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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

January 13, 2012

Dear Clean Energy Finance and Investment Authority Board of Directors:

We are looking forward to seeing you all next week.

We will focus a large part of our meeting on a major legislative initiative to achieve the goal of deploying 30 MW of new residential solar PV systems by the end of 2022. Attached you will find our first Program Plan which outlines the details of this initiative.

Our regular meeting is scheduled for Friday, January 20, 2012 at 9:00 a.m. at our offices located at 865 Brook Street Rocky Hill, CT. For those of you that are interested in participating by webinar, we have established a capability to do that through iMeet.

To prepare you for the meeting, we have provided you with all of the necessary background information that will be covered on the agenda and the associated proposals and resolutions.

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

We look forward to the meeting next week.

Sincerely,

Bryan Garcia
President and CEO

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

AGENDA

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

Friday, January 20, 2012 – Regular Meeting
9:00-11:00 a.m.

Staff Invited: Jocelyn Anastasiou, George Bellas, Christin Cifaldi, Brian Farnen, Keith Frame, Bryan Garcia, David Goldberg, Dale Hedman, Dave Ljungquist, and Bob Wall

1. Call to order
2. Public Comments – 10 minutes
3. Approval of meeting minutes for December 16, 2011* – 5 minutes
4. Update from the President – 5 minutes
5. Residential Solar Investment Program update and recommendations* – 60 minutes
6. Financing Program priorities and recommendations* – 20 minutes
7. Approval of Committees 2012 meeting calendars* - 5 minutes
8. Other Business – 5 minutes
9. Executive Session – 15 minutes
10. Adjourn

* Denotes item requiring Board action

Call-in information: 1-719-867-0487 Audio Key: 772184

Log into iMeet room URL: http://www.imeet.com/cefia/cefia (instructions provided above)

Next Meeting: Friday, February 17, 2012 from 9:00-11:00 a.m.
Clean Energy Finance and Investment Authority, 865 Brook Street, Rocky Hill, CT

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

RESOLUTIONS

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

Friday, January 20, 2012 – Regular Meeting
9:00-11:00 a.m.

Staff Invited: George Bellas, Brian Farnen, Keith Frame, Bryan Garcia, David Goldberg, Dale Hedman, Dave Ljungquist, Peter Longo, and Bob Wall

1. Call to order

2. Public Comments – 10 minutes

3. Approval of meeting minutes for December 16, 2011* – 5 minutes

   Motion to approve the minutes of the Board of Directors December 16, 2011 Regular Meeting. Second. Discussion. Vote.

4. Update from the President – 5 minutes

5. Residential Solar Investment Program update and recommendations* – 60 minutes

   WHEREAS, Section 106 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) requires CEFIA to design and implement a Residential Solar Photovoltaic Investment Program (Program Plan) that results in a minimum of thirty (30) megawatts of new residential PV installation in Connecticut before December 31, 2022.

   WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to identify barriers to the development of a permanent Connecticut-based solar workforce and support comprehensive training and accreditation and certification programs.

   WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to offer direct financial incentives, in the form of performance-based incentives or expected performance-based buydowns, for the purchase or lease of qualifying residential solar photovoltaic systems.

WHEREAS, CEFIA has prepared a declining incentive block schedule ("Schedule") that: (1) provides for a series of solar capacity blocks the combined total of which shall be a minimum of thirty megawatts and projected incentive levels for each such block; (2) provides incentives that are sufficient to meet reasonable payback expectations of the residential consumer; (3) provides incentives that decline over time and will foster the sustained, orderly development of a state-based solar industry; (4) automatically adjusts to the next block; and (5) provides comparable economic incentives for the purchase or lease of qualifying residential solar photovoltaic systems.

NOW, therefore be it:

RESOLVED, that the Board hereby approves the Program Plan and Schedule.

RESOLVED, the Board directs CEFIA to submit the proposed Schedule to the Commissioner of the Department of Energy and Environmental Protection for approval as required by Section 106 of the Act.

RESOLVED, that the Board approves the allocation of $23,675,000 for the Program Plan fiscal years 2012 through 2014.

RESOLVED, that this Board action is consistent with Section 106 of the Act.

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 this Resolution.

6. Financing Program priorities and recommendations* – 20 minutes

WHEREAS, a major goal of CEFIA is to attract and deploy capital to finance Connecticut's clean energy goals;

WHEREAS, CEFIA must develop financing programs that attract private capital investment in Connecticut to enable a dramatic scale-up in clean energy deployment;

WHEREAS, the search for an Executive Vice President and Chief Investment Officer of CEFIA is taking more time and effort than had originally been anticipated; and

WHEREAS, Lamont Financial Services Corporation provides financial advisory services on public finance including support for the Connecticut Office of Policy and Management, Connecticut Office of the State Treasurer, Connecticut Health and Educational Facilities Authority, and the Connecticut Development Authority.

NOW THEREFORE BE IT:

RESOLVED, that the President of CEFIA shall engage the services of Lamont Financial Services Corporation to provide financial advisory services to assist with the development and implementation of new and innovative financing programs.

RESOLVED, that per CEFIA's Operating Procedures, the Chair and the President of CEFIA, are authorized to expend up to $150,000.00 over twelve (12) months for services such as these.

RESOLVED, that this Board action is consistent with Connecticut General Statutes § 16-245n and with the CCEF's comprehensive plan.

7. Approval of Committees 2012 meeting calendars* – 5 minutes

Motion to approve the Regular Committee Meeting Schedules for the Budget and Operations Committee, Audit, Compliance and Governance Committee, and the Deployment Committee for the calendar year 2012, as presented. Second. Discussion. Vote.

8. Other Business – 5 minutes

9. Executive Session – 15 minutes

10. Adjourn

* Denotes item requiring Board action

Call-in information: 1-719-867-0487 Audio Key: 772184

Log into iMeet room URL: http://www.imeet.com/cefia/cefia (instructions provided above)

Next Meeting: Friday, February 17, 2012 from 9:00-11:00 a.m.
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

January 20, 2012

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #2

Public Comments

January 20, 2012

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 December 16, 2011

January 20, 2012

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #4

Update from the President

January 20, 2012

Update from the President

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- **Chief of Staff Search Update**
- **ARRA SEP Grant Update**
- **Legislative Session Update**
- **Banking Tour**

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #5

Residential Solar Investment Program

January 20, 2012

Statutory Goal
Section 106

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

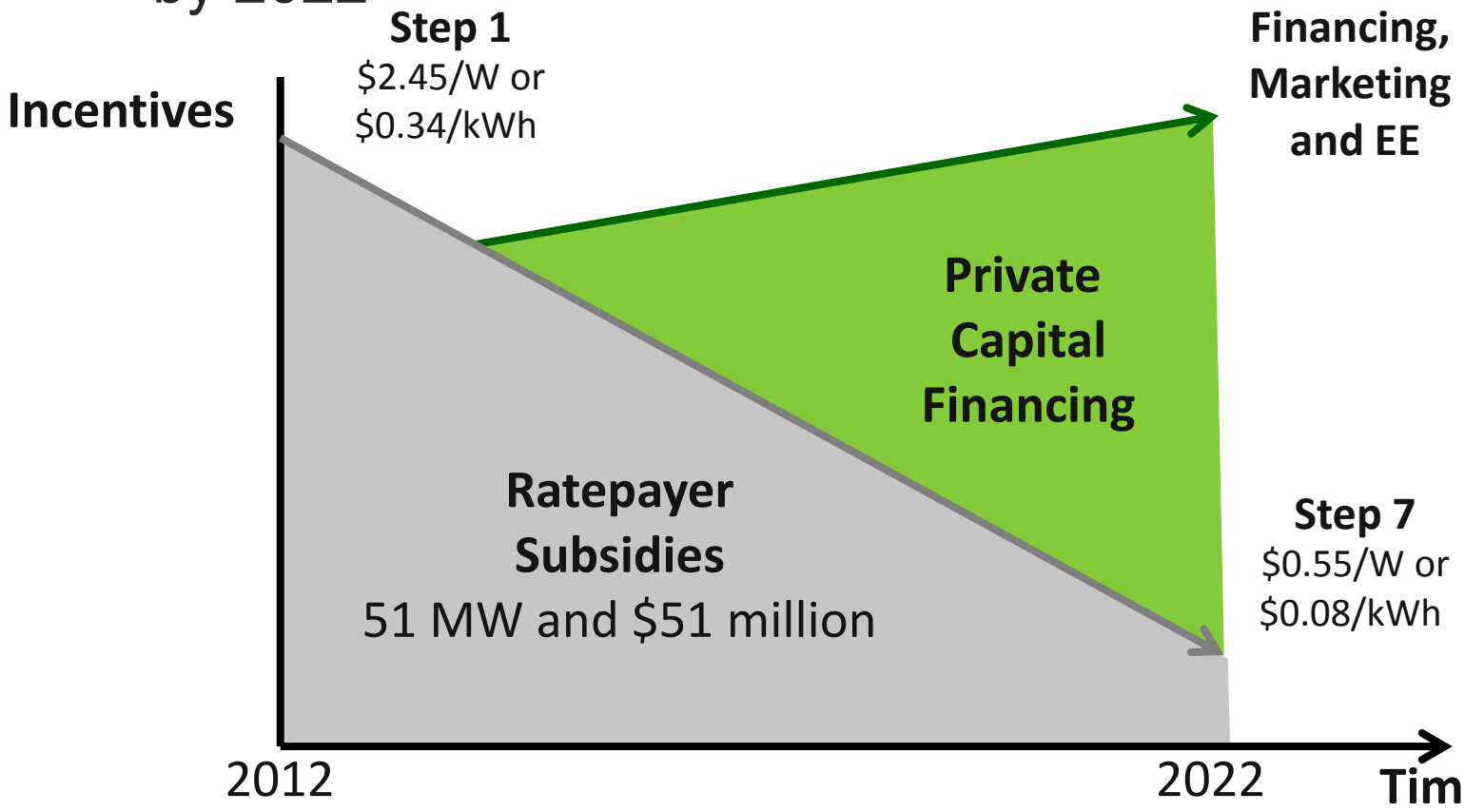
- The Clean Energy Finance and Investment Authority established pursuant to section 16-245n of the general statutes, as amended by this act, **shall structure and implement a residential solar investment program** established pursuant to this section, which **shall result in a minimum of thirty megawatts** of new residential solar photovoltaic installations located in this state **on or before December 31, 2022**, the annual procurement of which shall be determined by the authority and the **cost of which shall not exceed one-third of the total surcharge collected annually** pursuant to said section 16-245n.

CEFIA Goal

My Challenge to the Staff on the Policy

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

"Design an incentive structure that exceeds the 30 MW goal at half of the allowable costs (i.e. $90-$100 million) by 2022"



CEFIA Goal (cont'd)

My Challenge to the Staff on a Project

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

	Without EE	With EE	With EE and Lower Subsidy	With EE and Lower Interest Rate (4%)
Incentive ($/kW)	$2,450	$2,450	$1,463	$288
Avoided Monthly Energy Costs	$1,244	$1,983	$1,983	$1,983
Payback	10.5	7.6	10.5	11.6
IRR	6.00%	11.31%	6.00%	4.00%
NPV	0	$4,036	0	0

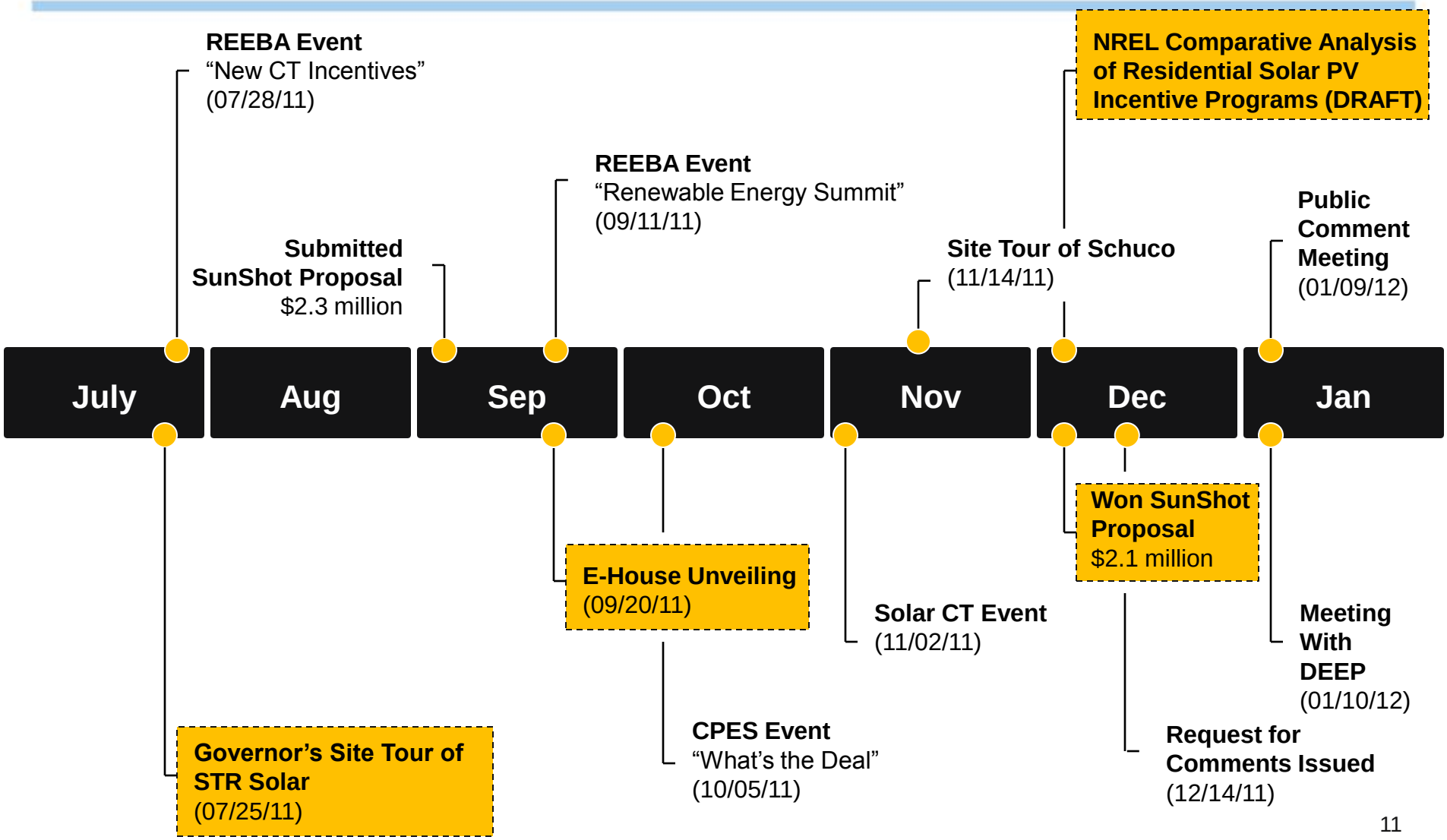
Which one is better for Connecticut?

REFERENCES

5 kW system, $5,000/kW installed cost, $2,450/kW EPBB, 14% capacity factor, 0.5% degradation rate, 2% inflation rate on electricity, $0.1826/kWh, 6% debt rate, 15-year term

Process
Stakeholder Engagement

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY



Residential Solar Investment Program
Key Components

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

	FY 2012	FY 2013	FY 2014	Total	% Budget
Incentives	$3,250,000	$6,500,000	$6,000,000	$15,750,000	67%
Financing	$3,500,000	-	-	$3,500,000	15%
Marketing	$600,000	$600,000	$300,000	$1,400,000	6%
Legal	$50,000	$100,000	$50,000	$200,000	1%
Workforce Development	$150,000	$700,000	$625,000	$1,475,000	6%
Technology	$100,000	$200,000	$200,000	$500,000	2%
EM&V	$100,000	$200,000	$200,000	$500,000	2%
Miscellaneous	$50,000	$100,000	$100,000	$250,000	1%
Total	**$7,800,000**	**$8,400,000**	**$7,475,000**	**$23,675,000**	

Residential Solar PV Incentive Structures
NREL Definitions of Incentives

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

- **Capacity Based** – upfront incentives either based on the DC or AC rating of the system, or based on the expected performance of the system by taking into account installation characteristics and equipment de-rating factors (i.e. EPBB)

- **Performance-Based Incentive** – paid out based on the number of actual kilowatt hours a PV system produces over some fixed time period usually between 5 to 10 years (i.e. PBI)

- **Environmental-Based Incentives** – depending upon the market, the environmental attributes that a PV system produces expressed in megawatt hours (i.e. SREC or ZREC)

- **Income Tax Credits** – some states provide personal income tax credits for a portion of the PV system cost incurred by the owner and there is a federal tax credit of 30% of the installed cost of the system (i.e. ITC)

- **Sales and Tax Exemption** – some states (i.e. Connecticut) provide an exemption for PV system components and/or installation from state sales (and property) tax.

REFERENCES
Comparative Analysis of Residential Solar PV Incentive Programs, NREL (December 2011)

Direct Financial Incentives
Section 106

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- The Clean Energy Finance and Investment Authority **shall offer direct financial incentives**, in the form of **performance-based incentives** or **expected performance-based buydowns**, for the **purchase or lease** of qualifying residential solar photovoltaic systems. For the purposes of this section, **"performance-based incentives" means incentives paid out on a per kilowatt-hour basis**, and **"expected performance-based buydowns" means incentives paid out as a one-time upfront incentive based on expected system performance**.

Direct Financial Incentives
EPBB and PBI

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EPBB

- Upfront incentive
- Supports local installers
- Ownership model – avoided cost of energy
- CEFIA incentive and federal tax credit to the household

PBI

- Paid out over time (i.e. 6 years)
- Supports investors
- Lease/PPA model – paying lower electricity cost for set period of time (i.e. 10 to 15 years)
- CEFIA incentive, federal tax credit and accelerated depreciation to the investor

Expected Performance Based Buydown

How the ownership model works

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

	Year 0	15-Year CashFlow
System Cost	($25,000)	
EPBB	$10,903	
Cost post EPBB	($14,098)	
Federal ITC	$4,229	
Avoided Costs		$18,666
Debt Interest		($5,373)
Net Cash Flow	($9,868)	$5,378
NPV	$0	
IRR	6.00%	
Payback (Years)	10.5	

REFERENCES

5 kW system, $5,000/kW installed cost, $2,450/kW EPBB, 14% capacity factor, 0.5% degradation rate, 2% inflation rate on electricity, $0.1826/kWh, 6% debt rate, 15-year term

"Cleaner and Cheaper!"

SolarCity®

SUNGEVITY
SOLAR HOME SPECIALISTS

SUN RUN

SunEdison
simplifying solar

Performance-Based Incentive
How the lease model works

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- **Appropriate Site** – contractor assesses whether or not the site is adequate
- **Price Quote** – contractor provides the household with a price quote and manages paperwork and processing
- **Agreement** – household decides to sign 10 to 15 year lease at a monthly fixed price
- **Electricity Savings** – lease payment is offset by the electric bill and the customer is saving money over time (i.e. 5 to 8 years)

Schedule of Incentives
Policy Performance

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FINANCE AND INVESTMENT AUTHORITY

"Doing more, with less"

Step	EPBB Budget ($MM)	PBI Budget ($MM)	Total Budget ($MM)	Estimate Installed Capacity (kW)	Estimate of Systems Installed	Estimate of Budget Months
1	2.75	2.75	$5.50	2,508	406	6
2	3.25	3.25	$6.50	3,466	561	8
3	3.75	3.75	$7.50	4,816	779	10
4	4.25	4.25	$8.50	6,858	1,110	15
5	4.50	4.50	$9.00	9,769	1,581	22
6	3.75	3.75	$7.50	11,397	1,844	26
7	3.25	3.25	$6.50	12,900	2,087	33
Total	**$25.50**	**$25.50**	**$51.00**	**51,712**	**8,368**	**120**

CEFIA can modify the approved incentive schedule

EPBB
Schedule of Incentives

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Step	EPBB Incentive ≤5 kW ($/W)	EPBB Incentive >5 kW and ≤10 kW ($/W)	Estimated Monthly Budget ($MM)	Estimated System Installs per Month
1	2.45	$1.25	$0.460	34
2	2.10	$0.90	$0.410	35
3	1.75	$0.55	$0.380	39
4	1.40	$0.20	$0.280	37
5	1.05	$0.00	$0.200	35
6	0.75	$0.00	$0.140	35
7	0.55	$0.00	$0.100	33

PBI
Schedule of Incentives

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FINANCE AND INVESTMENT AUTHORITY

Step	PBI Incentive ≤5 kW ($/W)	PBI Incentive >5 kW and ≤10 kW ($/W)	Estimated Monthly Budget ($MM)*	Estimated System Installs per Month
1	$0.34	$0.19	$0.460	34
2	$0.29	$0.14	$0.410	35
3	$0.24	$0.09	$0.380	39
4	$0.19	$0.03	$0.280	37
5	$0.14	$0.00	$0.200	36
6	$0.10	$0.00	$0.140	36
7	$0.08	$0.00	$0.100	31

REFERENCES

* Note – the payment of the PBI is over a 6-year period and not all upfront. The budget impact on cash is spread out over a six-year period.

