Final Progress Report

Project Title:	Northeast Provider of Solar Instructor Training - North	
Covering Period:	July 1, 2012 – June 30, 2015	
Date of Report:	June 30, 2015	
Recipient:	Maine Community College System, dba Kennebec Valley Community College	
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Working Partners:	N/A	
Cost-Sharing Partners:	N/A	
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Kennebec Valley Community College served as the Northeast region training provider for the Department of Energy Solar Instructor Training Network (SITN) from July 1, 2012 to June 30, 2015. During that time we accomplished the following objectives:

- Implemented a two-year train the trainer program that taught 25 instructors to incorporate solar PV into their curricula.
- Designed a mobile solar training lab and used it to deliver equipment and training to partner institutions and code official workshops.
- Educated and informed instructors of Interstate Renewable Energy Council (IREC) credentialing program.
- Held a series of workshops on solar PV in support of the National Administrator on-line program for Code and Building Officials, Inspectors, Firefighters, and other Authorities Having Jurisdiction (AHJs).
- Educated and informed the region on solar education activities and partner institution success stories through a webpage, quarterly newsletter and periodic e-mails.
- Actively participated in the National Administrator (hereinafter IREC) collaborative activities including: yearly meetings, monthly conference calls and working groups.

Train – the – Trainer Program for Instructors

Program recruitment

The core of our program was a rigorous two year training for instructors on how to incorporate solar PV into their existing electrical, building trades and engineering programs. Beginning in December 2012, we began a marketing campaign to recruit instructors from throughout the region which included: New York, Vermont, New Hampshire, Maine, Massachusetts, Connecticut and Rhode Island. KVCC developed a database of 1,250 instructors from technical high schools, community colleges, colleges/universities, and apprenticeship/union training organizations.

Marketing materials were distributed to this database and a total of 26 educational institutions (including 33 instructors) applied to the program. Applications were scored based on a rubric developed by KVCC which evaluated each instructor's ability to: incorporate solar technologies into existing course curriculum and to foster and strengthen relationships within the parameters of the SunShot Initiative. Twenty four institutions (including 29 instructors) were accepted into the program. Three instructors withdrew from the program due to scheduling/time constraints. A total of 26 instructors—hereinafter referred to as instructor trainees—from 21 educational institutions entered the program in April 2013. Each of the 21 institutions was required to sign a Memorandum of Understanding (MOU) (see Attachment 1) codifying the roles and responsibilities of the KVCC SITN program.

Educational institutions that joined the KVCC SITN program in April 2013:

- Alfred State College- (ASC) Wellsville, NY
- Cayuga-Onondaga BOCES- (BOCES) Auburn, NY
- Sullivan County Community College- (SCCC) Loch Sheldrake, NY
- Bramson Ort College- (BOC) Queens, NY
- Riverbend Career and Technical Center- (RBCTC) Bradford, VT
- McCann Technical School- (MTS) North Adams, MA
- Monument Mountain Regional High School- (MMRHS) Stockbridge, MA
- Greater Lawrence Technical School- (GLTS) Andover, MA
- Gloucester High School- (GHS) Gloucester, MA
- Massasoit Community College- (MCC)Canton, MA
- Plymouth South High School- (PSHS) Plymouth, MA
- Cheney Technical High School- (CTHS) Manchester, CT
- International Brotherhood of Electrical Workers- (IBEW) Wallingford, CT
- University of Bridgeport- (UB) Bridgeport, CT
- Dover Regional Career Technical Center- (DRCTC) Dover, NH
- Oxford Hills Technical School- (OHTS) Norway, ME
- Mid-Maine Technical Center- (MMTC) Waterville, ME
- Kennebec Valley Community College- (KVCC) Fairfield, ME
- Waldo County Technical Center- (WCTC) Waldo, ME
- Northern Maine Community College- (NMCC) Presque Isle, ME
- St. Croix Regional Technical Center- (SCRTC) Calais, ME

Program curriculum

KVCC designed a rigorous two year curriculum for instructor trainees. The curriculum was distributed to instructor trainees early in the program and consisted of:

