

# QI Supporting Policy-Making for PV Markets

Les Nelson

North American Board of  
**NABCEP**  
Certified Energy Practitioners

**Forum on Regional Cooperation:  
Developing Quality Infrastructure for  
Photovoltaic Energy Generation**

September 13, 2017  
Santiago, Chile



# About NABCEP

- Founded in 2002
- Non-Profit Corporation based in New York
- Governed by a volunteer Board of Directors consisting of experienced renewable energy professionals
- First PV Installation Professional certification examination in 2003 – currently ~ 2,200 certified PV Installation Professionals
- First PV Entry Level examination in 2006 – currently ~ 20,300
- PV Associate Program began in 2016 – currently ~ 1,400
- Approximately 200 current and former subject matter experts have volunteered to sit on NABCEP's many committees
- Accredited by American National Standards Institute (ANSI) according to ISO/IEC 17024 Accreditation Program for Personnel Certification Bodies

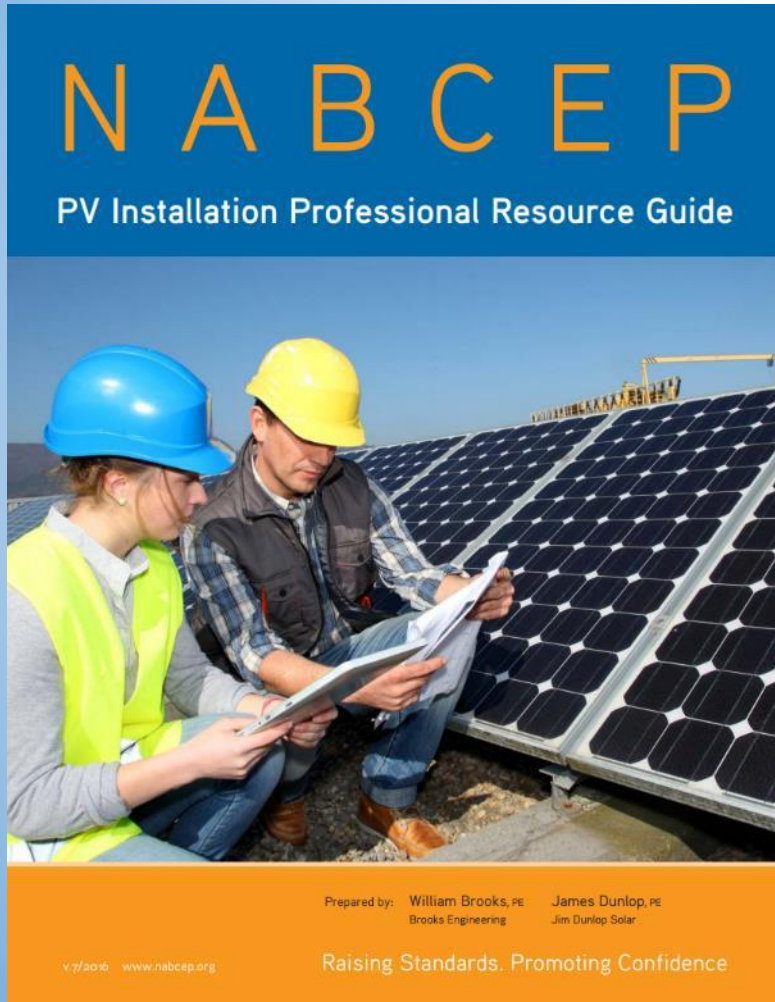


PV Installation  
Professional



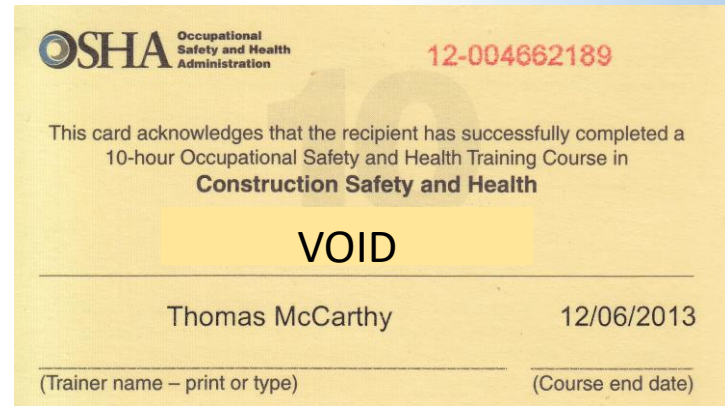
Photovoltaic

# PV Installation Professional Certification



## Requirements to Take Examination

- 58 hours advanced PV training
- 10 hours OSHA safety training



- Documented experience in field as individual responsible for installing systems