Financing Program
Goals

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- Comprehensive loan that is technology agnostic (i.e. clean energy – energy efficiency, renewable energy, EV recharger)
- Require cost effective energy efficiency measures be undertaken to access the financing program
- Obtain loan capital from private sources using ARRA SEP grant repurposed loan loss reserve funds – target of at least 5 to 1 leverage ratio
- Buy-down the interest rate to a reasonable level for households to access the financing program – between 4 to 6 percent
- Use revolving loan fund (provided by the CEF) as a means to attract capital through a subordinated position
- Achieve monthly debt service payments less than or equal to the avoided energy costs

Financing Program (cont'd)
ARRA SEP Grant Repurposing

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- **Residential Clean Energy Financing Program** – $8,250,000 of the $20,000,000 from grant programs (i.e. solar thermal, geothermal, fuel cell, and solar PV) to a clean energy financing program

- **Residential Clean Energy Financing Program** – $7,000,000 allocation for LLR and IRB
  - Create an attractive loan (or lease) for large amounts of comprehensive clean energy measures (i.e. renewable energy and energy efficiency)
  - Obtain loan capital from a low-cost source with a leverage of at least 5:1
  - Build in an interest rate buydown to get towards a rate of 4 to 6 percent

- **Clean Energy Financial Innovation Program** – $1,250,000 allocation for credit enhancements (i.e. LLR, IRB, and TPI) to identify new and innovative ways to finance residential clean energy projects at scale and in underserved markets (i.e. low and middle income)

Marketing
Residential Solar Investment Program

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- **Goal** – scale-up customer demand and help homeowners realize the economic, energy and environmental benefits from energy efficiency and renewable energy

- **History of marketing innovation** – Clean Energy Communities Program
- **New program** – comprehensive with new and innovative approaches:
  - SunShot Initiative – MassCEC partner?
  - Solarize Connecticut
  - Neighbor to Neighbor Energy Challenge – Better Buildings program leader
  - Solar ambassadors and coaches – foundation proposal to match funding 1:1
  - Better Business Bureau

Workforce Development
Section 106

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

- (g) The Clean Energy Finance and Investment Authority **shall identify barriers to the development of a permanent Connecticut-based solar workforce** and **shall make provision for comprehensive training, accreditation and certification programs** through institutions and individuals accredited and certified to national standards.

Workforce Development
Barriers

CLEAN ENERGY
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- **December 2011 contractor survey results**
  - Collaboration with CBIA Education Foundation and CEFIA
  - Surveyed 120+ PV contractors and HES vendors – 80% surveyed are CEFIA approved contractors
    - 93% have difficulty hiring skilled workers
    - 76% identify applicants' lack of job-specific skills/qualifications as largest barrier to finding and/or retaining employees
    - 65% believe their current workforce will need to upgrade skills to continue performing their jobs

Workforce Development
Provisions

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- Training for contractors
- Clean energy workforce RFP
- Green technologies initiative
- Clean energy internship program

Technology and EM&V
Residential Solar Investment Program

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

Project Tracker – linked to Power Clerk and Aggregated into Incentive Level Blocks

Program Administrator

Contractor Portal

Customer Portal

Residential Solar Investment Program
Budget

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

	FY 2012	FY 2013	FY 2014	Total	% Budget
Incentives	$3,250,000	$6,500,000	$6,000,000	$15,750,000	67%
Financing	$3,500,000	-	-	$3,500,000	15%
Marketing	$600,000	$600,000	$300,000	$1,400,000	6%
Legal	$50,000	$100,000	$50,000	$200,000	1%
Workforce Development	$150,000	$700,000	$625,000	$1,475,000	6%
Technology	$100,000	$200,000	$200,000	$500,000	2%
EM&V	$100,000	$200,000	$200,000	$500,000	2%
Miscellaneous	$50,000	$100,000	$100,000	$250,000	1%
Total	**$7,800,000**	**$8,400,000**	**$7,475,000**	**$23,675,000**	

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #6

Financing Program Priorities

January 20, 2012

Comprehensive Plan

"Big Picture" – Capital Continuum

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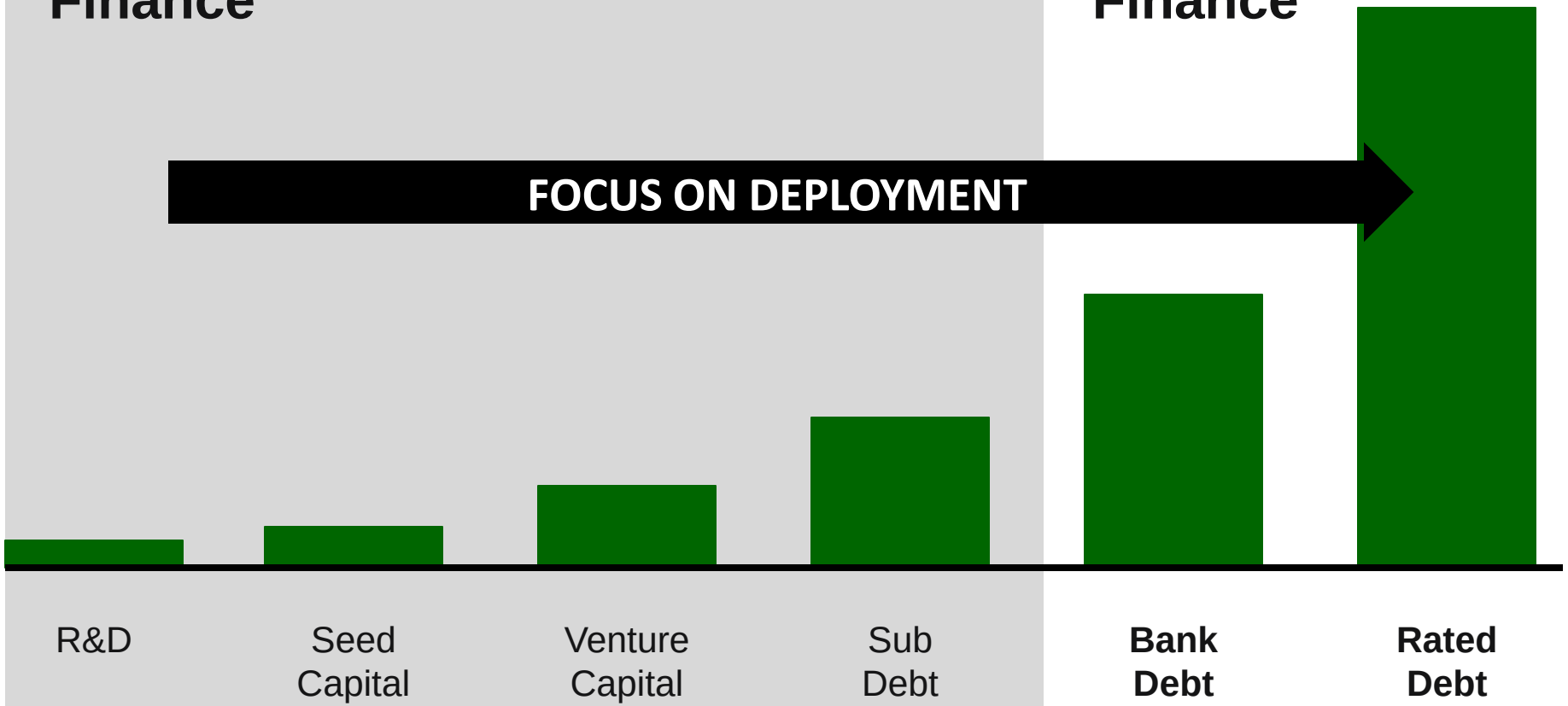
Innovation Finance

Deployment Finance



REFERENCES
CDFA Innovation Finance Reference Guide

Comprehensive Plan

Objectives and Financing Strategies (DRAFT)

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY

#1

PRIORITY ORDER

#6

End-Use Sectors	
	Residential
	Municipal
	Commercial
	Industrial
	Institutional
	Non-Profit

Objectives

Energy Efficiency (Example)

- Deliver all cost-effective energy efficiency by 2020 (20% by 2020)

Renewable Energy (Example)

- Achieve sustained orderly deployment

Finance Strategies	
Subsidies	EPBB and/or PBI
Enhancements	LLR, IRB, TPI
	ESPC
Loans	Loans and leases
Eco Markets	RECs, FCMs, CO2
	PACE
Bonds	CEVB

Financing Consultants
Program Design and Development

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- **EVP-CIO Search** – difficult time finding the right individual with the credentials (i.e. commercial banking or public finance) and willingness to join CEFIA – misaligned compensation and incentive structure between financial services industry and public service…need more time to find the right individual

- **Contractor Support** – continue to proceed forward with the development of innovative financing programs through subcontracting. Lamont Financial Services Corporation comes highly recommended by CDA and the Office of the State Treasurer.

- **Motion** – CEFIA to engage the services of Lamont Financial Services Corporation for a limited time period to provide financial advisory services to assist in the development and implementation of new and innovative financing programs.

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #7

Approval of Committee 2012 Meeting Calendars

January 20, 2012

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #8

Other Business

January 20, 2012

CLEAN ENERGY
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Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #9

Executive Session

January 20, 2012

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Board of Directors of the Clean Energy Finance and Investment Authority

Agenda Item #10

Adjourn

January 20, 2012

CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY
Board of Directors
Draft Minutes – Regular Meeting
Friday, December 16, 2011

A regular meeting of the Board of Directors of the **Clean Energy Finance and Investment Authority ("CEFIA")** was held on December 16, 2011, at the office of CEFIA, 865 Brook Street, Rocky Hill, CT.

1. **Call to Order**: Catherine Smith, Chairperson of the Authority, called the meeting to order at 3:37 p.m. Board members participating: Mun Choi (by phone); Mark Cirilli (by phone); Daniel Esty, Vice Chairperson of CEFIA and Commissioner of the Department of Energy and Environmental Protection; Norma Glover; Jonathan Harris, State Treasurer's Office; Reed Hundt (by phone), John Olsen (by phone); Matthew Ranelli; Catherine Smith, Commissioner of the Department of Economic and Community Development; and Patricia Wrice.

Staff Attending: George Bellas, Keith Frame, Brian Farnen, Bryan Garcia, David Goldberg (by phone), Dale Hedman, Dave Ljungquist, Shelly Mondo, Cheryl Samuels and Bob Wall.

Others Attending: Eric Brown, CBIA; Peggy Diaz, DPUC; and Henry Link, Enviro Energy Connections**.**

2. **Public Comments:** There were no public comments.

3. **Approval of Minutes of Meeting of November 21, 2011:**

Ms. Smith asked the Board to consider the minutes from the November 21, 2011 Board meeting.

> **Upon a motion made by Mr. Esty, seconded by Ms. Glover, the Board members voted in favor of adopting the minutes from the November 21, 2011 meeting as presented (Mr. Harris was not present for the vote).**

4. **Update from the President:**

Mr. Garcia introduced Attorney Farnen, CEFIA's general counsel. He noted that Attorney Farnen was one of 40 applicants. Mr. Garcia talked about Attorney Farnen's background and experience. The Board members welcomed Attorney Farnen, and it was noted that Attorney Farnen administered the oath of office to Ms. Wrice as a member of the Board before the meeting.

Mr. Garcia reported that a ribbon cutting ceremony was held last week for the Fuel Cell Energy fuel cell installation at Carla's Pasta in South Windsor. Also located in close

proximity is the fuel cell at South Windsor High School and UTC Power. Mr. Garcia mentioned that during the storm, the emergency shelter was open at the South Windsor High School that is powered by a UTC Power fuel cell. He also acknowledged Gladys Rivera for her work in securing Senator Blumenthal and Representatives Larson and Murphy for the fall 2012 Fuel Cell Summit.

Mr. Garcia provided an update on the American Recovery and Reinvestment Act projects. He mentioned that CEFIA is working closely with the Department of Energy and Environmental Protection ("DEEP") on filing revised grant programs with the U.S. Department of Energy in January 2012. He acknowledged the hard work of Ray Wilson and Dennis Thibodeau from DEEP.

Mr. Garcia indicated that staff will continue to e-mail to the Board a summary and various communications about on-going CEFIA activities.

Mr. Garcia mentioned that CEFIA received a SunShot Innovation Grant in the amount of $480,000 in round one from the U.S. Department of Energy ("DOE") to be used to reduce non-hardware related costs for rooftop solar installations. Mr. Garcia stated that CEFIA is currently working with 11 towns and various other partners (i.e. United Illuminating, Connecticut Light and Power, Yale, UCONN, DEEP, Snugg Homes, and the New England Governors Conference) to help standardize interconnection, net metering and local permitting processes. A suggestion was made by Mr. Ranelli to also include the Planners' Association in those discussions. Mr. Garcia mentioned that should CEFIA successfully complete round one then an additional $1.6 million is available for round two expansion of the program across the state and throughout the region. He noted that staff will continue to apply for competitive federal grants. A suggestion was made to make an announcement about the grant funds through the Governor's office. Mr. Garcia noted that CEFIA is already coordinating with the Governor's office on a press release for the New Year. He also acknowledged David Goldberg for his work in coordinating the successful grant application to the DOE.

5. <u>Budget and Operations Committee Update</u>:

Mr. Esty, Chair of the Budget and Operations Committee ("Budget Committee"), mentioned that the Budget Committee met on December 12. The Budget Committee recommends the approval of the proposed Operating Procedures. Mr. Garcia stated that a notice of intent for the adoption of the Procedures was posted in the <u>Connecticut Law Journal</u> on October 25, 2011 and posted on CEFIA's Website. Comments were received from UTC Power and CEFIA's former legal counsel, Attorney Stone, who offered grammatical changes. The grammatical changes were incorporated into the draft. Mr. Garcia noted that an additional change was made to clarify the definition of "Clean Energy Project" in the proposed Operating Procedures. Since the definition is a clarifying change and not substantive, CEFIA has been advised by legal counsel that the additional change does not require further public notice or comments. Mr. Esty mentioned that energy efficiency is covered in the definition because of the reference to the Connecticut General Statutes.

Upon a motion made by Ms. Glover, seconded by Mr. Hundt, the Board voted in favor of accepting the recommendation of the Budget Committee to adopt the Operating Procedures of the Clean Energy Finance and Investment Authority, including the clarifying language for "Clean Energy Project" (Mr. Harris was not present for the vote).

Mr. Esty stated that the Budget Committee also recommends the approval of the Employee Handbook and other policies and practices. Mr. Garcia explained that per the bylaws one of the responsibilities of the Budget Committee is to recommend to the Board various employee policies, internal control procedures and operational practices. He stated that the proposed CEFIA Employee Handbook, policies and procedures are the same as CI, but reference to CI was changed to CEFIA. Mr. Garcia stated that as requested by the Budget Committee, the proposed Severance Policy has been modified to clarify that eligibility is based on continuous service at CEFIA or "another State of Connecticut quasi-public agency." After further discussion, there was general consensus to amend the language further to include other state service rather than just quasi-public agency service as long as there isn't a break in service. In response to a question, it was noted that the other quasi-public agencies have Severance Policies.

Upon a motion made by Ms. Glover, seconded by Mr. Ranelli, the Board voted unanimously in favor of adopting the Severance Policy, as further amended in Section A. 1. as follows:

1. Either a lump sum payment or continuation on the payroll or a combination thereof of six weeks, plus for each full six month period of <u>continuous</u> service at CEFIA or another State of Connecticut <u>public or</u> quasi-public agency, an additional week of salary based on the employee's then current base salary, all subject to a maximum for each employee of 26 weeks;

Upon a motion made by Ms. Glover, seconded by Mr. Harris, the Board voted unanimously in favor of accepting the recommendation of the Budget Committee to approve the Employee Handbook and other policies and practices of the Clean Energy Finance and Investment Authority, including:

- **CEFIA 101—Purchasing and Accounts Payable**
- **CEFIA 102—Contracts**
- **CEFIA 103—Credit Cards**
- **CEFIA 104—Mobile Communications**
- **CEFIA 104A—Mobile Communications Pre-Approval Form**

Mr. Garcia mentioned that the Budget Committee reviewed and recommends approval of amendments to the Connecticut Clean Energy Fund ("CCEF") fiscal year 2012 budget. As a result of the reduction in the receipt of revenues from Regional

Greenhouse Gas Emissions auctions, staff recommends reducing projected revenues for 2012 by 9 percent. Mr. Garcia explained that the first two auctions were significantly lower than projected. However, the last auction was closer to anticipated projections. Based on the CCEF operating budget for 2011, staff recommends reducing expenses by 6 percent. Mr. Garcia reviewed the recommended changes to expenses.

Upon a motion made by Ms. Glover, seconded by Mr. Hundt, the Board voted unanimously in favor of accepting the recommendation of the Budget Committee to approve the revisions to the FY 2012 Operating Budget of the Connecticut Clean Energy Fund to the FY 2012 Operating Budget of the Clean Energy Finance and Investment Authority.

6. <u>Technology Innovations Program Update and Recommendations</u>:

Mr. Garcia noted that a presentation was made to the Board in November about Technology Innovations Programs. He mentioned that Section 99 of Public Act 11-80 indicates that CEFIA will fund emerging technologies that have significant potential for commercialization. Mr. Garcia stated that staff would like to continue discussions and obtain guidance from the Board on expectations regarding CEFIA's future with technology innovations.

Mr. Frame discussed innovation ecosystems in Connecticut. He discussed CEFIA's role through its Alpha and Operational Demonstration programs to identify emerging technologies with significant potential for commercialization for eventual government, industry, venture capital and angel investor funding. Mr. Frame talked about the funding gaps that exist for pre-commercial emerging technology and how CEFIA's programs help fill those funding gaps. He noted that CEFIA helps to reduce the technology risks so that the technology is more financeable to private investors. Mr. Frame discussed the applications received and those currently under review by staff for the Alpha, Operational Demonstration and other technology innovation programs. Mr. Garcia explained that the Technology Innovation Program has demonstrated extraordinary leveraging of CEFIA funding and provides a critical link from university research and development to entrepreneurs, investors and markets. In response to a question, Mr. Frame stated that funding is in the form of nonrecourse loans, payable upon commercial success.

There were varying opinions on the future role of CEFIA with respect to technology innovation and deployment. The Board discussed the importance of technology innovation in Connecticut and questions arose as to whether CEFIA is the appropriate agency to do that work. After a lengthy discussion on the issue, there was general consensus that there is not another agency presently filling this funding gap for clean energy innovation; and therefore, CEFIA should continue to play a role in technology innovation while working to avoid duplication of effort or expertise with any other state or quasi-public agencies in this regard. A suggestion was made to allocate 10 to 15 percent of CEFIA's funding to support technology innovation and/or to have the

Technology Committee come back with recommended program funding levels. Some concerns were raised with being able to effectively execute two very different missions. Suggestions were made to contact the Coalition for Green Capital to work with them about the common theme of deployment. The Board discussed the importance of having separate matrices in place to measure success for innovation technology versus measuring the success for deployment efforts

A discussion ensued on forming clean energy technology hubs. Ms. Smith mentioned that CI will be soliciting input from the market on the creation of hubs, and it is possible to create ecosystem hubs focused on clean energy.

7. Residential Solar Investment Program Update and Recommendations:

Mr. Garcia talked about Section 106 of Public Act 11-80. He noted that the requirement under the act is to create at least 30 megawatts of new residential solar photovoltaic systems by 2022, and up to one-third of annual ratepayer funds will be allocated to residential solar photovoltaic programs. He discussed the need for sustained orderly deployment of photovoltaic in Connecticut and explained the connection between energy efficiency goals and clean energy**.** Mr. Garcia noted the importance of developing economic rationale for homeowners to make energy efficiency measures before investing in photovoltaic. There was general consensus that deployment of clean energy cannot be looked at in isolation. Discussions ensued on whether energy efficiency measures should be required before renewable energy installations. There was general consensus that energy efficiency is important to the sustained orderly deployment of residential solar PV in Connecticut, but that there was a need to work with solar PV contractors to help them incorporate energy efficiency over time. There was also general consensus that marketing and public awareness are key to successful goals with respect to renewables and energy efficiency. Mr. Garcia stated that before designing the programs, meetings will be held with stakeholders to obtain comments.

Mr. Garcia discussed the Connecticut Solar Lease Program. He noted that CCEF's program was very successful and the first-of-its-kind. Connecticut's program was used as a model for other states. Mr. Garcia reviewed the recommendation to spend up to $150,000 to hire an independent third party consultant to take the program's loan repayment and technology data to evaluate the overall performance of the program. He discussed the importance of having a strong marketing campaign to educate consumers on the value proposition and financing strategies to drive the demand for solar. Suggestions were made to consider the following tools in the marketing campaign for solar: Neighbor to Neighbor Energy Challenge Program, Property Assessed Clean Energy, and non-profit developers. It was noted that private investors are likely to perform independent due diligence before investing, and it may not be necessary for CEFIA to hire an independent third party consultant to assess the performance of the Connecticut Solar Lease Program.

It was the general consensus of the Board to table the recommendation to issue a Request for Proposal to hire a consultant to evaluate the Connecticut Solar Lease Program.

Mr. Wall explained the recommendation to conduct a solar market research study in order to determine the best structure for a marketing strategy to achieve the requirement to create at least 30 megawatts of new residential solar photovoltaic systems by 2022. Ms. Glover requested that the conversation about solar market research be discussed as part of the joint marketing and outreach campaign discussions.

8. Joint Marketing and Outreach Campaign Update and Recommendations:

Mr. Wall spoke about the ad hoc Energy Marketing Committee that has been established and includes representatives from the DEEP, the Connecticut Energy Efficiency Fund ("CEEF") and CEFIA. He noted the importance of developing a central campaign to motivate consumers to take action. Mr. Wall explained that the cost of the study would be shared in a manner that is consistent with the ratepayer surcharges received by each agency. A majority of the Board supports the three agencies working together to develop a central clean energy campaign for Connecticut and for CEFIA to pay its share of the costs. The Board indicated the need to do some preliminary research before launching a marketing campaign. The Board asked that further research be conducted to determine who are the customers, what the customers know and don't know about clean energy and energy efficiency, and the level of support and the subsidies needed to draw in customers. A suggestion was made to target small businesses, low-income households and people that do not know about the programs as part of this research. A suggestion was also made to utilize the study being performed through a grant from the Hartford Foundation for Operation Fuel on low-income consumer energy usage and barriers to energy efficiency. The Board discussed the need to offer renewable energy choices to customers.

