MAINE PUBLIC UTILITIES COMMISSION

REPORT TO THE JOINT STANDING COMMITTEE ON UTILITIES AND ENERGY PURSUANT TO LD 1556, RESOLVE, TO REVIEW CERTIFICATION REQUIREMENTS FOR INSTALLATION OF SOLAR PHOTOVOLTAIC SYSTEMS

Presented to the
Utilities and Energy Committee
March 30, 2010

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REPORT PRUSUANT TO LD 1556, RESOLVE, TO REVIEW CERTIFICATION REQUIREMENTS FOR INSTALLATION OF SOLAR PHOTOVOLTAIC SYSTEMS **March 30, 2010**

I. CURRENT LAW

The Solar and Wind Incentive Program was first enacted in 2005, as "An Act To Encourage the Use of Solar Energy." 35-A M.R.S.A. § 3211-C. The program includes a rebate system administered by The Public Utilities Commission (Commission or PUC)'s Efficiency Maine Energy Program Division. The qualifications of solar photovoltaic system installers are addressed in §3211-C(2)(A) as follows:

> A. To qualify for a rebate, a solar photovoltaic system must meet the following installation requirements:
>
> (1) For a system installed after July 1, 2005, but before January 1, 2007, the system must be installed by a Master Electrician who has completed a training course to prepare for certification by a North American Board of Certified Energy Practitioners or by a Master Electrician working in conjunction with either a person who has been certified by a North American Board of Certified Energy Practitioners or a person who has completed a training course to prepare for certification by a North American board of certified energy practitioners; or
>
> (2) For a system installed on or after January 1, 2007, the system must be installed by a Master Electrician who has been certified by a North American Board of Certified Energy Practitioners or by a Master Electrician working in conjunction with a person who has been certified by a North American Board of Certified Energy Practitioners.

Chapter 930 of the Commission's Rules further defines the terms and conditions of the Solar and Wind Incentives. Chapter 930 defines a Qualified Solar Photovoltaic System Installer as follows:

> Until January 1, 2007, [a qualified solar photovoltaic system installer] is a Master Electrician who has completed a training course to prepare for certification by the North American Board of Certified Energy Practitioners, (NABCEP), or is a Master Electrician working with someone who has completed the training course, or is a Master Electrician working with someone who is certified by NABCEP. After January 1, 2007, a "Qualified Photovoltaic System Installer" is a Master Electrician who is certified by NABCEP or is working in conjunction with a person who is certified by NABCEP.

II. THE RESOLVE

LD 1556 was signed on March 1, 2010. This Resolve includes the following provisions directing the Commission to conduct further review of the requirements for solar photovoltaic installers and make recommendations:

> **Sec. 1 Certification requirements reviewed. Resolved:** That the Public Utilities Commission, Energy Programs Division shall review the installation qualifications required for a rebate for solar photovoltaic systems under the Maine Revised Statutes, Title 35-A, section 3211C, subsection 2, paragraph A,

subparagraph (2) and evaluate whether those rebate program requirements are necessary and appropriate for ensuring safe and proper installation of solar photovoltaic systems, with particular attention to the requirement of certification by a North American Board of Certified Energy Practitioners. The division shall consider the appropriateness of a requirement based on a photovoltaic entry-level exam offered by a North American Board of Certified Energy Practitioners; and be it further

Sec. 2 Report and recommended actions to be made. Resolved: That the Public Utilities Commission, Energy Programs Division shall report its findings and recommendations under section 1, including suggested legislation, to the Joint Standing Committee on Utilities and Energy within 30 days of the effective date of this resolve. The Joint Standing Committee on Utilities and Energy may introduce a bill to implement the recommendations to the Second Regular Session of the 124th Legislature.

III. STAKEHOLDER INPUT REGARDING NABCEP CERTIFICATION

In order to compile this report, the Commission circulated a request for input from all persons on our interested parties list relating to renewable energy installations and the rebate program. The request for input went out to over 200 addresses. A fairly robust debate ensued, and the Commission received 26 responses, many of which were thoughtful and comprehensive. Approximately 9 of the respondents favored maintaining the current NABCEP certification requirement; 14 favored a more flexible certification requirement; and 3 expressed a variety of views neither for nor against any particular position.

Some of the comments in favor of maintaining the existing NABCEP certification requirement included that current NABCEP certified electricians can handle more work; strong ethical standards are essential; improperly installed systems are bad for consumers; full certification is necessary for consumer confidence; electricians could get certified but do not because the funding for the rebate program is insufficient; regular electricians are not qualified to do a good installation of photovoltaic systems; and a person who can't pass the NABCEP test should not be installing solar photovoltaic systems.