Train-the-Trainer Schedule

Spring Semester 2013	**Dates**
Introduction to Solar PV (Online)	April 15 – May 31, 2013
Summer Semester 2013	**Attend one—all courses at KVCC**
Intro to Solar PV for Electrical Technology Programs	June 26-28, 2013
Intro to Solar PV for Construction or Building Technology Programs	July 17-19, 2013
Intro to Solar PV for Engineering Programs	August 7-9, 2013
Fall Semester 2013	
Instructor Mentoring (Online)	Oct 1, 2013–Dec 31, 2014

Integrating Solar PV into Existing Curricula (Online)	Oct 18-Nov 18, 2013
IREC Credentialing Pathway (Online)	Nov 22-Jan 6, 2013

Spring Semester 2014

Solar PV Design and Installation (Online)	April 18-June 2, 2014

Summer Semester 2014 Attend one

Solar PV Design and Installation for Engineering Programs Bridgeport, CT	June 24-26, 2014
Solar PV Design and Installation for Electrical Technology Programs Manchester, CT	July 15-17, 2014
Solar PV Design and Installation for Construction or Building Technology Programs Loch Sheldrake, NY	July 29-31, 2014

Fall/Winter/Spring Semesters 2014/2015

Instructor Mentoring/Mobile Solar Lab Site Visits	Sept 2014 – June 2015

Spring 2015

Best Practices for Solar PV Instruction Workshop Canton, MA	April 16-17, 2014

See Attachment 2 for the program curriculum, which contains more detail on each course.

KVCC Hybrid courses

Introduction to Solar PV we considered to be a 'hybrid' course, with the instructor trainees completing an online component in the spring of 2013 as their entry course in the program. Over the summer, each of them travelled to KVCC to attend one of a series of three-day lecture/hands-on courses which built upon information from the online course but was specific to their curriculum area. A total of 25 instructor trainees completed both *Introduction to Solar PV online* and the in-person *Introduction to Solar PV* summer course at KVCC. Alfred State College had to withdraw its instructor from the program. See Attachment 3 for the Fall 2013 Northeast SITN Quarterly which has a story featuring the initiation of the train-the-trainer program.

Images from 'Intro to Solar PV' hands-on training at KVCC Photos: A. Hudnor, KVCC

In fall/winter of 2013-14, a series of online courses began for instructor trainees. *Instructor mentoring online* was a course designed as a method of mentoring instructors and sharing resources. Michael Paradis, KVCC solar instructor, developed for each instructor trainee an individualized mentoring plan which identified which courses and activities the instructor trainee would perform to become prepared to teach solar PV in their curriculum by the end of the SITN program. Draft mentoring plans were distributed via this online course and instructor trainees were able to comment and suggest changes, after which final mentoring plans were adopted. See Attachment 4 for a summary of the instructor trainee mentoring plans. Instructor trainees also took an online course titled *Integrating Solar PV into Existing Curricula* the culmination of which was to design a plan to integrate solar in their own curricula. Five instructor trainees were asked to complete the online course *IREC Credentialing Pathway*. They were chosen because their programs already contained a rich amount of solar content and were therefore considered most likely to apply for and be awarded IREC credentials.

At this point in the program, KVCC had three partners withdraw due to the rigors of the program and scheduling conflicts: Northern Maine Community College, Riverbend Career and Technical Center and Monument Mountain Regional High School. This left KVCC with 17 partner educational institutions and 20 instructor trainees who all remained active and completed the program in April 2015.

Another hybrid model was used by KVCC instructor Paradis to deliver the course *Solar PV Design and Installation*. Instructor Trainees took *Solar PV Design and Installation online* over the spring of 2014. Then in the summer of 2014, three in-person lecture and hands-on sessions of *Solar PV Design and Installation* were offered at various locations. Three instructor trainees volunteered their schools to host the in-person sessions: University of Bridgeport in Bridgeport, CT, Cheney Technical High School in Manchester, CT and Sullivan County Community College in Loch Sheldrake, NY. Program Manager Amy Hudnor and Instructor Michael Paradis traveled to each location with the mobile solar lab (which will be described in more detail below) to deliver the three courses.

Solar PV Design and Installation for Engineering Programs at University of Bridgeport Photo: K. Shoji, University of Bridgeport

See Attachment 5 for summary of surveys from the courses offered during the Train-the-Trainer program.

