required?

Document	BGPT	CORN	COVE	DANB	FAIRF	GRNCH	HAMP	MANC	MTWN	MLFD	STAM	W HRT
Insurance Certificate	R/C	R/C	R/C				R/C	R/C				Build Only
Affidavit of Worker's Compensation	R/C	R/C	R/C	R/C	R/C	R/C	R/C	R/C			R/C	Building Only
Copy Of License	R/C	R/C	R/C	R/C	R/C	R/C	R/C	R/C				
Line Drawing	R/C	R/C	R/C	R/C	R/C			R/C	R/C		R/C	R/C
Roof Description	R/C	R/C	R/C	R/C	C		R/C	R/C				R/C
List of System Components	R/C	R/C	R/C	R/C				R/C				R/C
Engineer/Architect Approved Plans	R/C	R/C	C	C	R/C			C	R/C	R/C	R/C	Roof analysis (not 'official')
Building Plans			R/C	R/C	R/C			R/C				R/C
Signed Application Fee	R/C		R/C		R/C		R/C	R/C	R/C	R/C		
Application Sign-off Sheet	R/C				R/C	R/C					R/C	
Consent form from homeowner	R/C	R/C	R/C		R/C		R/C	Only if condo assoc.	R/C	R/C	R/C	
Other			Letter from electrician if electrician not signing	Mounting Detail			Tax Clearance R/C					

4. Through which departments or what types of approvals are required for a typical installation? (Check all that apply even if coordinated through one office/department.)

	Building	Electrical	Fire	Planning	Plumbing	Structural	Zoning	Other
BGPT	R/C	R/C	R/C	R/C	R/C	R/C	R/C	(see note)
CORN	R/C						R/C	
COVE	R/C	R/C	C			R		
DANB	R/C	R/C					R/C	
FAIRF	R/C	R/C			R/C			
GRNCH	R/C	R/C		C	R/C	R/C	R/C	
HAMP	R/C							R/C
MANC	R/C		C				R/C	
MLFD	R/C		C					
MTWN	R/C							
STAM	R/C	R/C	C	C		R/C	C	R/C
W HRT	R/C	R/C	C		R/C	R/C	R/C	R/C

4a. What is the total number of departments that require approval?

	1	2	3	4	5	6	7
BGPT							R/C
CORN		R/C					
COVE	R/C						
DANB			R/C				
FAIRF			R/C				
GRNCH					R	C	
HAMP		R/C					
MANC		R	C				
MLFD	R	C					
MTWN	R/C						
STAM				R			C
W HRT		R/C					

5. You selected Other. Please specify which departments permits are processed through.

STAM	Tax Department
W HRT	Historical if designated as such by town or state

6. Describe the permitting process, listing departments and types of approvals as they are involved. Provide links to relevant websites which supplement this information. (Indicate whether requirements pertain to residential and/or commercial installations)

BGPT	For both residential and commercial permits, you will need two sets of documents, completed permit application, certificate of worker's compensation for contractors, and state licenses. For residential building permits (one and two family), the order of necessary approvals is: zoning, engineering and building departments. For commercial building permits, the order of necessary approvals is: zoning, engineering, fire and building. If the work requires only an electrical permit, then the order of necessary approvals is: zoning and building.
CORN	1st step - roof mount - goes to zoning first. If there are any original non-conformance, zoning approval first, then goes to buildings. Only two steps. 99% of installations are residential. Ground mount systems must also be approved by the Health Department. Professional Engineers are only required for specific installations - it depends on the age of the building, what records exist for the building, etc.
COVE	Submitted application reviewed for code compliance. Building permit for structural, electrical for PV components for both residential and commercial projects, ground mounted systems would require zoning, wetlands and Health Department review.
DANB	Danbury has one central "Permit Center" location. Working at the office are 3 customer reps and one manager. The initial PV application is sent to zoning for initial approval. After zoning as approved, the application and plan are sent to the electrical and building inspectors. Eligible installers are able to submit their applications online after having first signed up (involved depositing an escrow with the permitting office, which in turns gives the eligible contractors a CD that they can then use to submit the application online. Solar installers, due to their low quantity of work, do not use this online application system.
FAIRF	Applicant must submit electrical permit and in most situations, a building permit (could potentially be avoided if the house is new or has up to date roof construction). Applicant must also receive P&Z approval, which in most cases can be done very quickly - with a quick approval across the hall. If the applicant is in on of Fairfield's historical districts, they must also receive approval from the chairman of that board. Professional engineer-approved structural design diagrams are generally required (Fairfield's proximity to the ocean creates potentially dangerous wind uplift situations). Commercial installations required fire marshal approval.
GRNCH	A sign-off sheet is given to the applicant who is required to have other Town agencies review and sign the plans and sheet prior to our Dept. accepting the application. Typical agency sign-offs are, Health Dept., IWWA, Highway and Sewer Depts., DPW, Fire Marshal, Zoning, Tax Collector.
HAMP	Both the Building Department and Tax Collector require separate application for a rooftop solar PV system for both residential and commercial
MANC	Residential - Building/Zoning Dept. - Buildingdept@manchesterct.gov Commercial - Building/Zoning Dept./Fire Marshal Fire Marshal - Ltalbot@manchesterct.gov
MLFD	Department of Permitting and Land Use Fire Department http://www.ci.milford.ct.us/Public_Documents/MilfordCT_Building/BuildingIndex
MTWN	For rooftop PV installations, there is one application for both building & commercial. If it's a historical building, then the P/Z dept. must also approve. Applications can be filled out online, but the contractor/owner must physically come into the office in order to submit payment the necessary signatures. A one-line electrical diagram and a structural diagram are also required.
STAM	Start with building department for application, which is checked by staff who will then direct applicant to where they need to go for signatures, permits and approvals. Most departments are within the Stamford Government Center building The exception is areas with volunteer fire departments (Longridge and Turner River). Applicants would have to go to those departments directly. Usually the flow order is Tax department->Environmental Protection->zoning and then back to building
W HRT	westhartford.org. Town website-> Community Services-> Building Department Building and zoning applications-see drop down menus for forms.

7. What approvals from Professional Engineers are required as part of the permit package for a typical installation? (Check all that apply.)

	Civil	Electrical	Environmental	Fire Protection	Mechanical	Structural	Notes
BGPT		R/C			R/C	R/C	
CORN						R/C	Only needed on some occasions
COVE						C	
DANB		R/C				R/C	
FAIRF						R/C	
GRNCH		R/C				R/C	
HAMP						R/C	Only needed on some occasions
MANC		C				C	
MLFD					R/C	R/C	
MTWN		C				R/C	
STAM		R/C				R/C	
W HRT						R/C	

8. [N/A (no one chose “other”]

9. In addition to state licensing requirements, does your city/town require any additional licensing for contractors working on a solar PV installation? (Indicate applicability to residential and/or commercial installations.)

BGPT	No
CORN	Installer has to be licensed - either PV1 (can install, but requires an electrician) or PV2 (can install, but can't get permit). Electricians require an E1. (Note from Joe - this seems to be the standard procedure for all of CT.)
COVE	No
DANB	No
FAIRF	No
GRNCH	No
HAMP	No
MANC	No
MLFD	No
MTWN	No
STAM	Yes - installers must be registered and licensed with Consumer Protection for the state of CT. In structural cases (commercial)- major construction contractors license and registration is also needed. For residential, Home Improvement Registration for contractor for single family home (up to 6 units).
W HRT	No

10. What do you estimate to be the average time it takes for an installer/customer to complete a permit application? (This refers to the original application submission) Provide answer in terms of hours (e.g., 5 business days should be entered as 40 hours.)

	R	C
BGPT	.25	.25
CORN	1	1
COVE	1-2	2-4
DANB	.5	.5
FAIRF	.25	.25
GRNCH	40	80
HAMP	<4	<4
MANC	0.5	0.5
MLFD	20	20
MTWN	< 24	< 24
STAM	2	3
W HRT	2	5

11. What do you estimate to be the average time it takes for an installer/customer to provide revisions to or additional information requested to complete a permit application? Provide answer in terms of hours (e.g., 5 business days should be entered as 40 hours.)

	R	C
BGPT	16	16
CORN	0	0
COVE	0.5	0.5
DANB	40	40
FAIRF	.25	.25
GRNCH	16	32
HAMP	<4	<4
MANC	24	24
MLFD	40	40
MTWN	16	16
STAM	10	15
W HRT	20	40

12. What are the options for obtaining an application? (Check all that apply.)

	Online	Email	In person	Mail
BGPT			R/C	
CORN	R/C		R/C	
COVE	R/C		R/C	R/C
DANB	R/C	C	R/C	
FAIRF	R/C			R/C
GRNCH	R/C		R/C	R/C
HAMP	R/C		R/C	
MANC	R/C		R/C	R/C
MLFD	R/C	R/C	R/C	R/C
MTWN	R/C		R/C	
STAM	R/C		R/C	
W HRT	R/C		R/C	

13. What are the options for submitting an application? (Check all that apply.)

	Online	Email	In person	Mail
BGPT			R/C	
CORN			R/C	R/C
COVE	R/C		R/C	R/C
DANB	R/C		R/C	C
FAIRF			R/C	
GRNCH			R/C	
HAMP			R/C	R/C
MANC	R/C		R/C	R/C
MLFD	R/C	R/C	R/C	R/C
MTWN			R/C	
STAM			R/C	
W HRT			R/C	Has City Permit – capable of online submission, but are not fully utilizing

14. What forms, design documents or other paperwork are required for applicable permit approval? (Indicate applicability to residential and/or commercial installations)

BGPT	For both residential and commercial permits, you will need two sets of documents, completed permit application, certificate of worker's compensation for contractors, and state licenses.
CORN	Insurance certificates, affidavit of workman's comp (this depends on whether an established contractor is doing the work). If it's a new contractor, a copy of the license is required. PV systems require a line drawing, descriptions of the roof type, and listing of the system components.
COVE	Copy of valid license or registration for all contractors. Certificate of workers compensation for all contractors with employees. OF WORKERS COMPENSATION FOR ALL CONTRACTORS WITH EMPLOYEES.
DANB	In addition the application, engineer/architecture-approved plans are required. This used to no be the case, but Danbury found that some plans were not submitting the correct structural info for roofs.
FAIRF	Workman's comp, state license, 3 copies of building plans
GRNCH	Permit application form Workman's Compensation Affidavit Permit sign-off sheet Copy of State license Forms associated with Town Drainage Manual Above for both Residential and Commercial
HAMP	For both residential and commercial: insurance certificate, affidavit of worker's compensation, copy of license, roof description, signed application fee, consent form from homeowner, and tax clearance
MANC	The more information the faster plan review for both residential and commercial.
MLFD	Require stamped, engineered drawings showing that solar installations are installed in a way that can sustain 110 mph winds.
MTWN	Signed application fee, consent form signed by homeowner giving installer permission to apply on their behalf. Engineer-approved plans are only required for particularly large installations.
STAM	Two sets of drawings, with a professional engineer approved design. Completed application (sign-off sheet, through different departments), application for electrical permit, owner's form (for owner of property), worker's compensation form.
W HRT	See attached documents. Additionally, you can submit mail for electrical permits, but for Building you must submit in person.

15. Do you have an online permitting system in place already?

	No	Yes
BGPT	R/C	
CORN	R/C	
COVE		R/C
DANB		R/C
FAIRF	R/C	
GRNCH	R/C	
HAMP	R/C	
MANC		R/C
MLFD		R/C
MTWN		R/C
STAM	R/C	
W HRT	R/C	

16. You selected Yes. What is the name of the software?

COVE	View Permit Automated Permit Management
DANB	HTE Permitting System (computer management system) - a secondary platform is used to allow eligible contractors to submit applications online via email.
MANC	View Permit
MTWN	PWPermit (developed in-house)
MLFD	View Permit

17. Can you accept permit application data electronically, particularly in a format that may expedite the process? If so, please specify the types of files and data formats you are able to accept (email, spreadsheet, PDF, CSV, etc.) (Indicate applicability to residential and/or commercial installations.) What types of files are you able to accept?

BGPT	No
CORN	N/A
COVE	All – also accept e-mail. Issues with Paypal online payment methods but do allow mail in check
DANB	Pdf, email, spreadsheet
FAIRF	No
GRNCH	No
HAMP	No
MANC	View Permit, PDF, email
MLFD	Applicants can attach files in all formats. However, engineered documents require a wet stamp/seal under Connecticut State Law. There is no electronic stamp format accepted in Connecticut (there is in other states), therefore we need the original stamp and seal on the documents. We can conduct the review on electronically submitted documents but to issue the permit we need a wet stamp.
MTWN	Yes – still must come to office
STAM	No
W HRT	No

18. Specify the best persons to contact (and their contact information) for further questions about electronic submission capabilities.

