Certification Programs for the Photovoltaic Industry Status and Plans*

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ABSTRACT

Photovoltaic power systems of all types are now being installed in the United States. Grid-connected installations have seen a tremendous jump in their numbers and a wide range of designs and sizes are observed. Standards for utility interconnect, listing for safety, and qualification of hardware are written and listing and qualification programs are now available, but practitioner and hardware certifications are not yet in place. This paper addresses the established framework, progress and plans for consensus-based hardware and practitioner certification efforts currently under way as part of the US DOE Solar Program.

1. Introduction

Tremendous progress toward a National Voluntary Practitioner Certification Program has been made over the past 24 months. This preparatory work is nearing completion and by doing so, it is anticipate the first certificants will complete the certification process by the end of FY2003. Initially, the "North American Board of Certified Practitioners (NABCEP)" will administer the program with collaborative support from the US DOE Solar Program and various State Programs. [1,2,3]

A program to certify inverter performance is a first step towards guaranteeing the quality and energy production of installed PV systems. An important part of this first step is the required test protocol that determines what tests need to be conducted and how to conduct those tests in a cost effective manner.[4] This protocol is in the last stage of completion and will be distributed to participating industry members for review and acceptance. A must in this effort is that the certification "VALUE EXCEEDS THE COSTS".

Leadership in the certification programs reinforces and ties together all five of the technical objectives in the systems category of the DOE Program Plan. The five objectives are

1) Reduce life-cycle costs,
2) Improve reliability,
3) Increase and assure performance of fielded systems,
4) Remove barriers to the use of the technology, and
5) Support market growth for commercial U.S. photovoltaic systems.

Correspondingly, near-term goals listed in U.S. Photovoltaic Industry Roadmap, 2000 - 2020 are "We must work with the government to establish standards, codes, and certification, which are essential for consumer protection and acceptance" as part of the goals of "building toward our expectation of a $15 billion industry in 2020."

These certification elements tie to the National Solar Program and are a direct response to the "Photovoltaic Industry Roadmap", which highlighted the need for certification programs. Roadmap goals include determining the key characteristics, requirements and installation procedures that will lead to economical and useful photovoltaic applications. Laboratory qualifications, accreditation, and requirements for a certifying body will be part of the hardware certification program in the future.

2. Practitioner Certification

A key to the market acceptance of photovoltaic (PV) and other renewable energy technologies is a commonly accepted standard means by which potential users and conventional financing organizations can evaluate the competency of design, installation, and maintenance practitioners. Prior to recent state initiatives and rebate programs for photovoltaic installations, the market for PV power technologies did not extend much beyond systems for research and early-adopter enthusiasts, or was tied to federal applications programs. This insulated the PV industry from many of the demands placed on more established industries. Now, as the PV market grows to a more commercial level, it must meet these important market demands. If it is to succeed in the marketplace, the PV industry must provide consensus measures of quality to assure customers and funding agencies alike that they are working with properly trained practitioners.

The improvements and advantages offered by a national voluntary certification program can only expand the horizons for photovoltaic applications. The certification program can aid the technology by:

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- Encouraging safe and professional work practices;
- Spurring lower installed system costs;
- Increasing public acceptance of the solar industry and technology;
- Preserving consumer choice by providing a quality seal for qualified practitioners;
- Giving qualified practitioners a competitive edge;
- Promulgating quality training guidelines available for use in curriculum development;
- Encouraging increased availability of financing, incentives, and public funds.

Status of Practitioner Certification

Thanks to a host of expert volunteers from the photovoltaic industry, accreditation organizations, academia, the inverter industry, experienced installers, dedicated engineers and technicians, the NABCEP team has completed nearly all of the groundwork needed to launch a voluntary program. Dedicated collaborative work with strategic partners including the Florida Solar Energy Center, the Interstate Renewable Energy Council, the National Renewable Energy Laboratory, the Southwest Technology Development Institute, the Solar Energy Industries Association, and the National Joint Apprenticeship and Training Committee has contributed volumes of valuable experience and straw-man documents to accelerate the progress.

This work has been completed with financial and technical support of the US DOE Solar program as well as from State programs. The check list for completed work is a long one and deals with the full range of technical details, legal issues, ethics, bylaws, task analysis, applicant requirements, testing and validations.

The list of critical milestones completed includes:

☑ Technical Committees Created
☑ Administrative Committee Created
☑ Marketing Committee Created
☑ NABCEP Created
☑ Task Analysis Completed and Approved [5]
☑ Applicant Requirements Completed and Approved [6]
☑ Study Guide Prepared
☑ Tests Prepared, Evaluated, and Secured
☑ Outreach Documents Prepared
☑ NABCEP Incorporated as a Non-profit
☑ Bylaws Completed and Approved
☑ Legal Counsel Contracted
☑ Appeals Procedures Completed and Approved
☑ Code of Ethics Completed and Approved
☑ Ethics for Volunteers Approved
☑ Applications Drafted
☑ Offices for NABCEP Identified
☑ Administrator Selected
☑ Professional Testing Organization Contracted
☑ Timeline for Launching Program Established

Plans for Practitioner Certification

Plans for launching the national voluntary certification program are currently contingent upon continuing funding commitments from the US DOE and collaborating agencies. The DOE funding is expected to ratchet down as the program picks up income from applicants and certificants, and financial support from state and other agencies especially where the value of the voluntary program is greater than the costs of state-by-state licensing or organizational requirements. The goal is reduce to zero funding support from the DOE Solar Program in five years, but that goal will depend upon the photovoltaic industry markets and the number of systems being installed.