Instructor Mentoring/Mobile Solar Lab site visits

By August 2014, instructors had completed a rigorous series of online and in person courses. A new phase of the program began in September, which focused more on individual support for instructor trainees. Instructor trainees were invited and encouraged to schedule a mobile solar lab site visit with the KVCC Instructor. KVCC acquired a mobile solar lab, which consists of a van and trailer filled with solar PV training equipment, to assist regional solar training by providing instructional support and equipment where it is needed. See Attachment 6 for the Northeast SITN Quarterly Summer 2014 story on the mobile solar lab.

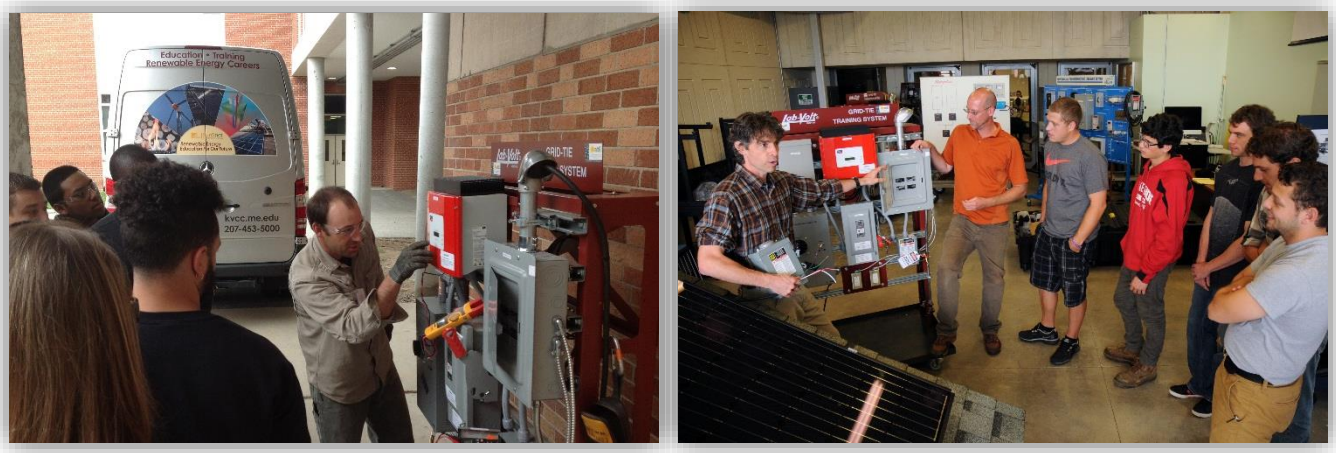
Mobile Solar Lab at Kennebec Valley Community College Photo: J. Humphries, KVCC

The van and trailer are packed full of the equipment needed for solar PV hands-on training. A total of 10 educational institutions receive instructor mentoring/mobile solar lab site visits:

KVCC instructor mentoring and mobile solar lab site visits to partner institutions				
KVCC Partner Institution	**Dates**	**Instructor Trainee**	**KVCC Instructor**	**# of students**
Sullivan County Community College	Sept 29-30, 2014	Larry Reeger	Mike Paradis	19
Cayuga-Onondaga BOCES	Oct 1-2, 2014	Ray Ludemann	Mike Paradis	24
Cheney Technical High School	Oct 28-29, 2014	Peter Jennings	Mike Paradis	21
Dover Regional Technical Center	Nov 12-13, 2014	Nathan Poland	Mike Paradis	35
St. Croix Regional Technical Center	Nov 20-21, 2014	Stan Sluzenski	Mike Paradis	15
University of Bridgeport	April 3-4, 2014	Linfeng Zhang	Mike Paradis	31
Gloucester High School	April 28-29, 2015	Bob Devlin	Dave Lawless	32
Greater Lawrence Technical School	April 30-May 1, 2015	Charlie Kennedy	Dave Lawless	44
Waldo County Technical Center	May 5-6, 2015	Dan Shaeffer	Dave Lawless	14
McCann Technical School	May 12-13, 2015	Don Tatro	Dave Lawless	25

During these visits, the KVCC instructor delivered solar training equipment to the school and set up equipment (including mini-mock roofs) within the instructor trainee's classroom or lab space. KVCC instructor worked with the

instructor trainee to team-teach solar to the instructor trainee's students. The KVCC instructor also advised each instructor trainee on how to improve their solar instruction and better develop their solar training equipment and facilities. See Attachments 7 and 8 for the Fall 2014 and Winter 2015 editions of Northeast SITN Quarterly where the 'SITN Partner Spotlight' story describes the mobile solar lab visits to each partner institution.



