QUALITY PROGRAMS FOR WORKFORCE DEVELOPMENT FOR RENEWABLE ENERGY TECHNOLOGIES

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Abstract – We describe the development and implementation of International Quality Training Standards for renewable energy, energy efficiency and distributed generation practitioners. Qualified training for renewable energy practitioners, within the vocational training infrastructure of each country, supports access to reliable rural energy supplies and services, providing a number of paths leading to sustainable workforce creation, program success, and market expansion, while reducing liability, system failures, and financial and human risks. The number of countries participating in this framework is growing, providing greater access to funding, improved reliability of rural energy systems, and evidence that quality training is a key to success for renewable energy programs and sustainable jobs for well trained practitioners.

Keywords: training, standards, quality, renewable energy.

1. INTRODUCTION

Based on the growing need, the growing market, and an interest from the financial community, the Institute for Sustainable Power (ISP) was formed in 1996 as a non-profit organization to work with the global renewable energy industry, stakeholders, and actors to develop, implement, and maintain a common set of quality standards for the accreditation of training programs. A broadly acknowledged credential of professional skills capability supports customers in choosing competent practitioners, and provides financial institutions with a tool for risk assessment in evaluating lending and funding requests. Moreover, qualified professionals would then provide higher quality service to their customers, reducing errors and system failures, increasing customer satisfaction, thereby providing a path for sustainable employment.

The long-term goal of the ISP is a set of quality standards for each renewable energy, energy efficiency, and distributed energy technology and service. Photovoltaics (PV) were chosen as the initial technology on which the standards framework was developed based upon its wide use and the intense interest from stakeholders for qualification of training. Once the framework for International Training Standards was developed, similar standards with other technologies and services (e.g., solar thermal, hybrid systems, wind, micro hydro, energy efficiency, etc.) have been undertaken.

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2. DEVELOPMENT PROCESS

2.1 Developing National Standards and Certification Programs

ISP has developed, via an international expert committee and stakeholder process a standard, ISPQ DIS01021, that provides General Requirements for Trainers and Training Programs offering Renewable, Efficiency, and Distributed Generation Training. International task analysis committees analyze the knowledge, skills, competency and experience required for particular practitioners (e.g., of PV or solar thermal, etc.). The international task analysis addresses the core tasks associated with quality practice (e.g., PV system installation) and forms the basis for those task analysis standards that might be adopted to meet national needs and other requirements such as safety, national or local codes, etc.

Development of national standards via a national task analysis committee is often based upon stakeholder coordination to promote broad and open communication. These stakeholder groups include industry (manufacturers, installers, designers, engineers, dealers/distributors, industry associations), government (national and local: energy, education, training, housing, technology, licensing), finance (bankers, development groups, utilities, foundations, NGOs), standards experts, training/education (trade schools, apprenticeship programs, traditional academic programs), union/non-union trades organizations, licensing/certification specialists, and other relevant groups.

This coalition of stakeholders establishes the administrative structure and scope for developing national standards, and a certification program, if desired, including decisions on the examination process, levels of certification to be offered, prerequisites for certification, approval of the recommended competency standards, costs, etc. In addition, this group oversees the work of a task analysis committee, consisting of subject-matter experts that make the technical competency recommendations based on the ISP international standard.

Achieving consensus in this phase of development is often difficult. However, the keys to consensus are broad involvement of stakeholders, communication among stakeholders and to relevant market participants, and building on existing resources, expertise, and infrastructure. Most countries have some system of trades training, education, and qualification. Learning from the lessons that experts from these areas can offer will assist in validating the process, and integrating the developing quality programs with the existing infrastructure will provide benefits of credibility, efficiency, and cost savings. In addition, there are many resources available from ISP on national implementation, in the form of recommended practice guides, case studies, and an existing international quality standards framework on which to build.

2.2 Accrediting Training Programs

A key component in establishing a qualified infrastructure of practitioners is the availability of quality training programs, recognized through a third-party evaluation as having the ability and expertise to provide an appropriate level of training. Without such a third-party review and approval, selection of training programs by interested practitioners and students would have to be based on chance or, at best, anecdotal information.

As the demand for training grows, it will be important to have a means to verify the capabilities of training programs, to ensure that participants receive training that will lead to appropriate levels of knowledge and skills competencies for installing safe, reliable, and appropriate systems, and that they will maintain them over time.