BGPT	N/A
CORN	N/A
COVE	Brigit Tanganelli (860)742-4064 btanganelli@coventryct.org
DANB	Sean Hearty
FAIRF	N/A
GRNCH	IT Dept. (203) 622-6448
HAMP	John Berard & Lesley Davis
MANC	Debbie Bowen (860) 647-3184
MLFD	Jocelyn Mathiasen (203) 783-3374
MTWN	John Parker & Dean Lisitano
STAM	No contact
W HRT	Mary Ann Basile

19. How is information describing the permitting process accessible? (Check all that apply.)

	Online and easily accessible	Online	Email	In person	Mail	Phone
BGPT	R/C	R/C	R/C	R/C		R/C
CORN		R/C		R/C		R/C
COVE	R/C	R/C	R/C	R/C	R/C	R/C
DANB	R/C			R/C		R/C
FAIRF				R/C		R/C
GRNCH	R/C		R/C	R/C	R/C	R/C
HAMP		R/C		R/C	R/C	
MANC		R/C	R/C	R/C	R/C	
MLFD	R/C	R/C	R/C	R/C	R/C	R/C
MTWN	R/C					
STAM		R/C		R/C		R/C
W HRT		R/C		R/C		

20. Is there an accessible designated point of contact (POC), with contact information available online, for questions about the PV permitting process?

	No designated POC	Yes, there is POC but contact info not online	Yes, POC info is online
BGPT			R/C
CORN	R/C		
COVE			R/C
DANB	R/C		
FAIRF			R/C
GRNCH	R/C		
HAMP			R/C
MANC	R/C		
MLFD			R/C
MTWN	R/C		
STAM		R/C	
W HRT	R/C		

21. Is there a policy to issue/deny PV permits within a specified number of business days from submission of application?

	No	Yes, ≤ 3 days	4-10 days	> 10 days	30 days	Notes
BGPT					R/C	
CORN					R/C	
COVE					R/C	Usually 1-2 weeks
DANB					R/C	
FAIRF					R/C	
GRNCH					R/C	
HAMP					R/C	
MANC					R/C	
MLFD					R/C	
MTWN					R/C	
STAM					R/C	
W HRT					R/C	

22. Specify the applicability of the time limit. Does the time limit apply to full process resulting in permit issuance/denial, or just response time to original application which may include notice about revisions or additional information required? (Indicate applicability to residential and/or commercial installations.)

FAIRF	Standard state guidelines - must approve within 30 days
MANC	Action on application is 30 days to either approve or deny CT State Building Code Section 105.3.1.
STAM	State building code, 30 day requirement to issue/deny permits
W HRT	State building code requires permits be issued or denied within 30 days. The time limit applies to the response time to the original application.

23. If there is a time limit, is there an opportunity to shorten the existing time limit, and why or why not? If there is no time limit, would it be feasible to set a time limit, and why or why not? (Indicate applicability to residential and/or commercial installations.)

MANC	Typically permits are approved in 1 to 2 weeks.
STAM	Stamford doesn't have its own time limit outside of the state's guidelines.
W HRT	If all required info available, including structural, will expedite.

24. What are the biggest factors impacting permit processing time? (Indicate applicability to residential and/or commercial installations.)

BGPT	Tax collection searches, historical district
CORN	There is no policy, but verbal approvals are done almost instantaneously. They are required to make a decision within 30 days (unclear if there's ever a delay anywhere near that long). If the contractors are difficult and don't submit full paperwork, etc., then the process can take longer. Quality of the application is the single most important determinant. The office is usually never too busy to take and process permits.
COVE	Incomplete applications (has not been a problem with solar); building department workload
DANB	Quality of the original plan. If drawings are complete, the building inspector can give a verbal approval within 10 minutes or so.
FAIRF	Application fullness
GRNCH	Incomplete applications - both
HAMP	Hours of building department & incompleteness of forms
MANC	Lack of information
MLFD	1) Overall volume of work in the office / 2) Available staffing / 3) Quality of materials submitted to us
MTWN	Nothing really. Clerical staff usually processes permits quickly.
STAM	Depends on departments permits are processing through. Zoning or Environment have tendency to be slower. If construction documents are in order, then things move quickly. Issues with design can slow things down.
W HRT	Lack of structural approvals

25. What are the biggest factors impacting the decision to issue/deny permits? (Indicate applicability to residential and/or commercial installations.)

BGPT	Compliance with code
CORN	Permits are never denied, but are sometimes received as incomplete and require additional follow-up.
COVE	Incomplete applications – has not been a problem with solar
DANB	Quality of the original plan. Revisions are asked for fairly often.
FAIRF	Full application
GRNCH	Permits are not denied by building department but are sometimes delayed due to lack of information or code violations that need to be corrected on plans. Zoning is the agency that usually denies applications.
HAMP	Hours of building department & incompleteness of forms
MANC	Amount of detailed information or lack of information
MLFD	Materials must show code compliance. #1 issue on solar is fastening details and 110 mph wind rating.
MTWN	Only reason permit may be denied is if the application is missing some major information.
STAM	Completeness of application and appropriate construction documents.
W HRT	Structural approvals missing

26. Does the jurisdiction track the number of days each permit takes to process?

	No	Yes
BGPT	R/C	
CORN	R/C	
COVE		R/C
DANB		R/C
FAIRF		R/C
GRNCH		R/C
HAMP	R/C	
MANC		R/C
MLFD		R/C
MTWN		R/C
STAM	R/C	
W HRT		R/C

27. What data pertaining to the permit application, if any, is recorded? Is the information recorded on paper or saved electronically? (Indicate applicability to residential and/or commercial installations.)

BGPT	Construction documents and item list on paper, then indexed in database
CORN	A hard copy of each permit is kept on file. An additional hard copy is sent to the tax assessor.
COVE	All data is entered electronically into ViewPermit and saved indefinitely. Any paper records are kept for at least two years for residential and indefinitely for commercial.
DANB	All applications and plans are stored electronically using their HTE system. However, there is not an easy way to analyze the data (each permit would have to be manually identified as being a solar PV installation. 8
FAIRF	All application info electronically input into Mitchell Humphrey management system
GRNCH	Application date/ issue date, CO date recorded electronically date for both
HAMP	Create spreadsheet of permit data
MANC	All data, both residential and commercial, is recorded on paper.
MLFD	Our software indicates date of submission, date of initial review completion, date of resubmission, date of issuance, etc. This isn't the software, but currently it is very difficult to run results that aggregate this information. We are working on this.
MTWN	Clerical staff time-stamps the application when it comes in. Permit is open for 180 days (6 months).
STAM	Is tracked by date manually when the application is submitted (dated envelopes)
W HRT	Since 2008, all stored in electronic file.

28. What is the average number of business days between application submission and decision (issuance or denial) regarding permits? Provide answer in terms of hours (e.g., 5 business days should be entered as 40 hours).

	Residential	Commercial
BGPT	24	24
CORN	8	8
COVE	40	40
DANB	16-32	16-32
FAIRF	24	24
GRNCH	40	80
HAMP	40	40
MANC	40	75
MLFD	Building (80-120), Electrical (24)	Building (80-120), Electrical (24)
MTWN	<24	<24
STAM	80	80
W HRT	80	80

29. If the permit application is incomplete upon original submission, what is the average number of business days between application submission and response to applicant including notice about need for revisions or additional information? Provide answer in terms of hours (e.g., 5 business days should be entered as 40 hours).

	Residential	Commercial
BGPT	16	16
CORN	0.5	0.5
COVE	24	24
DANB	8	8
FAIRF	<24	<24
GRNCH	16	32
HAMP	0	0
MANC	15-40	30-40
MLFD	80-120	80-120
MTWN	< 24	< 24
STAM	20	20
W HRT	80	80

29a. How many hours does it take to review an application (hours)?

	Residential	Commercial
BGPT	0.5	0.5
CORN	1	1
COVE	1	2
DANB	1-1.5	1-1.5
FAIRF	1	3
GRNCH	0.5	0.5
HAMP	0.5	0.5
MANC	1	2
MLFD	1	1
MTWN	0.5	1-3
STAM	0.5	1
W HRT	0.5	2

29b. How much time does an inspection take? Include all inspections – electric, structural, fire, mechanical etc. (Hours.)

	Residential	Commercial
BGPT	0.5	0.5
CORN	0.5	0.5
COVE	0.5	0.5
DANB	0.5	0.5
FAIRF	0.5	1
GRNCH	0.5	0.5
HAMP	0.5	0.5
MANC	0.75	2
MLFD	1	1
MTWN	0.5	1
STAM	0.5-1	1
W HRT	1	2

30. Are there mechanisms in place for accelerating PV permitting processes under certain conditions (e.g., expedited process for standard residential systems meeting certain criteria, option to pay for expedited issuance, or expediting for experienced installers with a track record of code compliance)?

	No	Yes
BGPT	R/C	
CORN	R/C	
COVE	R/C	
DANB	R/C	
FAIRF	R/C	
GRNCH	R/C	
HAMP	R/C	
MANC		R/C
MLFD	R/C	
MTWN	R/C	
STAM	R/C	
W HRT	R/C	

31. You indicate there are options for accelerating the PV permitting process. Please specify.

MANC	A $79.00 additional fee for immediate review.

32. How is information on permit fees made available? (Check all that apply.)

	Online	Email	In person	Mail	Phone	Not Available
BGPT	R/C	R/C	R/C		R/C	
CORN	R/C		R/C		R/C	
COVE	R/C	R/C	R/C	R/C	R/C	
DANB	R/C		R/C		R/C	
FAIRF			R/C		R/C	
GRNCH	R/C		R/C			
HAMP		R/C	R/C	R/C	R/C	
MANC	R/C		R/C		R/C	
MLFD	R/C	R/C	R/C	R/C	R/C	
MTWN	R/C		R/C			
STAM	R/C				R/C	
W HRT	R/C		R/C			

33. What is the average total amount charged for the applicable permit fee(s) for typical residential installations?

	≤ $250	$251-$500	> $500
BGPT	R (as of 12/2012)		
CORN		R	
COVE		R	
DANB		R	
FAIRF	R		
GRNCH			R
HAMP		R	
MANC		R	
MLFD	R		
MTWN			R
STAM			R
W HRT		R	

34. Specify an exact amount in dollars and specify the contributing components of this fee.

BGPT	As of Dec 2012, ~$50. The cost of the class-1 renewable system is not included in the permit fee calculation [NO FEE for residential rooftop PV as of Dec. 10, 2012]
CORN	$25 for first $1,000 (minimum), then $7 for each $1000 or part there-of
COVE	Varies based on construction value at $15.00 per $1000.
DANB	$22 for first $1,000, then $11 for each additional $1,000; no ceiling
FAIRF	$50.26 for 1st $1k, then $12.26 for every additional $1k, then $6 for every $k over $10M
GRNCH	$13.26 per $1,000 Res
HAMP	$10 per $1,000
MANC	$20 first $1,000 and $15 per each additional $1,000 (SINCE ZEROED FOR CLASS 1)
MLFD	$15 for the first $1,000 in value; $12 for each subsequent. $0.26/$1,000 goes to the state
MTWN	$15.26 for first $1,000 then $14.26 for each additional $1,000
STAM	$12 per 1,000
W HRT	$32.26 for first $1,000 and $17.26 for each additional $1,000

35. What is the average total amount charged for the applicable permit fee(s) for typical commercial installations?

	≤ $1000	$1001-$2000	> $2000
BGPT	C		
CORN	C		
COVE		C	
DANB	C		
FAIRF	C		
GRNCH	C		
HAMP	C		
MANC		C	
MLFD	C		
MTWN	C		
STAM			C
W HRT		C	

37. Specify an exact amount in dollars and specify the contributing components of this fee.

BGPT	A bit higher than residential at ~$150
CORN	$25 for first $1,000 (minimum), then $7 for each $1000 or part there-of
COVE	Varies based on construction value at $15.00 per $1000
DANB	$18 for each $1,000, no ceiling
FAIRF	$50.26 for 1st $1k, then $12.26 for every additional $1k, then $6 for every $k over $10M
GRNCH	$15.26 per $1,000 Commercial
HAMP	$10 per $1,000
MANC	$20 first $1,000 and $15 per each additional $1,000
MLFD	$15 for the first $1,000 in value; $12 for each subsequent. $0.26/$1,000 goes to the state
MTWN	Same as residential
STAM	$16 per 1000
W HRT	$32.26 for first $1,000 and $17.26 for each additional $1,000

37. Is/are the permit fee(s) structured as flat, cost recovery, valuation open ended, valuation capped, valuation with exclusions, or other structure?

	Flat	Cost Recovery	Valuation Open Ended	Valuation Capped	Valuation with Exclusions	Other
BGPT		R/C				
CORN			R/C			
COVE			R/C			
DANB			R/C			
FAIRF			R/C			
GRNCH			R/C			
HAMP			R/C			
MANC		R/C				
MLFD			R/C			
MTWN			R/C			
STAM			R/C			
W HRT			R/C			R/C

38. You selected Other. Specify what type of permit fee structure you use.

W HRT	Commercial requires fire marshal plan review fee

39. Please elaborate on how this fee is calculated, providing an example(s). (Indicate applicability to residential and/or commercial installations.)