> **Upon a motion by Mr. Esty, seconded by Ms. Glover, the Board voted unanimously in favor of supporting an allocation of funding to coordinate and support a statewide energy marketing campaign in an amount that is one-third of the amount committed by the Energy Efficiency Fund that is not to exceed TWO-HUNDRED FIFTY THOUSAND DOLLARS ($250,000), and that said funding shall also be used to support preliminary research to better understand customers.**

9. Comprehensive Plan Update and Recommendations:

Discussion on this item was deferred until January 2012.

10. **Adjournment**: Upon a motion made by Ms. Wrice, seconded by Mr. Esty, the Board members voted in favor of adjourning the December 16, 2011, meeting at 5:22 p.m.

Respectfully submitted,

Catherine Smith, Chairperson

General Assembly

January Session, 2011

Bill No. 1243 **(P.A. 11-80)**

LCO No. **8345**

08345_____

Referred to Committee on No Committee

Introduced by:

SEN. WILLIAMS, 29th Dist.

REP. DONOVAN, 84th Dist.

AN ACT CONCERNING THE ESTABLISHMENT OF THE DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION AND PLANNING FOR CONNECTICUT'S ENERGY FUTURE.

Sec. 106. (NEW) (*Effective July 1, 2011*) (a) The Clean Energy Finance and Investment Authority established pursuant to section 16-245n of the general statutes, as amended by this act, shall structure and implement a residential solar investment program established pursuant to this section, which shall result in a minimum of thirty megawatts of new residential solar photovoltaic installations located in this state on or before December 31, 2022, the annual procurement of which shall be determined by the authority and the cost of which shall not exceed one-third of the total surcharge collected annually pursuant to said section 16-245n.

(b) The Clean Energy Finance and Investment Authority shall offer direct financial incentives, in the form of performance-based incentives or expected performance-based buydowns, for the purchase or lease of qualifying residential solar photovoltaic systems. For the purposes of this section, "performance-based incentives" means incentives paid out on a per kilowatt-hour basis, and "expected performance-based buydowns" means incentives paid out as a one-time upfront incentive based on expected system performance. The authority shall consider willingness to pay studies and verified solar photovoltaic system characteristics, such as operational efficiency, size, location, shading and orientation, when determining the type and amount of incentive. Notwithstanding the provisions of subdivision (1) of subsection (j) of section 16-244c of the general statutes, as amended by this act, the amount of renewable energy

produced from Class I renewable energy sources receiving tariff payments or included in utility rates under this section shall be applied to reduce the electric distribution company's Class I renewable energy source portfolio standard. Customers who receive expected performance-based buydowns under this section shall not be eligible for a credit pursuant to section 16-243b of the general statutes.

(c) Beginning with the comprehensive plan covering the period from July 1, 2011, to June 30, 2013, the Clean Energy Finance and Investment Authority shall develop and publish in each such plan a proposed schedule for the offering of performance-based incentives or expected performance-based buydowns over the duration of any such solar incentive program. Such schedule shall: (1) Provide for a series of solar capacity blocks the combined total of which shall be a minimum of thirty megawatts and projected incentive levels for each such block; (2) provide incentives that are sufficient to meet reasonable payback expectations of the residential consumer, taking into consideration the estimated cost of residential solar installations, the value of the energy offset by the system and the availability and estimated value of other incentives, including, but not limited to, federal and state tax incentives and revenues from the sale of solar renewable energy credits; (3) provide incentives that decline over time and will foster the sustained, orderly development of a state-based solar industry; (4) automatically adjust to the next block once the board has issued reservations for financial incentives provided pursuant to this section from the board fully committing the target solar capacity and available incentives in that block; and (5) provide comparable economic incentives for the purchase or lease of qualifying residential solar photovoltaic systems. The authority may retain the services of a third party entity with expertise in the area of solar energy program design to assist in the development of the incentive schedule or schedules. The Department of Energy and Environmental Protection shall review and approve such schedule. Nothing in this subsection shall restrict the authority from modifying the approved incentive schedule before the issuance of its next comprehensive plan to account for changes in federal or state law or regulation or developments in the solar market when such changes would affect the expected return on investment for a typical residential solar photovoltaic system by twenty per cent or more.

(d) The Clean Energy Finance and Investment Authority shall establish and periodically update program guidelines, including, but not limited to, requirements for systems and program participants related to: (1) Eligibility criteria; (2) standards for deployment of energy efficient equipment or building practices as a condition for receiving incentive funding; (3) procedures to provide reasonable assurance that such reservations are made and incentives are paid out only to qualifying residential solar photovoltaic systems demonstrating a high likelihood of being installed and operated as indicated in application materials; and (4) reasonable protocols for the measurement and verification of energy production.

(e) The Clean Energy Finance and Investment Authority shall maintain on its web site the schedule of incentives, solar capacity remaining in the current block and available funding and incentive estimators.

(f) Funding for the residential performance-based incentive program and expected performance-based buydowns shall be apportioned from the moneys collected under the surcharge specified in section 16-245n of the general statutes, as amended by this act, provided such apportionment shall not exceed one-third of the total surcharge collected annually, and supplemented by federal funding as may become available.

(g) The Clean Energy Finance and Investment Authority shall identify barriers to the development of a permanent Connecticut-based solar workforce and shall make provision for comprehensive training, accreditation and certification programs through institutions and individuals accredited and certified to national standards.

(h) On or before January 1, 2014, and every two years thereafter for the duration of the program, the Clean Energy Finance and Investment Authority shall report to the joint standing committee of the General Assembly having cognizance of matters relating to energy on progress toward the goals identified in subsection (a) of this section.

Comparative analysis of residential solar PV incentive programs

Kimberly Peterson, National Renewable Energy Laboratory

December 2011

PURPOSE:

As of 2012, the Connecticut Clean Energy Finance and Investment Authority (CEFIA) is mandated by a new law to devise solar incentives that will result in a minimum of 30 MW of new residential solar PV by December 31, 2022. At CEFIA's request, the U.S. Department of Energy's Solar Market Transformation Team tasked the National Renewable Energy Laboratory (NREL) to review successful incentive structures for supporting markets such as Connecticut's. This qualitative comparative analysis of several state and utility residential solar PV incentives is intended to be used for informational purposes as CEFIA revises its residential solar PV incentive structure.

THE MAIN CONCLUSION:

Connecticut's proposed incentive structure is uniquely crafted to reflect its market conditions and policy goals. The incentive levels appear to be comparable to those in other states with similar, aggressive solar programs. This conclusion is based on reviewing calculations from CEFIA for both internal rates of return and payback periods for customer owned and third party owned residential systems as well as reviewing financial incentives available in other states that reduce the final costs of residential PV systems.

HIGHLIGHTS:

- CEFIA's stated goals are to create a long-term, diverse solar market without over-subsidizing residential PV systems. The other states referenced for this report have expressed similar goals for their solar markets and stressed the importance of transparency and steady disbursement of program funds.

- While CEFIA's proposed solar incentive model is unique, it includes elements found in other states that allow for some comparative analysis.

- Nationwide, there is a trend away from capacity-based upfront residential PV rebates toward performance-based incentives. This approach often reduces cash flow challenges for incentive programs where system benefits charge funding comes in monthly, as incentive funds are parsed out over time instead of in large upfront payments.

- Block incentive programs that step down when a certain installed capacity is reached link incentives to solar demand rather than an artificial timetable.

- While only one state, Colorado, currently has different incentives for third-party owned versus resident-owned systems, Tucson Electric Power (TEP) and Connecticut are proposing changes in 2012. TEP is proposing a change to pay out less for third-party owned systems. Xcel Energy states its incentive program is intended to create equity between the third-party owned and resident-owned systems. Massachusetts treats third-party owned systems as commercial systems, thus making them eligible for commercial incentives. In states where there is a distinction, and if equity between the resident-owned and third-party owned markets is a priority, separating the funding allocations between the two markets within the program is necessary.

- Incentives cover between 3% and 50% of the total system costs in the states referenced.

- New Jersey's solar renewable energy credit (SREC) program does not offer an equivalent comparison to the other states' models because it is a market-based program model; however, some lessons can be drawn from New Jersey's incentive history.

- This analysis includes California in order to capture any lessons learned from the development of a robust market there. However, California may be an outlier as it is the only state in which a large PV market persists despite high installed costs and low PV incentives. The other states referenced appear to have a more similar market to Connecticut.

- None of the states referenced have mandatory requirements for energy efficiency to qualify for the PV incentives. Under New Jersey's previous rebate incentive, energy efficiency measures were required to receive a solar rebate. Predicating solar incentives on mandatory energy efficiency measures is a topic for further research, as the market mechanisms and policy drivers require careful design.

Contents

Introduction

States with strong markets for residential solar PV typically have state policies and incentives to spur the market. New Jersey, California, Colorado, and New York have established such markets and, while the residential installations in these markets have dipped slightly in the second quarter of 2011, demand forecasts are positive as third-party financing models make the technology available to broader markets. Solar module prices are falling, but state incentive levels have influenced demand more than system costs (SEIA, 2011a).

Solar incentives are a market expansion policy for distributed generation. In a policy environment with strong market-creation policies that allow for all parties to equitably participate in the market if they so desire, incentives can support market expansion by reducing the first cost of solar installations or ensuring project pay-back periods. Incentives also reduce investor uncertainty and overcome informational barriers related to a lack of public awareness and understanding related to solar technologies. As markets progress toward saturation, the need for financial incentives decreases as a result of economies of scale (NREL, 2011). Thus it falls to incentive program managers to devise appropriate incentive levels and structures to meet their goals.

Policy Context

This section looks at state renewable portfolio standard (RPS)[1] policies and solar carve outs as background information for state and utility PV incentive programs. Additional detail on the states' incentive programs is included in the "Residential PV Incentive Structures" section.

New Jersey's RPS, considered among the most aggressive in the United States, contains an energy-based goal from solar PV. It requires 5,315 gigawatt hours (GWH) of solar generation in 2026. The original RPS goal included a 2% solar carve out that later transitioned to a performance goal. To assist in meeting the RPS, New Jersey initially opted for a capacity-based residential PV rebate incentive, but it was quickly oversubscribed (TX, 2011). The state then transitioned to the current incentive model, a market-based performance incentive whereby solar PV system owners can sell their SRECs[2] to utilities to help meet the RPS requirements for 15 years after they are connected to the grid. Prices for SRECs, although market based, are capped with a ceiling and that cap declines each year until 2016 (DSIRE, 2011b). New Jersey has become a leading state in installed capacity largely due to the RPS and its associated financing models (NJCEP, 2011b).

[1] Also known as renewable electricity standard (RES).
[2] An SREC (solar renewable energy certificate) is generated for every 1,000 kWh a solar system generates.

Massachusetts has an RPS with a solar carve out that is designed to support 400 MW[3] of PV (DSIRE, 2011c). For the 2012 compliance year, the minimum solar carve out will be 0.163% or 81,559 MWh (MASS, 2011). Massachusetts uses a hybrid incentive approach by offering both an upfront, capacity-based rebate and a performance-based incentive.

California's RPS is 33% of retail electricity sales by 2020 with interim goals established (DSIRE, 2001o). California's solar market expanded with the implementation of Senate Bill 1 (SB 1) in 2007, which established the California Solar Initiative and offered capacity-based rebates and authorized the state to invest $3.3 billion over 10 years to create 3,000 MW of solar electricity. SB 1 also provided for some market-development policy changes, and initial incentives covered nearly one-third of installation costs (TX, 2011). California offers a choice of incentive structures for small PV systems including an upfront rebate, a performance-based incentive, and a feed-in tariff payment.

New York has an RPS to achieve 30% renewable power in the state by 2015. The program goal of installing 82 MW of PV power is part of the plan to achieve the RPS, although no specific targets have been set for the portion to come from residential PV (NYSERDA, 2011a). New York's PV incentives are designed to offer the lowest incentive possible while continuing to grow the market for PV and are based on an upfront capacity rebate (NYSERDA, 2011c).

Colorado's renewable energy standard is 30% of retail electricity sales by 2020 for investor-owned utilities and 10% of retail electricity sales for municipal utilities and electric cooperatives by 2020. Utilities must have a certain percentage of their retail sales come from distributed generation. For 2020, the distributed generation requirement is 3%, with half of that required to be located on customers' facilities (DSIRE, 2011p.) Colorado's incentives are based on whether the PV system is customer or third-party owned. Customers get both an upfront rebate and a performance-based incentive, whereas third-party owned systems receive only the performance-based incentive.

Arizona's renewable energy standard is 15% by 2025, with 30% of the renewable energy to be provided by distributed energy technologies (DSIRE, 2011q). Arizona offers an upfront rebate incentive.

Connecticut's RPS calls for 27% of electric loads to come from renewable sources by 2020. Class I renewables, which include solar energy, must supply 20%, with the remaining 7% to come from Class II and III resources. Connecticut's solar market will be further strengthened by the enactment of Public Act 11-80 in 2011, which requires CEFIA to develop solar incentives that will result in 30 MW of new residential solar PV by December 31, 2022 (DSIRE, 2011r). Connecticut currently offers an upfront capacity-based incentive. For 2012, the state is considering offering customer-owned systems an upfront capacity-based incentive, and third-party owned systems a performance-based incentive.

[3] The 400 MW goal includes both residential and non-residential systems.

Market Context

This section looks at the market context of residential PV in the states studied, including retail electricity rates, state/utility incentives as a percentage of system costs, and installed capacity. Where available, data specific to the residential market are referenced. These data are included because higher retail electricity rates make PV systems a more attractive investment for residential customers. Incentive levels as a percentage of the total system cost can help program administrators determine appropriate incentive levels, and installed capacity figures provide relative market scale among the states.

Retail Electricity Rates are noted in Table 1.

Table 1[4]. Average retail price of electricity to residential sector, by state and utility (cents per kWH)

	Through July 2011	2010	2009
New York	18.12	18.53	
New Jersey	16.28	16.42	
Massachusetts	14.75	15.2	
Connecticut	18.09	16.5	
Colorado	11.17	11.11	
Xcel Energy (PSCo)	-	-	9.80
Arizona	11.07	10.93	
Tucson Electric Power	-	-	9.67
California	15.21	15.23	

Residential incentives as a percentage of system costs and residential installed capacity are noted in Table 2.

Residential PV system prices have increased slightly despite falling module costs. Because residential installers often carry inventory purchased at higher prices, lags often occur in price adjustments for residential systems. The higher percentage of non-hardware costs for residential systems also means that smaller, residential-scale systems do not see price adjustments as the spot market for solar panels changes (SEIA, 2011a).

[4] Sources: By state (USEIA, 2011a), by utility (USEIA, 2011b).

Table 2. Metrics of State Residential PV Incentive Programs

	Retail Electric Rates (cents/ kWh)	Installed cost per watt[5]	Rebates as % of system cost	Installed Capacity (MW)	# of residential systems	Average System Size (kw)
New York	18.12	$7.10	Not to exceed 40%[6]	16.3	3,027	5.4
New Jersey	16.28	$6.75	N/A[7]	23.5	2,780	8.5[8]
Massachusetts	14.75	$5.56	~35[9]	4.8	895	6.4
California	15.21	$8.23[10]	3-4%[11]	271.6[12]	56,656	4.7
Colorado (Xcel Energy)	11.17[13]	$5.90	50[14]	85	8,500[15]	5-6
Arizona (TEP)	11.07[16]	$6.21	12[17]	9.425[18]	1,872	5
Connecticut (CEFIA)	18.26	$5.75[19]	50[20]	12.4	1,887	7.5[21]

[5] Installed cost data from SEI U.S. Solar Market Insight: 3rd quarter 2010 report, except as noted.
[6] http://www.nyserda.org/funding/2112summary.pdf
[7] New Jersey's market-based SREC program makes it difficult to calculate the percentage of the system cost covered by SREC sales, although if SREC prices as noted in Table 4 held for the full 15 years that a system owner can sell RECs (an unlikely scenario), a system owner could recoup the full cost of the system. When the SREC program was started, program managers envisioned that SREC sales would allow an 8-year average payback on a residential system. Bachmann, J. (22 November 2011). Telephone interview. New Jersey Clean Energy Program.
[8] Data from NJ CEP report. An analysis by program managers in 2010 showed average residential size around 6 kW. Due to high SREC prices since the inception of the SREC program and influx of third-party leasing companies into the NJ market, residential system size at 8.5 kW is plausible. See footnote 3 for citation.
[9] Rebate covers 15% of system cost based on historic program data per Lambert, J. and Kennedy, E. (14 November 2011). Telephone interview. Massachusetts Clean Energy Center, Boston, MA. SREC sales cover ~20% of system cost. See Table 4 for assumptions.
[10] Data from California Solar Initiative.
[11] See table 2 for calculations.
[12] Data from CSI as accessed on 11/21/11 and includes installed residential systems only. Does not include pending.
[13] CO statewide average retail price of electricity; data for Xcel Energy was only available as of 2009 so not used.
[14] This figure has not been verified. Through the Solar America Communities work, this was an often-cited metric for Colorado. Further citation and refinement forthcoming.
[15] Xcel Energy tracks by system size, not by residential. Figure listed is for systems less than 10 kW.
[16] Retail electric rates statewide for AZ, as TEP only data is from 2009.
[17] $0.75/watt current incentive level/$6.21 average installed cost per watt = 12% (data from Table 1).
[18] Does not include reserved systems.
[19] Data from CEFIA program administrators.
[20] Historic CEFIA incentive levels as relayed by CEFIA program managers.
[21] Recent trend in larger average residential system size as per CEFIA program administrators

Geographical Context

Differences in PV system production due to solar insolation are described in Table 3 and Figure 1. Table 3 provides a calculation of a 7.5 kW system for illustrative data sets available in PV watts in the states referenced. As noted, annual output of PV systems is projected to be highest in the western and southwestern states and lower in the northeast states.

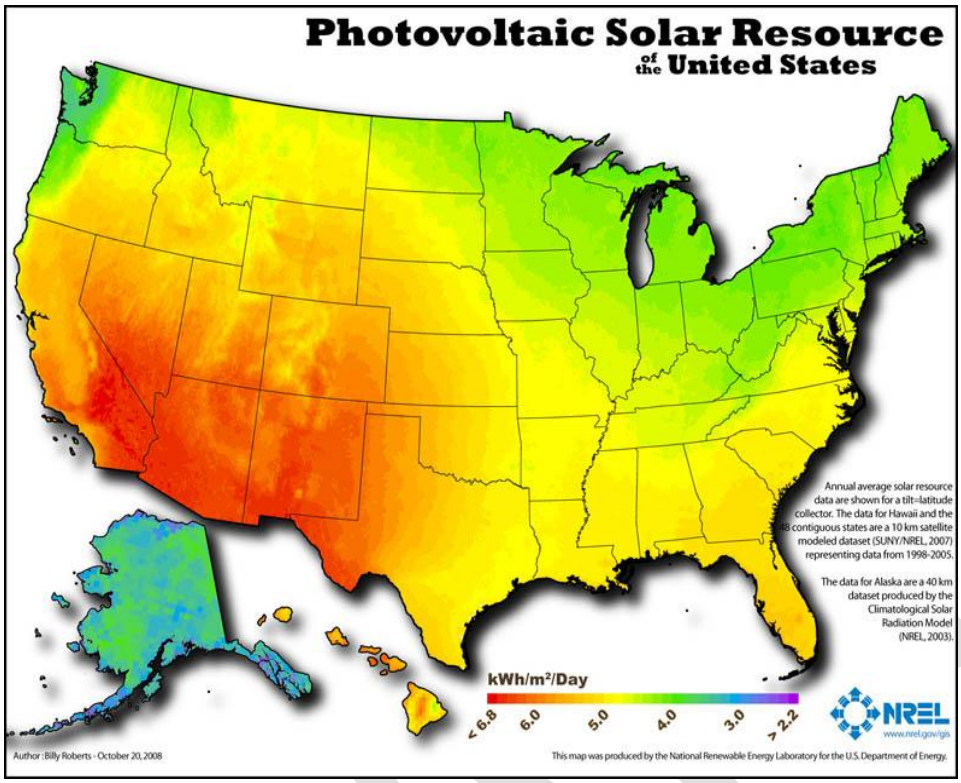
Table 3. PV watts modeling for a 7.5 kW residential system

Location	Annual Output (kWh)
New York City, NY	9,138
Albany, NY	8,695
Buffalo, NY	8,065
Massena, NY	8,721
Newark, NJ	8,872
Atlantic City, NJ	9,377
Boston, MA	9,328
Worcester, MA	9,155
Bridgeport, CT	8,963
Hartford, CT	8,676
Grand Junction, CO	11,471
Boulder, CO	10,939
Alamosa, CO	12,725
Tucson, AZ	12,470
Fresno, CA	10,876
San Francisco, CA	10,612
San Diego, CA	11,239

Source:

National Renewable Energy Laboratory. PVWatts Site Specific Data Calculator (Version 1). http://rredc.nrel.gov/solar/calculators/PVWATTS/version1/. Accessed November 11, 2011.

Figure 3– Solar Insolation in U.S.



Residential PV Incentive Structures

The states referenced in this report employ several different and sometimes complementary incentive models for residential PV systems including:

- **Capacity based** – upfront incentives either based on the DC or AC rating of the system, or based on the expected performance of the system taking into account installation characteristics and equipment de-rating factors (also known as an EPBB).
- **Performance-based incentives (PBI)** – paid out based on the number of actual kilowatt hours a PV system produces over some fixed time period (5-10 years).
- **Environmental-based incentives** – depending on the market, the environmental attributes (SRECs) that a PV system produces (expressed in megawatt hours) might have significant value. Sometimes residential system owners must work through an aggregator to sell their SRECs.
- **Income tax credits –** some states provide a personal income tax credit for a portion of the PV system cost incurred by the owner. The credit is applied dollar for dollar against the owner's state tax liability and oftentimes can be carried over for several years to allow an owner to realize the full benefit.
- **Sales tax exemptions –** Some states provide an exemption for PV system components and/or installation from state sales tax. States may also allow municipalities to determine whether to allow a local tax exemption.