To provide this evaluation, an objective third-party would audit the training programs against a set of technical, administrative, and program standards, including:

- Staff experience and capabilities;

- Facilities and equipment resources;
- Teaching and research materials;
- Business practices;
- Student support (e.g., job search resources);
- Documentation; and
- Quality practices and procedures.

Under the ISP program, this third-party audit requires that a training program submit an application, along with a self assessment based on the guidelines outlined in the *Accreditation Application Manual*. (available at www.ispq.org). Once the application is approved as meeting the stipulated qualifications, an auditor would visit the training program to evaluate the staff, facilities, resources, course materials and records against the information provided in the self assessment. The training program receives a debriefing at the end of this visit, indicating the status of the site evaluation, including any issues that might require additional development or clarification. Finally, the evaluations and recommendations of the auditors are reviewed by the Audit Review Committee for final recommendations. If approved, the accreditation would be valid for three years, though interim reviews and audits could be performed at the discretion of the committee.

Training programs that might apply for accreditation include traditional trades training and apprenticeship programs, manufacturers' in-house training programs, dedicated independent training programs, and others with programs that instruct practitioners.

3. NATIONAL AND REGIONAL PROJECTS

A number of activities around the world are addressing the adoption of the international standard to national needs, and the study and development of national or regional practitioner certification programs. In addition, the International Energy Agency Photovoltaic Power systems (IEA PVPS) Task 9 Experts Group on PV in Developing Countries (IEA Task 9 et al) is evaluating the development of international certification and accreditation standards and is developing recommended practice guides to document the efforts. The following sub-sections provide summaries of a few of these efforts.

3.1 Europe: ALTENER

In 2001, a team of organizations from Germany, The Netherlands, Switzerland, and the United Kingdom received a contract under the ALTENER program to develop a framework for establishing national PV practitioner certification programs in the participating countries. (Wilshaw et al, 2000) These organizations, IT Power Ltd., ISPQ Europe, and TNEI, from the UK; ECN from The Netherlands; WIP from Germany; and Alpha Real, from Switzerland, have been evaluating the existing training infrastructures in their countries, reviewing the international standards framework for training accreditation, and meeting with the relevant stakeholders in each country to determine the value and importance of implementing national and international standards for PV and solar thermal training and practitioner quality.

Following on initial coordination activities, each country held a stakeholders' workshop to introduce the available materials and proposals, gaining expert input and evaluating whether or not there is interest in pursuing the development of national, regional, and/or international quality standards. For those countries with sufficient stakeholder interest, recommended practices guides, existing resource materials, and guidance in the development and

implementation of national standards frameworks were provided and national standards are under development. Technologies include PV and Solar Thermal. A CD, "Quality is the Key to the PV Market: European PV Training Accreditation and Certification," summarizes the results.

3.2 United States: NABCEP

In the United States, a volunteer board of stakeholders has begun the implementation of a renewable energy practitioner quality standards framework under the name of the North American Board of Certified Energy Practitioners (NABCEP). This group, meeting since April 2001, has engaged stakeholder representatives from the education sector (apprenticeship trades, technical training, and conventional academic programs), the industry (national and state industry associations, manufacturers, solar thermal, and independent installers), the government sector (the Department of Energy, the National Renewable Energy Laboratory, and Sandia National Laboratories, with expertise in technology and policy), the trades (electricians and contractors), and the states. NABCEP, with input from their stakeholder groups and with broad public comment, has completed the development issues associated with the administration of such a program, the validity of the standards in the U.S. market, the inclusiveness of the process, and the value of the certification to the industry and the individual participants. (Pulaski et al, 2001)

By year end 2003, NABCEP will have offered its first certification exam for PV practitioners. The process of developing an examination process includes the validation of the written examination and the validation of the evaluation of skills and practical experience, as well as agreement on the prerequisites for taking the examination (e.g., training, experience, documentation, signing a code of ethics, etc.). Further, NABCEP will establish the infrastructure for testing and training, to be easily accessible to those wishing to participate without being too much of a financial and logistical burden. Details may be found at www.nabcep.org

3.3 The World Bank: QuaP-PV

In 1999, The World Bank received support from the government of The Netherlands to study and implement quality programs that would encourage the development of sustainable PV installations in developing countries, as part of a larger goal of mitigating global climate change. To do this, The World Bank's Asia Alternative Energy Unit contracted with four organizations to develop workshops, support materials, and manuals (World Bank, 2001) for

- Quality Component Design (ECN)
- Quality Manufacturing (PV GAP)
- Quality Testing (Florida Solar Energy Center); and
- Quality Practitioner Certification and Training (ISP)

Under the Practitioner Certification and Training component, ISP developed a workshop and training support materials to assist in the development of national practitioner certification standards programs. Initial workshops were held in Jaipur, India, followed by a formal workshop training in Midrand, South Africa. In its final phase under this contract, the ISP oversaw the implementation of a practitioner certification training program in Colombo, Sri Lanka.