BGPT	Based on value of the work. If it is a building permit then a certificate of occupancy will be required and thus the fee
CORN	Fee is based on "true" value of construction. Occasionally an affidavit of value is required
COVE	Permit fees based on construction value – materials and labor $15 per $1000 for both residential and commercial
DANB	Residential: $22 for first $1,000, then $11 for each additional $1,000; no ceiling Commercial: $18 for each $1,000, no ceiling
FAIRF	1st $1,000 is $50 + $0.26 rounded up = $51 and $12 + $0.26 for every thousand after rounded up to the nearest $
GRNCH	$15.26 per $1,000 of valuation for Commercial. $13.26 per $1,000 of valuation for Residential
HAMP	Valuation - $10 per $1,000 of value
MANC	Fee schedule
MLFD	$15 for the first $1000 in value; $12 for each subsequent. .26/$1000 goes to the state. For zoning approvals there is a flat $85 fee of which $60 goes to the state
MTWN	$15.26 for 1st thousand; $14.26 for every thousand thereafter; same for residential & commercial
STAM	$12 per 1000, residential, $16 per 1000 commercial. Certificate of approval $25 (residential), $75 (commercial)
W HRT	$32.26 for first $1,000 and $17.26 for each additional $1,000

40. Are there any conditions for which there is an exemption or discount on the permit fee? If Yes, what are

the conditions and how much? (Indicate applicability to residential and/or commercial installations.)

BGPT	The only fee exemption is for city projects done by city employees [NO FEE for residential rooftop PV as of Dec. 10, 2012]
CORN	Not really, but the selectman can waive the fee for certain projects (e.g. - school projects). Paul mentioned "only the rich can afford PV"
COVE	Town property is exempt but State Education Fee is still required. State Education Fee is 0.26 per $1000
DANB	City projects and cultural projects (cultural non-profits)
FAIRF	Town projects
GRNCH	No
HAMP	Town Buildings
MANC	Town projects 0.26 per 1,000
MLFD	Municipal projects are exempt but by statute the state fees must always be paid
MTWN	City projects (must still pay state fee)
STAM	If solar system can be installed without building permit and only needs mechanical, electrical and/or Plumbing (MEP), then there is no fee
W HRT	Only town-owned properties

41. Are there any situations in which a fine may be issued for non-compliance, and if so what are the conditions and fines? (Indicate applicability to residential and/or commercial installations.)

BGPT	R: Double fee for work being done without permit. The City adheres to the State of Connecticut penalties
CORN	$200 additional charge/fine if construction begins before permit is accepted. Fine rarely occurs and never has for PV work
COVE	Work done without a permit will add $100 to the permit fee. There is also a $25 re-inspection fee for failure to cancel inspection if work is not ready for scheduled inspection
DANB	No, but a stop work order can be issued and a contractor can be required to tear out all prior changes made to a structure and re-start after the permit is granted
FAIRF	$700-$1,000 fine for work started w/ out permit
GRNCH	$200 investigation fee for work started w/o a permit - both
HAMP	No
MANC	Double fee for work started without a permit
MLFD	Technically, we can issue a fine for violation of the state building code but I cannot recall any time when this has been done. We do not issue zoning fines
MTWN	No fines. Not much in terms of non-compliance because CL&P needs Dean Lisitano’s approval before system can be powered on
STAM	Only time would charge during inspection process is if they call an unneeded inspection or if they did not correct errors that were identified before final inspection. In both cases, the fine is $50.00
W HRT	Work without a permit- fine is 2 times permit fee with maximum of $100 fine

42. To what degree do you use the Solar ABCs expedited permitting process template for typical residential installations? (Please see Survey Instructions.)

	Default Template	Optional Template	Have Reviewed and Considered	Unaware/ Reject
BGPT			X	
CORN				X
COVE			X	
DANB				X
FAIRF				X
GRNCH				X
HAMP				X
MANC				X
MLFD				X
MTWN				X
STAM				X
W HRT				X

43. Comment about use of Solar ABCs expedited permitting process template (Indicate applicability to residential and/or commercial installations.)

COVE	Statewide acceptance of this template process would certainly help expedite the approval process.

44. What is the average number of business days from inspection request to actual inspection? Provide exact answer in terms of hours (e.g., 5 business days should be entered as 40 hours.)

	Residential	Commercial
BGPT	16-56	16-56
CORN	24 (max)	24 (max)
COVE	24-48	24-48
DANB	8	8
FAIRF	72-96	72-96
GRNCH	24	24
HAMP	40	40
MANC	24	24
MLFD	24	24
MTWN	40	40
STAM	40	40
W HRT	24	24

45. Is the installer provided with a specific appointment time for the final onsite inspection, or a window of time?

	Specific Appointment Time	Window of Time
BGPT		R/C
CORN	R/C	
COVE		R/C
DANB		R/C
FAIRF		R/C
GRNCH		R/C
HAMP	R/C	
MANC		R/C
MLFD		R/C
MTWN	R/C	
STAM		R/C
W HRT		R/C

46. Specify the window of time in terms of hours.

BGPT	0.5 hour
COVE	2 hour window
DANB	2 hour span, to occur the next business day after the inspection is requested/approved
FAIRF	1 hour (if contractor calls day of appointment, they can get a more specific time)
GRNCH	2 hours
MANC	2 Hours – can be more specific day of inspection
MLFD	2 hours
STAM	4 hours
W HRT	9-12 PM or 1-2 PM. However, if you book first AM or 1PM, then window is only 40 minutes or so.

47. How is information on inspection requirements made available? (Check all that apply.)

	Online	Email	In person	Mail	Phone	Not Available
BGPT	R/C	R/C	R/C		R/C	
CORN			R/C		R/C	
COVE	R/C	R/C	R/C	R/C	R/C	
DANB	R/C		R/C		R/C	
FAIRF		R/C	R/C	R/C	R/C	
GRNCH	R/C			R/C		
HAMP			R/C		R/C	
MANC		R/C		R/C		
MLFD						R/C
MTWN	R/C		R/C			
STAM	R/C				R/C	
W HRT	R/C		R/C	R/C		

48. How many separate inspection trips are required? (Check all that apply.)

	Single Comprehensive Inspection	Electrical Rough-in	Electrical Final	Roof Penetrations (pre-install)	Structural/ Building Final	Other
BGPT		R/C	R/C			
CORN			C	R/C		
COVE	R/C					
DANB			R/C	R/C		
FAIRF				R/C	R/C	
GRNCH		R/C	R/C		R/C	
HAMP	R/C					
MANC	R/C					
MLFD					R/C	
MTWN	R/C					
STAM		R/C	R/C	R/C		
W HRT	R	C	C		C	All in one trip

49. What is the average number of business days from inspection request to actual inspection? Provide exact answer in terms of hours (e.g., 5 business days should be entered as 40 hours)

	Residential	Commercial
BGPT	16-56	16-56
CORN	24 (max)	24 (max)
COVE	24-48	24-48
DANB	8	8
FAIRF	72-96	72-96
GRNCH	24	24
HAMP	40	40
MANC	24	24
MLFD	24	24
MTWN	40	40
STAM	40	40
W HRT	24	24

50. How many people do you employ and/or subcontract to for conducting inspections? (Enter numbers in blank spaces). (Note: An FTE amounts to 2000 hours per year, or 40 hours per week times 50 weeks per year.)

	FTE (R)	FTE (C)	# Subcontractors (R)	# Subcontractors (C)
BGPT	5	5	0	0
CORN	0	0	0	0
COVE	1	1	0	0
DANB	8	8	0	0
FAIRF	5	5	0	0
GRNCH	8	8	0	0
HAMP	1	1	0	0
MANC	5	5	0	0
MLFD	1	3	1	0
MTWN	2	2	0	0
STAM	5	5	0	0
W HRT	4	4	0	0

	Part-Time (R)	Part-Time (C)	Total # Subcontracted Hours Per Year (R)	Total # Subcontracted Hours Per Year (C)
BGPT	0	0	0	0
CORN	0	0	0	0
COVE			0	0
DANB				
FAIRF				
GRNCH	2	2		
HAMP	0	0	0	0
MANC	1	1		
MLFD				
MTWN				
STAM	1	1		
W HRT	1 (1000 hrs.)	1 (1000 hrs.)		

51. Comment on how you estimate residential versus commercial workforce.

BGPT	Same – based on first come, first serve
CORN	Same person does both
COVE	Same person conducting residential and commercial
DANB	8 total full-time inspectors, which cover both commercial and residential
FAIRF	no split
GRNCH	Don't understand the question
HAMP	Same
MANC	Same staff covers both when necessary
MLFD	We don't specialize but we do a lot of residential projects.
MTWN	Same staff cover both. Two total, but Middletown is in the process of hiring one additional FTE.
STAM	Everyone shares. No one works on exclusively residential or commercial projects
W HRT	Our inspectors are cross-trained and do both commercial and residential.

52. Do the utility and local jurisdiction coordinate regarding inspection requirements and on-site inspection times for the permit and interconnection inspections?

	No	Yes
BGPT		R/C
CORN	R/C	
COVE	R/C	
DANB	R/C	
FAIRF	R/C	
GRNCH	R/C	
HAMP	R/C	
MANC		R/C
MLFD		R/C
MTWN	R/C	
STAM		R/C
W HRT	R/C	

53. You selected Yes. Specify how the utility and local jurisdiction coordinate on inspection and interconnection.

FAIRF	Once permit approved, building office calls automated utility service to confirm.
MANC	Direct access to utility tech assigned to area.
MTWN	CL&P has an inspector website that they go on and Dean Lisitano makes his approval/denial. Calvin Hart (CL&P employee), also lives in Middletown, is the City’s contact person. CL&P approval process may take the longest time.
STAM	Need release from municipality saying applicant has been approved before proceeding with scheduling

54. What are the benefits of and what are the difficulties of coordinating these inspections? (Indicate applicability to residential and/or commercial installations.)

BGPT	UI marches to own time table, not all there at one time
CORN	The installers coordinate directly with the utilities (building office has no direct role)
COVE	The building official calls CL&P to approve installation. The interconnection by the utility can take quite a bit of time. Not really anything that muni can do to speed up the process.
DANB	N/A
FAIRF	None
GRNCH	Inspections are scheduled by the permit applicant
HAMP	N/A
MANC	A quicker service connection; there are no difficulties.
MLFD	N/A
MTWN	Yes; CL&P has an inspector website that they go on and Dean Lisitano makes his approval/denial. Calvin Hart (CL&P employee), also lives in Middletown, is the City’s contact person. CL&P approval process make take the longest time.
STAM	Don't usually have a problem. They coordinate scheduling in accordance with approval of permits.
W HRT	N/A

55. Is there any communication between the utility and local jurisdiction that is aimed at expediting interconnection? (Indicate applicability to residential and/or commercial installations.)

BGPT	Depending on nature, we'll coordinate appointments, but very little communication
CORN	No
COVE	No
DANB	N/A
FAIRF	N/A
GRNCH	Inspections are scheduled by the permit applicant
HAMP	N/A
MANC	Yes, both residential and commercial
MLFD	N/A
MTWN	No
STAM	No
W HRT	Once inspection is completed and approved, inspectors send in OK via e-mail to utility

56. How long did it take you to complete this survey? Incorporate time spent gathering data and information into your figure.

BGPT	2.25 hours
CORN	1.5 hrs.
DANB	1 hour
GRNCH	Too Long
MANC	3.5 hours
STAM	45 minutes
W HRT	2.75 hours including research

Appendix III
Installer Permitting Survey

Installer Survey Report

The CEFIA Sun Rise New England team distributed a survey to 14 solar PV installers working in the State of Connecticut. The questions below contain feedback given by installers on the current state of the permitting and inspection process for rooftop solar in Connecticut. Text answers have been edited for grammar and spelling.

Bridgeport replaced New Haven as a project participant due to timing constraints in part resulting from relocation of New Haven's original project contact. However, this installer permitting survey had already been conducted before Bridgeport joined the project so data for New Haven is still included here. Findings from this installer survey were largely aggregated to help identify overall opportunities for permitting improvement. The project team did provide Bridgeport with an individual municipal permitting survey, so data for Bridgeport is used in Appendix II.

1. In which of the following Connecticut towns have you installed rooftop solar PV systems? (Check all that apply.)

Town	Residential	Commercial	Responses
Cornwall	3	0	3
Coventry	3	0	3
Danbury	5	2	7
Fairfield	7	3	10
Greenwich	5	2	7
Hampton	5	2	7
Manchester	4	1	5
Middletown	7	2	9
Milford	5	1	6
New Haven[212]	7	3	9
Stamford	5	3	8
West Hartford	5	0	5

[212] Bridgeport replaced New Haven as a participating municipality but it was after this installer survey had already been conducted.

2. Compared to other towns in CT, where do these towns stand in terms of the amount of time required to secure a permit (including completing the application and receiving approval)?

Town	C/R	Significantly Slower than Average	Slower than Average	Average	Faster than Average	Significantly Faster than Average	N/A
Cornwall	Res.			1			
	Com.						
Coventry	Res.			2	1		
	Com.						
Danbury	Res.		1	1			1
	Com.			1			1
Fairfield	Res.		1	1	2	1	
	Com.		1				
Greenwich	Res.	1		1			1
	Com.			2			
Hampton	Res.			2	1		
	Com.			1	1		
Manchester	Res.						
	Com.						
Middletown	Res.	1		1	1	2	
	Com.						
Milford	Res.	1	3	1			
	Com.						
New Haven	Res.	1		2	1		
	Com.	1					
Stamford	Res.	2		1			
	Com.		1	1			
West Hartford	Res.			1			
	Com.						