- **Rebates for components manufactured in state –** one state surveyed (New Jersey) offers an additional upfront incentive based on the system capacity for components that are manufactured or partially manufactured within the state.

New York

New York's PV Incentive Program, managed by NYSERDA[22], is capacity based and is currently set at $1.75 per watt DC[23]. The incentive can be adjusted for losses for less than optimal siting and caps out at $12,250 per residential system. The system size cannot exceed 110% of demonstrated energy demand. NYSERDA owns the SRECs[24] for the first three years of system operation, then they revert to the system owner. NYSERDA limits the application amount for each installer at 225kW per eligible installer per month, but so far has not had to impose that restriction. PV installers provide customers with basic information regarding energy efficiency, but there is no energy efficiency requirement to participate in the PV rebate program (DSIRE, 2011a). Residential customers get a "clipboard" energy efficiency audit prior to participating in the rebate program. For a description of the audit, see Appendix A (NYSERDA, 2011). The goal of NYSERDA's PV program is to install 82 MW of solar electric power systems. NYSERDA credits cooperation between the installers and NYSERDA for its success in residential PV deployment. Previous practices have been streamlined and more program changes will be announced soon but were not public as of this paper (NYSERDA, 2011). New York state also offers a personal income tax credit for the installation of residential solar systems. The credit is for 25% of the costs of the solar system up to $5,000 and is limited to a 10kW system maximum capacity. Any excess credit may be carried forward for five years (DSIRE, 2011f). In addition, New York has a 100% statewide sales tax exemption for residential solar systems that also saves solar adopters money (DSIRE, 2001g).

New Jersey

New Jersey has a performance-based incentive for its residential PV program that is based on a system owner selling the SRECs. SRECs can be sold by the system owner for 15 years after the interconnection date (DSIRE, 2011 b). Prices for SRECs are determined by the current SREC market and are subject to a floor and ceiling price. As of September 2011, the weighted average price of SRECs was $401.90 per megawatt hour or $0.40 per kilowatt hour (although SRECs must be bundled in units of megawatt hours to be sold) (NJCEP, 2011c). In 2012, it is anticipated that there will be an oversupply of SRECs. Systems must be sized so that annual solar output does not exceed annual on-site load and SRECs have a life of three years from the time they are generated. Normally under performance-based incentives, the customer does not receive any upfront financing for the PV system. However, in New Jersey, one utility (PSE&G) offers a loan program to help customers finance PV systems. Customers may borrow up to 60% of the cost of the PV system from the utility. The loan is then paid back through SREC sales (DSIRE, 2011b). New Jersey has witnessed significant growth in the third-party owned/power-purchase agreement model over the past two years (NJCEP, 2011d). In addition to the SREC payments, New Jersey offers a 100% sales tax

[22] New York Research and Development Authority
[23] Based on direct current.
[24] renewable energy certificates

exemption for residential PV systems and there is no maximum limit (DSIRE, 2011h). The current sales tax rate in New Jersey is 7% of the system cost. To complement the SREC program, customers of the New Jersey utilities that pay into the system benefit fund can get up to $0.55/watt for residential systems that incorporate panels, inverters, and racking systems made in New Jersey (DSIRE, 2011i). New Jersey switched from a rebate program to the SREC program because it needed to increase its solar capacity to meet its RPS requirements. Under the old rebate program, 50% of the cost of solar installations was provided by the state and there was insufficient funding to meet the targeted goals. The SREC program was adopted to meet the RPS goals at the lowest cost to ratepayers while meeting other policy goals of equity to all ratepayer classes, job growth, improved reliability, and improved environmental quality (NJCEP, 2007).

Massachusetts

Massachusetts has both installed-capacity and performance-based incentives for residential PV. Prices for the PBI are set by the market subject to a minimum of $0.30/kilowatt hour and a maximum of $0.55/kilowatt hour and are paid out over 10 years. The solar rebates as published by the Massachusetts Clean Energy Center are $0.75/watt DC with possible adders[25] for a maximum of $2.70/watt. However, the rebates are paid out in blocks that are funded every quarter. Block 8 opened on October 14, 2011 (Mass CEC, 2011a), and offers a base rebate of $0.66/watt, which represents about 12% of the system cost (Mass CEC, 2011b).[26] Projects that are owned by third parties are treated as commercial systems and are eligible for the commercial rebates. An energy efficiency audit is generally required. As of October 2011, applications received were two years ahead of projections. Massachusetts also offers a personal income tax credit for 15% of the installed costs of a residential PV system up to $1,000. Excess credits may be carried forward three years and owners and tenants of residential properties are eligible (DSIRE, 2011j).

California

California offers three types of incentives for residential PV systems, but a PV system owner can access only one of the three methods of funding: upfront capacity-based payment, expected performance basis, and feed-in tariff. The capacity and PBI incentives allow the customer to net meter, whereas the feed-in tariff does not. The goal of the California Solar Initiative (CSI) is to install 3,000 MW of solar by 2016 with 1,940 MW of that total being residential PV. The program is managed in 10 steps with incentive levels declining as aggregate installed capacity increases. Rebate levels began at $2.50/watt AC on an expected performance basis in 2007 and are now at $0.25 to $0.65/watt AC depending on the utility (CSI, 2011b). An energy efficiency audit is required. Systems under 30 kW have the option of receiving a performance-based incentive rather than the upfront expected performance basis rebate. PBI payments are made monthly over five years (DSIRE, 2011e) with current levels for residential PBI between $0.03 and $0.09/kWh (CS, 2011b). Current information on CSI incentive levels can be found at: http://www.csi-trigger.com/. Solar customers who want to participate in the feed-in tariff program cannot receive any

[25] Adders include Massachusetts components ($0.10/watt), moderate home value or moderate income ($0.85/watt) and natural disaster relief ($1.00/watt).

[26] Further information on Massachusetts rebate blocks can be found at: http://masscec.com/masscec/file/CS%20Summary%20Report%2010-31-11%20for%20website.pdf

other CSI incentives. They enter into 10, 15, or 20-year contracts to sell all the output from their PV systems directly to the utility. Prices are determined by a market reference price (MRP) and range from approximately $0.08 to $0.14 per kilowatt hour.[27] However, as of this paper, PG&E's feed-in tariff program for purchases of renewable energy was oversubscribed and not accepting further applications (PG&E, 2011a).

Colorado

For Colorado, the incentive structures for Xcel Energy were surveyed along with other statewide incentives available for residential PV systems. Xcel Energy offers two different incentive structures depending on whether the PV system is customer or third-party owned. Customer-owned systems less than 10kW receive an upfront payment of $1/watt plus $0.09/kWh for the SRECs. Third-party owned systems receive no upfront payment but do get $0.15/kWh for the SRECs.[28] SREC payments are for 20 years. The incentive amounts step down as installed capacity goals are met (DSIRE, 2011s). Xcel Energy stated that the utility is moving away from upfront rebates toward performance-based incentives for all system sizes to more widely disburse the incentives. The program cap on spending is limited because the utility can only collect 2% on customer bills through its systems benefit charge. Xcel Energy has seen 90% growth in its solar market since 2006. To reflect the declining price of solar modules, Xcel's blocks step down so as to not over subsidize PV systems (Xcel, 2011). Colorado also offers a statewide sales tax exemption on PV system components, including trackers, generating equipment, supporting structures or racks, inverters, towers and foundations, and balance of system components including wiring, control systems, switchgears, and generator step-up transformers (DSIRE, 2011k). Installation costs are not exempt.

Arizona

For Arizona, the incentive structures for Tucson Electric Power were referenced along with any statewide incentives available for residential PV systems. Tucson Electric Power offers$2/watt DC for residential systems up to 10 kW. Both customer-owned and third-party owned systems are eligible, although the funding is aggregated. In 2011, a third-party leasing company received a large percentage of the incentive pool, thereby depleting funds for customer-owned systems. The Arizona Corporation Commission approved a "bridge" plan that will fund the existing residential applications at the current level and provide an upfront payment of $0.75/watt DC until funds are exhausted (TEP, 2011). Tucson Electric Power's docket filed with the Arizona Corporation Commission for 2012 includes an incentive of $1.75/watt DC for residential systems and $1/watt for leased systems up to 30 kW. The utility also includes a measure to slow the rate of incentive demand, if needed, by enacting a "trigger rate." The trigger rates go into effect if 60% of the annual budget is reserved on or before June 30, 2011, and the rates lower the residential incentives to $1.50/watt DC and the leased systems to $0.75/watt DC (ACC, 2011). Arizona also offers a statewide personal income tax credit for residential PV systems of 25% of the system costs up to a $1,000 maximum credit per residence. The excess credit may be carried forward for

[27] Market price referents can be found at: http://www.cpuc.ca.gov/PUC/energy/Renewables/Feed-in+Tariff+Price.htm
[28] Incentive data current as of 11/16/2011.

five years (DSIRE, 2011l). In addition, Arizona offers a statewide exemption for 100% of the sales tax on eligible equipment and installation. There is no maximum limit (DSIRE, 2011m).

Connecticut

Connecticut's current residential PV incentives are EPBB based and set at $1.75/watt PTC rating for the first 5 kW, then $1.25/watt for the next 5 kW for its residential PV rebate program and $2.68/watt PTC rating for the first 5 kW, then $2.18/watt for the next 5 kW for its solar lease program. The limit for the rebate program is $15,000 and $24,300 for the solar lease program, subject to a maximum of the customer's average annual or expected load (DSIRE, 2011t). However, program administrators are currently considering a change to the residential PV structure so that customer-owned systems would receive an EPBB, and third-party owned systems would receive a PBI. This report is meant to inform those changes. Data included in Table 4 is for the proposed incentive structure to take effect in January 2012, not for the current incentive structure. Connecticut also has a 100% state sales tax exemption for residential PV system components and installation costs (DSIRE, 2011n).

Table 4 – State Comparison of Residential PV Incentive Structures

Data point	**NY**	**NJ**	**MA**	**CA**	**CO** (Xcel Energy)	**AZ** (Tucson Electric Power)	**CT**(CEFIA proposed)
Type of incentive	Capacity	PBI (market-based SREC program)	Capacity + PBI	Capacity or PBI or FIT[29]	Capacity + PBI for resident owned; PBI only for third-party owned	Capacity	Capacity for resident owned; PBI for third-party owned
Current incentive levels	$1.75/watt	$0.40/kWh [30]	$0.66/watt [31] + $0.30-$0.55/kWh	$0.25-$0.65/watt EPBB[32]; $0.03/kWh PBI	Customer owned: $1/watt + $0.09/ kWh; third-party owned $0.15/kWh[33] [34][35]	$0.75/watt DC ($0.50/watt DC off-grid)[36]	$3.49/watt EPBB; $0.47/ kWh PBI (for Step 1)

[29] Feed-in tariffs are only available to customers who don't net meter on site but sell all their PV directly to the utility. Customers under 30 kW can choose either capacity or PBI incentive.

[30] Based on Sept. 2011 data from: http://www.njcleanenergy.com/renewable-energy/project-activity-reports/srec-pricing/srec-pricing

[31] Additional capacity payments for qualified adders. See: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=MA71F&re=1&ee=1 for a list of adders.

[iii] EPBB depends on which step utilities are in. For current levels, see: http://www.csi-trigger.com/

[i33] For systems < 10kw. Program is on hold for systems 10 kw – 500 kw.

[v] CO incentive levels current as of 11/16/2011.

[vi] For current Xcel Energy steps, visit: http://www.xcelenergy.com/Save_Money_&_Energy/For_Your_Home/Renewable_Energy_Programs/Solar*Rewards_-_CO

[36] Incentive can be reduced for performance derating.

Cap ($)	$12,250	$0.675/kWh [37]	$0.55/kWh (PBI); $8,500 (capacity)	Max $10.26/watt [38]	$30,648 resident owned; $34,413 third-party owned[39]	~$21,000	$28,440
Data point	**NY**	**NJ**	**MA**	**CA**	**CO** (Xcel Energy)	**AZ** (Tucson Electric Power)	**CT**(CEFIA proposed)
Cap (system capacity)	7 kW	100% of on-site load	No cap, but rebates only up to 5 kW	30 kW for EPBB; larger systems must do PBI	120% of average annual consumption; only first 10 kW eligible for incentives	20 kW (AC)	10 kW (ptc)
Percent of system cost	Limited to 40% after tax credits	Up to 100%[40]	~ 15% from rebate + ~20% from SRECs[41]	3% from rebate; 4.2% PBI[42]	50%	Limited to 50% of project cost[43]	55% of project cost
Incentive payout	75% component delivery; 25% grid interconnection	System owner chooses how to sell SRECs (for up to 15 years)	Capacity paid at completion of project; SRECS minted quarterly for 10 years	Capacity paid in one lump sum; PBI paid monthly over 5 years	PBI paid monthly over 20 years	Paid to installers after interconnection	EPBB – 60% component delivery, 40% final inspection; PBI paid quarterly over 6 years upon verification of production
EE	EE audit encouraged but not required	No current requirement; previous mandatory measures via Energy Star for rebates	No requirements; munis help finance	Self-EE audit	No requirement	No requirement	EE audit and EE measures with < 5 year payback required

[37] For compliance year 2010-2011 high price. It is anticipated that in 2012 there will be an oversupply of SRECs, causing prices to drop. See footnote 7 for citation.

[38] See http://www.californiasolarstatistics.ca.gov/faq/#costcap for cost cap methodology.

[39] Assumptions in calculation – production for Grand Junction, CO. Net present value not applied to PBI. Assumed system size of 10 kW as incentive levels referenced in Table 4.

[40] Calculation based on current SREC price per Table 1 holding for 15 years, net present value and transaction costs of selling SRECS not applied.

[41] Assuming SREC prices are at floor of model, net present value of 10 year SREC payments

[42] Assumptions: 4.7 kW system, net present value not applied to PBI at $0.03/kWh, system production representative of Fresno, CA. Installed cost as listed in Table 1.

[43] TEP customers must pay at least 15% of the PV system cost after other government incentives.

REC ownership	NYSERDA for 3 years, then owner	System owner	System owner	System owner	Utility	Utility (for 20 years)	CEFIA
Program Budget	$144 M ($2M per month) (2010-2015)		$8M ($3M for Block 8[44], [45])	$2.167B (2007-2016)	$200M	$14.4 M (2011 budget)	$90-$100M (2011-2022)
Data point	**NY**	**NJ**	**MA**	**CA**	**CO** (Xcel Energy)	**AZ** (Tucson Electric Power)	**CT**(CEFIA proposed)
Funding Source	RPS surcharge		SBC[46]	SBC	RPS surcharge	RPS surcharge	SBC
Program goals	82 MW by 2015 total PV (no separate goal for residential)		No specific residential goals; 250 MW by 2017 and SREC program to support 400 MW	1,940 MW by 2020 (500 MW cap under FIT)	20 MW for all systems between 10.1 kW and 500 kW; goal N/A for under 10 kW		30 MW (by 2022)
Other statewide residential PV incentives[47]	Personal income tax credit (25% up to $5,000, limit 10 kw); sales tax exemption	Full sales tax exemption (currently 7%); up to $0.55/watt rebate for components manufactured in state	Personal income tax credit (15% up to $1,000)	None	Full sales tax exemption for PV system components	Personal income tax credit (25% up to $1,000); full sales tax exemption	Full sales tax exemption

Conclusion

This document provides a comparative and qualitative analysis of several state and utility residential PV incentive structures. CEFIA's redesign of its residential PV incentive program provides an opportunity to incorporate some of the best practices implemented by other states (as well as to avoid some of their pitfalls) in order to most efficiently use ratepayer funds while achieving the desired installed capacity goals. Several different types of incentive structures are described. One clear trend is a move away from residential PV incentives that subsidize the nameplate capacity of PV installations and towards production and performance-based incentives.

There are many variables that determine the value proposition of PV systems to various stakeholders including homeowners, third party owners/financiers, the solar installer community and clean energy fund managers. Program administrators may be most likely to align their state's incentives with geographically surrounding states as solar labor is somewhat mobile and maintaining a healthy solar community is often a policy and program goal in order to encourage competitive pricing. Since Connecticut's program structure differs from those in surrounding states, caution must be

[44] Block 8 opened on 10/14/2011 and will run until 12/31/2011 or until funds are exhausted.
[45] Funding blocks are usually $1M, but block 8 combined previously unallocated funds.
[46] Systems benefit charge.
[47] Only incentives that effectively reduce the out-of-pocket PV system costs to the system owner are identified.

applied in making judgmental comparisons. With that caveat, a cursory comparison of CEFIA's proposed incentive structure, based on nominal dollars available for a representative solar installation using current program and market parameters[48], shows that CEFIA's incentives are higher than NYSERDA's, but lower than New Jersey's and Massachusetts'. However, since the SREC payments in New Jersey and Massachusetts are market based, and Connecticut's PBI payments are defined by blocks, there is more certainty for Connecticut's third party system owners in calculating their overall incentive. Connecticut's proposed program also offers more money upfront for homeowners through the EPBB. Ultimately, in designing Connecticut's solar incentive program, program administrators factored in installed costs, retail electricity prices, and costs of capital in order to determine internal rates of return and payback periods against which to benchmark their proposed incentive structure against other states' programs and to meet their own policy goals.

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Appendix A – Energy Efficiency Linkages to PV Rebate Programs

California – Homeowners who participate in the CSI rebate program must complete a self-energy audit using online tools from the utility or over the phone.

New York – Installers complete a "clipboard" energy efficiency audit before homeowners can participate in the solar PV rebate program. The audit inspects the residence to identify potential energy savings that would reduce the electric loads and interviews the homeowner on energy use. Inspection includes the hard-wired lighting systems, other lighting fixtures, appliances (i.e., whether they are ENERGY STAR®), power strips, vampire loads, programmable thermostats, condition of doors and windows, and recent addition of insulation. The installer then makes recommendations for the homeowner for increasing the energy efficiency of the home and provides a list of contractors that can handle the more complex upgrades as well as information on NYSERDA incentives available. Homeowners are encouraged, but not required, to implement any energy efficiency measures before participating in the PV rebate program, as often homeowners do not have the funds to do both simultaneously (NYSERDA, 2011a,b).

[48] Net present value not applied.

New Jersey – Under the rebate program, residential customers installing 10 kW or smaller PV systems had to participate in the Home Performance for Energy Star Program, which offered a $1,000 subsidy for air sealing homes. System owners installing more than 10 kW had to show a 5%-25% energy efficiency improvement to be eligible for the rebate. The Energy Star program could not keep pace with demand and so was decoupled from the PV incentive program. As future funding cycles were approved, the energy efficiency requirements were dropped. One lesson learned that New Jersey cited is the need to make sure the energy efficiency market and contractors are in place to meet demand (NJCEP, 2011e).

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

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

From: Bryan Garcia and Dale Hedman

Date: January 13, 2012

Re: Proposal for the Residential Solar Investment Program – Section 106 of Public Act 11-80

[NOTE – THE PROGRAM PLAN FOR THE RESIDENTIAL SOLAR PHOTOVOLTAIC INVESTMENT PROGRAM HAS BEEN INCLUDED AS PART OF THIS MEMO. THE PLAN PROVIDES DETAILS ON THE PROGRAM.]

BACKGROUND

Per Section 106 of Public Act 11-80, CEFIA is required to design and implement a residential solar investment program. The act requires that the program result in a minimum of 30 MW of new residential photovoltaic installations in Connecticut on or before December 31, 2022 and to support the solar workforce by making provisions for comprehensive training, accreditation, and certification programs. The program is to be funded by no more than one-third of the total surcharge collected annually through the Clean Energy Fund (CEF) – approximately $9 to $10 million annually or up to $100 million over the life of the program.

In developing the Program, CEFIA undertook the following steps:

- **Historical Performance Assessment** – assessed the historical performance of the CCEF's residential solar photovoltaic programs to understand consumer and workforce trends, including a survey with CBIA to assess barriers to the development of a Connecticut-based solar workforce.

- **Benchmark "Best Practices"** – working with the National Renewable Energy Laboratory, a report entitled *Comparative Analysis of Residential Solar PV Incentive Programs* was commissioned. The report compares the proposed incentive structure of CEFIA with that of leading states including AZ, CA, CO, MA, NJ, and NY.

- **Public Comment** – sought public comment through an official Request for Comments. Received nearly 80 comments in four (4) primary areas: CEFIA ownership of Class I

RECs, energy efficiency requirement, system incentive cap, and the proposed schedule of incentives.

- **Survey** – initiated a survey following the public comment process which received nearly 35 responses from contractors and identified the following:
    - Nearly 50% of those surveyed, provide third party financing (i.e. Sunpower Solar Loan, Nova Group, SunRun, GE Money Financing, and Admirals Bank)
    - Nearly 60% of those surveyed felt that solar panel costs would increase over the next 2 years.
    - Nearly 30% of the contractors currently offer energy efficiency services and over 50% stated that their company will not be expanding to incorporate energy efficiency services.

Based on these steps, CEFIA developed a multi-year Program Plan to support the successful implementation of the Program – see the attached Program Plan. Based on the Plan, CEFIA would exceed the minimum 30 MW requirement in Connecticut at approximately half of the allowable level of incentives per the Act.

PROPOSAL

The proposed program seeks to achieve the goal of installing at least 30 MW by the end of 2022 at an incentive level of approximately half of the allowable incentives of the Act and to support the solar workforce by making provisions for comprehensive training, accreditation, and certification programs. The program includes incentives, financing, marketing, legal, workforce development, technology, and evaluation measurement and verification components (see Table 1).