### Free download:

<http://www.nabcep.org/wp-content/uploads/2016/10/NABCEP-PV-Resource-Guide-10-4-16-W.pdf>

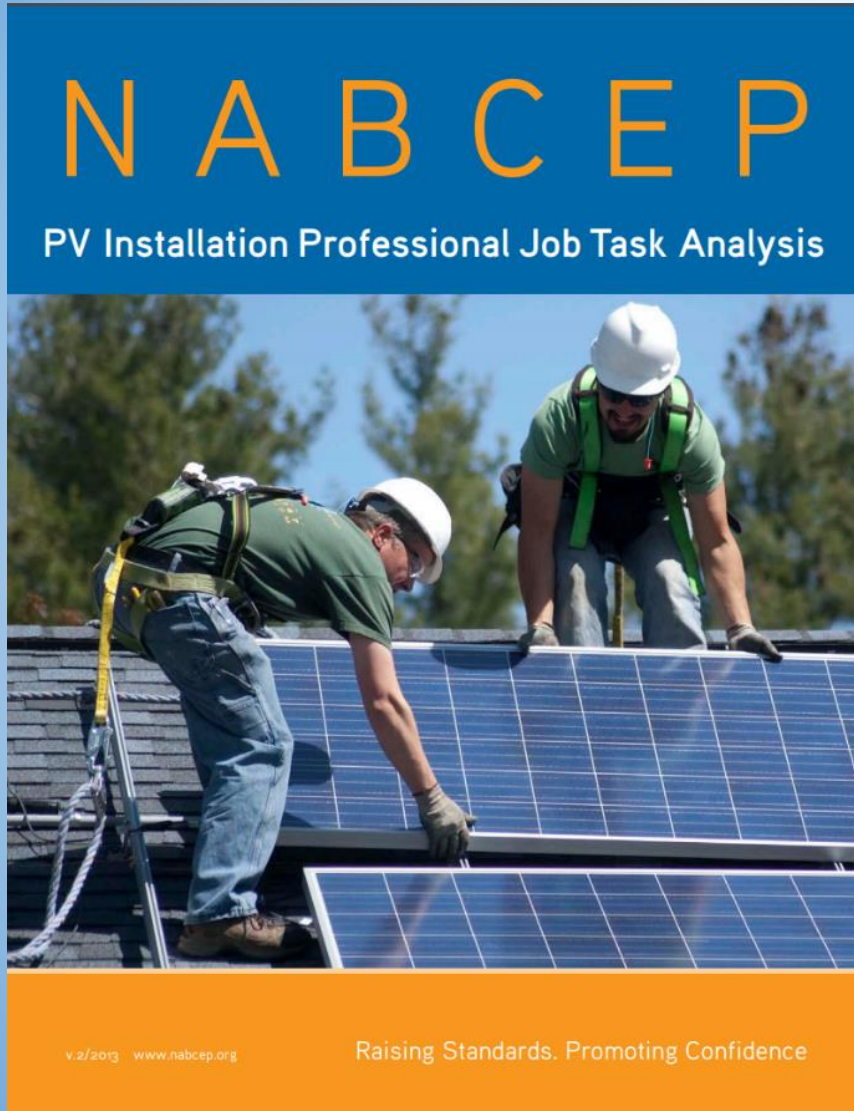
# Job Description for NABCEP Certified PV Installation Professional

Given a potential site for a solar photovoltaic system installation and given basic instructions, major components, schematics, and drawings, the NABCEP Certified PV Installation Professional will: specify, adapt, implement, configure, install, inspect, and maintain any type of photovoltaic system, including grid-connected and stand-alone systems with or without battery storage, that meet the performance and reliability needs of customers in the United States and Canada, by ensuring quality craftsmanship and compliance with all applicable codes, standards, and safety requirements.