3. Please comment on the time required to secure a permit. Are there reasons why this town is faster or slower to process permits? Please comment on issues such as the number of visits required to permit offices, the number of different departmental approvals required, and your travel time. Please indicate the applicability of your comments to residential and/or commercial installations.

Town Name	Text Response
Cornwall	• Permitting is quick and straightforward. Everything can be done by mail.
Coventry	• Town is typical of many smaller towns. The applicant goes to the building department, fills out an application and leaves it with the secretary along with the appropriate documents and payment. The inspector then reviews the application at a later time and the permit is mailed to the contractor.
Danbury	• Danbury requires permitting to be done in-person. Getting information for required documents is inaccurate or incomplete. Hence, multiple trips were taken before we fully understood that we were misinformed. • Permits were still required despite the project being for two Danbury schools. Two trips for each commercial installation were required.
Fairfield	• Although permits are issued on the same day, the applicant needs to go around the Town Hall to collect various signatures. In addition, there are usually long lines at the building department. • This town requires multiple visits because you have to obtain signatures from multiple departments in multiple buildings. Unlike a simple electrical permit which they will sign off on right away, solar rooftop permits require multiple departments which take time, especially since it is not guaranteed that the necessary contacts are in the office. In addition, there is only a limited time to get permits which is in the morning maybe around 8:30 to 10. • The requirement of an engineer stamp letter for load and wind lift is the biggest hassle. You do not need this letter when building a second story addition or roofing but you need it to install a solar system weighing less than a layer of shingles. On the other hand I am starting to see and be called for spotty workmanship and can see the point. • There needs to be continuity in the permit process throughout the state. Some towns such as Cheshire require two weeks of review. Some towns do not require any review • Fairfield needs no appointment AND they give you the permit the same day
Greenwich	• Took about two weeks and the permit was mailed. Lack of interest and knowledge of PV slowed down process. • 2 visits with not much effort required - school under construction so we just piggy backed on the existing electrical permits • Took 3-4 weeks to obtain permit
Hampton	• Town of Hampton building inspector is only available one night a week for 2 hours. This makes obtaining a permit an inconvenience sometimes. • Due to part time building department it may take extra time

Middletown	• Middletown issues permits same day and the applicant need not gather signatures from other offices. • Online portal had a tremendous positive impact on securing the permit. However the inspection schedule was significantly and unexpectedly bad. Two weeks out. When normally you can have a system inspected same day. Definitely room for a SIP [simplified inspection process].
Milford	• Permit is issued same day but the applicant needs to collect many signatures from other offices. The Tax Collector and Zoning take significant time. • Permit process seems arbitrary. Permit hours are very limited, lines of up to one hour long will form and if you exceed the time window for permit application submittal you may have to come back again. • There is no continuity from town to town. It is challenging to obtain a permit when the installer does not know the requirements from town to town. • Some towns require approval from multiple departments, some unnecessary.
New Haven	• Permit is issued same day. • This again takes multiple trips and a long time frame to get the permits. The electrical inspector must review the materials and he is usually not in the office. So you have to come back in person to drop off the files, review the paperwork and pay the fees. You can't do it all in one trip. • In the past only electrical permit application have been required for roof mounted systems where sealed structural engineering plans are provided. The chief electrical inspector David Kaplan is knowledgeable, friendly, and helpful.
Stamford	• Even though the permit is issued on the same day, the applicant must collect a myriad of signatures (Tax Collector, WPCA, EPB, Zoning) and it can take 3-5 hours because lines are so long. • Process is refined, and requires a plan review on all projects. Plan review must be scheduled in advance and has set hours. The plan review process could be expedited if a list of criteria, drawings types and documents required was provided by the building department. • Residential permits much more difficult to obtain than large commercial installations. Now working on small solar project for the City and permits were very difficult for their own project!

4. Compared to other towns in CT, how reasonable is the permit fee amount?

Town Name	R/C	Significantly Below Average Fee	Below Average Fee	Average	Above Average Fee	Significantly Above Average Fee	N/A
Cornwall	Res.			1			
	Com.						
Coventry	Res.			1	1		
	Com.						
Danbury	Res.			1	1		1
	Com.			1			1
Fairfield	Res.		1	2		1	
	Com.					1	
Greenwich	Res.				1		1
	Com.						1
Hampton	Res.		1	2			
	Com.		1	1			
Manchester	Res.						
	Com.						
Middletown	Res.			3			
	Com.						
Milford	Res.			3	1		
	Com.						
New Haven	Res.			1	1	2	
	Com.				1	1	
Stanford	Res.			1	2		
	Com.			1	1		
West Hartford	Res.			1			
	Com.						

5. Please comment on the permit fee amount and how fairly you believe the fee is calculated. Please indicate the applicability of your comments to residential and/or commercial installations.

Town Name	Text Response
Cornwall	• Fee reasonable compared to surrounding towns. Usually .8% of pre-rebate system cost.
Coventry	• I think all permit fees are a bit high in CT
Danbury	• City should not have permit fees for school buildings.
Greenwich	• High for the cost of the system. Especially, in light of the difficulty in getting the permit. • No fee on school project
Fairfield	• The permit fee is based on full value of solar, not taking into account what the actual customer is paying after rebates which can be 70% less. VALUE means what the person is willing to pay. It does not mean full cost of the project. • No different from when obtaining an electrical or building permit. Solar is not higher or lower than these permits.
Hampton	• I feel any fees for a solar PV permit are too much.
Middletown	• We have no visibility into how the fees are calculated and therefore cannot comment. Ultimately the fees are passed onto the customer. We would like to see them reduced to a flat rate per job and not calculated on the value of a job.
Milford	• Towns would benefit from setting fees based on kW capacity. Then it would not be a guessing game on "contract Value." The problem with contract value calculations is that the value must account for Building permit fees which means you’re paying a fee on a fee. In addition, many times we sign a lease contract where the construction does not actually have a value in the contract document. • Fee is fair, calculated by total job cost
New Haven	• Very expensive compared to other towns! • Very High Permit fee even for a small residential project. The cost can exceed $500 for a small 5 KW project.
Stamford	• Fees in the CT cities are quite a bit more than in your more common town.

6. Compared to other towns in CT, please indicate your overall experience in acquiring permits in this town.

Town Name	R/C	Significantly Harder than Average	Harder than Average	Average	Easier than Average	Significantly Easier than Average	N/A
Cornwall	Res.			1			
	Com.						
Coventry	Res.			2			
	Com.						
Danbury	Res.		2				1
	Com.			1			1
Fairfield	Res.	1	1	1	1		
	Com.	1					
Greenwich	Res.	1					1
	Com.				1		
Hampton	Res.			3			
	Com.			2			
Manchester	Res.						
	Com.						
Middletown	Res.			1	1	2	
	Com.						
Milford	Res.	2	1	1			
	Com.						
New Haven	Res.		1	2	1		
	Com.		1		1		
Stamford	Res.	2		1			
	Com.		1	1			
West Hartford	Res.			1			
	Com.						

7. Please highlight any best practices that make the overall permitting process in this town more efficient and streamlined. Are there other aspects that are particularly burdensome or difficult? Please indicate the applicability of your comments to residential and/or commercial installations.

Town Name	Text Response
Coventry	• This town is nice to work with because the applicant just fills out an application and drops off paperwork. However, it can be annoying to have to drive all the way out to the town just to be there for less than five minutes. • Having to include a PE stamped structural letter in the submitted application packet is burdensome.
Danbury	• They always require a Building permit and Electrical permit. Many towns will only require an Electrical permit for roof mounted PV systems when a Sealed Engineering letter/plans are provided for the structural component of the project. The building permit process in most towns is typically much more drawn out and costly.
Fairfield	• Harder given the process of gathering signatures from multiple offices takes time and the long lines at the building department can be time-consuming. • For rooftop solar, there should be a one page application just like electricians use for an electrical permit. There should be one department you have to go to, not multiple departments and multiple trips. You should also have an online application that you can upload all the files and pay by credit card. • Educate the inspectors. Most are not comfortable because there is no continuity between towns in the inspection process. • Applicable to residential: quick, one-stop process.
Greenwich	• More knowledgeable staff with regards to solar PV.
Hampton	• One night a week is difficult and slows down the project
Milford	• The scavenger hunt for signatures is annoying; the town requires engineering which adds significant cost to the project; inspections are difficult to schedule. • More continuity from town to town on requirements. Educate the inspectors • Plumbing and zoning - burdensome when installing on the roof. Streamline when town has specific guidelines for solar installations
Middletown	• Permit issued same day; no long lines; no scavenger hunt for signatures. • Online permitting definitely adds efficiency. • Positive factor includes standard requirements that are posted on the town's web site so that an installer is well prepared and can secure the permit in one visit. • Merchant account capabilities are definitely a problem for towns. Checks and cash are such outdated methods of payment. We utilize Square, not sure why the town cannot adopt the same technology. • Many of our experiences seem to indicate that the towns are out of touch with standard ITIL practices and rather than continuously improve their services, they remain the same and do not adapt to the needs of their customers. This can be very discouraging for new startups as it presents a logistical challenge that is avoidable.

Stamford	• Very long permitting process. After the job is complete, inspections are very difficult to schedule. Once the inspection has passed, the contractor has to go back to City Hall to close-out the permit. This entails going back to all departments for signatures - like securing the permit, this process takes a few hours. They also require a final as-built letter from the engineer, which along with the required engineer's report to pull the permit, adds even more cost that has to be passed on to the homeowner. • Electrical inspectors are very knowledgeable and "up to snuff" on PV systems

8. Please estimate the total number of man-hours required to secure a rooftop solar PV permit in CT (excluding travel time).

Fast Permit Process		Average Permit Process		Slow Permit Process	
Res.	**Com.**	**Res.**	**Com.**	**Res.**	**Com.**
2	2	30 minutes		8	12
10 minutes	-	6	8	hours, days	-
2	2	3	-	16	30
2	-	1	2.5	8	-
0.25	1	10-20 min	10-20 min	3	4
2	3	4	-	5-6	7
0.5	-	3-4	5	>2	-
-	-	2	-	-	-
-	-	7	6	-	-

9. Regarding the amount of time required to secure permits, please comment on best and worse practices you have observed both in and outside CT. When applicable please include the towns/states that employ these practices.

Text Response
• See notes about Stamford. In addition, Stamford requires two forms of the building permit application to be notarized and two forms be signed by the homeowner - very inconvenient! • Greenwich requires a form be signed by the homeowner and notarized - this can be difficult to coordinate with the homeowner. • Lebanon allows contractors to mail permit applications and then the town will mail the permit to the contractor when approved - this is the easiest and most time-saving of all. • Newtown is similar to Stamford in that the applicant needs to get many signatures. They also require that the applicant pick up the permit after it is approved - they will not mail it. After the job is complete, the contractor has to go back to the building department in person to close-out the permit. • Norwalk permits are issued by appointment only, and the applicant needs to gather many signatures beforehand. This can be difficult to coordinate if the applicant does not want to make two trips to City Hall.

- Southbury requires applicants to apply for a zoning permit first. After that has been approved (can take a few weeks), the applicant must come back to Southbury to apply for the electrical permit in person. They also require a notarized form.
- Waterford is the same as Southbury.
- Making two separate trips to a town hall is very inconvenient and a waste of time.
- There are many towns similar to Coventry that the applicant fills out the permit applications and leaves it with the documents and once the inspector approves them, the permits are mailed. This is the easiest, except it can be annoying to have to travel long ways just to be there for less than five minutes.
- These towns should be like Lebanon and accept mailed-in permit applications.

- Best practice: Submit the application package, pay the clerk and within a few days you have the permit.
- Best practice: Fill out the form online, pay online and the permit is issued within a week.
- The worst practice is requiring in-person applications during a short morning period and requiring multiple trips to acquire multiple signatures from different departments.
- Trumbull is a worst case example.
- Durham and East Haddam are the best examples.

- The best experiences to date have been with Bristol, Middletown and E. Windsor.
- The most challenging practice we have observed was a W. Hartford permit.
- Regarding fees: Fees are based on the value of the contract, therefore we cannot present the average or highest fee for obvious reasons.

- This would account for time spend in building dept/town hall. This does not include permit application rejections for discrepancies or subjective matter.

- Some towns require a health department permit (Woodstock for a ground mount system). This slows down the process since the average time takes a week to obtain this permit.

- The inspectors need to be educated and more comfortable with solar PV. Some take up to two weeks to review a simple residential plan. This is mainly due to under staffed departments

- No consistency

- We mail all our permit packets to the towns

- Stumbling blocks more often come from the lack of understanding of PV systems or oddball interpretation of rules. For example, Falls Village requires a P&Z sign-off roof-mounted PV (costs $75) to determine that the system does not cause the home to exceed height regulations. Doesn't matter how many times you tell them a properly designed system sits below the ridgelines.