Table 1. Funding Request for the Residential Solar Investment Program

	FY 2012	FY 2013	FY 2014	Total	% Budget
Incentives[1]	$3,250,000	$6,500,000	$6,000,000	$15,750,000	67%
Financing[2][3]	$3,500,000	-	-	$3,500,000	15%
Marketing	$600,000	$600,000	$300,000	$1,400,000	6%
Legal	$50,000	$100,000	$50,000	$200,000	1%
Workforce Development[4]	$150,000	$700,000	$625,000	$1,475,000	6%
Technology	$100,000	$200,000	$200,000	$500,000	2%
EM&V[5]	$100,000	$200,000	$200,000	$500,000	2%
Miscellaneous	$50,000	$100,000	$100,000	$250,000	1%

[1] $5,500,000 of the incentives budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.

[2] ARRA SEP grant repurposing of $8,250,000 from grants towards financing is currently in process. Funds will be used as credit enhancements to attract private capital into a residential clean energy finance program.

[3] $3,500,000 of revolving loan fund budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.

[4] $1,475,000 of the workforce development fund budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.

[5] $200,000 of the EM&V budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.

Total	**$7,800,000**	**$8,400,000**	**$7,475,000**	**$23,675,000**	

Of the $23,675,000 requested for the Program, $10,675,000 was approved by the Clean Energy Fund Board of Directors as part of the FY 2011 and FY 2012 comprehensive plan.

The key components of the incentive aspects of the Program include REC ownership, energy efficiency requirements, system size caps, and a schedule of incentives (see Table 2). Per the Act, the Department of Energy and Environmental Protection must review and approve the schedule of incentives.

Table 2. Key Components of the Residential Solar Investment Program

REC Ownership	Energy Efficiency Requirements	System Size Cap	Schedule of Incentives
CEFIA will own all Class I RECs created from the projects that receive incentives.	CEFIA will require that each home that receives an incentive undertake a Home Energy Solutions assessment or an equivalent energy audit from a trained professional contractor	CEFIA will provide incentives up to and including 10 kW per system.	<u>EPBB Step 1 Incentive</u> $2.45/W≤5 kW $1.25/W>5kW≤10 kW <u>PBI Step 1 Incentive</u> $0.34/kWh≤5 kW $0.19/kWh>5kW≤10 kWh For further details on Steps 2-7 see Section 4 of the Program Plan.

For details on the Program, please see the attached Program Plan.

The staff proposes a two-and-a-half-year budget for FY 2012 through FY 2014 in the amount of $23,675,000. The successful implementation of the Program over this time period would result in the market being well into Step 4 for the schedule of incentives where the EPBB is set at $1.40/W and the PBI is set at $0.19/kWh – a reduction of 40 percent of the initial incentive levels from Step 1. At this point in time, CEFIA will have provided resources that will have deployed over 12 MW of residential solar PV systems – approximately one-third of the 2022 target and at a rate that achieved this installed capacity that is three-times as fast as what was deployed by the CCEF from 2004 through 2011.

RESOLUTION

WHEREAS, Section 106 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) requires CEFIA to design and implement a Residential Solar Photovoltaic Investment Program (Program Plan) that results in a minimum of thirty (30) megawatts of new residential PV installation in Connecticut before December 31, 2022.

WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to identify barriers to the development of a permanent Connecticut-based solar workforce and support comprehensive training and accreditation and certification programs.

WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to offer direct financial incentives, in the form of performance-based incentives or expected performance-based buydowns, for the purchase or lease of qualifying residential solar photovoltaic systems.

WHEREAS, CEFIA has prepared a declining incentive block schedule ("Schedule") that: (1) provides for a series of solar capacity blocks the combined total of which shall be a minimum of thirty megawatts and projected incentive levels for each such block; (2) provides incentives that are sufficient to meet reasonable payback expectations of the residential consumer; (3) provides incentives that decline over time and will foster the sustained, orderly development of a state-based solar industry; (4) automatically adjusts to the next block; and (5) provides comparable economic incentives for the purchase or lease of qualifying residential solar photovoltaic systems.

NOW, therefore be it:

RESOLVED, that the Board hereby approves the Program Plan and Schedule.

RESOLVED, the Board directs CEFIA to submit the proposed Schedule to the Commissioner of the Department of Energy and Environmental Protection for approval as required by Section 106 of the Act.

RESOLVED, that the Board approves the allocation of $23,675,000 for the Program Plan fiscal years 2012 through 2014.

RESOLVED, that this Board action is consistent with Section 106 of the Act.

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 this Resolution.

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Residential Solar Photovoltaic Investment Program

Program Plan

Table of Contents

Section 1 - Program Summary

1.1. Executive Summary and Funding Request

Per Section 106 of Public Act 11-80 (the Act), the Clean Energy Finance and Investment Authority (CEFIA) is required to design and implement a residential solar photovoltaic investment program (the Program). The Act requires that the Program result in a minimum of thirty (30) megawatts (MW) of new residential solar photovoltaic (PV) installations in Connecticut on or before December 31, 2022. Based on the Act, the Program is to be funded by no more than one-third of the total surcharge collected annually from the Clean Energy Fund (CEF).

Key components of the Program include:

- **Incentives** – direct financial incentives that decrease over time in the form of expected performance-based buy-down incentives (EPBB) and performance-based incentives (PBI) for the purchase and/or lease of qualifying residential PV systems.

- **Financing** – residential clean energy (i.e. energy efficiency and renewable energy) financing from repurposed American Recovery and Reinvestment Act (ARRA) State Energy Program (SEP) funds.

- **Marketing** – community-based social-marketing campaigns and technical support offerings through solar ambassadors and coaches to acquire residential customers through innovative techniques.

- **Legal** – integration of local, state, and federal policies and regulations to support consumers, contractors, and program administrators.

- **Workforce Development** – identification of the barriers to the development of a permanent Connecticut-based solar workforce and support for comprehensive training, accreditation and certification programs.

- **Technology** – inclusion of metering and monitoring equipment, software, and online tools that are developed to provide households, contractors, program administrators and stakeholders readily accessible information.

- **Evaluation, Measurement and Verification (EM&V)** – determination of the causal effects and impacts of the Program on achieving the intentions of the Act.

The proposed program seeks to achieve the goal of at least 30 MW by the end of 2022 at an incentive level of half of the maximum level of incentives allowable by the Act (i.e. $50 million).

To support the Program, the following funds are being requested for FY 2012-2014 (see Table 1):

Table 1. Funding Request for the Residential Solar PV Investment Program

	FY 2012	FY 2013	FY 2014	Total	% Budget
Incentives[1]	$3,250,000	$6,500,000	$6,000,000	$15,750,000	67%
Financing[2][3]	$3,500,000	-	-	$3,500,000	15%
Marketing	$600,000	$600,000	$300,000	$1,400,000	6%
Legal	$50,000	$100,000	$50,000	$200,000	1%
Workforce Development[4]	$150,000	$700,000	$625,000	$1,475,000	6%
Technology	$100,000	$200,000	$200,000	$500,000	2%
EM&V[5]	$100,000	$200,000	$200,000	$500,000	2%
Miscellaneous	$50,000	$100,000	$100,000	$250,000	1%
Total	**$7,800,000**	**$8,400,000**	**$7,475,000**	**$23,675,000**	

Of the $23,675,000 requested for the Program, $10,675,000 was approved by the Clean Energy Fund Board of Directors as part of the FY 2011 and FY 2012 comprehensive plan.

1.2. Background

The Connecticut Clean Energy Fund (CCEF) implemented a multi-year residential solar PV program that was launched in 2005. Since the inception of the program it has gone through several iterations and revisions (see Table 2). This program provided households with the opportunity to own solar PV systems.

Table 2. CCEF Residential Solar PV Rebate Program (2005-2011)

# of Months	Incentive Level ($/kW)	# of Systems	Installed Capacity (kW)	Installed Cost ($/kW)	Average Incentive Paid per Month
31	1st 5 kW = $5.00/W 2nd 5 kW = $0.00/W	180	622	$10,993	$115,000
21	1st 5 kW = $5.00/W 2nd 5 kW = $4.30/W	559	2,674	$10,847	$675,000
1	1st 5 kW = $4.00/W 2nd 5 kW = $2.50/W	123	636	$10,391	$2,300,000

[1] $5,500,000 of the incentives budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.
[2] ARRA SEP grant repurposing of $8,250,000 from grants towards financing is currently in process. Funds will be used as credit enhancements to attract private capital into a residential clean energy finance program.
[3] $3,500,000 of revolving loan fund budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.
[4] $1,475,000 of the workforce development fund budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.
[5] $200,000 of the EM&V budget allocation from the Connecticut Clean Energy Fund's FY 2011 and FY 2012 Comprehensive Plan.

30	1st 5 kW = $1.75/W 2nd 5 kW = $1.25/W	363	1,920	$7,624	$130,000
Total		1,225	5,851	$9,756	$300,000

In 2008, the CCEF launched a first-of-its-kind solar lease program, which achieved extraordinary success (see Table 3). This program provided households with an opportunity to lease solar PV systems and pay less on their monthly electric bill.

Table 3. CCEF Residential Solar PV Lease Program (2009-2011)

# of Months	**Incentive Level** ($/kW)	**# of Systems**	**Installed Capacity** (kW)	**Installed Cost** ($/kW)	**Average Incentive Paid per Month**
17	1st 5 kW = $5.00/W 2nd 5 kW = $4.30/W	369	2,053	$9,995	$640,000
4	1st 5 kW = $4.40/W 2nd 5 kW = $3.30/W	246	1,451	$8,579	$1,700,000
13	1st 5 kW = $2.68/W 2nd 5 kW = $2.18/W	194	1,127	$7,425	$290,000
Total		809	4,632	$8,926	$630,000

For Connecticut's residential rooftop solar PV sector, total installed costs have dropped by nearly 40 percent over a five-year period from $11,235 to $6,911 per installed kilowatt. In general, the installed cost of a residential solar PV system is 70% for hardware related costs – 60% panels and 10% inverter – and 30% from non-hardware related costs like labor, permitting, etc. (see Table 4)

Table 4. Residential Sector Average Solar PV Hardware and Non-Hardware Costs (2007-2011)

Year	**Average System Size** (kW)	**Hardware Costs**		**Non-Hardware Costs**	**% of Costs Non-Hardware Costs**	**$ Installed kW**
		Average Module Costs	Average Inverter Costs			
2007	4.39	$28,669	$4,285	$16,266	33%	$11,235
2008	5.07	$33,853	$4,633	$15,098	28%	$10,566
2009	5.54	$34,514	$4,309	$15,345	28%	$9,783
2010	5.63	$27,885	$4,771	$12,855	28%	$8,083
2011	5.59	$22,278	$4,822	$11,516	30%	$6,911

Given the high level of incentives, increase in customer demand, and the lack of the availability of incentive funds, the Connecticut market for residential solar PV deployment experienced some challenging times beginning in 2010. The CCEF was running out of incentive funds and dropped its incentive levels resulting in a significant

decrease in customer demand, a departure of local contractors to neighboring states, and contractors going out of business.

It is because of this unfortunate circumstance of too much demand in combination with high incentives and limited incentive funds that the Act now seeks to achieve the goal of sustained orderly development of the residential solar PV industry in Connecticut to develop stable and well-planned growth instead of ebbs-and-flows. The Program being proposed is designed to better manage the growth and development of the residential solar PV industry in Connecticut, while seeking to encourage competition and cleaner and cheaper energy in the marketplace.

1.3. Stakeholders

The people and organizations that will be impacted by the implementation of this program are:

- **Customers** – residential ratepayers of Connecticut Light and Power (CL&P) and The United Illuminating Company (UI) seeking to have solar PV systems installed on their homes

- **Users** – electricians and home improvement contractors working in Connecticut seeking to do the installation work for solar PV systems as well as energy efficiency

- **Partners** – financial institutions, including community, state and national banks, policy-makers (i.e. DEEP) and regulators (i.e. PURA), and companies providing 3rd party financing, and community-based and non-profit organizations assisting in acquiring customers

The staff members at CEFIA that will be actively involved in the implementation of the program include (see Table 5):

Table 5. CEFIA Staff FTE's in the Program

Position	FTE Equivalent
Director, Renewable Energy Deployment	0.15
Director, Energy Efficiency Deployment	0.10
Director, External and Government Affairs	0.10
Director, Marketing and Outreach	0.25
Senior Manager(s), Marketing and Outreach	0.50
Manager, Clean Energy Deployment	0.80
Manager, EM&V	0.30
Associate, Clean Energy Deployment	0.80
Associate, Marketing and Outreach	0.50
Assistant, Clean Energy Deployment	1.00
Total	**4.50**

1.4. Program Goals

Per Section 106 of the Act, CEFIA's goals with the Program are:

- Deploy at least 30 MW by the end of 2022 at half of the allowable incentives
- Attain stable and well planned growth of the solar PV industry (e.g. sustained orderly development)
- Achieve cleaner and cheaper energy for Connecticut by working towards a zero-subsidy model for solar PV deployment
- Be transparent with our incentives, processes, and performance
- Create a vibrant market for clean energy innovation

1.5. Organizational Goals

How does this Program meet the following organizational goals:

- **Attract and deploy capital to finance the clean energy goals for Connecticut** – the Program is designed to leverage limited ratepayer resources by decreasing incentives over time and transitioning towards finance. The Program also encourages third party financing models to enter Connecticut and offer lease financing.
- **Become the most energy efficient state in the nation** – the Program requires participation in the Home Energy Solutions (HES) program or an energy assessment conducted by a certified contractor. It is envisioned that the Program will provide financing whereby cost-effective energy efficiency will be required to improve the economics of the solar PV system.
- **Scale-up the deployment of renewable energy in the state** – the Program is focused on supporting the local in-state deployment of at least 30 MW of solar PV systems in the residential sector.
- **Support the infrastructure needed to lead the clean energy economy** – the Program identifies the barriers to the development of a permanent Connecticut-based solar workforce and provides support for the comprehensive training, accreditation, and certification programs.

1.6. Measures of Success

1. **Installed Capacity** – install at least 30 MW of residential solar PV systems by the end of 2022 at half of the allowable incentives (i.e. $50 million)

2. **Incentives Leveraged** – deploy $200 million of private capital leveraged by no more than $50 million of ratepayer incentive funds to achieve a leverage ratio of at least 4:1

3. **Financing Leveraged** – launch a revolving clean energy financing program that uses credit enhancements to leverage private capital at a ratio of at least 4.5 to 1.0

4. **Customer Acquisition** – reach at least 7,500 households installing solar PV systems

5. **Model Communities** – demonstrate that 5% of households in a community can install solar PV systems.

6. **Cost Reductions** – reduce non-hardware related costs by at least 15% by improving permitting, interconnection, and net metering processes and standards, and undertaking innovative customer acquisition strategies to further lower these costs

7. **Energy Efficiency Economics** – homeowners recognizing the importance of and then acting on cost-effective energy efficiency measures as part of a residential solar PV system

8. **Workforce** – increase the trained and employed workforce installing residential solar PV systems as well as undertaking energy efficiency measures

9. **Public Awareness** – Increase the knowledge and awareness of the benefits and availability of clean energy by households

10. **Accessibility** – demonstrate that solar PV systems are accessible by all income classes

1.7. Opportunity for Financial Innovation

Through the Connecticut Solar Lease program, CEFIA has been a national leader in the development of lease financing programs that require no upfront costs and provide a cheaper electricity solution for homeowners. This program has reached over 800 households and has had only two defaults.

CEFIA is developing a technology agnostic residential clean energy financing program that will take the financial innovation of the lease program for solar PV and turn it into a comprehensive program for renewable energy and energy efficiency. In collaboration with the Connecticut Energy Efficiency Fund (CEEF), CL&P and UI, CEFIA will provide financing support for a long-term loan and/or lease financing program(s) for clean energy installations. Through the use of credit enhancements and investments, a pool of capital will be raised from community banks, community development financial institutions, credit unions, pension funds, impact investors (i.e. foundations, university

endowments, etc.), and/or system benefit funds (i.e. CEFIA and/or CEEF) to provide low-cost financing for homeowners. A standard underwriting process and program guidelines will be pursued in order to develop a financial product that has the potential to be securitized and sold to institutional investors (i.e. pension funds).

CEFIA's ownership of renewable energy credits (RECs) and other energy or environmental attributes coming from the residential solar PV projects (i.e. forward capacity market payments) will be monetized. If CEFIA can find a long-term purchaser of its RECs at a reasonable price, then there is the possibility of creating a Clean Energy Victory Bond that will provide capital upfront to invest in cost-effective energy efficiency measures or for interest rate buydowns of a loan as a component of the solar PV system.

1.8. Prior Programs

1.8.1. Similar or Related CEFIA Programs

Through ARRA SEP grant funding support, CEFIA administers residential solar thermal hot water and geothermal incentive programs. The programs offer incentives of $275/MMBtu and $1,050 to $1,200/ton for solar thermal and geothermal projects respectively. These programs have reached nearly 1,000 households and created new markets for clean energy deployment.

(See also Section 1.2 – Background)

1.8.2. Benchmarking Leaders

Working with the National Renewable Energy Laboratory (NREL), CEFIA was able to benchmark leading residential solar PV programs across the country (see Table 6).[6]

Table 6. Comparative Analysis of Residential Solar PV Incentive Programs

	AZ	CA	CT	NJ	NY	MA
Electric Rates ($/kWh)	$0.1107	$0.1521	$0.1826	$0.1628	$0.1812	$0.1475
Installed Cost ($/W)	$6.21	$8.23	$5.75	$6.75	$7.10	$5.56
# of Residential Solar PV	1,872	56,656	1,887	2,780	3,027	895

[6] *Comparative Analysis of Residential Solar PV Incentive Programs* by Kim Peterson of the National Renewable Energy Laboratory for CEFIA (December 2011)

Systems						
Installed Capacity (MW)	9.4	271.6	12.4	23.5	16.3	4.8
Average System Size (kW)	5.0	4.7	7.5	8.5	5.4	6.4
Incentives Budgets (CT Proposed)	$14.4 MM (2011)	$1.167B (2007-2016)	$51.0 MM		$144 MM (2010-2015)	$8.0 MM
Current Incentive (CT Proposed)	$0.75/W	$0.25-$0.65/W EPBB; $0.03/kWh PBI	$2.45/W EPBB; $0.34/kWh PBI	$0.40/kWh	$1.75/W	$0.66/W + $0.30-$0.55/kWh
Cap	20 kW	10 kW	Greater of 5.5 kW or 75% of electric load up to 10 kW	100% of on-site load	7 kW	No cap, but rebates up to 5 kW
Energy Efficiency	No requirement	Self EE audit	EE audit	No requirement	EE audit encourage but not required	No requirement
REC Ownership	Utility	System Owner	CEFIA	System Owner	NYSERDA then System Owner	System Owner

Section 2 - Program Structure

2.1. Program Scope

Per Section 106 of the Act, CEFIA is required to design and implement a residential solar PV investment program. The Act requires that the Program result in a minimum of 30 MW of new residential solar PV installations in Connecticut on or before December 31, 2022. The Program is to be funded by no more than one-third of the total surcharge collected annually through the CEF – approximately $9 to $10 million a year or between $90 to $100 million over the life of the Program.

The Program serves customers seeking to install solar PV systems on their homes and contractors that are willing to provide the work to install the systems. The Program includes incentives, financing, marketing, legal, workforce development, technology, and evaluation measurement and verification components.

Incentives are a key component of the Program and are designed to:

- Decrease over time through a seven-step process; and
- Support homeowners that want to either own or lease a system.

Financing and marketing are also key components of the Program and are designed to:

- Provide access to low-cost capital to enable a homeowner to install a system;
- Reduce customer acquisition costs; and
- Scale-up the deployment of clean energy in Connecticut.

As a result of the successful implementation of the Program, Connecticut will not only have achieved the goal of installing at least 30 MW at half of the allowable incentives per the Act, but more importantly CEFIA will have developed a sustainable market for residential solar PV deployment that is not constrained by the need to provide incentives, but is instead driven-by market forces.

2.2. Program Objectives

The following are key objectives for the Program:

- Deploy at least 30 MW by the end of 2022 at half of the allowable incentives
- Attain stable and well planned growth of the solar PV industry (e.g. sustained orderly development)
- Achieve cleaner and cheaper energy for Connecticut by working towards a zero-subsidy model for solar PV deployment

- Be transparent with our incentives, processes, and performance
- Create a vibrant market for clean energy innovation

2.3. Assumptions

The Program makes assumptions in a number of areas as it pertains to incentives, financing, marketing, legal, workforce development, technology, and evaluation measurement and verification. The two key areas are incentives and financing, which are taken up below.