Some of the comments in favor of a more flexible requirement included that the pool of installers is too small; there are already too many requirements on the profession; NABCEP certification takes two years and is too expensive; homeowners should be allowed to install their own systems; technological changes make solar photovoltaic simpler to install than previously; it would be possible to tailor a curriculum that could be taught in Maine but not be full NABCEP certification; the current restriction is bad for competition; current rules are too restrictive; current system inhibits economic growth; wind installations allow more flexible qualifications by comparison; and no one should have to use out of state electricians to do an installation in Maine.

IV. RECOMMENDATION

The PUC carefully reviewed all the comments in light of its experience in this sector. The Commission believes that any installation that qualifies for the solar photovoltaic rebate

system should be done safely and effectively and should follow stringent standards to protect the public and ensure good quality workmanship. The PUC also believes, however, that certification requirements that are too strict may restrain the market and make it difficult or impossible for members of the public to take advantage of this legislatively created program. The Commission notes that the estimated number of active installers ranges from 5 to 10 across the entire state.

Although challenging, the Commission believes it is possible to reconcile these two objectives with a balanced approach that both ensures high quality work and allows for meaningful numbers of professionals to participate in the rebate program. The current NABCEP certification requirement has worked well to ensure quality of installation, safety, adherence to codes and professional ethics. But those objectives may still be served by a more flexible approach that would increase consumer access to qualified installations. The Commission believes it is time to consider a revision to the existing requirement followed by continued monitoring for quality, safety and the availability of an appropriate number of installers around the State.

If the Committee concurs that we may safely relax the existing requirement of full NABCEP certification, there are at least three options which the Commission recommends for your consideration. (Any new standard would not change the requirements for installation in the state, but would only change the types of installations that would qualify for the state rebate program.)

Regardless of which option is chosen, the Commission believes it is appropriate to always require a Master Electrician to be involved in the installation.

Option I: NABCEP Entry Level Certification

There are several levels of NABCEP certification. Typically the term "NABCEP certification" refers to a full program that requires two years of on-the-job training. There is also an Entry Level NABCEP certification which requires approximately 40 hours of classroom time. The Entry Level NABCEP certification is currently being taught by some Maine Community Colleges as part of the enrolled two year electrical degree programs. Entry Level NABCEP certification training could also be replicated for certifying Master Electricians who have been in the workforce for a number years through a two or three day refresher course.

Since the installer must always be a Master Electrician or be accompanied by a Master Electrician, the Commission believes that allowing the entry Level NABCEP certification would constitute no threat to the safety of consumers. A question remains, however, whether some solar photovoltaic systems might be unfamiliar even to a Master Electrician working in conjunction with an Entry Level NABCEP certified person.

Option II: Community College Based Training Approved By Efficiency Maine

Another approach to balancing the need for high quality installation with the need to create more flexibility in the marketplace would be to develop a new solar photovoltaic installer curriculum that does not require the two years necessary for a typical full NABCEP certification but does ensure appropriate professional competency for this work.

The Commission envisions that this new certification could consist of a 40 to 48 hour course curriculum at the Community College level that would run parallel to the NABCEP certification process. Class material may be integrated into the existing two year degree program, offered in evening classes, daily or weekend classes for the workforce who cannot take five or six days off for training. Currently the Community College system provides all training and certification for the Solar Thermal Program.

The Commission believes this option provides an important refresher for electricians who have been out of the educational system for a period of time. Additionally, it will provide electrical students with an in-depth training for real world installations following all applicable codes, based out of the Community College System. Such an educational opportunity could be offered at multiple locations across the State (at least initially) and would provide a new business opportunity for many start-up companies as well as expansion of existing solar companies.

Option III: Proof of Factory Training For Rebate Program

A third option would be to continue to require all electrical connections to be handled by a Master Electrician, but the full NABCEP certification requirement would be waived for any person who is factory-certified to install the particular equipment at any given site. Although some factory-certification programs are quite good, others offer significantly inferior training. For this reason, we cannot recommend factory certification as a substitute for the current full NABCEP certification requirement.

V. CONCLUSION

The Commission's recommendation, based on its experience in this sector and on the input received from stakeholders, is to add a Community College based training program approved by Efficiency Maine as an alternative to full NABCEP certification. The Commission believes this would provide the right balance between continued assurance of high quality and safety, and somewhat reducing the constraints some businesses are feeling in the current marketplace. As an example of how we might approach this, a comprehensive curriculum drafted by Kennebec Valley Community College is attached for your consideration. (The Commission greatly appreciates the effort of KVCC to submit this curriculum, but we have not yet endorsed this particular version for this purpose.)