10. Regarding permit fees, please provide the following information to the best of your knowledge.

Average permitting fee in CT		Highest fee and town(s) with highest fee(s)		Lowest fee and towns(s) with lowest fee(s)	
Residential	Commercial	Residential	Commercial	Residential	Commercial
$300	$600	$650	$1,500	$150	$200
$400	$800	$600 New Haven	$1,200 New Haven	$200 Durham	$300 Durham
unknown	unknown	unknown	unknown	Unknown	Unknown
Depends on cost of project		$27/$1,000, New Haven	Bridgeport	$6/$1,000 Kent	$12/$1,000 Trumbull
$13.50/$1,000	$14/$1,000	$25/$1,000		Litchfield	
$15/$1,000				$8.50/$1,000	
$15/$1,000					

11. Regarding permit fees, please comment on best and worst practices that you have observed both in and outside of CT. Have you observed whether different fee structures are more/less effective (e.g. flat fees, cost recovery, valuation open ended or capped, etc). Where possible, please include the towns/states that employ these practices and indicate applicability of your comments to residential and/or commercial installations.

Text Response
• Flat fees seem to work the best for residential-MA & FL towns seem to have more of a flat fee structure. A flat fee would be great for commercial projects. Currently fees are uncertain adding difficulty to planning the project and creating a budget.
• In my experience, every town has permit costs that are a certain amount of money per thousand dollars. This rate varies between towns. A small PV system in New Haven can cost the same as a large PV system in another town that is not as expensive. Since the contractor does not know the rates when closing a sale, the permit fees are usually under-estimated.
• A town with a limited fee is Durham. They are very good with permit processing and reduced fees. • The worst towns are New Haven, Trumbull and some small towns in Fairfield County.
• There are no primary standards, again making it very difficult to navigate and accurately prepare customer proposals.
• Fixed fee based on System Capacity would be an effective way to build permit fees into project costs and eliminate the guessing game.
• All towns I have obtained permits in have been based on the cost of the job. The Town of Shelton CT requires a roof analysis by a PE
• It is dictated by the Municipality and I have no comment on their budget
• No. All towns calculate the permit fee the same way. Regulating these fee schedules would be the most advantageous
• Having basic knowledge of PV system requirements greatly speeds up the process. Even if additional departments need to weigh-in or approve. Knowing who to contact, what the process requires and how much it costs on the phone prior to the appointment or waiting in line, greatly speeds up the process. Building department personnel that are unfamiliar with PV slow things down.

12. Have you used online permitting systems for solar PV permits (or other types of permits) in CT or elsewhere? If so, please indicate the town/state and comment on how they have helped or hindered the permitting process. If possible, please also provide the name of the online system.

Text Response
• We have not done online applications as we need to hand in documentation.
• I believe the online permitting system is for regular building permits only, not for solar.
• Yes, North Haven has an online application but they did not process it properly and still required the electrician to come into the office, which negated the point of having the online application. But the process of filling out everything online and uploading documents and paying online was a step in the right direction.
• Yes, Middletown. A very good experience
• Litchfield and Harwinton I believe. Online process is nice because Permits and Signoffs are all emailed out. Cuts down on lag time between inspection and signoff's

13. Please provide an overview of the best and worst practices for rooftop solar PV permitting both in CT and elsewhere. What methods or systems help/hinder the most in securing permits?

Text Response
• Requiring structural engineering for residential homes is too much money and time. This is required by West Hartford.
• For rooftop PV systems, allowing an electrical permit application only when structural engineering plans/letter is provided is simplest way to obtain proper technical information and also have the properly qualified Structural engineer sign off and assume liability.
• Best practices: Have all your paperwork ready (electrical diagrams, site plans, system specs) • Town of Shelton required a PE stamp for a roof analysis. This caused a major delay and added expense to the homeowner. In my opinion this was not needed. Any building inspector knows that a solar system will not compromise the structure with a 2x10 rafter 16 in on center with a 45 degree pitch.
• Help = Educating the inspectors Hinder = not educating the inspectors.
• Help: Speaking with building inspector beforehand to go over required documentation. If town has experience with PV= good. If doesn't have experience with PV= bad/slow Hinder: Planning and Zoning approval for roof-mounted systems prolongs permitting process Planning and zoning fees increase cost of permitting.
• No consistency between towns and projects.

14. From your perspective, what aspects of the solar PV business in Connecticut (either residential and/or commercial) could be improved? While this project is focused on reducing non-hardware costs (and in particular, permitting), we welcome additional information that may inform other initiatives.

Text Response
• Uniform permit application, documentation required and fee structure
• Solar standard form just like an electrical permit form used in CT. There needs to be a streamlined program that all towns understand and use for ROOFTOP solar. This is not complicated. Electricians have simplified their permit process and they get permits on the spot using a simple yellow form.
• Speaking from experience as a grass roots organization, we are pleased with how CT's PV practice has evolved in just the last three years. That said, there is always room for improvement. Therefore, streamlining the rebate process is one opportunity. • Increased CEFIA PV marketing would certainly help educate the general population and drive our joint PV objectives. • Providing more lead time on RFP's would be helpful and improved ZREC program • Awareness/education towards our CT commercial community would help take the explanation out of our presentation decks so that we can focus on the design and installation side of the project.
• Sunset the PV license it is electrical work
• Do not require sealed engineering for residential systems: Installers assume responsibility
• Focus on market wide programs and efforts, not town or installer specific. There is a very strong market in CT that CEFIA was instrumental in getting ramped-up. All programs/efforts should leverage this by providing access to all approved installers. It is probably impossible to create a more efficient process than a strong market to best protect ratepayers and incentivize competition. The economic road is strewn with the wrecks of market manipulation.
• A better ZREC program - need more frequent auctions to have a stable industry
• A standardized permitting process, mandated by the state is the only way towns will change. As frustrating as the permitting process can be, the expense is relatively insignificant and typically accounts for less than 1% of the total project cost.
• Open Secret that the fees based on construction value are high relative to the burden placed on inspectors.

15. Please provide a rough estimate of how many people you employ and subcontract to for your solar PV installation work in Connecticut. If unsure of your residential versus commercial workforce, please estimate.

Full-Time Employees		Part-Time Employees		Sub-Contractors	
Residential	Commercial	Residential	Commercial	Residential	Commercial
4	2	5	2	6	8
10		2		1	
4	4	0	0	6	6
2	2	0	Mix	4	10
18	Mix	2		2	Mix
1		1	0	2	
4		5		1	2
3	5		2	3	
2				1	3
	5				

Appendix IV
Municipal Planning and Zoning Survey

Table 22: Solar Rights and Access Data for Participating Jurisdictions

Solar Rights and Access	Is there a state or local law that protects property owner rights to install solar systems on their property?		If there is a state or local law that protects property owner rights to install solar systems on their property, does it protect from both local ordinances and restrictive covenants?		What type of enforcement mechanism is used to support solar rights?		Is there a state or local law that provides for solar easements to protect access to sunlight (solar access)?	Is there a state or local process for a PV system to be registered in order to protect solar access?
Bridgeport	N (R)	N (C)	N (C)	N (R)	N/A (R)	N/A (C)	N	N
Cornwall	Y (R)	Y (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Coventry	Y (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Danbury	N (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Fairfield	Y (R)		N (R)	N (C)	N/A (R)	N/A (C)	N	N
Greenwich	N (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Hampton	Y(R) like any other structure	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Manchester	Y (R)	Y (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Middletown	Y (R) treated like any roof accessory	Y (C) treated like any roof accessory	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Milford	Y (R)	Y (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
New Haven	N (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
Stamford	N (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N
West Hartford	N (R)	N (C)	N (R)	N (C)	N/A (R)	N/A (C)	N	N

Table 23: Zoning Data for Participating Jurisdictions

Zoning	Approximately what percent of structures in your jurisdiction are zoned to allow rooftop solar facilities automatically "as a matter of right" or "by right"? (Show residential and commercial/ non-residential separately)			Approximately what percent of structures in your jurisdiction are zoned to allow rooftop solar facilities only after a public hearing and the issuance of a special or conditional use permit? (Show residential and commercial/ non-residential separately)			Has your jurisdiction conducted a review of local ordinances to identify barriers to solar installations and make recommendations for updating ordinances to address those barriers? Do you have any solar-friendly regulations or practices?	
Bridgeport	None (C)	None (R)		None (R)	None (C)	Hearing is only required if a variance is required because of a height violation. This has not occurred and is unlikely to occur with current height limits.	Y	Ordinance exempts the value of solar PV panels and electrical wiring from permitting fees. Permit fee exemption is for all class I renewables. Labor is not exempt.
Cornwall	All Structures (R)	All Structures (C)	Zoning permit only required for stand-alone structure, not for rooftop solar PV system.	None (R)	None (C)		Y	
Coventry	All Structures (R)	None (C)		None (R)	> 50% (C)		N	No ordinances yet, but section 4.04.05 from the Zoning Regulations provides flexibility to height restrictions on accessory uses, such as solar panels.
Danbury	All Structures (R)	All Structures (C)	Approval for rooftop solar PV installations is granted through building permit application. If the application is complete and installation meets height restrictions, approval is granted within one day. For R and C, height may not exceed 10ft above rooftop of the building.	None (R)	None (C)		N	
Fairfield	All Structures (R)	All Structures (C)	For C, height may not exceed 5 ft above building	None (R)	None (C)		N	Subdivision regulations mirrors state in that it suggests that renewables, solar access and passive solar should be considered.
Greenwich	None (R)	None (C)	Commercial solar installations must come before the Architectural Review Committee (ARC) which sometimes makes suggestions for improvement to the system plans.	None (R)	None (C)	Exceptionally large systems (no specific size cutoff) would require special administrative review in addition to ARC approval.	Y	(1) Mechanical structures are limited to 25% of roof area. If a solar system stays within this limit, height restrictions waived. Otherwise, height restrictions apply. (2) Ground mounted systems may be likely to violate setback rules. (3) Municipality has no authority to prevent deed restrictions by real estate developers or neighborhood associations.
Hampton	All Structures (R)	Most Structures (C)	Some C, have to have commission review	None (R)	< 50% (C)	The hearing is for a site plan review. More visible system, more likely review needed. Reasons largely to protect town aesthetic.	N	Most zoning and permitting problems for solar in rural areas are ground-mount related.
Manchester	All Structures (R)	All structures (C)	Rooftop PV is permitted as an accessory use. Commercial panels must not be visible.	None (R)	None (C)		N	Rooftop PV is permitted as an accessory use. Ordinance waiving permit fees for all class I renewables.
Middletown	All Structures (R)	All Structures (C)	For R or C, in village district may have design committee review for aesthetic reasons	None (R)	None (C)		N	Online permitting system for building permits.
Milford	All Structures (R)	All Structures (C)	Zoning approval granted automatically when building permit issued for residential or commercial.	None (R)	None (C)		N	
New Haven	All Structures (R)	All Structures (C)	Approval for rooftop solar PV installation is granted through building permit application. Solar PV installation is treated as an accessory.	None (R)	None (C)		N	
Stamford	None (R)	None (C)	Solar not listed as accessory use	None (R)	None (C)		N	Exception for solar in code: Solar can exceed building height limits by 25%.
West Hartford	All Structures (R)	All Structures (C)	Solar PV installation is not dealt by with by planning and zoning department. It is handled through building permit process.	None (R)	None (C)		N	

Table 24: New Construction Standards; Other Solar and Clean Energy Commitments

New Construction; Other Solar and Clean Energy Commitments	**Are there state or local standards for new construction that reduce barriers to solar deployment?**			**Plans and commitment to supporting solar energy and other clean energy deployment.**
Bridgeport	No (R)	No (C)		Comprehensive Plan includes a Sustainability Plan and a specific Energy Plan, including support for municipally-owned solar arrays.
Cornwall	Yes (R)	No (C)	Cornwall does enforce the state statute encouraging consideration for passive solar in its subdivision regulations, but no subdivision development since 1990s. Space between lots makes solar access concerns minimal.	Energy Task Force works to support renewables.
Coventry	None			Town Plan of Conservation and Development encourages alternative energy sources. Clean energy task force.
Danbury	No (R)	No (C)		
Fairfield	Yes (R)	No (C)	Subdivision regulations mirrors state in that it suggests that renewables, solar access and passive solar should be considered.	
Greenwich	Yes (R)	No (C)	Subdivision regulations require thate homes are aligned to make use of passive solar	Greenwich Plan of Conservation and Development encourages use of solar energy. Solar starting to be seen as economic investment rather than just as a value statement.
Hampton	Yes (R)	No (C)	Subdivision regulations note being enforced anywhere in CT.	
Manchester	Yes (R)	No (C)	Subdivision regulations support consideration of energy conservation, renewables and passive solar techniques, mirroring state statute.	Looking at Capital Region Sustainable Communities plan recommendations for renewables. Intends to share with neighboring town planning commissions and discuss further.
Middletown	Yes (R)	No (C)		Clean energy task force
Milford	Yes (R)	No (C)	Subdivision regulation suggests use of passive solar techniques.	
New Haven			There are no municipal subdivision regulations.	City plan encourages use of clean energy.
Stamford	Yes (R)	No (C)	For new construction, it is required that "energy conservation" is considered in Stamford's subdivision regulations, which include passive solar.	Stamford is undergoing a comprehensive master plan update, which will include ways to foster more sustainable energy development.
West Hartford	None			Clean energy task force

Appendix V
Installer Planning and Zoning Survey

1. Are there towns in CT which require a planning and zoning (P&Z) permit or P&Z approval to install rooftop solar PV?

- Trumbull, Reading, Fairfield, Newtown - anything west of Highway 95.
- Most towns do if you have a ground mount near setbacks or near wetlands for residential. For commercial, you never know what a town could come up with.
- For a 6 kW ground mount system, the Town of Willington wanted a professional site plan to scale. If it was over 10’ tall it would require P&Z review.
- No, but some towns do have a review for commercial sites that are on main streets.
- None that we’ve found yet.
- Yes, Towns need more education to feel comfortable letting some things go. We in the electrical industry are used to this kind of process. Other out of state companies are not accustomed to this protocol.
- Yes, it’s on a case by case basis.