# Pathways to Installation Professional Exam

NABCEP CERTIFIED PV INSTALLATION PROFESSIONAL ELIGIBILITY REQUIREMENTS SUMMARY TABLE		
All Applicants must be at least 18 years of age; document a minimum of 10 hours of OSHA Outreach Training Program for the Construction Industry training (or state or provincial equivalent); complete at least 58 hours of relevant qualified training (see Section 3.5.2); sign a Code of Ethics; and pay all applicable fees.		
Category	Who	Minimum Experience
A	Professional with a documented decision making role in the installation of PV systems – such as Lead Installers, System Designers, Project Managers, Site Managers, Foreman, Electricians, System Engineers, and Quality Assurance / Commissioning Agents	Documented decision making role in the installation of five (5) PV systems
B	Existing licensed contractor in good standing in a solar or electrical construction trade	Documented decision making role in the installation of three (3) PV systems
C	Four (4) years of electrical construction-related experience working for a licensed contractor (includes licensee or owner/operator)	
D	Three (3) years of experience in a U.S. Dept. of Labor Registered Electrical Construction Trade Apprenticeship Program	
E	Two (2) or more year renewable energy, construction technology, electrical technology, or engineering technology degree; or four (4) or more year electrical, mechanical, structural or civil engineering, or architecture degree	

# Installation Professional Exam Development



## 6 Content Domains

### Content Domains and Examination Specifications

Content Domain	Percentage of Examination
Verify System Design	30%
Managing the Project	17%
Installing Electrical Components	22%
Installing Mechanical Components	8%
Completing System Installation	12%
Conducting Maintenance and Troubleshooting Activities	11%

### Verify System Design Domain – 10 Tasks

1. Verify Client Needs
2. Review Site Survey
3. Confirm System Sizing
4. Review Design of Energy Storage Systems
5. Confirm String Size Calculations
6. Review System Component Selection
7. Review Wiring and Conduit Size Calculations
8. Review Overcurrent Protection Selection
9. Review Fastener Selection
10. Review Plan Sets

Free download:

<http://www.nabcep.org/wp-content/uploads/2008/11/NABCEP-PV-JTA-2-4-13.pdf>

# Job Task Analysis Content

## Task Steps and Knowledge in each Category Level

CATEGORY / LEVEL	DESCRIPTION
● Critical	Absolutely essential for a PV installer. Installers do these tasks most frequently.
● Important	Very important, but not of the highest level of criticality. These tasks are done with less frequency by installers yet have been identified as important to the knowledge base of installers.
● Useful	Might be useful; can inform education and training to add richness and depth. Installers do these tasks infrequently.



## Verify System Design Domain – 10 Tasks

1. Verify Client Needs
2. Review Site Survey
3. Confirm System Sizing
4. Review Design of Energy Storage Systems
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6. Review System Component Selection
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8. Review Overcurrent Protection Selection
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### TASK STEP

### CATEGORY

#### A: Verify System Design

##### 1. Verify Client Needs

● Confirm desired location of equipment	Critical
● Address aesthetic concerns	Critical
● Address legal concerns	Important
● Confirm loads assessment	Useful *
● Confirm critical loads	Useful *
● Confirm system matches client expectation	Useful

##### 2. Review Site Survey

● Evaluate roof conditions	Critical
● Evaluate desired array and equipment locations	Critical
● Locate solar equipment	Critical
● Locate conduit paths	Critical
● Evaluate roof structure	Critical
● Determine obstructions	Critical
● Conduct site hazard assessment (existing hazards)	Critical
● Identify staging/lifting/access locations	Critical
● Confirm accuracy of shading analysis	Important
● Evaluate existing electrical equipment	Important
● Determine true south	Important
● Evaluate wall structure	Important
● Confirm existing roof tilt and orientation (pitch and azimuth)	Important
● Confirm accuracy of site drawings	Important
● Evaluate wind exposure	Useful
● Evaluate soil conditions	Useful
● Confirm solar resource	Useful



# Job Task Analysis

Content Domain	% of Exam	# of Tasks	# of Task Steps
Verify System Design	30%	10	114
Managing the Project	17%	6	60
Installing Electrical Components	22%	8	123
Installing Mechanical Components	8%	3	45
Completing System Installation	12%	4	60
Conducting Maintenance and Troubleshooting Activities	11%	4	72

Total Individual Task Steps 474



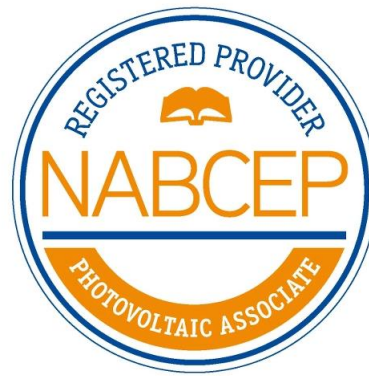
## **NABCEP Associate credentials distinguish individuals in the work place by:**

