North American Board of Certified Energy Practitioners (NABCEP)

The solar sector currently offers the most advanced certification model for renewable energy occupations. The North American Board of Certified Energy Practitioners (NABCEP) has completed task analyses for two key occupations in this sector: solar electric (photo-voltaic) system installers and solar thermal system installers. (NABCEP has also completed task analysis for small wind, but does not yet certify practitioners).[16] A formal task analysis, which identifies an occupation's critical tasks, knowledge, and skills, functions as a foundational document for credentialing assessment and provides the learning objectives for curriculum development. NABCEP used its task analyses to build and launch a certification program that provides professional certification to a broad range of journeymen, contractors, and foremen.[17] In addition, NABCEP developed an entry-level exam program for PV systems, aimed at workers interested in getting into the field.

The advantage of NABCEP is that the Board recognizes a variety of pathways into a solar career, and offers a wide variety of experience and training combinations to qualify to sit for its twice-yearly exams. The professional installer credentials set a very high bar, and are intended to recognize advanced skill and knowledge in the field, serving as an indicator of excellence (and ongoing skill development) for experienced installers. The entry-level PV exam sits at the other end of the training spectrum,

Table 1

NORTH AMERICAN BOARD OF CERTIFIED ENERGY PRACTITIONERS (NABCEP) CERTIFICATION REQUIREMENTS

NABCEP Certification	*Requirements*
PV Entry Level Exam Program	Taking a course from a registered provider. For the list of providers: www.nabcep.org/wp-content/uploads/2009/01/RegisteredProviders09162009.pdf
PV Installer Certification	Experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Be an existing licensed contractor in good standing in solar or electrical construction-related areas with experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Four years of electrical construction-related experience working for a licensed contractor, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR Three years experience in a U.S. Dept. of Labor-approved electrical construction trade apprentice program, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam in addition to completion of a Board-recognized training program; OR A two-year electrical construction-related, or electrical engineering technology, or renewable energy technology/technician degree from an educational institution or four-year construction-related or engineering degree from an educational institution, including experience installing PV systems occurring at some point in the two years prior to submitting an application for the exam.

marking completion of a standardized instructional program in basic concepts and skill sets for PV installation. This is a benchmark of sorts, rather than a professional certification. NABCEP offers no intermediate credentials, although many of these are actually "traditional" credentials that can be earned within a particular training system – an applied associate degree, for example, or an electrician's journey card.

Organizations training for some or all of NABCEP certifications include regional leaders like Solar Energy International (CO), the Midwest Renewable Energy Association (WI), and the Florida Solar Electric Center. Other accepted instructional paths include college and university programs, formal apprenticeships (JATCs are frequent partners here), and manufacturer training.

Table 1 continued

NABCEP Certification	*Requirements*
Solar Thermal Installer Certification	Four years of experience installing Solar Hot Water Systems; OR Two years of experience installing Solar Pool Heating Systems in addition to completion of a Board-recognized training program; OR Two years of experience installing Solar Thermal Systems in addition to completion of a Board-recognized training program; OR Be an existing licensed contractor in good standing in solar or construction-related areas with one year of experience installing Solar Thermal Systems; OR Four years of HVAC, mechanical, pipe-fitting, or plumbing-related experience working for a licensed contractor, including one year of experience installing Solar Thermal systems; OR Three years experience in a government/trade union-approved construction trade apprentice program, including one year of experience installing Solar Thermal Systems; OR A two-year construction-related, or engineering technology, or renewable energy technology/technician degree from an accredited educational institution plus one year of experience installing Solar Thermal Systems; OR A four-year engineering degree from an accredited educational institution, including one year of experience installing Solar Thermal Systems; OR NABCEP© Solar PV Installer Certification; AND Sixteen hours of Board-recognized training; AND Installation of at least two solar hot water systems. These two systems require permitting and inspection process by a permitting authority, but in the absence of such, an appropriate underwriter is authorized to provide an inspection certificate. In regions where neither of these inspection options exist, the Application Review Committee will judge experience based on supplied documentation.

Association of Energy Engineers (AEE)

The Association of Energy Engineers (AEE), an international society whose certifications are recognized by USDOE and USAID, among others, has by far the most clearly articulated and elaborate set of technical certifications for clean energy occupations. To an even greater degree than NABCEP solar installation credentials, AEE certifications in energy and building management are aimed at highly educated, deeply experienced practitioners. Candidates must take AEE preparatory seminars and sit for a rigorous examination, followed by demonstration of continuing education and skill development. While these are excellent standards that promote expertise in the field, this Olympian view offers little perspective on establishing and coordinating benchmarks for individual training programs.