2. Are you aware of any P&Z restrictions/hurdles to rooftop solar PV installation in CT towns (e.g., height restrictions, aesthetic requirements, homeowners association restrictions, restrictions in historic districts)?

- Not yet, condo associations have been slow to adopt solar.
- Historic districts and aesthetic requirements for residential, and aesthetic requirements for commercial sites.
- Some homeowners associations and historic districts have restrictions, but this is usually a minor problem and most approve installations upon review.
- None so far.
- No.
- Yes, all exist in one town or another. Most are not onerous except for the separate applications or application order (for example Falls Village). Chief grievances are treating PV installs flat against the roof as potential height variations; there should be an exception if less than 5” are added or if the PV does not extend above the ridge line. Another is treating ground mounts as structures and requiring them to meet setbacks; the ground mounts should be viewed in this case as fences (if under 8’ or so) so they can be backed neatly up to the property line. If plantings to hide the system are required, fine.

3. Are there improvements you would recommend to P&Z ordinances in CT towns to remove hurdles to rooftop solar PV installation?

- No, but we would like a better inspection process. Hanging wires are not good. We don't want solar to get a bad name from a few reckless installers.
- Does DOT need municipal approval to install a culvert? CEFIA projects are state level DEEP projects. Municipalities can tag along for community awareness, but should not hold the strings.
- None so far.
- If a company has best practices there should not be any problems. For those who try and skirt the system these things need to be in place.
- Same as stated in previous question.

4. Are you aware of any green, sustainable or solar-friendly P&Z ordinances in CT?

- Fee limit in Durham to $200.
- No
- Some towns have eliminated permitting fees.
- No.
- No.
- No.

5. Are you aware of any green, sustainable or solar-friendly P&Z ordinances in other states?

- Fee elimination in East Haddam. Both East Haddam and Durham fee changes were passed with help from solar installers.
- No.
- California
- No.
- No.

6. Other comments/suggestions?

- Make it all online at least so it is all done without using paper.
- Someone at CL&P recently told my electrician that line side tap is not permitted on 100 amp service? Let's ensure this is not true or doesn't become a rule. Can we get a centralized single pre-approval on electrical diagrams? Not all parts have only one way to be installed. I was taught one way, municipal inspectors think it should be another way despite code, and Richard Dziadul wants to see things another way. At least Richard will consider alternatives with code based arguments. Richard is helpful and informative at the end of process, but these issues should be clear before we start. Let's not waste SunShot funds trying to get a bunch of municipalities on the same track. CEFIA is now a branch of DEEP, so CEFIA projects are state level projects. DOT doesn't need town permission to install a culvert. Municipalities follow state building codes. Let's build a centralized state level solar permit process.
- We license holders in Connecticut work hard to earn our licenses and continue to with CEU courses mandated by our state. By introducing a limited PV license, an E-1 unlimited license loses value. By introducing the limited license for PV we in Connecticut are opening up other industries to do the same. For example, swimming pool companies will want a limited license for wiring swimming pools, landscape companies will want a limited license to wire landscape lighting and so on. How could we deny other industries and allow PV, and before we know it E-1 and E-2 licenses have no value.

Appendix VI
Planning & Zoning – Example Solar Access Ordinances

Permitting and Recordation Ordinance

Permitting and recordation ordinances protect a home owner's investment in a solar collector by creating a "first-in-time, first-in-right" system that preserves the solar collector's access to sunlight. If the owner of solar collector successfully obtains and records a solar access permit, future construction will not be allowed to obstruct solar access. Such an ordinance should include the following elements:

- **Record solar agreements:** The ordinance should provide a recordation procedure that provides for documentation of solar easements, agreements, and permits in the local land records.
- **Establish Guidelines for Permits:** The ordinance should issue solar access permits based on a "first-in-time, first-in-right" concept, and should not place any restrictions on vegetation or structures that predate the collector. The ordinance should provide for a permit to be revoked if it is not put to beneficial use—i.e., the owner removes its solar panel or the panel falls into disrepair. The ordinance should provide for a maximum time period of non-use before the permit is terminated. The ordinance should provide an exception for de minimis obstructions of a solar collector that arise after recordation, and should define what level of obstruction qualifies as de minimis.
- **Establish Procedure for Obtaining Solar-Access Permits:** The ordinance should create a clear procedure for obtaining a solar-access permit, which includes, at a minimum, notification of potentially affected property owners, ability for affected property owners to request a hearing on the issuance of the permit, and opportunity for appeal. The ordinance should provide for criteria for when the permit will or will not be granted. For example, the ordinance may provide that the permit will not be granted if a neighboring land owner can provide evidence of pre-existing plans to build a structure that will obstruct the solar panel. This procedure may also include a mechanism for cost-allocation or recovery to affected property owners.
- **Outline Access Reconciliation Procedures**: The ordinance should provide a remedy for interference with a permitted solar collector. For example, if a neighboring property owner's tree obstructs a pre-existing solar panel, the neighboring property owner should be responsible for the costs of trimming the restricted vegetation. Permits should not be granted to neighboring property owners for structures that will obstruct a pre-existing permitted solar collector.

Solar Envelope Ordinance

Solar envelopes provide a more comprehensive form of solar rights protection, and place more restrictions on neighboring properties than the "permit and recordation" ordinance model. For this reason, the "permit and recordation" model may be preferable for some towns. Solar envelope ordinances work by creating solar overlay zones that impose solar fences around a property on the property line. Shadows from structures on neighboring properties may not exceed a shadow that would be cast by the hypothetical solar fence on a certain day and time of the year. For example, Boulder, Colorado's solar envelope ordinance creates two different solar overlay zones, which create either a 12 foot or 25 foot solar fence that neighboring properties must comply with (i.e., the shadow from any building or structure on a neighboring property, may not exceed the shadow cast by a 12 foot or 25 foot fence on the property line, between 9am-3pm on the winter solstice). Boulder combines the solar envelope model with the permit and recordation model by creating a third zone where no fence is imposed because such fences might unduly burden development. In these no-fence overlay zones, solar access permits are available. It is thus possible to combine the solar envelope model and the permit and recordation model, depending on the needs and pattern of development of the municipality. If a town chooses to adopt a solar envelope ordinance, we recommend that it should include the following elements:

- **Define Applicable Structures:** The ordinance should exempt pre-existing structures from complying with the ordinance and should create an exemption for de minimis breaches of the solar fence, and should define what level of obstruction qualifies as de minimis.
- **Develop Calculation Method for Solar Envelope:** The ordinance should clearly define the scope and method of calculating a solar envelope. A variety of solar envelope models exist other than the solar fence model adopted by Boulder. Ashland, Oregon, for instance, uses a formula to ensure that buildings on properties on the south facing side of a property are a certain setback distance from their northern property line.
- **Specify Duration of Envelope:** The ordinance should specify the time frame for which the solar envelope is in effect. Many existing solar ordinances enforce the envelope to protect solar access from 9am to 3pm on the Winter Solstice—the day on which the longest shadows occur.
- **Determine Appropriate Envelope Overlay Zones:** The ordinance should only use solar envelope overlay zones where such zones are feasible in light of the development pattern of the underlying zones involved. Some neighborhoods may be well positioned to adopt such an envelope, while heavily developed neighborhoods or neighborhoods with a high-development potential may be ill-suited to the solar envelope model. Close evaluation of the development characteristics of a municipality's neighborhoods is required to determine whether this model is feasible.

Appendix VII
Sample Solar Site Design Worksheet for a Proposed Subdivision

Please provide information in the fillable form below to describe how the developer of the proposed subdivision has considered solar access in the design of the subdivision site and homes.

Street and Lot Layout

☐ Home lots are arranged on streets that run within 20 degrees of east/west to maximize solar exposure

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

House Orientation

☐ Homes are designed in a manner that the longer axis of the house is aligned within 20 degrees of east/west in order to maximize solar exposure

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

☐ Homes are designed so that south-facing roof surfaces (and more generally, sections of the roof ideal for placement of solar energy systems) receive unobstructed sun between 9 am and 3 pm

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

☐ Homes are designed so that primary living spaces include a southern exposure

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

☐ Homes are designed so that at least 50% of window area contributes to passive heating during the heating season and are shaded in the cooling season (attach calculations)

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

Vegetation

☐ Plantings support solar access

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

Protection of solar access within the development

☐ Subdivision regulations protect solar access

If yes, describe details below. If no, describe reason(s) not implemented (include attachments if needed)

____

Appendix VIII
Installer Interconnection Survey

1. What is your experience with rooftop solar PV interconnection in CT in terms of process, timing, requirements, cost?

- It is very costly and very time consuming. Even the utility requires a printed and mailed copy of paperwork and a check. Interconnection should be free in CT.
- Generally painless. Used to the process. 1-2 week turn around. Average $350 for under 10kW. New Haven was painful and took 1-2 weeks turn around.
- The municipal permitting process is a large part of our soft cost. Unfamiliar building inspectors require unnecessary engineering. Many take a subjective position on a job that should be fact and code based. In construction the inspectors are met with while other parts of the project are in progress. For us meeting with inspectors is another trip back to a project that has been finished and we could be working across the state. Many inspectors don't have evening hours, so access to the house can be a challenge to schedule with the homeowner.
- Residential and commercial PV systems - about 100 systems in CT.
- The process is time consuming and expensive, much more so with systems over 10kW. An average residential job is around $1,000 with interconnection costs. Average commercial job is substantially more.
- Category 2 takes too long and too expensive.
- I have no issues with the process. I would like to see more representatives to keep up with the load. I suggest having the clearance desk reps assigned to certain areas.
- Well run program, modest cost ($100 for 10 kW and under), inspections waived after a few passes.

2. What are the costs associated with interconnecting rooftop solar PV in CT? How could these costs be reduced?

- Getting permits and doing the utility application is extensive and time consuming. A registration policy will eliminate this similar to Vermont.
- Electrical permit, building permit, interconnection. Unsure.
- Let's build a centralized state level total permitting process so we only have one inspector. Send the municipality a token $100 to verify that the house is constructed to modern code. This information should be on file so they don't even have to go to site. Use the SunShot $ to build this process. Our fees will maintain it.
- $100 if 10kW or less, $500 for 10kW+, witness test fee usually $500. I think these are reasonable.
- Application fees usually amount in the $200-$500 range. Biggest expense is time associated with witness tests and scheduling.
- CL&P & UI category 1 $100 (negligible), category 2 $500 for interconnect and $550 for witness test (both too much).
- Costs are passed to the rate payer. The cost should be absorbed before the installer or the rate

payer sees them. Taken by the utility on a case by case basis out of the fund making less paper work for the installer. This does not lower the cost but makes it more efficient for the installer.

- Some are advocates of removing the utility disconnect requirement (as inverters are 1741 listed). I'd leave that decision to safety studies.

3. In what ways can the rooftop solar PV interconnection process be improved in CT?

- Eliminate it at the state level and the utility can just register them without any paperwork or fees. Pass a law like Vermont's law.
- Consistency.
- Interconnection works well. But please remove the unfamiliar building inspectors from the required steps.
- It is pretty good compared to some other states and their utilities. The downside is after the town inspection. Some inspectors are not computer savvy and never fill in the proper information so we can move to interconnection and net meter the installation.
- Need faster and simpler process. Updating existing metering systems would also be helpful.
- Requirement for homeowner signature can delay process – establish electronic signature process or eliminate need for homeowner signature.
- Costs are passed to the rate payer. The cost should be absorbed before the installer or the rate payer sees them. Taken by the utility on a case by case basis out of the fund making less paper work for the installer. This does not lower the cost but makes it more efficient for the installer.

4. What is your experience with coordination between municipal permitting and utility interconnection, including coordination on inspection requirements, on-site inspection times, and approval notifications?