At the same time, the Commission recommends continued monitoring by stakeholders to ensure that the program continues to achieve the correct balance of quality assurance and availability.

Suggested Curriculum for a 45 hour PV System Installation Course:

Course Description:
This course will cover the principles of photovoltaics and how to effectively and safely incorporate PV systems into stand-alone or grid-tied electrical systems. Topics covered include, but are not limited to, items such as the advantages and disadvantages of PV systems, site evaluation, component operation, system design and sizing, installation requirements, and recommended installation practices. Safety practices as they apply to PV system installation will be covered throughout the course. This 45 contact hour course will consist of 35 hours of instruction and 10 hours of lab exercises designed to reinforce the student's understanding of PV system installation.

Suggested Textbooks:
Photovoltaic Systems 2nd Edition, James Dunlap, American Technical Publishers
National Electrical Code (Latest Edition)

Suggested Course Topics:
Unit 1: Introduction to Photovoltaic Systems (2 Hours)

1. Photovoltaics
2. PV Applications
3. The PV Industry
4. Solar Energy Technologies

Unit 2: Solar Radiation (2 Hours)

1. The Sun
2. Solar Radiation
3. Sun-Earth Relationships
4. Array Orientation
5. Solar Radiation Data Sets
6. Estimating Array Performance

Unit 3: Site Surveys and Preplanning (2 Hours)

1. Preliminary Assessment
2. Site Surveys
3. Preparing Proposals
4. Installation Planning

Kennebec Valley Community College
92 Western Avenue, Fairfield, Maine 04937-1367
(207) 453-5000 Fax (207) 453-5010

Unit 4: System Components and Configurations (2 Hours)

1. Components
2. Electrical Energy Sources
3. PV System Configurations

Unit 5: Cells, Modules, and Arrays (2 Hours)

1. PV Cells
2. Current – Voltage (IV) Curves
3. Device Response
4. Modules and Arrays

Unit 6: Batteries (2 Hours)

1. Battery Principles
2. Battery Types
3. Battery Systems

Unit 7: Charge Controllers (2 Hours)

1. Charge Controller Features
2. Charge Controller Types
3. Charge Controller Setpoints
4. Charge Controller Applications

Unit 8: Inverters (2 Hours)

1. AC Power
2. Inverters
3. Power Conditioning Units
4. Inverter Features and Specifications

Unit 9: System Sizing (2 Hours)

1. Sizing Methodologies
2. Sizing Calculations

Unit 10: Mechanical Integration (3 Hours)

1. Mechanical Considerations
2. Array Mounting Systems
3. Mechanical Integration

Unit 11: Electrical Integration (6 Hours)

1. National Electrical Code
2. Voltage and Current Requirements
3. Conductors and Wiring Methods
4. Overcurrent Protection
5. Disconnects
6. Grounding
7. Battery Systems

Unit 12: Utility Interconnection (2 Hours)

1. Distributed Generation
2. Utility Interconnection Policies

Unit 13: Permitting and Inspection (2 Hours)

1. Building Codes and Regulations
2. Permitting
3. Inspection

Unit 14: Commissioning, Maintenance, and Troubleshooting (2 Hours)

1. Commissioning
2. Maintenance
3. Monitoring
4. Troubleshooting

Unit 15: Economic Analysis (2 Hours)

1. Incentives
2. Cost Analysis

Suggested Lab Exercises:

Note: The lab exercises could be more extensive based on whether sufficient PV system components will be available.

1. Interpret sun path charts for a specific latitude.
2. Interpret NREL solar radiation data for specific locations.
3. Perform a site survey.
4. Use a Solar Pathfinder to determine the amount of potential shading at a specific location.
5. Measure roof slope with an angle finder.
6. Measure roof slope by calculating it from the rise and run.
7. Determine the orientation of a proposed PV array location using a compass.
8. Determine true south using a compass and magnetic declination information for a specific location.
9. Interpret information found on a module label.
10. Diagram module connections in series, parallel, or series-parallel that will result in proper voltage and amperage values.
11. Diagram battery connections in series, parallel, or series-parallel that will result in proper voltage and amperage values.
12. Diagram the proper location and connections for charge controllers.
13. Interpret information found on an inverter nameplate.
14. Perform an electrical load analysis for a typical PV system installation.
15. Calculate the size of a PV system battery bank using a battery sizing worksheet.
16. Calculate the size of an array using an array sizing worksheet.
17. Install modules on mounting racks.
18. Calculate conductor sizes for PV system wiring using a maximum voltage drop of 2%.
19. Diagram the proper location and connections for inverters.
20. Determine possible solutions for PV system problems using a troubleshooting guide.