Table 2

ASSOCIATION OF ENERGY ENGINEERS (AEE) CERTIFICATION REQUIREMENTS

AEE Certification	*Requirements*
Certified Energy Manager	A four-year engineering or architectural degree, or a registered Professional Engineer (P.E.) or Registered Architect (R.A.), with at least three years experience in energy engineering or energy management; OR A four-year business or related degree, with at least five years experience in energy engineering or energy management; OR A two-year technical degree, with eight years experience in energy engineering or energy management; OR Ten years or more of verified experience in energy engineering or energy management.
Certified Sustainable Development Professional	A four-year engineering or architectural degree from an accredited university or college and/or the current status of P.E. or R.A. or Certified Energy Manager (CEM®), with at least three years verified experience in energy efficiency and pollution prevention, or sustainable development; OR A four-year degree in business or related degree from an accredited university or college, with at least five years verified experience in energy efficiency and pollution prevention, or sustainable development; OR A two-year technical degree from an accredited college, with at least eight years verified experience in energy efficiency and pollution prevention, or sustainable development; OR Ten years or more of verified experience in energy efficiency and pollution prevention, or sustainable development.
Certified Carbon Reduction Manager	A four-year engineering or architectural degree, and/or the current status of Certified Energy Manager (CEM®) in good standing; OR A four-year business or related degree, with at least three years experience in energy/carbon management; OR A two-year technical degree, with at least five years experience in energy/carbon management; OR Eight years or more of verified experience in energy/carbon management.

Table 2 continued

AEE Certification	*Requirements*
Certified Energy Auditor	A four-year degree from an accredited university or college in engineering or architecture, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR A four-year non-engineering degree, with at least four years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR A two-year technical degree, with at least five years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR Ten years of verifiable experience in energy auditing, energy management, facility management, or experience related to energy management; OR The current status of Certified Energy Manager (CEM®).
Certified Building Commissioning Professional	A four-year degree from an accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in HVAC or process engineering design, architecture, construction project management, facilities management, testing, adjusting and balancing, or building commissioning; OR A two-year technical degree, or four-year non-technical degree from an accredited university or college in a field not specified above, with five years experience in HVAC or process engineering design, architecture, construction project management, facilities management, or testing, adjusting and balancing, or building commissioning; OR Ten years or more of verified experience in HVAC or process engineering design, architecture, construction project management, facilities management, or testing, adjusting and balancing, or building commissioning; OR The current status of Certified Energy Manager (CEM®).
Certified Business Energy Professional	A four-year degree from an accredited university or college in business/marketing, engineering or architecture, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least two years of experience in business/marketing/management/sales in the energy field; OR A four-year non-technical degree from an accredited university or college, with at least three years experience in business/marketing/management/sales in the energy field; OR A two-year technical degree from an accredited college, with at least five years experience in business/marketing/management/sales in the energy field; OR Eight years of experience in business/marketing/management/sales in the energy field; OR The current status of Certified Energy Manager (CEM®).

Table 2 continued

AEE Certification	*Requirements*
Certified Measurement and Verification Professional	A four-year degree from an accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in energy or building or facility management, or measurement and verification; OR A two-year technical degree or a four-year non-technical degree from an accredited university or college in a field not specified above, with five years experience in energy or building or facility management, or measurement and verification; OR Ten years or more of verified experience in energy or building or facility management, or measurement and verification; OR The current status of Certified Energy Manager (CEM®).
Certified Energy Procurement Professional	A four-year degree from accredited university or college in science, engineering, architecture, business, law, finance, or related field, or be a registered Professional Engineer (P.E.) or Registered Architect (R.A.). In addition, the applicant must have at least three years experience in energy or building or facility management, or real estate, or procurement, or brokering; OR A two-year technical degree or a four-year degree in a field not specified above, with five years experience in energy or building or facility management, or real estate, or procurement, or brokering; OR Ten years or more of verified experience in energy or building or facility management, or real estate, or procurement, or brokering; OR The current status of Certified Energy Manager (CEM®).
Certified Lighting Efficiency Professional	A four-year engineering or architectural degree from an accredited university or college, and/or be a registered Professional Engineer (P.E.), and/or a Registered Architect (R.A.), and/or a Certified Energy Manager (CEM®), with at least three years experience in lighting efficiency; OR A four-year business or related degree from an accredited university or college, with at least five years experience in lighting efficiency; OR A two-year technical degree from an accredited college, with eight years verified experience in lighting efficiency; OR Ten years or more of verified experience in lighting efficiency.
Distributed Generation Certified Professional	A four-year degree in science, engineering, architecture, business, law, finance, or related field and/or be a registered Professional Engineer (P.E.), with at least three years experience in cogeneration or distributed generation; OR A two-year technical degree or a four-year non-technical degree, with at least five years experience in cogeneration or distributed generation; OR Ten years or more of verified experience in cogeneration or distributed generation; OR The current status of Certified Energy Manager (CEM®).