- Coordinating with towns for the final inspection is time consuming and they usually do not know enough about electrical parts for solar to do a good survey anyway. Having a CEFIA trained inspector is enough to keep quality high and eliminate all local and utility permits.
- 7 years used to working with towns. Hardly any problems.
- Some inspectors approve online the same day, others take a week. This is a bad set-up. Having unfamiliar inspectors with so much power. Please change the format. New installers should have a pre net meter inspection by CEFIA, post inspection for those of us that have earned it, or let us request a pre inspection or project review if a project is out of norm.
- This is the weakest link, not from utilities but inspectors doing the proper online submittal in a timely fashion. CL&P is pretty good and timely. Usually temporary interconnect within a week and net meter usually 1-2 weeks after inspector filing.
- After the local inspection we call the town and ask them to release the job to the utility company. There are some instances where the town does not know how to do this or realize it needs to be released to the utility company. CL&P has a way to keep track of the job and where it is in the release process. You need the utility job number and the town the customer lives in and you can access the online feature from their website.
- Scheduling witness tests can be difficult as three parties are involved (utility company, customer, and contractor). The utility company does not seem to have set available hours (Monday-Friday

9am-5pm, etc) as the local municipality does. The utility company picks a date and time and asks if you can make that time and then contact the customer to confirm they can as well.

- CL&P witness test are always scheduled at least 10 days after the job has been released. UI witness tests are after scheduled after 5 business days of the job being released. The weather impacts the witness test and rescheduling can be difficult as well as costly in some cases.
- The amount of time the witness test takes is 15-30 minutes for the entire process which is great. CL&P usually sends the approval to us within 2 business days of installing the net meter via email. UI sends the approval to us several days after the witness test and via snail mail for the customer (the customer already has the ok to power on the system after the witness test though).
- All takes too long. Some towns advise utilities of inspection approval directly, others require contractor to handle; inconsistent. CEFIA inspections take too long – perhaps due to third party contractors for inspections.
- More educational courses for inspectors, they would understand how easy the process could be, and inspectors would be more comfortable with installers. On the flip side there are so many companies jumping in the game because of how easy the state has made it for licensing for example for HIC, laborers, even painting companies hiring out of state unregistered workers spoils the industry and inspectors need to be harsh with everyone. I think the more control of registered workers and licensing needs to be in place before inspectors and interconnection would be easier.
- No coordination, separate tracks, doubtful coordination (desirable) would be possible in this area.

5. What best practices for rooftop solar PV interconnection would you recommend from CT or other states?

- See Vermont's process.
- Consistency
- The more electronic the process can become the quicker the process will become. Credit card processing for payments would also speed up process.
- Like Massachusetts. Only electrical contractors should install PV, no laborers, no HIC contractors, no out of state unregistered workers.

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: Board of Directors

From: Bryan Garcia, President and CEO, and Mackey Dykes, Chief of Staff

Cc: Suzanne Kaswan, Vice President, Human Resources, Connecticut Innovations

Date: October 18, 2013

Re: Sick Leave Bank Policy Revision

Background

Connecticut Innovations established a Sick Leave Bank in 2009. Employees donated sick time to this bank in order to allow employees with a qualified illness or injury to withdraw time from the Sick Leave Bank in order to be paid until our short term disability insurance becomes effective on the 31st day after the qualifying illness or injury. CEFIA adopted this policy at its inception in 2011 and the Sick Leave Bank is now jointly administered for the benefit of employees at both agencies.

Our benefits package has allowed us to recruit several incredibly high caliber candidates. The Sick Leave Bank is an important part of that because:

- CEFIA employees presently earn ten sick days per year – five less than employees at most State Agencies (due to the paid short and long-term disability insurance that employees receive);
- CEFIA has a young workforce with many recent hires and employees haven't had the opportunity to build up these sick leave balance; and
- CEFIA has no paid maternity leave policy.

Recommendation

Currently, the Sick Leave Bank policy requires that employees exhaust all other time (vacation, personal leave and compensatory time) prior to accessing the sick leave bank. However, once short term disability insurance coverage begins (31 days after a qualified illness or injury), an employee is only paid about 70% of their pay. They can supplement this using their leave accruals (vacation, personal leave), but they can't supplement this with sick accruals. In addition, if an employee had to take all their accruals prior to accessing the Sick Leave Bank, it would leave them with no accrued time. This makes it difficult in the event of a serious illness or injury to deal with follow up appointments or family issues relating to the birth of a child.

CEFIA and CI staff recommend modifying the Sick Leave Bank Policy by removing the requirement that employees exhaust their personal leave, vacation and compensatory time accruals. Employees should still be required to exhaust their sick leave accruals before accessing the Sick Leave Bank. However, removing the requirement to exhaust all other accruals will allow employees to supplement their pay when short term disability kicks in. It also won't exhaust all their leave balances. There is no cost to CEFIA as a result of this modification.

Resolution

WHEREAS, the CEFIA Handbook Sick Leave Bank Policy requires that employees exhaust vacation, personal and compensatory leave prior to withdrawing leave from the CI/CEFIA Sick Leave Bank;

WHEREAS, in order to recruit and retain qualified employees, we would like to be able to offer an attractive benefit package including the opportunity to be paid in the event of a qualifying illness or injury, and there is no cost to the agency;

NOW, therefore be it:

RESOLVED, that the Board approves that the CEFIA Handbook can be revised as follows:

The CEFIA Sick Leave Bank is a pool of sick days that has been established by employees of CEFIA who have made a donation of their accumulated sick days. The Bank is available to members to draw up to ten (10) eight- hour sick days per year in the unfortunate event that they experience a qualified illness or injury.

Sick Leave Bank members will receive benefits in the form of paid sick leave if all of the following requirements are met:

- the member has a medical condition that prevents them from working that has been verified by a Medical Certificate OR a member's immediate family member has a medical condition that has been verified by a Medical Certificate and requires the Sick Leave Bank member's care.
- the member has been out on approved medical leave (paid or unpaid) as described above for at least two consecutive weeks.
- the member has exhausted all of their sick[~~, vacation, personal leave and compensatory~~] time
- the member has not been disciplined for an absence-related reason for the past 12 months
- the member has completed a Sick Leave Bank Withdrawal Request Form and it has been approved by human resources

Submitted by: Bryan Garcia, President and CEO, and Mackey Dykes, Chief of Staff

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

October 25, 2013

Kathleen H. Burgess
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New York State Public Service Commission
Empire State Plaza
Agency Building 3
Albany, NY 12223-1350

RE: Public Comments on the Petition of New York State Energy Research and Development Authority to Provide Initial Capitalization for the New York Green Bank [Case 13-M-0412]

Dear Secretary Burgess:

On behalf of the State of Connecticut and the Board of Directors of the Clean Energy Finance and Investment Authority ("CEFIA") – Connecticut's "Green Bank" – I am submitting the attached public comments pertaining to Case 13-M-0412 "Petition of New York State Energy Research and Development Authority to Provide Capitalization for the New York Green Bank" filed by NYSERDA on September 9, 2013.

The petition requests repurposing $165.6 million in uncommitted NYSERDA EEPS I and SBC III funds, uncommitted utility EEPS I funds, and NYSERDA RPS funds to provide the initial capitalization for the New York Green Bank ("NYGB"). The NYGB would use public dollars to mobilize private sector capital to stimulate the growth of New York's clean energy economy.

The public comments submitted by CEFIA are intended to:

- Provide background on CEFIA, to provide some context for our relation to the NYGB;

- Highlight some of the results experienced by Connecticut to date in launching its "Green Bank" that are relevant to the issues identified by NYSERDA in this petition;

- Acknowledge some of the challenges CEFIA experienced in establishing Connecticut's "Green Bank" so as to help the NYGB avoid or at lease learn from those experiences – with a focus on administration, governance and personnel; and

- Identify areas of opportunity where CEFIA can partner with the NYGB – including product development market assessment and metrics and evaluation.

CEFIA looks forward to working with NYSERDA, the NYGB, and other key stakeholders to offer easier access to affordable capital that provides cleaner, cheaper, and more reliable sources of energy for our states while creating jobs and supporting local economic development.

Background

CEFIA was introduced by Governor Dannel Malloy and adopted by the Connecticut legislature with bipartisan support as an integral part of Connecticut Public Act 11-80, “An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut’s Energy Future”.[1]

The rationale for CEFIA is to:

- Create a flexible portfolio approach to clean energy in which the marketplace (not the government) picks winners and losers;
- Focus on deployment of commercially available technologies at scale to lower costs;
- Drive “all cost effective” energy efficiency in government, institutional, residential, and commercial and industrial sectors;
- Push for “deeper” energy efficiency – covering not just lighting but also heating, ventilation, air conditioning, insulation, windows, machinery, and appliances; and
- Move away from traditional “subsidy” approaches to a “finance” model – using limited government resources to leverage private capital.

In short, CEFIA was established to do more clean energy deployment with less ratepayer resources at a faster rate than the subsidy-driven model.

As the nation’s first state-level “green bank,” CEFIA’s mission is to support the Governor’s and Legislature’s energy strategies to achieve cleaner, cheaper, and more reliable sources of energy while creating jobs and supporting local economic development.

CEFIA is governed by an eleven (11) member Board of Directors that includes ex-officio members and Gubernatorial and Legislative appointees that oversee the quasi-public organization in accordance with its bylaws, operating procedures, comprehensive plan, and fiscal budget. CEFIA has a memorandum of understanding with Connecticut Innovations – Connecticut’s quasi-public venture capital organization – to provide administrative support services, including accounting, HR, and IT departments. CEFIA has a staff of thirty (30) professionals focused on the residential, commercial and industrial, institutional, and infrastructure sectors.

CEFIA’s goals are to:

- Attract and deploy capital to finance the clean energy[2] goals[3] of Connecticut, including:

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[1] §99

[2] It should be noted that for the purposes of CEFIA, “clean energy” has the meaning as provided in Connecticut General Statutes Section 16-245n(a), as amended from time to time. This includes, but is not limited to renewable energy, financing energy efficiency projects, storage, distribution, alternative fuel vehicle infrastructure, and manufacturing.

- Helping Connecticut become the most energy efficient state in the nation;
- Scaling up the deployment of renewable energy in the state; and
- Providing support for the infrastructure needed to lead the clean energy economy.

- Develop and implement strategies that bring down the cost of clean energy in order to make it more accessible and affordable to consumers.

- Reduce reliance on grants, rebates, and other subsidies and move towards innovative low-cost financing of clean energy deployment.

CEFIA's current balance sheet of current and non-current assets is approximately $100 million – $73 million of which came from repurposed funds of the Connecticut Clean Energy Fund (CCEF), CEFIA's predecessor, to capitalize CEFIA. CEFIA is funded on an ongoing basis by a $0.001 per kilowatt-hour surcharge on electric ratepayer bills that provides approximately $30 million of ratepayer capital a year without a sunset, allowance proceeds from the Regional Greenhouse Gas Initiative ("RGGI") for renewable energy and energy efficiency financing, access to bond proceeds from the state, federal competitive (e.g., SunShot Initiative) and non-competitive (e.g., ARRA-SEP) resources, and other sources.

Results to Date

CEFIA has been an official quasi-public organization by statute since July 1, 2011. In its first fiscal year – FY 2012 (i.e. July 1, 2011 through June 30, 2012) – the organization focused its efforts on governance (i.e. creating a Board of Directors, establishing a resolution of purposes, bylaws, and operating procedures), reorganization (i.e. rebuilding staff with the requisite skills and expertise in finance, developing employee policies, and forming a new organizational structure), strategic planning (i.e. developing a multi-year Comprehensive Plan and Budget), and new product development.

At the conclusion of FY 2013, nearly two (2) years after the passage of Connecticut's "Green Bank" legislation, CEFIA began to show results in terms of its goals:

- Attract and deploy capital to finance the clean energy goals for Connecticut, has resulted in:

  - **Leverage Ratio** – attracted $180 million in private capital using $40 million of ratepayer funds, of which $20 million of ratepayer funds used are in loans (i.e. paying back over time), thus achieving a leverage ratio of 9:1.

  - **Increase in Deployment** – deploying nearly 30 MW of new clean renewable energy as a result, including the largest fuel cell power plant in the United States.[4]

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[3] Goals are inclusive of Connecticut's clean energy policies (i.e. PA 98-28, PA 05-01, PA 07-242, PA 11-80, PA 13-298, etc.), including, but not limited to, the Integrated Resources Plan (§89 of PA 11-80), Comprehensive Energy Strategy (§51 of PA 11-80), and other clean energy public policies.

[4] A 15-MW fuel cell power plant manufactured by Fuel Cell Energy in Connecticut and installed on a redeveloped brownfield in a distressed community.

- **Comparison with the Subsidy Model** – from 2001 to 2011, the Connecticut Clean Energy Fund ("CCEF"), CEFIA's predecessor, attracted $155 million in private capital using $170 million of ratepayer funds, of which $15 million of ratepayer funds used were in loans, thus achieving a leverage ratio of about 1:1 and deploying 35 MW of clean renewable energy as a result.

Here is a breakdown of the comparative results of the subsidy model pursued by the CCEF versus the "Green Bank" model by CEFIA – see Table 1 below.

Table 1. Comparison of Subsidy Model (i.e. CCEF) versus "Green Bank" Model (i.e. CEFIA)

	CCEF	**CEFIA**
Period of Time	2001-2011	2012-2013
Private Capital Attracted	$155,000,000	$180,000,000
Ratepayer/Taxpayer Capital at Risk	($170,000,000)	($40,000,000)
Ratepayer/Taxpayer Capital Payback	$15,000,000	$20,000,000
Leverage Ratio	1:1	9:1
Clean Energy Deployed (MW)	35	30

The "Green Bank" model is focused on "doing more with less and faster."