- Promoting the status and credibility of renewable energy practices
- Facilitating consumer confidence in renewable energy technologies
- Enhancing worker safety and skill
- Advancing uniform professional standards by holding Associates to a Code of Ethics and Standard of Conduct
- Encouraging professional development through maintenance of the credential



## QUALIFYING FOR A NABCEP ASSOCIATE EXAM

- **Experience Pathway**
  - Six months documented full-time employment directly related to photovoltaics
- **Education Pathway**
  - Successful completion of a course covering the NABCEP Associate Learning Objectives
  - Course Provider must be registered with NABCEP



NORTH AMERICAN BOARD OF CERTIFIED ENERGY PRACTITIONERS™

## TRAINING TOPICS

**The Photovoltaic Associate Learning Objectives include ten (10) knowledge content domains:**

- PV Markets and Applications
- Safety Basics
- Electricity Basics
- Solar Energy Fundamentals
- PV Module Fundamentals
- System Components
- PV System Sizing Principles
- PV System Electrical Design
- PV System Mechanical Design
- Performance Analysis, Maintenance and Troubleshooting

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# Before Certification There Must Be Training



The image shows a screenshot of the Solar Energy International (SEI) website. The background is a high-angle photograph of a large solar farm with rows of blue photovoltaic panels. The website's header is green and white. On the left, there are social media icons for Facebook, RSS, Twitter, YouTube, and LinkedIn, followed by the SEI logo and the tagline "Educate. Engage. Empower." On the right, there are input fields for "Email address" and "Password", and a "LOG IN" button. Below the header, there are four navigation links: "ONLINE TRAINING SCHEDULE", "FREE ONLINE COURSE", "ALUMNI & CAREER CENTER", and "MY COURSES". The main content area features the text "ONLINE SOLAR TRAINING" in large white letters, followed by a subtitle: "Online Courses from the world's leading renewable energy technical training provider - Solar Energy International (SEI)." Below this is a green button with a play icon and the text "VIEW TRAINING SCHEDULE".

ONLINE SOLAR TRAINING & RENEWABLE ENERGY COURSES

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# Before Certification There Must Be Training

PAQUETE DE ESTUDIOS EN LÍNEA

El paquete incluye FVOL101, FVOL203 y nuestro Manual de Diseño e Instalación de Sistemas Fotovoltaicos. La combinación te dará una comprensión completa de los conceptos y métodos de energía fotovoltaica (FV) para los sistemas residenciales y comerciales.

Llámenos para hablar con un Asesor de Servicios al Estudiante - +1 970.527.7657 opción 8

RECIBE UN PRECIO ESPECIAL



### CURSO GRATUITO

Conoce los diferentes tipos de aplicaciones de Energías Renovables disponibles en la actualidad, experimenta nuestra plataforma educativa y crea una red de contactos con profesionales de la industria ¡gratis! Regístrate aquí.



### ELIGE A SEI EN AMÉRICA LATINA

SEI es líder en capacitación técnica en Energías Renovables y cuenta con la mayor cantidad de instructores de habla hispana certificados. Más de 2.900 latinos ya eligieron SEI, ¡sumáte hoy!



### PROGRAMA DE CERTIFICADO PROFESIONAL FV

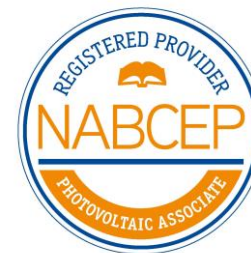
Nuestro Programa de Certificado Profesional (PCPEF) es el entrenamiento técnico más completo en su área y prepara profesionales con habilidades y conocimientos para avanzar a la par con la Industria Solar.



### LAS PERFECTAS VACACIONES PARA CAPACITACIÓN SOLAR

Nuestro centro educacional ofrece a los estudiantes una oportunidad incomparable de practicar y aprender en un hermoso lugar. Desde el segundo en que llegas a nuestro centro de capacitación en Paonia, tu vida cambia para siempre.

Specifically designed for NABCEP PV Associate Examination – 13 registered providers with online programs



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PV Technical Sales  
Professional



**PV Installation  
Company**  
Acme Solar  
California



# CA Policy Requiring Certification via Standards

Self-Generation Incentive Program

**Self-Generation Incentive Program HANDBOOK**

*Provides financial incentives for installing clean, efficient, on-site distributed generation*

**May 17, 2017**

Center for Sustainable Energy

EDISON  
AN EDISON ENERGY SERVICES COMPANY

PGE Pacific Gas and Electric Company

SDGE  
A Semptra Energy utility

SoCalGas  
A Semptra Energy utility

V.2

“All eligible technologies must be certified for safety by a nationally recognized testing laboratory (NRTL).”