2.3.1. Incentives

A large part of the Program is the schedule of incentives for the Expected Performance Based Buy-Down Incentives (EPBB) and the Performance-Based Incentives (PBI). To develop the incentives for the Program, the following assumptions were used:

Assumption	EPBB	PBI
System Cost	$5/W$_{STC}$ declining by 5% from each step	$5/W$_{STC}$ declining by 5% from each step
Utility Avoided Cost	$0.1826 per kWh increasing by 1% annually	$0.1826 per kWh increasing by 1% annually
Incentive	Paid during and immediately after in-service date	Paid out on a quarterly basis based on performance over a 6-year period
Federal ITC Calculation	(Installed Cost – EPBB) * ITC	Installed Cost * ITC with PBI as taxable income
Debt Ratio	100%	35% (+ or -)
Debt Rate	6%	6%
Debt Term	15 years	15 years
Equity Rate	N/A	12%
Depreciation	N/A	5 years MACRS
Tax Rate	N/A	39.4%
Inflation Rate	N/A	2%
Source/Servicing Fee	N/A	4% outstanding debt

2.3.2. Financing

In order to achieve the goal of sustained orderly development, not only do incentives have to decrease over time, but financing must be offered to customers interested in either owning or leasing solar PV systems. To support the Program, the following assumptions of the terms and conditions for the product are being considered for financing:

Term	Description
Size of a loan	$1,000 – $25,000
Term of a loan	60, 120, or 180 months, according to the residential

	customer's choice – target is 10 years with solar PV and energy efficiency integration.
Expected average loan size	$20,000
Target capital providers	Community banks, community development financial institutions (CDFIs), credit unions, pension funds, impact investors (i.e. foundations, university endowments, etc.) and/or system benefit funds (i.e. CEFIA and/or CEEF)
Interest rate charged to the customer	Seeking to establish a competitive market rate of 5.99%
Loan coverage to the customer	Up to and including 80% for renewable energy; up to and including 100% for energy efficiency[7]
Measures[8]	Lighting, duct sealing, air sealing, insulation, solar PV, solar thermal, geothermal, small wind, micro fuel cell, micro CHP, furnace replacement, boiler replacement, window replacements, AC systems, heat pumps, electric vehicle recharging station, all cost-effective energy efficiency measures, and measures with SIR≥1 within the terms of the loan
Loan repayment	On-bill or direct payment
Loan underwriter and administrator	Seeking to identify an underwriter and administrator with experience servicing high volume and high performing residential energy efficiency and/or renewable energy loans. Identifying a rated servicing entity would be preferable.
Underwriting cost	Seeking to identify a competitively-priced underwriter and administrator.
Underwriting process	A competitive selection process is envisioned. Identifying a local entity would be preferable.[9]
Underwriting criteria	FICO score of 640 if salaried, 680 if self-employed for at least 2 years, 720 if self-employed for less than 2 years, no bankruptcy in the last 7 years, debt to income or monthly obligations to monthly income of 50% for all FICO scores.[10] Or, if on-bill repayment, then the underwriting criteria of CL&P and UI are appropriate.
Source of funds for interest rate buy-	ARRA SEP

[7] Per Section 99(2)(D) of the Act, "The authority may provide financing support under this subsection if the authority determines that the amount to be financed by the authority and other non-equity financing sources do not exceed eighty percent of the cost to deploy a clean energy project or up to one hundred percent of the cost of financing an energy efficiency project.

[8] Subject to change, however the focus of residential measures is on those that have or will receive categorical exclusions for NEPA and NHPA.

[9] Per the Operating Procedures of CEFIA, grants, loans or loan guarantees, debt and equity investments for clean energy projects are subject to a selection and award process including (1) competitive selection and award, (2) programmatic selection and award, and (3) strategic selection and award.

[10] Based on the underwriting criteria of the Connecticut Solar Lease program.

down	
Source of loan loss reserve funds	ARRA SEP
Eligible customers	Residential electric, natural gas, heating oil, and propane customers. Customers must have also completed an energy assessment by an insured HES approved vendor or a Buildings Performance Institute (BPI) certified contractor. Vendors using the HEY or other approved customer interface tool to calculate the energy savings and payback for customer follow-on recommendations.
Eligible installers	Renewable Energy – insured, PV-1, E-1, ST-1 and STC-1 solar contractors. For PV installations at least one staff member must have achieved a passing score on the NABCEP entry level PV exam, or hold a full NABCEP certification. Energy Efficiency – insured HES approved program venders or a BPI certified contractor, Certified Energy Manager (CEM), Professional Engineer (PE) on the job who is a registered home improvement contractor with the Connecticut Department of Consumer Protection.
Evaluation, Measurement and Verification	Renewable Energy – real-time advanced metering equipment (i.e. ANSI C12) with online performance data collection and analysis and inspections of all jobs by an independent contractor Energy Efficiency – use of the Home Energy Yardstick or other approved customer interface tool, Program Savings Document of the CEEF, ongoing utility bill analysis for electric and natural gas customers, or inspections of a random sample of jobs by an independent contractor Installation of any data acquisition system or meter may be required by CEFIA for performance measurement and verification. CEFIA will have access to and ownership of this data.
Third party insurer	Seeking to identify a third party insurer of energy savings performance to ensure that month-to-month and/or annual savings cash flows match debt service.

2.4. Dependencies

There are several areas of dependency that the Program relies on, including:

- **Availability of Resources** – the Program requires a steady stream of resources to support the schedule of incentives. Creating an incentive system that achieves the goal of sustained orderly development is challenging – as running out of incentives as a result of an increase in customer demand requires careful attention. CEFIA has planned it so that Steps 1-4 are achieved through the FY 2012 through FY 2014 budget request.

- **Systems** – to administer the expected increase in demand for residential solar PV systems, CEFIA will be developing a more streamlined and automated system for application processing. With the goal of expediting the process, reducing human resource requirements, and collecting and analyzing data, technology systems will need to be developed to handle intake.

- **Regulatory** – regulatory ruling that would allow for the long-term contracting for and purchasing by the electric distribution companies of renewable energy credits created, aggregated, and sold through the Program (see Section 3.4.2 – State Laws and/or Regulations below for Long-Term REC Contracts). If CEFIA can aggregate and sell a 15-year stream of RECs at a reasonable rate (no less than $40 per REC) from the projects supported through the Program, then CEFIA can issue bonds (i.e. Clean Energy Victory Bonds) to raise capital upfront to cover either an interest rate buydown if a homeowner wants to finance a project or to support additional cost-effective energy efficiency measures free of charge. Accessing the long-term value of REC payments today, can be used to reduce the payback period and increase the IRR and NPV of the project for the customer.

These are but a few of the dependencies that will have an effect on the overall success of the Program.

2.5. Constraints

As the Program proposes an innovative, comprehensive and new approach to residential solar PV deployment in Connecticut, there will be a number of constraints that will impact its development, including:

- **Financial Resources** – ensuring that we have funds to support the implementation of the Program.

- **Personnel** – equipping personnel with the systems and training to handle applications, respond to inquiries, and manage the Program.

- **Market Effects** – as the solar PV industry is undergoing dramatic change as a result of U.S.-China relations, there are a number of uncontrollable factors that could positively or negatively effect the Program.

- **Adaptability** – enabling CEFIA to be flexible, adaptable and responsive to changes in the marketplace.

- **Policies and Standards** – unforeseen policy and standard changes could beneficially or adversely impact the Program.

These are but a few of the constraints that will impact the Program.

Section 3 - Implementation Considerations

3.1. Target Market

CEFIA seeks to target residential customers in CL&P and UI service territory seeking to install solar PV systems on their homes.

3.2. Eligibility Criteria

List specific eligibility requirements for this program:

- **Homeowners** – must be CL&P or UI customers and agree to:
    - Work with a contractor or third-party service provider approved by CEFIA.
    - Complete an energy assessment through participation in CEEF's HES program, or performed by a BPI certified contractor, CEM or PE.
    - Install a kWh monitoring device to track system performance.
    - Install a revenue grade meter to verify system performance.
- **Contractors** – must be approved by CEFIA to participate in the Program and meet the following criteria:
    - At least one permanent employee or subcontractor must hold an E-1 license.
    - At least one permanent employee must hold the NABCEP Entry Level Passing Score Achievement Certificate, or full NABCEP certification.
    - Carry at least $1 million in general liability insurance.
    - Provide verifiable evidence of financial solvency and health in the form of a bank letter of reference/credit.
    - Provide a copy of standard contract or sales agreement.
    - Provide a five year workmanship warranty to homeowners. The warranty must cover all components of the generating system against breakdown or degradation in electrical output of not more than 10% from the original rated electrical output, and full costs of labor and repair or replacement of defective components or systems.
- **Third-party service providers** – must be approved by CEFIA to participate in the Program and meet the following criteria:

- Contract with a Connecticut licensed E-1 to perform PV system installation. The E-1 must carry at least $1 million in general liability insurance.

- Contract with a NABCEP Entry Level Passing Score Achievement Certificate holder, or full NABCEP certified individual to perform solar PV system design and engineering.

- Provide verifiable evidence of financial solvency and health in the form of a bank letter of reference/credit.

- Provide a copy of standard third-party services agreement.

- Provide a five year workmanship warranty to homeowners. The warranty must cover all components of the generating system against breakdown or degradation in electrical output of not more than 10% from the original rated electrical output, and full costs of labor and repair or replacement of defective components or systems.

3.3. Partners and Leverage

The partners for the Program include:

- **Financial Institutions** – including community, state and national banks that will provide capital for the Program as a result of credit enhancements offered by CEFIA;

- **Policy-Makers and Regulators** – that will make decisions effecting the Program;

- **3rd Party Financiers** – companies that will enter Connecticut as a result of the Program that will provide 3rd party financing for homeowners to lease systems; and

- **Non-Profit Organizations** – community-based organizations that will assist the Program in acquiring customers.

3.4. Law and Regulations

There are several local, state and federal laws and regulations that provide support for residential clean energy deployment.

3.4.1. Local Laws and/or Regulations

Connecticut has passed several local laws that support clean energy deployment, including:

- **Building Permit Fee Waivers for Renewable Energy Projects** – As of July 2011, Connecticut authorizes municipalities to pass a local ordinance to exempt

"Class I" renewable energy projects from paying building permit fees. Class I renewable energy projects include energy derived from solar power, wind power, fuel cells (using renewable or non-renewable fuels), methane gas from landfills, ocean thermal power, wave or tidal power, low-emission advanced renewable energy conversion technologies, certain newer run-of-the-river hydropower facilities not exceeding five megawatts (MW) in capacity, and sustainable biomass facilities. (Emissions limits apply to electricity generated by sustainable biomass facilities.) (Act Section 14)

- **Property Tax Exemption for Renewable Energy Systems** – Connecticut provides a property tax exemption for "Class I" renewable energy systems and hydropower facilities that generate electricity for private residential use. The exemption is available for systems installed on or after October 1, 2007, that serve farms, single-family homes or multi-family dwellings limited to four units. (Conn. Gen. Stat. § 12-81 (57))

3.4.2. State Laws and/or Regulations

Connecticut has passed several state laws that support clean energy deployment, including:

- **Green Loan Guaranty Fund** –Act Section 124 transfers the Green Loan Guaranty Fund to CEFIA from the Connecticut Health and Educational Facilities Authority (CHEFA) to identify eligible energy efficiency and renewable energy projects for residential, non-profit and small businesses (i.e. less than 50 employees).

- **Heating Equipment Replacement Program** – Act Section 116 requires DEEP to establish a residential heating equipment program, allowing customers to finance (via on-bill financing or other mechanism) the installation of energy efficient natural gas or heating oil burners, boilers and furnaces to replace electric heating systems, or burners boilers and furnaces that are not less than 7 years old with an efficiency rating of not more than 75%.

- **Installation of Metering Equipment** – Public Act 07-242 Section 39 (now codified at Conn. Gen. Stat. § 16-243h) states that the electric distribution companies (EDCs), at the request of a residential customer, **shall** provide for the installation of metering equipment that measures electricity consumed by such customer, deducts from the measurement the amount of electricity produced by the customer and not consumed by the customer, and registers, for each billing period, the net amount of electricity produced by the customer.

- **Interconnections Standards** – In December 2007, the Connecticut Department of Public Utility Control (DPUC) approved new interconnection guidelines 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. (Conn. Gen. Stat. § 16-243a)

Connecticut's interconnection guidelines, like FERC's standards, include provisions for three levels of systems:

- Certified, inverter-based systems no larger than 10 kilowatts (kW) in capacity (application fees: $100);
- Certified systems no larger than 2 megawatts (MW) in capacity (application fees: $500); and
- All other systems no larger than 20 MW in capacity. Note that the guidelines include "additional process steps" for generators greater than 5 MW (application fees: $1000, study fees will also apply).

Connecticut's guidelines include a standard interconnection agreement and application fees that vary by system type. However, Connecticut's guidelines are stricter than FERC's standards, differing from the federal standards in several significant ways:

- Customers are required to install an external disconnect switch and an interconnection transformer.
- 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 DPUC a status report on the research and development of area network interconnection standards. This report was completed in December 2009, and the DPUC has reached a final decision (03-01-15RE02) on the docket. The DPUC has determined that the utilities can interconnect inverter-based generators (up to 50 kW) on area networks. They also determined that once the IEEE 1547.6 standards are developed (which will address this issue on a national level), they will review the standards for area networks.

- **Locally Manufactured or Assembled and Distressed Municipalities** –Act Section 109 allows the Public Utility Regulatory Authority (PURA) to authorize additional incentives for residential PV projects using system components manufactured or assembled in Connecticut, and additional incentives if manufactured or assembled in distressed municipalities or a targeted investment community.

- **Long-Term REC Contracts** – Public Act 07-242 Section 71 allows EDCs to procure renewable energy certificates (RECs) from Class I, Class II and Class III renewable energy sources through long-term contract mechanisms. The EDCs **may** enter into long-term contracts for not more than 15 years to procure such RECs.

- **Net Metering** - Connecticut's two investor-owned utilities -- CL&P and UI -- are required to provide net metering to customers that generate electricity using "Class I" renewable-energy resources, which include solar, wind, landfill gas, fuel cells, sustainable biomass, ocean-thermal power, wave or tidal power, low-emission advanced renewable-energy conversion technologies, and hydropower facilities up to two megawatts (MW) in capacity. Legislation enacted in June 2007 (Public Act 07-242, Section 39) raised the individual system capacity limit to 2 MW and extended net metering to all customer classes. These changes took effect October 1, 2007. (Conn. Gen. Stat. § 16-243h)

  There is no stated limit on the aggregate capacity of net-metered systems in a utility's service territory. Any customer net excess generation (NEG) during a monthly billing period is carried over to the following month as a kilowatt-hour (kWh) credit. At the end of an annualized period, the utility pays the customer for any remaining NEG at the utility's avoided-cost rate. In January 2008, the DPUC ordered CL&P to calculate the reimbursement for PV systems, for any NEG at the end of an annualized period, on a time-of-use/generation basis. This significantly increases the financial benefits of net metering for PV system owners.

  Net-metered customers with systems greater than 10 kilowatts (kW) are assessed for the state's competitive transition assessment and the state's systems benefits charge, based on the amount of energy consumed by the customer from the facilities of the utility without netting any electricity produced by the customer.

- **Residential Solar PV Investment Program** –Act Section 106 requires CEFIA to design and implement a residential PV investment program. The program must result in a minimum of thirty (30) megawatts (MW) of new residential PV installations in Connecticut on or before December 31, 2022. This Program will be funded by no more than one-third of the total surcharge collected annually through the Clean Energy Fund.

- **Sales and Use Taxes for Items Used in Renewable Energy Industries** – Connecticut enacted legislation in May 2010 (H.B. 5435) that established a sales and use tax exemption for equipment, machinery and fuels used to manufacture solar thermal (active or passive) systems, solar electric systems, wind-power electric systems, or geothermal resource systems. (Conn. Gen. Stat. §12-412(117)(B))

- **Sales and Use Tax Exemption for Energy Efficient Products** – In Connecticut, *residential* weatherization products *for residential use only* are exempt from the state's sales and use tax. Eligible residential weatherization products include CFLs, programmable thermostats, window film, caulking, window and door weather strips, insulation, water heater blankets, water heaters, natural gas and propane furnaces and boilers that meet the federal Energy Star standard, windows and doors that meet the federal Energy Star standard, oil furnaces and boilers that are not less than 84% efficient and ground-source heat pumps that meet the minimum federal energy efficiency rating. Exemption only applies to in-store sales. (Conn. Gen. Stat. § 12-412k)

- **Sales and Use Tax Exemption for Solar and Geothermal Systems** – Connecticut enacted legislation in June 2007 (H.B. 7432) that established a sales and use tax exemption for solar energy equipment and geothermal resource systems. H.B. 7432 added passive and active solar water-heating systems, passive and active solar space-heating systems, and solar-electric systems to the list of exempt technologies. The sales and use exemption covers both the equipment related to eligible systems, and labor (services) relating to the installation of eligible systems. The exemption has no expiration date. (Conn. Gen. Stat. § 12-412)

- **Solar and Wind Contractor Licensing** - The Connecticut Department of Consumer Protection (DCP) is authorized to issue licenses for solar-thermal work, solar-electric work and wind-electric work. Solar electricity work is defined as "the installation, erection, repair, replacement, alteration, or maintenance of solar PV or wind generation equipment used to distribute or store ambient energy for heat, light, power or other purposes to a point immediately inside any structure or adjacent to an end use." The DPC has adopted regulations governing the following types of licenses:

    - A person who holds a PV-1 Limited Solar Electric Contractor license may perform only work limited to solar-electric systems (and wind-energy systems). The requirements to qualify for this license examination are two years (4,000 work hours) as a solar journeyperson (apprentice) and 144 hours of school/year or equivalent experience and training.

    - A person who holds a PV-2 Limited Solar Electric Journeyperson license may perform solar-electric work (including wind-energy work) only while in the employ of a licensed electrical contractor. The requirements to qualify for this license examination are the completion of a registered apprenticeship program or one year equivalent experience and training.

  It should be noted that an individual licensed as "E-1" or "E-2," (electrical licenses) does not require an additional PV license. That said, the individuals with E-1 or E-2 licenses are not exempt from the additional insurance

requirements required under CEFIA's program and, for purposes of the rebate, they must still be experienced or qualified to site and install PV systems (as detailed in legislation, Public Act 10-80). (Conn. Gen. Stat. § 20-330 et seq.)

- **Weatherization** – Public Act 07-242 Section 33 directs annual Conservation and Load Management (C&LM) plans to include an assessment of steps to achieve 80% residential weatherization by 2030.

3.4.3. Federal Laws and/or Regulations

The federal government has passed several laws that support clean energy deployment in Connecticut, including:

- **Energy Efficient Mortgages** – Homeowners can take advantage of energy efficient mortgages (EEM) to either finance energy efficiency improvements to existing homes, including renewable energy technologies, or to increase their home buying power with the purchase of a new energy efficient home. The U.S. federal government supports these loans by insuring them through Federal Housing Authority (FHA) or Veterans Affairs (VA) programs. This allows borrowers who might otherwise be denied loans to pursue energy efficiency, and it secures lenders against loan default.

- **Modified Accelerated Cost-Recovery System (MACRS) + Bonus Depreciation (2008-2012)** – Under the federal Modified Accelerated Cost-Recovery System (MACRS), businesses may recover investments in certain property through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to 50 years, over which the property may be depreciated. A number of renewable energy technologies are classified as five-year property (26 USC § 168(e)(3)(B)(vi)) under the MACRS, which refers to 26 USC § 48(a)(3)(A), often known as the energy investment tax credit or ITC to define eligible property. Such property includes solar electric technologies. (26 USC § 48)

  The federal *Economic Stimulus Act of 2008,* enacted in February 2008, included a 50% first-year bonus depreciation (26 USC § 168(k)) provision for eligible renewable-energy systems acquired and placed in service in 2008. This provision was extended (retroactively for the entire 2009 tax year) under the same terms by *The American Recovery and Reinvestment Act of 2009*, enacted in February 2009. Bonus depreciation was renewed again in September 2010 (retroactively for the entire 2010 tax year) by the *Small Business Jobs Act of 2010 (H.R. 5297)*.

  In December 2010 the provision for bonus depreciation was amended and extended yet again by *The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (H.R. 4853)*. Under these amendments, eligible property placed in service after September 8, 2010 and before January 1, 2012 qualifies for 100% first-year bonus depreciation. For

2012, bonus depreciation is still available, but the allowable deduction reverts from 100% to 50% of the eligible basis.

To qualify for bonus depreciation, a project must satisfy these criteria:

- the property must have a recovery period of 20 years or less under normal federal tax depreciation rules;
- the original use of the property must commence with the taxpayer claiming the deduction;
- the property generally must have been acquired during the period from 2008 - 2012; and
- the property must have been placed in service during the period from 2008 - 2012.

If property meets these requirements, the owner is entitled to deduct a significant portion of the adjusted basis of the property during the tax year the property is first placed in service. As noted above, for property acquired and placed in service after September 8, 2010 and before January 1, 2012, the allowable first year deduction is 100% of the adjusted basis (i.e., the property is fully depreciated and additional deductions under MACRS cannot be claimed). For property placed in service from 2008 - 2012, for which the placed in service date does not fall within this window, the allowable first-year deduction is 50% of the adjusted basis. In the case of a 50% first year deduction, the remaining 50% of the adjusted basis of the property is depreciated over the ordinary MACRS depreciation schedule. The bonus depreciation rules do not override the depreciation limit applicable to projects qualifying for the federal business energy tax credit. Before calculating depreciation for such a project, including any bonus depreciation, the adjusted basis of the project must be reduced by one-half of the amount of the energy credit for which the project qualifies.

- **Residential Energy Conservation Subsidy Exclusion** – According to Section 136 of the U.S. Code, energy conservation subsidies provided to customers by public utilities, either directly or indirectly, are non-taxable. This exclusion does *not* apply to electricity-generating systems registered as "qualifying facilities" under the Public Utility Regulatory Policies Act of 1978. If a taxpayer claims federal tax credits or deductions for the energy conservation property, the investment basis for the purpose of claiming the deduction or tax credit must be reduced by the value of the energy conservation subsidy (i.e., a taxpayer may not claim a tax credit for an expense that the taxpayer ultimately did not pay). (26 USC § 136)

  The term "energy conservation measure" includes installations or modifications primarily designed to reduce consumption of electricity or natural gas, or to

improve the management of energy demand. Eligible dwelling units include houses, apartments, condominiums, mobile homes, boats and similar properties. If a building or structure contains both dwelling units and other units, any subsidy must be properly allocated.

The definition of "energy conservation measure" implies that utility rebates for residential solar-thermal projects and solar-electric systems may be non-taxable. However, the IRS has not ruled definitively on this issue. Taxpayers considering using this provision for a renewable energy system should discuss the details of the project with a tax professional.

Other types of utility subsidies that may come in the form of credits or reduced rates might also be non-taxable, according to IRS Publication 525. This publication states: "If you are a customer of an electric utility company and you participate in the utility's energy conservation program, you may receive on your monthly electric bill either: a reduction in the purchase price of electricity furnished to you (rate reduction), or a nonrefundable credit against the purchase price of the electricity. The amount of the rate reduction or nonrefundable credit is not included in your income."