Images from mobile solar lab visits (left: Greater Lawrence Technical School, right: Sullivan County Community College)

Capstone of Train-the-Trainer: Best Practices for Solar PV Instruction Workshop

April 16 & 17 we held the capstone of the KVCC SITN program—the 'Best Practices for Solar PV Instruction' workshop. Instructors from both Kennebec Valley and Hudson Valley Community Colleges' SITN program were able to get together to learn from each other and from guest speakers, and share experiences of the excitement and challenges of teaching solar PV. Panel discussions included SITN instructors sharing successes and obstacles in integrating solar in their curricula and building their PV training facilities. The keynote speaker, national SITN manager Joe Sarubbi, shared the many successes the Solar Instructor Training Network had collectively achieved and how we fit into this national context. Joe also led a discussion with two solar employers—Solar City and ReVision Energy. Instructors learned more about hiring practices of solar employers, what they look for in an entry-level employee, what the future holds for hiring. This was the highlight of the workshop for participants such as Larry Wasko, who said 'having actual business reps was very beneficial to understanding the needs of industry from their perspective related to new hires.' For others, the technical workshops in the afternoons from Dave Lawless and Sue Stark were a highlight. See Attachment 9 for an agenda and Attachment 10 for the Spring 2015 Northeast SITN Quarterly article on the *Best Practices Workshop*.

Marshall Smith of SolarCity addresses the audience at the Best Practices for Solar Instruction Workshop Photo: J. Lynch Massasoit Community College

Instructor assessment of their own learning from train-the-trainer

A total of 20 instructor trainees from 17 partner institutions remained active and completed the program by June 2015. Instructors were given an assessment at the beginning and at the end of the program. The assessment, called 'Overall Training Program Desired Outcomes' was intended to measure their competencies in certain areas before the program and then measure how they had improved as a result of the program. Instructor trainees reported great improvements in all competencies.

Instructors who reported feeling 'very confident' or 'confident' in the *Overall Training Program Desired Outcomes* survey administered at the beginning and end of the program			
N=19 instructor trainees filled out both beginning and final survey	**Start of Program # very confident or confident**	**End of Program # very confident or confident**	**% who are confident or very confident at end of program**
1. Integrate solar PV content into your existing program's courses.	7	17	89%
2. Integrate solar PV courses into your existing program's curriculum.	6	16	84%
3. Prepare a solar PV training program summary, outline and sequence for your school.	6	14	74%
4. Outline a strategy of obtaining solar PV training program accreditation.	4	9	47%
5. Conduct an introductory solar PV lecture with topics consistent with NABCEP's solar PV entry level learning objectives.	5	15	79%

6. Conduct an advanced solar PV design and installation lecture with topics consistent with NABCEP's solar PV professional installer job task analysis.	3	11	58%
7. Organize and conduct a solar PV solar site survey training activity.	4	15	79%
8. Conduct PV system sizing exercises with students.	5	17	89%
9. Estimate solar PV system costs.	2	15	79%
10. Prepare introductory electrical installation lab activities with topics consistent with NABCEP's solar PV entry level learning objectives.	6	16	84%
11. Instruct introductory electrical installation lab activities.	10	17	89%
12. Prepare advanced electrical installation lab activities with topics consistent with NABCEP's solar PV professional installer job task analysis.	4	13	68%
13. Instruct advanced electrical installation lab activities.	7	14	74%
14. Prepare introductory mechanical installation lab activities with topics consistent with NABCEP's solar PV entry level learning objectives.	5	14	74%
15. Instruct introductory mechanical installation lab activities to a group of students on a mock roof.	3	15	79%
16. Prepare advanced mechanical installation lab activities with topics consistent with NABCEP's solar PV professional installer job task analysis.	2	14	74%
17. Instruct advanced mechanical installation lab activities to a group of students on a mock roof.	3	16	84%
18. Demonstrate safety procedures for mock roof training.	11	17	89%
19. Instruct commissioning solar PV systems lab activities.	3	13	68%
20. Instruct troubleshooting solar PV systems lab activities.	5	14	74%
21. Design and build a solar PV training lab.	4	17	89%