The near-term work plan includes completing or putting in place the following by the end of FY2003.

1. Continue to exert aggressive efforts in all preparatory activities to establish the remainder of the necessary documentation, procedures and policies to establish a National Voluntary Certification Program for installers and practitioners in the photovoltaic and solar disciplines;
2. Interview and hire an Executive Director for the program;
3. Maintain management and appropriate administrative support for the preparatory stages and preliminary operation of a voluntary PV installer certification program;
4. Work with a qualified "Testing Agency" to evaluate and validate tests already prepared and in the hands of NABCEP or its representatives. Work will include psychometric analysis, security and determining levels or required competency;
5. Work with legal organizations to finalize documentation and provide for the evolution for all aspects of the program including codes of ethics, appeals processes, applicant requirements, study guides, tests, applications and the like;
6. Facilitate and maintain working relationships with U.S. and international accreditation and certification groups,
7. Represent the U.S. PV and Solar community interests regarding domestic and international acceptance and recognition of practitioner certification, testing requirements, and reciprocity of certification approvals especially between states;
8. Provide and maintain appropriate coordination between industry, state and federal governments and the represented work force of installers;
9. Further efforts to promote and encourage participation by the PV community (manufacturers, users, etc.) and continue to evolve business plans that will ultimately make this effort independently funded through certificants and other stakeholders;
10. Negotiate and establish reciprocity protocols for associated certification and accreditation programs.

3. Hardware Certification

The objective of this certification effort is to provide cost effective means to certify the performance of inverters and eventually systems. The methodology chosen is to first write a test protocol for evaluating and certifying the performance of inverters for photovoltaic applications as a first step to certify inverters. This final draft will be distributed to all interested parties in an open forum to solicit comments and recommendations. All of the information obtained in a hardware certification process can also be incorporated into inverter models and reliability database being developed as part of a systems-driven approach for future development. Once recommendations and comments are incorporated into the protocol, and a majority consensus is established, the testing protocol can be used to help establish a certification program for inverters that can lead to complete PV system certification.

Hardware Certification Status

The testing protocol documentation is the next step towards an inverter certification program and the final draft is currently being written. The documentation for the inverter test protocol that is nearly completed includes test descriptions and protocols to collect information on:

1. Inverter Efficiency characteristics as a function of input, temperature and output;
2. Inverter Operating Ranges;
3. Maximum Power Tracking Range;
4. Maximum Power Point Tracking Accuracy (Steady state and dynamic characteristics);
5. Tare Losses including losses before startup and shutdown;
6. Input Power Startup and Shutdown;
7. Power Fold-back with temperature or power level;
8. Inverter Performance Level intended to provide a general characterization of inverter performance with results presented in kWh/kW (estimated ac energy out divided by inverter output power rating.

Hardware Certification Plans

The test protocol will be reviewed by members of the PV industry, designers, users, utilities, and system organizations to determine the value of the tests based on benefit to sales, performance expectations, incentive programs, financing and impact on overall costs. It is anticipated the public review will take several months. Incorporation of new input should take fewer than two weeks. Depending upon the responses and controversy level, a second public comment period may be needed to reach consensus. Sanity checks on the tests listed in the protocol will be provided by Sandia National Laboratories' Photovoltaic Systems Evaluation Laboratory. Unanimous approval is not expected because of its complexity and the potential costs of the needed tests.

Once it is apparent the test protocol and the value of the effort is determined to be greater than the costs, the test protocol will be submitted for consideration as a test standard. Concurrently, a means to establish a third-party certification program will be sought. Given the nature of the tests, the limited number of inverter models that will be submitted for tests, and the requirements for expensive and specialized test equipment, it is anticipated the third party testing facility will be an extension of other certification, qualification or quality laboratories that do not depend solely upon certifying inverters for photovoltaic applications. It is anticipated that meeting all milestones and the procedural requirements (description is beyond the scope of this article) will result in a formal hardware certification program that begins with inverter certification but will expand into PV module certification and eventually into system certification.

4. Summary

Both practitioner and hardware certification work has progressed to the point that documentation is in place to move forward. The National Voluntary Practitioner Certification Program has progressed rapidly, has completed nearly all required milestones and is nearly ready to be launched. The timetable shows graduation of the first certificants in FY2003. The hardware certification started later and has progressed more slowly. The draft test protocol for inverters is nearly complete. Industry reviews and public comment periods will evaluate the proposed test protocol to determine if it is comprehensive enough and that the value exceeds the costs. Consensus on proceeding forward will produce a final test protocol to be submitted to become a standard. Concurrently, the hardware certification program will seek a third party to certify hardware, provide sanity checks on all test procedures, and help establish a viable formal program.

5. References

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[5] Objectives and Task Analysis for the Solar Photovoltaic System Installer, North American Board of Certified Energy Practitioners' photovoltaic Technical Committee Document, Available at www.nabcep.org.

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