- **Residential Renewable Energy Tax Credit** – Established by the *Energy Policy Act of 2005*, the federal tax credit for residential energy property initially applied to solar-electric systems, solar water heating systems and fuel cells. *The Energy Improvement and Extension Act of 2008* (H.R. 1424) extended the tax credit to small wind-energy systems and geothermal heat pumps, effective January 1, 2008. Other key revisions included an eight-year extension of the credit to December 31, 2016; the ability to take the credit against the alternative minimum tax; and the removal of the $2,000 credit limit for solar-electric systems beginning in 2009. The credit was further enhanced in February 2009 by *The American Recovery and Reinvestment Act of 2009* (H.R. 1: Div. B, Sec. 1122, p. 46), which removed the maximum credit amount for all eligible technologies (except fuel cells) placed in service after 2008.

  A taxpayer may claim a credit of 30% of qualified expenditures for a system that serves a dwelling unit located in the United States and used as a residence by the taxpayer. Expenditures with respect to the equipment are treated as made when the installation is completed. If the installation is at a new home, the "placed in service" date is the date of occupancy by the homeowner. Expenditures include labor costs for on-site preparation, assembly or original system installation, and for piping or wiring to interconnect a system to the home. If the federal tax credit exceeds tax liability, the excess amount may be carried forward to the succeeding taxable year. The excess credit may be carried forward until 2016, but it is unclear whether the unused tax credit can be carried forward after then. The maximum allowable credit, equipment requirements and other details vary by technology, as outlined below. (26 USC § 25D)

3.5. Marketing and Outreach

Historically, customer participation in Connecticut residential solar programs has been driven by rebates and "no money down" financing options and was supported by limited, conventional marketing strategies such as collateral, event exhibits and workshops. As we now seek to scale up solar deployment, introduce innovative financing options and move beyond the "early adopter" customer audience, it is imperative that the Marketing and Outreach for the program also transition to think and act like retailers.

Drawing upon best practices identified by Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory (NREL) and the Clean Energy Group, we will develop a Marketing Plan that will drive demand for residential solar systems.

Specifically, the Plan will:

- Improve the technology's value proposition by creating messages about the affordability of solar, the availability of new financing mechanisms, the opportunity to reduce electric bills, the enhancement of property values and the security of the investment.

- Reinforce the reliability of solar technology through highly visible solar installations, positive testimonials from businesses, institutions and residents that have installed solar power, participation in solar home tours and educational seminars for specific targeted segments.

- Reduce the complexity of the solar decision-making process by simplifying the application process, reducing time for permitting, planning and zoning and interconnection processes and providing trusted advisors to assist prospective customers during the decision-making process.

- Overcome customer inertia by strong calls for action, promotional incentives and activities and raising awareness as to the program's declining incentive program.

3.5.1. Research

The Marketing Plan will be further guided by an analysis of customer motivations and attitudes toward solar power from a variety of sources including existing market research on solar programs, customer research developed through the statewide energy marketing campaign that will be conducted jointly by the Connecticut Department of Energy and Environmental Protection, the CEEF and CEFIA, and Connecticut-specific surveys of solar customers, "inerts" (customers that are interested in solar but have not yet acted), contractors and financing agents.

3.5.2. Promotion

Promoting the Program through various strategies over time will ensure the program's success by helping households understand the economic and environmental value of clean energy. Various strategies will be pursued, including, but not limited to:

- **Program Brand** – developing a program brand and identity in order to ensure the success of the Program.

- **Program Launch** – organizing a launch event to bring public attention to the Program and help galvanize customers and contractors.

- **Web Page** – creating an innovative and informative web page that provides households with information to act including online leader billboards, "Top 10" and "Worst 10" lists, testimonials, social media pages, etc.

- **Paid Media** – accessing paid media advertising through television, radio and web ads for target markets.

- **Earned Media** – seeking out opportunities for local earned media stories in community papers and television through tactics like ribbon-cutting ceremonies, town events, etc.

Taking the lessons learned from the Neighbor to Neighbor Energy Challenge, a $4.2 million DOE grant that CEFIA is administering in Connecticut, will provide the Program with key marketing insights.

3.5.3. Customer Acquisition

The Program will include a number of innovative and cost-effective customer acquisition strategies taken from national "best practices" including, but not limited to:

- **Program Campaign Brand** – creating a statewide "call to action" for homeowners to take action on energy efficiency and renewable energy. As part of the statewide campaign on energy that CEFIA is collaborating with DEEP and the CEEF on, a program brand will call attention to an action that homeowners can take to participate in the Program.

- **Clean Energy Communities Incentive** – providing performance-based rewards that drive local citizens to action can accelerate market demand and reduce customer acquisition costs.[11] Through the Clean Energy Communities program, cities and towns will receive rewards (i.e. solar PV systems, EV recharging stations, etc.) as more and more citizens, businesses and institutions lead Connecticut's transition to a clean energy economy.

- **Clean Energize Communities Test Pilot** – a volume-purchasing customer aggregation strategy that uses volunteer-driven community efforts to bring the benefits of solar PV and energy efficiency to homes. The program is anticipated to scale-up up the demand for solar PV deployment while also decreasing the installed cost of the systems. Portland, Oregon and Massachusetts have implemented such successful programs.

[11] *Climate Policy and Voluntary Initiatives: An Evaluation of the Connecticut Clean Energy Communities Program*, Matthew Kotchen: National Bureau of Economic Research (June 2010).

- **Energy Coach Program** – engaging households that have installed solar PV systems as "Ambassadors" and providing technical assistance through an expert "Coach" to households considering solar PV, will increase customer acquisition.

- **Better Business Bureau** – providing a mechanism to allow households that have participated in the Program to rate the product and service that they received from a contractor will provide information to advance marketplace trust between potential customers and contractors.

- **Clean Energy Loan Program** – providing households with a low-cost residential clean energy financing program that integrates renewable energy deployment with energy efficiency, will allow the market in Connecticut to move away from subsidies and towards finance – a more sustainable way to advance a market.

These are but a few of the customer acquisition strategies that will be deployed through the Program to scale-up the deployment of residential clean energy systems.

3.5.4. Other Programs

- **SunShot Initiative** – In December of 2011, CEFIA won a $2.1 million grant through the DOE's competitive SunShot Initiative. Round 1 of the $480,000 project is to work with 12 Clean Energy Communities to reduce non-hardware related costs for rooftop solar PV by 15 percent. The project will address permitting and interconnection processes that will result in a standardized online permitting application and an online database of local processes, net metering and interconnection standards, and planning and zoning that will result in a model ordinance for condominium associations and historical preservation. If successful in Round 1, then a $1.6 million Round 2 project will ensure scaling up the effort to across Connecticut and into New England.

- **Neighbor to Neighbor Energy Challenge** – In August of 2010, the CCEF won a $4.2 million 3-year grant through the DOE's competitive Energy Efficiency Conservation Block Grant General Innovation Fund Program. The Neighbor to Neighbor Energy Challenge is a nonprofit community savings program that engages residents in 14 Clean Energy Communities to reduce their home's energy use by 20%. As residents join and take actions to help their household, they earn points that can be redeemed for community rewards. The lessons learned from the challenge will be incorporated into the Program.

3.6. Operational Impacts

Given the comprehensive nature of the Program, there is a need to redirect staff-time to successfully administer various components of the Program, including incentives, marketing, legal, technology, and evaluation measurement and verification. It is

planned that between 4.5 to 5.0 FTE's will be required to successfully implement the Program. In order to better support human resources, technology systems will need to be developed to ensure quicker and more thorough processing of applications. It is expected that the financing aspects of the program (i.e. originating and servicing) will be subcontracted out.

3.7. Documentation Plan

In addition to the Program Plan, the Chief of Staff will work with the Director of Renewable Energy Deployment to develop a program manual. The program manual will be a document that changes over time as systems and processes change, but will be used as a guide to train anyone to step into and support the implementation of the Program.

The key documents for the Program include:

- Program Plan
- Program Manual
- Fact sheets and online documentation for customers and contractors
- RFP's for services
- Contracts with subcontractors

These are but a few of the key documents for the Program.

3.8. Workforce Development Impact

3.8.1. Survey

Per Section 106 of the Act, CEFIA will identify barriers to the development of a permanent Connecticut-based workforce and shall make provision for comprehensive training, accreditation, and certification programs through institutions and individuals accredited and certified to national standards.

In December of 2011, CEFIA, in collaboration with the CBIA Education Foundation, conducted a survey of 128 residential solar PV installers, residential solar thermal installers, and HES contractors. 80% of those surveyed were CEFIA approved installers. The key survey findings and barriers to the development of a permanent Connecticut-based workforce are listed below.

<u>Hiring plans:</u>

- **93% of respondents have difficulty hiring workers**
- The top three most difficult positions employers have difficulty finding are

  - Construction (HVAC, general skilled laborers)
  - Technical sales
  - Installation, maintenance, repair

- 63% of the respondents agree that the Act will have positive impact on their businesses

- 49% of the respondents consider adding more workers for existing job titles based on the Act

- 45% of the respondents will be hiring one to two employees next year, 34% will be hiring three to five employees next year, and 17% of the respondents anticipate adding more than 20 workers in the next three and five years

Training requirements; certifications and licenses:

- **65% of respondents believe their current workforce will need to upgrade their skills to continue performing their jobs**

- Desired certifications and licenses include:
  - OSHA Safety Training
  - BPI
  - PV-1 / PV-2
  - ST-1 / ST-2
  - E-1

Pre-employment testing:

- 56% of the respondents answered yes when asked whether the company conducts pre-employment testing

- 70% choose a basic knowledge test follows

- 60% use specific skills test such as communication, math, computer proficiency, safety, random problem solving, schematic reading, or NABCEP

Major barriers finding or retaining employees:

- **The major barrier companies faces in finding or retaining employees is applicants' lack job-specific skills and qualifications – 76% of the respondents face this challenge**

Average entry-level wage:

- 26% provide average hourly wages between $10.01 and $14.99
- 41% provide average hourly wages between $15.00 and $19.99

- 20% provide average hourly wages between $20.00 and $24.99
- 2% have entry-level employees with over $40 average hourly wage.

Average age:

- 30% has workforces with an average age between 25 and 29
- 49% of the respondents have workforces with an average age between 30 and 39
- 13% has workforces with an average age between 40 and 49

In January of 2012, CEFIA conducted a Residential Solar PV Investment Program Survey of approximately 100 solar PV industry stakeholders; including contractors and third party energy service providers. The key survey findings are listed below.

Total number of employees:

- 59% have 0-10 employees total
- 15% have a total of over 50 employees
- 65% have 0-10 employees located in Connecticut
- 18% have 11-20 employees located in Connecticut

Highest installation cost associated with PV:

- **73% identified equipment as their highest cost**
- 24% identified labor as their highest cost

Expansion of company to provide energy efficiency services:

- 29% of companies currently offer energy efficiency services
- 18% will be expanding
- **53%will not be expanding**

Types of training employers will be seeking for employees:

- **PV-1 59%**
- E-1 34%
- E-2 34%
- ST-1 22%
- STC-1 9%
- **Solar Sales 81%**
- **Marketing 41%**
- Customer Service 31%
- **Solar Finance 47%**
- BPI 22%
- CEM 16%

3.8.2. Workforce Support

As a result of the Act, customer demand for clean energy in Connecticut, especially rooftop solar PV, will increase significantly. The increase in customer demand will result in an increase in the supply of a skilled clean energy workforce. CEFIA's predecessor, the Connecticut Clean Energy Fund, installed over 10 MW of residential solar PV since 2004. CEFIA is mandated to install *at least* 30MW of residential solar by 2022. The 30 MW mandate, in addition to the Z-REC market, will significantly expand the clean energy economy in Connecticut.

As mandated by statute, CEFIA must make provisions for comprehensive training, accreditation, and certification programs through institutions and individuals accredited and certified to national standards that support the development of a permanent Connecticut-based workforce. In order to maximize the effectiveness of CT's workforce development community training programs need to be expanded; apprenticeship and internship programs must be expanded and/or implemented. CEFIA shall provide support to ensure that Connecticut's workforce has the required credentials (i.e. certifications, licenses) and skills to meet the projected demand by providing the workforce development support suggested below.

- **Training for Contractors**
  CEFIA will offer bi-annual seminars in energy efficiency in collaboration with the CEEF. All renewable energy contractors and energy efficiency contractors (HES vendors) will be invited to participate in the seminar. An overview of energy efficiency measures and example paybacks will be presented. CEFIA and CEEF programs will be reviewed and there will be time for contractor Q&A. The culmination of the event will include a contractor meet and greet. This time is intended to give contractors an opportunity to meet one another and forge relationships (i.e.: PV contractor working with an HES contractor).

- **Clean Energy Workforce RFP**
  CEFIA seeks to further the development and institution of self-sustaining clean energy training and education programs at public and private community colleges and universities, regional employment boards, community-based nonprofit organizations, and union and labor organizations. By working with these Connecticut entities and by providing funding for the purpose of purchasing clean energy demonstration and training equipment for practical laboratory and/or training space, the CEFIA will support these institutions and further educate students, clients and trainees in real-world scenarios that will prepare them for opportunities in the clean energy sector. Grants made through this solicitation are intended to prepare the Connecticut's training providers to meet the workforce needs of the clean energy sector. Programs must be designed based on local clean energy businesses' workforce needs.

- **Green Technologies Initiatives Program**
  The Green Technologies Initiatives Program incorporates solar PV, solar thermal, weatherization and energy efficiency hands on training. The hands on

component, E-Houses, are comprised of renewable energy technologies and energy efficiency technologies. The E-House provides both Weatherization and Building Analyst practical hands on experience, along with all required safety training as required by both NABCEP and BPI. The Green Technologies Program includes training and professional development for technical high school instructors, as well as curriculum and other classroom materials.

- **Clean Energy Sector Internship Program**
  The Clean Energy Sector Internship Program focuses on enhancing the talent pipeline for Connecticut companies engaged in the clean energy industry. The Clean Energy Sector Internship Program will facilitate the placement of current students and recent graduates who are considering career opportunities in clean energy through paid summer internships across the state.

Section 4 - Funding Structure and Amounts

4.1. Funding Level and Type

The Act focuses on CEFIA providing Expected Performance-Based Buy-down Incentives (EPBB) to support households that seek to own solar PV systems and Performance-Based Incentives (PBI) for households that seek to lease solar PV systems. The proposed combined budget for the EPBB and PBI is $51.00 million – $25.50 million for EPBB and $25.50 million for the PBI (see Table 7). If achieved, the Program would result in the installation of over 50 MW of residential solar PV systems over a 10-year period.

Table 7. Proposed Budget for the EPBB and PBI Schedule of Incentives by Steps

Step	EPBB Budget ($MM)	PBI Budget ($MM)	Total Budget ($MM)	Estimated Installed Capacity (kW)	Estimated Systems Installed	Estimated Budget Months	Estimated System Installs per Month
1	2.75	2.75	$5.50	2,508	406	6	68
2	3.25	3.25	$6.50	3,466	561	8	70
3	3.75	3.75	$7.50	4,816	779	10	78
4	4.25	4.25	$8.50	6,858	1,110	15	74
5	4.50	4.50	$9.00	9,769	1,581	22	72
6	3.75	3.75	$7.50	11,397	1,844	26	71
7	3.25	3.25	$6.50	12,900	2,087	33	63
Total	**$25.50**	**$25.50**	**$51.00**	**51,712**	**8,368**	**120**	

Although the EPBB and PBI step budgets are the same, the cash outlay for the PBI differs. Whereas the EPBB incentives are paid out upfront at the completion of a project, the PBI is paid out on a quarterly basis over a 6-year timeframe based on the performance of the system (see Tables 8 and 9). One of the many benefits of a PBI, is that the incentives are spread out over time and therefore do not require a large upfront source of funds.

Table 8. Cash Outlay for the EPBB and PBI through the End of the Schedule of Incentives

Step	EPBB Cash Outlay ($MM)	PBI Cash Outlay ($MM)	Total Cash Outlay ($MM)	Estimated Cash Outlay per Month ($MM)
1	2.75	$0.46	$3.21	$0.535
2	3.25	$1.00	$4.25	$0.531
3	3.75	$1.63	$5.38	$0.538
4	4.25	$2.33	$6.58	$0.439
5	4.50	$3.08	$7.58	$0.344

6	3.75	$3.71	$7.46	$0.287
7	3.25	$3.79	$7.04	$0.213
Total	**$25.50**	**$16.00**	**$41.50**	**$0.345**

Table 9. Cash Outlay for the EPBB and PBI Incentives for the Years Following the Schedule of Incentives

Year Following Step 7	EPBB Cash Outlay ($MM)	PBI Cash Outlay ($MM)	Total Cash Outlay ($MM)
1	$0.00	$4.11	$4.11
2	$0.00	$3.00	$3.00
3	$0.00	$1.80	$1.80
4	$0.00	$0.59	$0.59
Total	**$0.00**	**$9.50**	**$9.50**

It is anticipated that over a 14-year period, a programmatic investment of $51 million will be made in the Program.

4.2. Level of Support for Individual Awards

The EPBB supports local installers and homeowners that seek to own their solar PV system. Starting at an incentive level of $2.45/W for up to 5 kW and $1.25 for greater than 5 kW and up to 10 kW in Step 1 and ending at $0.55/W for up to 10 kW in Step 7, CEFIA seeks to support the installation of nearly 26 MW of solar PV in over 4,000 homes. EPBB incentives will be provided at various levels up to and including 5 kW for the first level and greater than 5 kW and up to and including 10 kW for the second level. CEFIA will not provide EPBB incentives beyond 10 kW per home.

Projects that incorporate major components that are manufactured or assembled in Connecticut and/or major components that are manufactured or assembled in a distressed municipality or strategic investment community, will receive an additional 5 and 10%, respectively, from the Public Utility Regulatory Authority (PURA). CEFIA anticipates processing about 35 applications and expending between $400,000 to $500,000 a month through the Program (see Table 10).

Table 10. Proposed EPBB Schedule of Incentives by Step

Step	EPBB Incentive ≤5 kW ($/W)	EPBB Bonus Incentive of 5%@≤5 kW ($/W)	EPBB Incentive >5 kW and ≤10 kW ($/W)	EPBB Bonus Incentive of 5%@>5 kW and ≤10 kW ($/W)	Estimated Monthly Budget ($MM)	Estimated System Installs per Month
1	2.45	$0.12	$1.25	$0.06	$0.460	34
2	2.10	$0.11	$0.90	$0.05	$0.410	35
3	1.75	$0.09	$0.55	$0.03	$0.380	39

4	1.40	$0.07	$0.20	$0.01	$0.280	37
5	1.05	$0.05	$0.00	$0.00	$0.200	35
6	0.75	$0.04	$0.00	$0.00	$0.140	35
7	0.55	$0.03	$0.00	$0.00	$0.100	33

The PBI supports third-party financiers working with homeowners that seek to lease their solar PV system. Starting at an incentive level of $0.34/kWh for up to 5 kW and $0.01 for greater than 5 kW and up to 10 kW in Step 1 and ending at $0.08/kWh for up to 10 kW in Step 7, CEFIA seeks to support the installation of nearly 26 MW of solar PV in over 4,000 homes. PBI incentives will be provided at various levels up to and including 5 kW for the first level and greater than 5 kW and up to and including 10 kW for the second level. CEFIA will not provide PBI incentives beyond 10 kW per home.

Projects that incorporate major components that are manufactured or assembled in Connecticut and/or major components that are manufactured or assembled in a distressed municipality or strategic investment community, will receive an additional 5 and 10%, respectively, from the Public Utility Regulatory Authority (PURA). CEFIA anticipates processing about 35 applications and expending approximately $400,000 a month through the Program (see Table 11).

Table 11. Proposed PBI Schedule of Incentives by Step

Step	**PBI Incentive ≤5 kW** ($/W)	**PBI Bonus Incentive of 5%@≤5 kW** ($/W)	**PBI Incentive >5 kW and ≤10 kW** ($/W)	**PBI Bonus Incentive of 5%@>5 kW and ≤10 kW** ($/W)	**Estimated Monthly Budget** ($MM)	**Estimated System Installs per Month**
1	$0.34	$0.02	$0.19	$0.01	$0.460	34
2	$0.29	$0.02	$0.14	$0.01	$0.410	35
3	$0.24	$0.01	$0.09	$0.01	$0.380	39
4	$0.19	$0.01	$0.03	$0.00	$0.280	37
5	$0.14	$0.01	$0.00	$0.00	$0.200	36
6	$0.10	$0.01	$0.00	$0.00	$0.140	36
7	$0.08	$0.00	$0.00	$0.00	$0.100	31

It is envisioned, that as the level of EPBB and PBI decline over time, that financing programs and energy efficiency will provide the necessary capital to support the sustained orderly development of the residential solar PV industry in Connecticut.

4.3. Financing

In collaboration with the CEEF, CL&P, and UI, CEFIA will provide financing support for a long-term comprehensive loan and/or lease Residential Clean Energy Financing Program (the Finance Program).

An American Recovery and Reinvestment Act (ARRA) State Energy Program (SEP) grant in the amount of $8,250,000 will be used for credit enhancements to support the implementation of the program. $7,000,000 in loan loss reserves and interest rate buy-downs will be used for a Residential Clean Energy Financing Program (see descriptions below) and $1,250,000 will be used for a Clean Energy Financial Innovation Program.

The sections below on the Finance Program are still in development. CEFIA is being provided technical assistance by the DOE to develop a comprehensive residential clean energy financing program.

4.3.1. Sources of Capital

The Finance Program envisions attracting low cost capital from community banks, credit unions, community development financial institutions, pension funds, impact investors (i.e. foundations, university endowments, etc.) and/or through revolving loan funds from system benefit funds like CEFIA and/or CEEF.

The target fund for the Finance Program is $25,000,000 and will provide financing for approximately 1,250 homes with a $20,000 loan.

4.3.2. Financing Mechanism

The Finance Program is expected to be a secured 10 or 15 year loan backed by the solar PV assets and will seek to incorporate cost-effective energy efficiency measures with less than a 5-year payback be included as part of the project. The goal of the Finance Program is to ensure that the energy savings from the solar PV system and the cost-effective energy efficiency measures cover the costs of the debt service payments.