Final count of instructors and institutions and students they taught solar PV to

Institutions who remained active until the end of the program:

Institution	Location	Instructor Trainee(s)	# of students they taught solar to

			between 9/2013-6/2015
Cayuga-Onondaga BOCES	Auburn, NY	Raymond Ludemann	24
Sullivan County Community College	Loch Sheldrake, NY	Lawrence Reeger	53
Bramson Ort College	Queens, NY	Anthony Dillon	21
McCann Technical School	North Adams, MA	Donald Tatro	58
Greater Lawrence Technical School	Andover, MA	Charles Kennedy	76
Gloucester High School	Gloucester, MA	Robert Devlin	31
Massasoit Community College	Canton, MA	Lawrence Wasko	12
Plymouth South High School	Plymouth, MA	Joseph Adragna Philip Strassel	33
Cheney Technical High School	Manchester, CT	Peter Jennings	50
International Brotherhood of Electrical Workers Local 90	Wallingford, CT	Paul Costello Mario Capozzo	71
University of Bridgeport	Bridgeport, CT	Linfeng Zhang Aymen Lpizra	59
Dover Regional Career Technical Center	Dover, NH	Nathan Poland	48
Oxford Hills Technical School	Norway, ME	David Langevin	10
Mid-Maine Technical Center	Waterville, ME	Keven Vachon	30
Kennebec Valley Community College	Fairfield, ME	Greg Fletcher	41
Waldo County Technical Center	Waldo, ME	Daniel Schaeffer	14
St. Croix Regional Technical Center	Calais, ME	Stanley Sluzenski	28
Total		20	659

Mini-grants for partner institutions for solar PV training equipment

In May 2015 we initiated a mini-grant program for partner institutions to apply for grants of up to $8,000 to use to purchase solar PV training equipment. Four instructors/institutions applied by the deadline and all four were awarded mini-grants totaling $29,462. Institutions were: University of Bridgeport, Sullivan County Community College, Gloucester High School and McCann Technical School.

IREC Credentialing

The KVCC SITN instructor, Michael Paradis, applied for and was awarded the IREC Master Trainer Certification for solar PV.

Partner institutions and instructor trainees were educated and informed of the IREC credentialing program (formerly ISPQ). KVCC designed an online course called *IREC Credentialing Pathway* and required five instructor trainees to take the course. The five instructor trainees were chosen because they and their institutions already had integrated solar PV into their curricula and we felt they had the best chance to qualify for IREC credentials. Instructor trainees indicated that the IREC application fee was a barrier and so KVCC offered to give mini-grants to any instructor or institution that wanted to apply. Some expressed interest, but no one had applied by the end of the KVCC SITN program in June 2015. We suspect that time was also a barrier to many of the instructors.

Solar PV Workshops for Code Officials

KVCC organized and held four workshops on solar PV as a follow up to the National Administrator on-line program for code and building officials, inspectors, firefighters, and other authorities having jurisdiction (AHJs). The four

workshops were centered on the International Association of Electrical Inspectors (IAEI) course on photovoltaic systems. For each workshop KVCC reached out to and partnered with the local IAEI chapter. KVCC program manager Amy Hudnor attended each workshop to host and coordinate and brought the mobile solar lab with equipment to the workshops in New Hampshire and Massachusetts. See Attachment 11 for flyer used to advertise the workshops. See Attachment 12 for the Winter 2014 edition of Northeast SITN Quarterly which details the code workshop held at KVCC.

Here is more info on the workshops:

Location	Date	Instructor	Partner IAEI Chapter	# of attendees
Vermont Technical College, Randolph, VT	9/25/2013	John Wiles & Cory Asbill	Green Mountain Chapter	62
Kennebec Valley Community College, Fairfield, ME	1/21/2014	Chris Warfel	Pine Tree Chapter	42
Lakes Region Community College, Laconia, NH	5/2/2014	Chris Warfel	Granite State Chapter	63
Common Market, Quincy, MA	3/4/2015	Chris Warfel	Paul Revere Chapter	110

Additionally KVCC supported Hudson Valley Community College in similar workshops they organized in Connecticut and Rhode Island. Amy Hudnor brought the mobile solar lab to the Connecticut workshop on 3/25/2014.