In follow-up activities on this project, South Africa is studying the potential to integrate the international quality practitioner certification standards into their national trades training program; Sri Lanka has continued to work with ISP and the Australian practitioner

certification program to implement a national program, with the support of the Sri Lankan Solar Industry Association; and, stakeholders from Ghana have held preliminary meetings to use the international quality standards to implement a national standards program.

3.4 Australia

In 1994, the Australian solar industry established a national PV practitioner certification program, as a means to better ensure safety, quality, and reliability in systems installation practices. With a growing market, the Australian sustainable energy industry has begun the task of transferring the certification program from the industry to the existing national training infrastructure. As part of this process, the stakeholders are looking at harmonising their national standards with the developing international practitioner quality standards.

3.5 Brasil

In the 2003, a broad set of Brazilian experts and stakeholders have formed a technical committee for capacity building as part of the national photovoltaic standards development process. Under INMETRO, the national standards organization, the photovoltaic working and technical groups are making rapid progress to develop national standards for hardware and training. At this time, ISP has provided the international standards and framework for consideration.

3.6 Sri Lanka

In February 2000, with funding from the QupP-PV (quality-photovoltaic) program of the World Bank, an ISP-Certified Master Trainer from Global Sustainable Energy Solutions Pty LTD (GSES) of Australia conducted a “Train the Trainers” course. The trainers were trained to teach a Solar Home System course that was based on the 5-day certification course conducted in Australia.

The aim of the course was to have three to four senior technicians from each of the qualified companies trained to conduct all future technician-training courses for their respective companies. Though the technicians were competent to conduct training, and some companies conducted in-house training, the scheme did have in-built problems. Because the companies expanded rapidly, the senior technicians were needed to help with the expansion, and they did not have the time to conduct 5-day training courses.

The Sri Lanka Industry Association then proposed that they hire a trainer who would conduct all training of technicians on behalf of all companies so that Sri Lanka developed its own capacity for conducting their own training courses and not rely on overseas experts.

Since June 2001, the SIA trainer, with a team of two co-trainers, has conducted 20 training courses and trained more than 400 technicians. Two of these were conducted for staff of SEEDS, who were trained in the basics of PV and also maintenance and trouble shooting. The SEEDS staff are those who collect the loan repayments from the villages. The SEEDS staff are trained to help customers who might have a problem with their system. The result of having well-trained technicians as well as SEEDS staff include increased customer satisfaction, system performance and reliability, rapid repair of any problems, customer/user education for better understanding of the benefits and limitations of the system, and most importantly, increased demand for new business which helps drive sales and increased employment.

Advanced training was provided to the senior technicians and in 2003, the Trainer in Sri Lanka will commence the process to become an ISP-accredited Master Trainer.

3.7 China

In May 2000, ISP signed a Letter of Intent with the Beijing JiKedian Renewable Energy Development Center, Peoples Republic of China, in an agreement to work together to develop and implement quality standards for training programs and the training of policy makers in support of the Chinese Brightness Program. Under this program, ISP is assisting JiKedian in evaluating existing training programs, qualifying a number of Chinese Master Trainers to international quality standards, and assisting these Master Trainers in the training of local trainers from participating provinces (Inner Mongolia, Tibet, and Gansu). The goal of this effort is to establish an infrastructure of local trainers and practitioners, to improve the quality and reliability of installed systems, and to create local, sustainable jobs.

Following on a number of successful planning meetings, the initial evaluation of existing training programs was done in September 2001, with the qualification of the Master Trainers in March 2002. Following success for development of national training standards for PV, a Chinese Task Analysis Committee was established to develop a hybrid system national training standard, with technical support from NREL and ISP.

4. CONCLUSIONS

Driven by the need for third party qualification of practitioners, International Training Standards for renewable energy practitioners are now available and have been adapted by a number of countries via their national task analysis committees. Training programs that are accredited to these standards help insure knowledge, skills and competency of practitioners, providing a basis for higher quality service to their customers, reducing errors and system failures, increasing customer satisfaction, and thereby providing a path for sustainable employment.

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