4.3.3. Collection Mechanism

Working with CL&P and UI, CEFIA seeks to establish an on bill repayment capability. It should be noted that the Connecticut Housing Investment Fund's (CHIF) energy efficiency loan program has an on bill repayment feature with CL&P and UI.

If on bill repayment is not an option, then direct billing will be required.

4.3.4. Enhancements

Several credit enhancements will be used for the Residential Clean Energy Financing Program, including an interest rate buydown, loan loss reserves, and renewable energy credits.

- **Interest Rate Buydown (IRB)** – the interest rate buy-down seeks to target an interest rate to the customer of 5.99%. Funds will come from ARRA SEP grants.

- **Loan Loss Reserves (LLR)** – a loan loss reserve seeks to leverage private capital at 4.5:1.0 Funds will come from ARRA SEP grants.

- **Renewable Energy Credits (RECs)** – CEFIA retains the ownership rights to the RECs created from the Program. A present value of a 15-year stream of RECs

at the right price[12] may be used to cover either the cost of the interest rate buy-down on their loan or to support cost-effective energy efficiency measures as part of the Program. The creation of a Clean Energy Victory Bond is being considered as a mechanism to generate funds upfront that get repaid over time through the sale of RECs. Per Section 71 of Public Act 07-242, CEFIA seeks to work with DEEP, PURA, and the electric distribution companies to engage in a long-term REC contract for the sale of its residential solar PV RECs.

4.3.5. Eligible Installers

For renewable energy, insured PV-1, E-1, ST-1 and STC-1 solar contractors. For PV installations at least one staff member must have achieved a passing score on the NABCEP entry level PV exam, or hold a full NABCEP certification.

For energy efficiency contractors, insured HES approved program venders or a BPI certified contractor, CEM, or PE on the job who is a registered home improvement contractor with the Connecticut Department of Consumer Protection.

4.3.6. Eligible Measures

The eligible measures for the Finance Program include energy efficiency and renewable energy technologies, including, but not limited to (see Table 12):

Table 12. Sample List of Eligible Energy Efficiency and Renewable Energy Measures for the Finance Program

Energy Efficiency	Renewable Energy
▪ Lighting	▪ Solar PV
▪ Duct sealing	▪ Solar thermal hot water
▪ Air sealing	▪ Geothermal
▪ Insulation	▪ Micro-wind
▪ Furnace replacement	▪ Micro-CHP
▪ Boiler replacement	▪ Micro-fuel cell
▪ Window replacements	

The goal is to incorporate cost-effective energy efficiency into the economics of solar PV systems. Combining energy efficiency with solar PV results in a quicker payback and higher rates of return and net present values for the solar PV system.

4.3.7. Underwriting Criteria

A FICO score of 640 if salaried, 680 if self-employed for at least 2 years, 720 if self-employed for less than 2 years, no bankruptcy in the last 7 years, debt to income or monthly obligations to monthly income of 50% for all FICO scores.[13]

Or, if on-bill repayment, then the underwriting criteria of CL&P and UI are appropriate.

[12] The present value of 15-years of RECs generated from 1 kW of installed solar PV is $450. This assumes a discount rate of 5% and a REC price of $40.

[13] Based on the underwriting criteria of the Connecticut Solar Lease program.

Section 5 - Process and Timeline

Per the Operating Procedures of CEFIA, there are programmatic, competitive and strategic investments that will be made for various components of the Program:

- **Incentives** – once the Board of Directors approves the schedule of incentives, CEFIA staff will manage those incentives as a program investment. It is expected that the Program will be launched in February of 2012;

- **Financing** – at a future date, the Board of Directors will approve of the financing program, and CEFIA's Executive Vice President and Chief Investment Officer will manage those resources per the competitive or strategic investment processes. It is expected that the financing program will be launched at the end of Q2 or the beginning of Q3 of 2012;

- **Marketing** – once the CEFIA Board of Directors approves the marketing budget, CEFIA's Director of Marketing and Outreach will manage those resources per the competitive or strategic investment processes. It is expected that the marketing program will be launched at the end of Q2 or the beginning of Q3 of 2012. The launch of the Program will coincide with the financing product;

- **Legal** – once the CEFIA Board of Directors approves the legal budget, CEFIA's General Counsel will manage those resources per the competitive or strategic investment processes;

- **Workforce Development** – once the CEFIA Board of Directors approves the workforce development budget, CEFIA's Director of Renewable Energy Deployment and Director of Marketing and Outreach will manage those resources per the competitive or strategic investment processes. It is expected that a series of workforce development programs will be launched at the end of Q1 of 2012;

- **Technology** – once the CEFIA Board of Directors approves the technology budget, CEFIA's Chief of Staff and Director of Renewable Energy Deployment will manage those resources per the competitive or strategic investment processes. It is expected that technology solutions will be developed on an ongoing basis and that major systems will be launched in Q3 of 2012; and

- **Evaluation, Measurement, and Verification** – once the CEFIA Board of Directors approves the EM&V budget, CEFIA's President and Chief of Staff will manage those resources per the competitive or strategic investment processes. It is expected that by the end of Q4 of 2012, an EM&V program will be in place.

On a quarterly basis, through the Deployment Committee, progress on the Program will be reported and discussed. Through the development of a dashboard, bi-weekly meetings on progress will be held to discuss progress towards goals and objectives.

5.1. Evaluation Criteria

Discuss the intended method and criteria for application evaluation including any weighting factors

5.2. Risk Analysis

Risks associated with the successful implementation of the Program are described below (see Table 13).

Table 13. Risks and Risk Mitigation Strategies for the Program

Risk	Risk Mitigation Strategy
Too much demand is created from either the EPBB or PBI incentive	▪ Provide contractors notice 6-8 weeks ahead of any decrease in schedule of incentives ▪ Ensure appropriate staffing by shifting resources to manage program administration
Not enough demand is created from either the EPBB or PBI incentive	▪ Increase marketing activities ▪ Provide a financing product ▪ Implement a “solarize” aggregation model to reduce system costs
Panel cost volatility	▪ Implement a “solarize” aggregation model to control costs
REC price volatility	▪ Use a conservative forecast of REC prices that under estimates REC proceeds that will support program expenditures
Utility price volatility	▪ Adjust incentives accordingly to provide a reasonable system cost payback with due notice to contractors ahead of any change in schedule of incentive

5.3. Resolution Authorizing Approval of a Residential Solar Photovoltaic Investment Program

WHEREAS, Section 106 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) requires CEFIA to design and implement a Residential Solar Photovoltaic Investment Program (Program Plan) that results in a minimum of thirty (30) megawatts of new residential PV installation in Connecticut before December 31, 2022.

WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to identify barriers to the development of a permanent Connecticut-based solar workforce and support comprehensive training and accreditation and certification programs.

WHEREAS, pursuant to Section 106 of the Act, CEFIA has prepared this Program Plan to offer direct financial incentives, in the form of performance-based incentives or expected performance-based buydowns, for the purchase or lease of qualifying residential solar photovoltaic systems.

WHEREAS, CEFIA has prepared a declining incentive block schedule ("Schedule") that: (1) provides for a series of solar capacity blocks the combined total of which shall be a minimum of thirty megawatts and projected incentive levels for each such block; (2) provides incentives that are sufficient to meet reasonable payback expectations of the residential consumer; (3) provides incentives that decline over time and will foster the sustained, orderly development of a state-based solar industry; (4) automatically adjusts to the next block; and (5) provides comparable economic incentives for the purchase or lease of qualifying residential solar photovoltaic systems.

NOW, therefore be it:

RESOLVED, that the Board hereby approves the Program Plan and Schedule.

RESOLVED, the Board directs CEFIA to submit the proposed Schedule to the Commissioner of the Department of Energy and Environmental Protection for approval as required by Section 106 of the Act.

RESOLVED, that the Board approves the allocation of $23,675,000 for the Program Plan fiscal years 2012 through 2014.

RESOLVED, that this Board action is consistent with Section 106 of the Act.

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 this Resolution.

Section 6 - Evaluation, Measurement and Verification

6.1. Data Format and Collection

The following is a list of some of the key data that will be collected through the Program (see Table 14)

Table 14. Partial Listing of Data Collection by Method and Frequency

Field Name	Method	Frequency
Customer Information – customer demographic data (i.e. household income, location, square footage, etc.), historical energy consumption (i.e. electricity,	CRM	Once

natural gas, etc.)		
Project Information – hardware costs, non-hardware costs, process timeline, system details (i.e. size, tilt, etc.), incentives, product type, etc.	Power Clerk	Once
Contractor Information – business, staff, FTEs on the job by specialization, etc.	Power Clerk	Once
System Performance – current energy consumption, clean energy production, REC production, time-of-day production, etc.	Metering equipment	Real-time
Energy efficiency – measures undertaken, costs, and estimated energy savings	CRM	Once
Financing – loan amount, interest rate, repayment history, etc.	CRM	Monthly

Data for the Program will be collected electronically as much as possible so as to automate administrative functions and to analyze data quicker.

6.2. Data Analysis

Data from the Program will be presented in various forms, including, but not limited to:

- **Customer Portals** – a customized public web-page for the customer to see how their system is performing in real-time and to track the economic savings resulting from the installation. Widgets for social media will be created to allow a homeowner to share how their system is performing with friends and family.

- **Program Administrator Portal** – a portfolio manager private web-page for CEFIA to see how a contractor and the program are performing. The web-page will provide a dashboard to the staff and a mechanism to see how progress is being made towards goals. It will include the performance of the system as well as loan repayment performance.

- **Virtual Utility** – a public web-page that serves to aggregate all of the installations into an online virtual utility. The virtual utility can be queried to see how a town is performing for example.

- **Cost Index** – a public web-page that provides up-to-date information on hardware and non-hardware related costs, installed costs by geography, size, etc.

Data for the Program will be used to bring transparency to consumers and contractors in the marketplace and for administrative and evaluation purposes.

6.3. Metrics

The following is a list of several of the key metrics for the Program (see Table 15):

Table 15. Key Metrics for the Program

Metric	Current	Target
Installed capacity	12 MW	At least an additional 30 MW by the end of 2022 at half of the allowable incentives
Incentives leveraged	1.0:1.0	Deploy $200 million of private capital leveraged by about $50 million from the CEF for a leverage ratio of 4.0:1.0
Financing leveraged		Leverage private capital at a ratio of 4.5:1.0
Financing performance	Very low defaults	Maintain very low default levels
Customer acquisition	2,000	At least an additional 7,500
Model community with 5% penetration rate	0	Between 5 to 10
Non-hardware related cost reductions	$2,100/kW	At most $1,785/kW (a 15% reduction from current costs)
Energy efficiency measures	HES	HES or BPI-certified, cost-effective energy efficiency measures
Workforce	TBD	Increase in the number of trained and employed people in the residential solar PV workforce
Accessibility	TBD	Demonstrate that solar PV system ownership or leasing can be accessible by limited and middle income households

Section 7 - Appendices

7.1. Section 106 of the Act

Sec. 106. (NEW) (*Effective July 1, 2011*) (a) The Clean Energy Finance and Investment Authority established pursuant to section 16-245n of the general statutes, as amended by this act, shall structure and implement a residential solar photovoltaic investment program established pursuant to this section, which shall result in a minimum of thirty megawatts of new residential solar photovoltaic installations located in this state on or before December 31, 2022, the annual procurement of which shall be determined by the authority and the cost of which shall not exceed one-third of the total surcharge collected annually pursuant to said section 16-245n.

(b) The Clean Energy Finance and Investment Authority shall offer direct financial incentives, in the form of performance-based incentives or expected performance-based buydowns, for the purchase or lease of qualifying residential solar photovoltaic systems. For the purposes of this section, "performance-based incentives" means incentives paid out on a per kilowatt-hour basis, and "expected performance-based buydowns" means incentives paid out as a one-time upfront incentive based on expected system performance. The authority shall consider willingness to pay studies and verified solar photovoltaic system characteristics, such as operational efficiency, size, location, shading and orientation, when determining the type and amount of incentive. Notwithstanding the provisions of subdivision (1) of subsection (j) of section 16-244c of the general statutes, as amended by this act, the amount of renewable energy produced from Class I renewable energy sources receiving tariff payments or included in utility rates under this section shall be applied to reduce the electric distribution company's Class I renewable energy source portfolio standard. Customers who receive expected performance-based buydowns under this section shall not be eligible for a credit pursuant to section 16-243b of the general statutes.

(c) Beginning with the comprehensive plan covering the period from July 1, 2011, to June 30, 2013, the Clean Energy Finance and Investment Authority shall develop and publish in each such plan a proposed schedule for the offering of performance-based incentives or expected performance-based buydowns over the duration of any such solar incentive program. Such schedule shall: (1) Provide for a series of solar capacity blocks the combined total of which shall be a minimum of thirty megawatts and projected incentive levels for each such block; (2) provide incentives that are sufficient to meet reasonable payback expectations of the residential consumer, taking into consideration the estimated cost of residential solar installations, the value of the energy offset by the system and the availability and estimated value of other incentives, including, but not limited to, federal and state tax incentives and revenues from the sale of solar renewable energy credits; (3) provide incentives that decline over time and will foster the sustained, orderly development of a state-based solar industry; (4) automatically adjust to the next block once the board has issued reservations for financial incentives provided pursuant to this section from the board fully committing the target solar capacity and available incentives in that block; and (5) provide comparable economic incentives for the purchase or lease of qualifying residential solar photovoltaic

systems. The authority may retain the services of a third party entity with expertise in the area of solar energy program design to assist in the development of the incentive schedule or schedules. The Department of Energy and Environmental Protection shall review and approve such schedule. Nothing in this subsection shall restrict the authority from modifying the approved incentive schedule before the issuance of its next comprehensive plan to account for changes in federal or state law or regulation or developments in the solar market when such changes would affect the expected return on investment for a typical residential solar photovoltaic system by twenty per cent or more.

(d) The Clean Energy Finance and Investment Authority shall establish and periodically update program guidelines, including, but not limited to, requirements for systems and program participants related to: (1) Eligibility criteria; (2) standards for deployment of energy efficient equipment or building practices as a condition for receiving incentive funding; (3) procedures to provide reasonable assurance that such reservations are made and incentives are paid out only to qualifying residential solar photovoltaic systems demonstrating a high likelihood of being installed and operated as indicated in application materials; and (4) reasonable protocols for the measurement and verification of energy production.

(e) The Clean Energy Finance and Investment Authority shall maintain on its web site the schedule of incentives, solar capacity remaining in the current block and available funding and incentive estimators.

(f) Funding for the residential performance-based incentive program and expected performance-based buydowns shall be apportioned from the moneys collected under the surcharge specified in section 16-245n of the general statutes, as amended by this act, provided such apportionment shall not exceed one-third of the total surcharge collected annually, and supplemented by federal funding as may become available.

(g) The Clean Energy Finance and Investment Authority shall identify barriers to the development of a permanent Connecticut-based solar workforce and shall make provision for comprehensive training, accreditation and certification programs through institutions and individuals accredited and certified to national standards.

(h) On or before January 1, 2014, and every two years thereafter for the duration of the program, the Clean Energy Finance and Investment Authority shall report to the joint standing committee of the General Assembly having cognizance of matters relating to energy on progress toward the goals identified in subsection (a) of this section.

7.2. Section 109 of the Act

Sec. 109. (NEW) (*Effective July 1, 2011*) The Public Utilities Regulatory Authority shall provide an additional incentive of up to five per cent of the then-applicable incentive provided pursuant to section 106 of this act for the use of major system components manufactured or assembled in Connecticut, and another additional incentive of up to five per cent of the then applicable incentive provided pursuant to section 106 of this act

for the use of major system components manufactured or assembled in a distressed municipality, as defined in section 32-9p of the general statutes, or a targeted investment community, as defined in section 32-222 of the general statutes.

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CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

Memo

To: Board of Directors

From: Bryan Garcia

Date: December 9, 2011

Re: Proposal to secure the services of a financial consulting firm to support the development and implementation of financing programs

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BACKGROUND
The Board of Directors, at the September 29th meeting, approved a motion to change the proposed "Director of Finance and Investments" position to "Executive Vice President and Chief Investment Officer" to attract "higher level candidates" in recognition of the central importance of this position to the goals of CEFIA. To date, the search for higher level candidates has not yielded the desired results.

CEFIA is challenged with the responsibility of developing innovative financing programs. At the same time, it is critical that the new programs be well-constructed and attractive to outside investors. CEFIA cannot afford to make mistakes, especially in light of the recent occurrences at the federal level with the U.S. Department of Energy on its financing programs. Until highly-qualified in-house financial expertise can be hired and brought up to speed, it seems logical to avail ourselves of seasoned external expertise to help guide our program development and enable us to avoid missteps or "reinventing the wheel."

This memo requests Board approval for CEFIA to retain the services of a consultant for one year to assist with program development, staff selection and training, and to act as a counselor to the President and to the Board of Directors on strategic issues related to financing.

PROPOSED SCOPE OF SERVICES
The consulting company shall perform the following tasks, upon request:

- Assist CEFIA in the creation of an overall Comprehensive Plan for funding clean energy through loans, credit enhancements, and other financing mechanisms as mandated by Public Act 11-80;
- Provide strategic planning assistance to CEFIA to facilitate and accelerate program development and implementation;
- Work with CEFIA through all steps necessary to access capital markets in connection with maximizing program leverage, especially as relates to the

development of the Green Loan Guaranty Fund – per Section 124 of Public Act 11-80.

Specific services would include, but not be limited to:

- Preparing for State Bond Commission approvals;
- Advising on financing structures;
- Developing methods to leverage incoming loan cash flow and program funds;
- Providing advice on loan underwriting and servicing requirements and processes;
- Advising on the cost effectiveness of different financing scenarios;
- If bonds are issued, performing customary pre-sale tasks such as reviewing disclosure documents, preparing financing schedules, preparing ratings materials, developing financial models, and other related tasks.

- Assist with the procurement of professional services such as Loan Origination and Loan Servicing.

- Assist with the selection of firms to provide investment banking and underwriting services.

- Advise on effective program marketing and which financing products will be effective for different property segments and types of borrowers.

- Participate in meetings with CEFIA staff, borrowers, utilities, municipalities, counsel, CEFIA's Board of Directors, and other parties, as necessary or appropriate.

- Any other services to be specified by CEFIA that are consistent with our mission, as requested.

PROPOSED CANDIDATE

Lamont Financial Services Corporation is a nationally ranked independent financial advisor specializing in public finance. The firm provides financial advisory services to their clients, which are primarily states, state agencies, and municipalities. Lamont has offices in New Jersey, Missouri, and California. Lamont was ranked 9th overall of the nation's top 100 financial advisors (Source: Thomson Financial Securities Data). Lamont has particular expertise in managing revolving loan programs, including mortgages, loans to localities for infrastructure improvements, and energy efficiency investments.

The firm is very familiar with Connecticut's financial community, and with many of the State's agencies. The President, Robert Lamb, is the advisor for most of the Firm's east-coast operations, and has Connecticut's Office of Policy Management and the Office of the State Treasurer as clients. Chris Valentino, Vice President, has worked on financing projects for the State of Connecticut, the Connecticut Health and Educational Facilities Authority, and the Connecticut Development Authority.

RESOLUTION

WHEREAS, a major goal of CEFIA is to attract and deploy capital to finance Connecticut's clean energy goals;

WHEREAS, CEFIA must develop financing programs that attract private capital investment in Connecticut to enable a dramatic scale-up in clean energy deployment;

WHEREAS, the search for an Executive Vice President and Chief Investment Officer of CEFIA is taking more time and effort than had originally been anticipated; and

WHEREAS, Lamont Financial Services Corporation provides financial advisory services on public finance including support for the Connecticut Office of Policy and Management, Connecticut Office of the State Treasurer, Connecticut Health and Educational Facilities Authority, and the Connecticut Development Authority.

NOW THEREFORE BE IT:

RESOLVED, that the President of CEFIA shall engage the services of Lamont Financial Services Corporation to provide financial advisory services to assist with the development and implementation of new and innovative financing programs.

RESOLVED, that per CEFIA's Operating Procedures, the Chair and the President of CEFIA, are authorized to expend up to $150,000.00 over twelve (12) months for services such as these.

RESOLVED, that this Board action is consistent with Connecticut General Statutes § 16-245n and with the CCEF's comprehensive plan.

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

REGULAR DEPLOYMENT COMMITTEE 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 **2012**.

- Friday, February 17, 2012 – Regular Meeting from 1:00 to 2:00 p.m.
- Friday, May 18, 2012 – Regular Meeting from 1:00 to 2:00 p.m.
- Friday, August 17, 2012 – Regular Meeting from 1:00 to 2:00 p.m.
- Friday, November 16, 2012 – Regular Meeting from 1:00 to 2:00 p.m.

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
865 Brook Street
Rocky Hill, CT 06067

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

BUDGET AND OPERATIONS COMMITTEE
REGULAR MEETING SCHEDULE FOR 2012

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 2012.

- Tuesday, May 8, 2012 – Regular Meeting from 9:00 to 10:00 a.m.
- Tuesday, November 6, 2012 – Regular Meeting from 9:00 to 10:00 a.m.

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
865 Brook Street
Rocky Hill, CT 06067

CLEAN ENERGY
FINANCE AND INVESTMENT AUTHORITY

AUDIT, COMPLIANCE AND GOVERNANCE COMMITTEE
REGULAR MEETING SCHEDULE FOR 2012

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 2012.

- Friday, March 16, 2012 – Regular Meeting from 8:00 to 9:00 a.m.
- Monday, September 17, 2012 – Regular Meeting from 12:00 to 1:00 p.m.

All regular meetings will take place at:

Clean Energy Finance and Investment Authority
865 Brook Street
Rocky Hill, CT 06067