- Develop and implement strategies that bring down the cost of clean energy in order to make it more accessible and affordable to consumers, has resulted in:

  - **C-PACE Warehouse** – in the process of selling-off of the first pool of Commercial Property Assessed Clean Energy ("C-PACE") energy efficiency and renewable energy transactions in the country which provides commercial, industrial, and multifamily end-users with access to low-interest and long-term financing for clean energy improvements, including deeper energy efficiency measures that aren't supported by conventional rebate programs.

  - **SunShot Initiative and Solarize Connecticut** – launched a pilot program based on "best practices" from Portland, Oregon and Massachusetts that reduced the installed costs for residential rooftop solar PV by between 20-30% (i.e. $7,500 per home). As the costs of clean energy have fallen as a result of reducing the "soft cost" of customer acquisition, the installed capacity more than doubled versus the best year of the CCEF in FY 2010. CEFIA expects to double its best year (i.e. FY 2013) again this year (i.e. FY 2014) and is adapting the community-based model to see if it works for natural gas conversions and energy efficiency. Initial indications are that it is working for natural gas conversions.

- Reduce reliance on grants, rebates, and other subsidies and move towards innovative low-cost financing of clean energy deployment, has resulted in:

  - **Residential Sector** – launching of four (4) residential sector financing products – the Smart-E Loan, Cozy Home Loan, CT Solar Lease, and CT Solar Loan – in partnership with nearly 15 local, state, regional, and national financial institutions. These financing products support renewable energy and energy efficiency, as well as other technologies that are consistent with the public policy goals outlined in Connecticut's Comprehensive Energy Strategy (i.e. EV recharging stations, natural gas conversions, etc.). It should be noted that in 2013, Connecticut passed on-bill repayment legislation for residential sector financing with shut-off and staying with the meter provisions. To date, CEFIA has trained approximately 100 installers on these products, and used $15 million of ratepayer and taxpayer funds to attract $75 million of private capital investment.

- **<u>Commercial and Industrial Sector</u>** – launching of C-PACE in just a little more than one year by onboarding nearly 60 cities and towns throughout the state comprising over 65% of the C&I building space, trained more than 200 contractors, closing on a warehouse of transactions, building a pipeline of projects which stands at over $75 million, and qualifying nearly 15 capital providers.

- **<u>Infrastructure Sector</u>** – financing the largest utility scale fuel cell project in North America, a 15-MW fuel cell project in a distressed municipality located on a reclaimed brownfield site. The project attracted $65 million of private capital investment from Dominion Resources, Inc. and created over 150 jobs in manufacturing, construction, and servicing of the fuel cell equipment.

By providing easy access to affordable capital, CEFIA has demonstrated through several proofs of concept the potential of the "Green Bank" model to do more with less and at a faster pace. In FY 2013, CEFIA's activities have resulted in the creation of 1,200 direct, indirect and induced jobs in a year and the reduction of 250,000 tons of carbon dioxide emissions over the life of the projects. Connecticut's "Green Bank" is helping make clean energy more accessible and affordable to consumers, building business for and creating jobs by contractors, and creating opportunities for local, regional, national and international capital providers to invest in clean energy in Connecticut.

<u>Challenges</u>
CEFIA has experienced numerous challenges in establishing Connecticut's "Green Bank". We would like to point these challenges out to the PSC so as to raise the level of awareness of issues that may arise and how potential barriers can be overcome.

These challenges include:

- **<u>Administration</u>** – CEFIA is a separate quasi-public organization that is capitalized by a repurposed pool of resources from the CCEF. This is different than the NYGB which is a division of NYSERDA. The NYGB operating as a division of NYSERDA for administrative purposes only (i.e. technical, administrative, financial/accounting, etc.) in the short-term (i.e. one to two years) seems reasonable, but over time it will want to become separate with its own governing authority. CEFIA has a Memorandum of Understanding (MOU) with Connecticut Innovations (CI) that outlines the administrative support it provides and would advise that NYSERDA and the NYGB execute a similar agreement to outline their mutual understandings.

  Here is a breakdown of the administrative support services that NYSERDA will provide to the NYGB based on the filed petition versus what CI provides for CEFIA currently under an MOU – see Table 2 below.

Table 2. Comparison of Administrative Services Provided by NYSERDA for NYGB versus CI for CEFIA

Administrative Services	NYSERDA for NYGB	CI for CEFIA
Technical	X	
Financial/Accounting	X	X
Contracting	X	
Human Resources	X	X
Communications	X	
Marketing	X	
Information Technology	X	X
Legal	X	

Similarities

There are several areas where CEFIA shares the same administrative support services based on the NYSERDA petition – financial/accounting, human resources, and information technology. With regards to financial/accounting, CEFIA's new "Green Bank" mission has required a complete transition of its financial statements. Working alongside CI, we have our own separate statements that are vastly different than the former CCEF, but CI provides the financial and accounting support we need. On human resources, CEFIA works closely with CI on staff searches and employee policies and procedures. CEFIA has restructured more than 50 percent of the staff that was at the CCEF. CEFIA has defined what staff skills and expertise it needs for its new mission and CI has provided the search services to deliver. And lastly, CEFIA shares CI's information technology infrastructure. Given that CEFIA now operates in two locations – one in close proximity to the financial hub in Stamford to attract talent – CI has been able to deliver solutions to allow for online meetings.

Differences

There are several areas where CEFIA differs from the NYSERDA petition with respect to administrative support services for the NYGB – technical, contracting, communications, marketing, and legal. With respect to technical support, CEFIA maintains several staff members with advanced degrees in engineering and experience with project development. Since CEFIA no longer supports early stage technology ventures, staff technical expertise is focused on engineering as it applies to project deployment to assist with understanding the risks of project financing. With regards to contracting, CEFIA has its own operating procedures that were brought before the Connecticut Law Journal for public comment. These procedures specify how we go about contracting so as to remain flexible and ensure responsiveness to market developments and business needs, while balancing our fiduciary responsibility to the Connecticut ratepayer for the appropriate management of funds. With regards to communications and marketing, CEFIA maintains its own identity given the different non-energy related mission of CI. This may not be the case between NYSERDA and the NYGB as you share the same statewide energy policy goals. And lastly, with regards to legal, CEFIA has its own internal counsel, which CI does not – CI subcontracts out that work. Given the complexity of transactions and responsive business nature of CEFIA, we felt it was important to have our own independent counsel – in fact General Counsel and Chief Legal Officer – for transactions, governance, policy and regulatory matters that can be accessed and responsive on a daily basis.

- **Governance** – the establishment of a NYGB Advisory Committee to review the plans for and operations of the NYGB, without any voting authority poses a challenge. Not only will the Executive Director of the NYGB have to manage two different governing authorities – the NYSERDA Board and the NYGB Advisory Committee – but, there may be times when the NYSERDA Board disagrees with the NYGB Advisory Committee. The CCEF was a division of CI before it became a separate quasi-public authority through CEFIA. The CCEF had an Advisory Committee that experienced many challenges with the CI Board when they disagreed on management, operational, transactional, policy, and other important matters. This caused the CCEF unnecessary disruptions. Now that CEFIA is its own quasi-public authority with a Board of Directors with full voting authority, there have been no issues with respect to CI and its role in providing administrative services to CEFIA.

  To overcome this challenge, CEFIA recommends that NYSERDA establish a subcommittee of its Board with full decisional authority to review and approve transactions that arise from the NYGB that are consistent with its strategic plan and budget. This subcommittee would be comprised of individuals with expertise in clean energy financing and operate under the Executive Director's leadership who would serve in an ex officio and non-voting capacity to the subcommittee. The chair of this subcommittee would be designated by the President of NYSERDA.

- **Personnel** – the expectations of a state-level "Green Bank" delivering on its promise in a short period of time are extraordinary. Finance industry professionals know that it takes time to develop financing products that serve specific market needs. The demands on the incoming Executive Director of the NYGB will be extreme to deliver immediate results. To that end, based on experiences in Connecticut, we recommend the following three positions be considered priority hires for the NYGB:

  - **General Counsel** – given the complex nature of transactions and the need to be responsive to an organization in start-up mode, having an on-staff general counsel who can ensure that decisions are being made within a defined set of processes and procedures while balancing the need for the NYGB to be responsive and open for business with the finance industry is important.

  - **Chief of Staff** – recognizing that the NYGB is starting anew, there will be a need for someone who works closely with the Executive Director to hire staff with the requisite expertise while balancing organizational resources and compensation policies. CEFIA's Chief of Staff serves an operations function that is necessary when building an organization.

  - **Chief Investment Office** – developing financial products is the core to the success of the "Green Bank" model. The hiring of an industry expert in finance (i.e. investment banking, public finance, etc.) will establish the organization's presence with the finance industry and allow the Executive Director to build the organization while ensuring that it supports the overall policy objectives of the state.

  It takes time to hire quality personnel. It will take 3 to 6 months to find and hire these individuals all the while the expectations on the NYGB will continue to increase.

These are a few of the challenges that CEFIA expects the NYGB will face as it establishes itself. CEFIA offers its assistance to the PSC, NYSERDA and the NYGB as it proceeds forward.

Opportunities

There are several areas of opportunity where CEFIA can work with the NYGB to advance the energy policies of Connecticut and New York respectively. These opportunities include:

- **Product Development** – Connecticut and New York face similar challenges. As neighbors, we experience related issues and pursue associated energy policy approaches. The following are areas where CEFIA believes product development with the NYGB can and should be coordinated:

  - **Micro Grids** – as a result of recent natural disasters, our states are pursuing the deployment of micro grids to ensure that critical facilities are powered during emergency time periods. We could create a regional fund to finance the clean energy generation (i.e. fuel cells, CHP, etc.) and distribution systems for our micro grids through a standardized process.

  - **C-PACE** – to build scale with commercial and industrial financing of renewable energy and energy efficiency, we could standardize our C-PACE programs to build larger warehouses of C-PACE transactions to attract lower cost and longer term private capital investment into our states.

  - **On Bill Repayment** – to build scale with residential financing of renewable energy and energy efficiency, we could standardize our on-bill repayment programs and combine loan and energy performance data hasten the path to securitization of these consumer obligations and achieve similar synergistic benefits as C-PACE coordination would provide.

  - **Financing Structures** – through public-private partnerships, we could develop specialized products with tax equity investors and debt providers to provide third-party financing at a lower cost of energy to end-users for solar PV, solar hot water, ground source heat pumps, fuel cells, anaerobic digesters, electric vehicle infrastructure, and other technologies. CEFIA has already demonstrated through its Solar Lease structure how a public-private partnership with tax equity investors and financial institutions can enable greater leveraging of Green Bank capital and a return of state incentives for reinvestment in other Green Bank activities. Through New York's creative use of the Clean Water Fund, we can develop financing structures for the public finance market and institutional investors that would provide our states with access to more affordable long-term capital.

  These are but a few areas of product development where CEFIA and the NYGB can partner. Also, working together to standardize contracts is important towards the scalability of clean energy assets as well.

- **Market Assessment** – understanding the market potential for clean energy in our states is important to determining the level of private capital necessary to attract to our efforts. The scope of work by Booz Allen Hamilton did not include a thorough assessment of end-user demand for financing in various market segments. Given the energy policies of our states, there may be opportunities to share resources and assess these markets together. CEFIA's efforts to attract private investment in Connecticut support the implementation of the Comprehensive Energy Strategy. Having a better understanding of the various end-user demand segments within that strategy and their interest in financing is important to the success of our programs.

- **Metrics and Evaluation** – CEFIA agrees with the energy, environmental and economic, financial, and market transformation performance indicators identified by NYSERDA in the petition. "Green Banks" are new entities with different objectives and approaches than the conventional subsidy model for market development. NYSERDA and CEFIA have been active participants in the State Energy Efficiency Action (SEEAction) Network[5] Financing Solutions Working Group (FSWG). The FSWG has recently been focused on facilitating a discussion on energy efficiency and renewable energy financing performance data (i.e. loan repayment performance, energy savings performance, etc.) collection and access. Through our respective organizations we can work together through a national effort to begin to define what success is for a state-level "Green Bank".

These are a few areas of opportunity where CEFIA and the NYGB can work together to support our state's efforts to provide cleaner, cheaper and more reliable sources of energy while creating jobs and supporting local economic development.

Conclusion

CEFIA appreciates to opportunity to provide the PSC, NYSERDA, and the NYGB with these public comments. The creation of the NYGB represents an extraordinary opportunity for Governor Cuomo to "do more with less and faster". CEFIA looks forward to working with the NYGB for years to come so that together we might provide easy access to affordable capital to support the development of our clean energy economies.

Best,

Bryan Garcia
President and CEO

[5] The State and Local Energy Efficiency Action Network (SEE Action) is a state- and local-led effort facilitated by the U.S. Department of Energy and the U.S. Environmental Protection Agency to take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020. SEE Action offers publications, events, and technical assistance to state and local decision makers as they provide low-cost, reliable energy to their communities through energy efficiency.