Table 2 continued

AEE Certification	*Requirements*
Certified Green Building Engineer	A Professional Engineering (P.E.) License (*U.S. only) AND a Certified Energy Manager (CEM®) registration.
Certified GeoExchange Designer	A four-year engineering degree and/or be a registered Professional Engineer (P.E.), and/or a Registered Architect (R.A.), with at least three years of combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field; OR A four-year non-technical degree, with at least five years of combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field; OR A two-year technical degree, with at least eight years of combined experience in the geothermal heat pump design and heating, ventilating, and air conditioning field; OR Ten years or more of verified combined experience in the commercial geothermal heat pump design and heating, ventilating, and air conditioning field.
Certified Power Quality Professional	A four-year engineering degree and/or be a registered Professional Engineer (P.E.), with at least three years experience in power quality, energy or building or facility management, or electrical design, engineering or contracting; OR A four-year non-engineering degree, with at least five years experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR A two-year technical degree, with five years experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR Ten years or more of verified experience in power quality, energy or building or facility management, or electrical design, engineering, or contracting; OR The current status of Certified Energy Manager (CEM®).

Electronics Technicians Association (ETA)

The Electronics Technicians Association (ETA), which is a professional association that certifies workers in a variety of electronics fields, with particular strengths in fiber optics and telecommunications, recently developed two certification tracks for alternative energy workers — installation and integration. Integrators use "pre-engineered systems and components to design packages for retrofitting" and are cross-trained in solar, wind, micro-hydro, and fuel cells. The installer track is much less well defined. It would seem that these programs are just getting off the ground, with a recently released series of "Hybrid Alternative Energy Job Training Guides." It remains to be seen whether race to green serves ETA's constituents well, and if the organization, which does provide third-party assessment of electronics competencies aligned with ISO 17024 standards, can leap effectively from electronics to electricity, adding value to a renewable energy field in serious need of rationalized, coordinated skill assessments.

Table 3
ELECTRONICS TECHNICIANS ASSOCIATION (ETA) CERTIFICATION REQUIREMENTS

ETA Certification	*Requirements*
Alternative Energy Integrator Level I	Electronics Exam 1 — Direct Current Theory; AND Electronics Exam 2 — Alternating Current Theory; AND Comprehensive Exam 1 — Photo-Voltaic, Wind, Micro-Hydro, and Fuel Cells; AND Comprehensive Exam 2 — Covers Physics, Chemistry, Meteorology, and Mathematics.
Alternative Energy Integrator Level II	Electronics Exam 4 — Digital Theory; AND Comprehensive Exam 1 — Covers Passive Solar and Geothermal; AND Comprehensive Exam 2 — Covers Project Development, Finance, Standards and Codes, Incentives, Feasibility Analysis, and Site Development.
Alternative Energy Integrator Level III	A battery of tests over the entire alternative energy area with a heavy emphasis on project and product development, finance, standards, laws, covenants, and return on investment (ROI) analysis; AND Candidate must either be a graduate of an ETA-approved four-year degree; OR Have held a Level II certification for 36 months; AND Have worked in the field during the 36-month period of certification.
Alternative Energy Installer Level I	A test including written and hands-on components.
Alternative Energy Installer Level II	An advanced test with written and hands-on components; AND Twelve months experience working in the field.
Alternative Energy Installer Level III	Six specialty tests and a comprehensive exam including technical competencies, management, and standards; AND Five years of experience.
Installer Level III — Electrical Energy Generation	At least two Level II certifications; AND Twelve months work experience; AND Pass four of the five Level II written exams (Photo-Voltaic, Wind, Micro-Hydro, Fuel Cells, and Stirling technology).
Installer Level III — Alternative Thermal Energy	A comprehensive exam including technical competencies, management, and standards; AND A Level II certification in each of two specialty areas (passive solar, geothermal); AND Five years experience working in the field.