Chris Warfel teaches the solar PV for code official workshops in New Hampshire (left) and Maine (right) Photos: A. Hudnor, KVCC

The Northeast SITN Quarterly newsletter and website

KVCC used many methods to disseminate information about solar PV education and the SITN program. A webpage was created within KVCC's website which focused on the KVCC SITN program, especially a map with hyperlinks of partner intuitions, the curriculum for train the trainer, upcoming code official workshops, and success stories of SITN partner institutions.

A quarterly newsletter was written beginning in fall of 2013. Each newsletter was posted on the above mentioned SITN webpage on the KVCC website. An e-mail distribution list was created and each quarterly newsletter was e-

mailed to this list. The newsletters were e-mailed to: instructor trainees in our train-the-trainer program, attendees of the solar PV for code official workshops, the SITN regional training providers around the U.S., Department of Energy and IREC staff, and members of environmental and energy NGOs and state agencies. Topics included: success stories of KVCC SITN partner institutions teaching solar PV, details of KVCC SITN courses and workshops, solar workforce/employment information and outlooks, and solar policy news and updates.

All editions of the Northeast SITN Quarterly are included as attachments to this report:

- Fall 2013 Attachment 3
- Winter 2014 Attachment 12
- Summer 2014 Attachment 6
- Fall 2014 Attachment 7
- Winter 2015 Attachment 8
- Spring 2015 Attachment 10

KVCC also used e-mail to disseminate resources to instructor trainees, especially national SITN resources and information about upcoming courses. KVCC shared SITN resources with instructor trainees through online courses, hands on courses and through e-mail and the newsletter. Examples of IREC resources shared include: *Best Practices* series, *U.S. Solar Market Trends*, *Solar Content Integration* webpage, and periodic webinars. Other examples shared include the Solar Foundation's *Solar Jobs Census* and the Department of Energy's *Solar Career Map.*

Collaboration with National Administrator (IREC) and national SITN

KVCC attended every monthly conference call with IREC and the other regional training providers (RTPs). KVCC frequently gave updates about the progress of our SITN program at RTP conference calls.

KVCC attended yearly in-person meetings for SITN including:

- November 13, 2012 Albany, NY
- May 14-15, 2013 Las Vegas, NV
- June 4-5, 2014 Philadelphia, PA

KVCC staff were also active participants in the three working groups organized by IREC:

- Solar Career Map Working Group: Amy Hudnor attended all meetings and recorded two interviews of solar professionals for use on the *Solar Career Map* webpage.
- Solar Online Education and Training Working Group: Mike Paradis attended meetings and assisted with the creation of the online course (which was the major deliverable for the working group). Amy Hudnor completed a pilot test of the online course.
- Solar Content Integration Working Group: Mike Paradis attended all meetings and assisted with the creation of a website which gives several examples of how solar PV is integrated at different educational institutions. KVCC's Electrical Technology program was used as an example of exemplary solar integration.

KVCC was extremely responsive to both IREC and DOE requests for metrics and information regarding our results in the SITN program. All requests for metrics were answered promptly and accurately including: IREC's surveys and metrics templates for each course KVCC taught to instructor trainees and code officials and DOE requests for information on veterans in the program and the number of students taught solar.

Conclusion:

In summary, KVCC has completed a successful and rewarding SITN program and fulfilled all program objectives in a timely manner. We served a total of 26 instructors who in turn taught solar PV to 659 students and will continue to expand their solar offerings to new students long after the SITN program is over. We taught solar PV and the codes to 277 code officials, installers and fire fighters. We contributed enthusiastically to all collaborative SITN projects led by the National Administrator, IREC and shared resources with our Northeast network. We have enjoyed being a part of the Solar Instructor Training Network and are proud at what we have collectively accomplished.

Report prepared by: Amy Hudnor, Principal Investigator, Kennebec Valley Community College