## Safety Standard UL 2703

**CERTIFICATE OF COMPLIANCE**

Certificate Number: 20160929-E479099  
Report Reference: E479099-20150912  
Issue Date: 2016-SEPTEMBER-29

Issued to: ENPHASE ENERGY INC  
1420 N McDowell Blvd,  
Petaluma CA 94954-6515

This is to certify that representative samples of COMPONENT - MOUNTING SYSTEMS, MOUNTING DEVICES, CLAMPING DEVICES AND GROUND LUGS FOR USE WITH PHOTOVOLTAIC MODULES AND PANELS  
See Addendum

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: See Addendum for Standard(s)  
Additional Information: See the UL Online Certifications Directory at [www.ul.com/database](http://www.ul.com/database) for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

The UL Recognized Component Mark generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark: **RM** may be used in conjunction with the required Recognized Markings. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.

*Sam Miller*  
Senior Vice President, Director North American Certification Program  
UL LLC

Any information and documentation including UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at [UL@ul.com](mailto:UL@ul.com) or [www.ul.com](http://www.ul.com)

UL





# FL Policy Requiring PV Certification via Standards



## Testing and Certification

- ▶ Photovoltaic
- ▶ Solar Thermal
- ▶ Florida Solar Standards
- ▶ FAQ

Search FSEC:

The Laws of Florida (§377.705, FS) require that all solar systems manufactured or sold in the state of Florida comply with Solar Equipment Standards promulgated by the Florida Solar Energy Center (FSEC). These standards cover both solar thermal equipment and solar electric equipment. FSEC works closely with industry, the research and development community and other interested stakeholders to ensure that its Standards encourage the effective use of renewable energy resources and protect the consumers of the state of Florida.



Find answers to frequently asked Testing & Certification questions.

## Florida Solar Standards



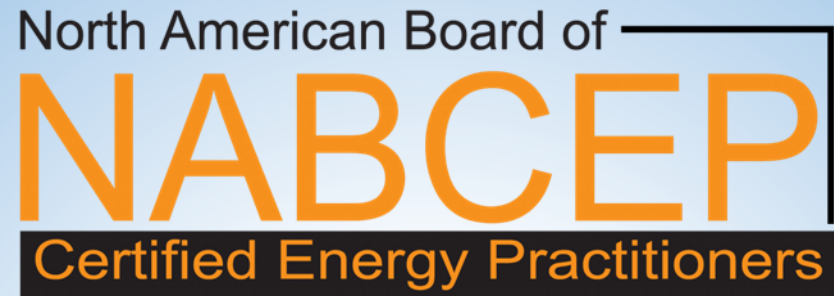
In accordance with Florida Law (§377.705, F.S.) [35KB, Adobe Acrobat PDF], the Florida Solar Energy Center is charged to "develop and promulgate standards for solar energy systems manufactured or sold in the state based on the best currently available information...." and "establish criteria for testing performance of solar energy systems...."

The standards developed by FSEC are incorporated by reference in rules (Rules 6C7-8.006 through 6C7-8.010) that are published in the Florida Administrative Code. The rules

Search FSEC's Publications:

may be viewed at the [Florida Administrative Code Web site](#) or in this [6C7-8 rule document](#) [123kb, Adobe Acrobat PDF]. The following is a list of certification and testing standards maintained by the Florida Solar Energy Center:

- **Operation of Photovoltaic Module Performance Certification Program**  
[FSEC Standard 201-10](#) (Adobe Acrobat PDF)
- **Operation of Photovoltaic Equipment Certification Program**  
[FSEC Standard 202-10](#) (Adobe Acrobat PDF)
- **Photovoltaic System Design Review and Approval Procedures**  
[FSEC Standard 203-10](#) (Adobe Acrobat PDF)



# Thank You!

Contact:

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NABCEP

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Clifton Park, NY, 12065

+1 (518) 631-2359

[www.nabcep.org](http://www.nabcep.org)

Email: [info@nabcep.org](mailto:info@nabcep.org)

# Why Accreditation?



- Overview
- How to Apply
- Accreditation Directory
- Documents and Resources
- PCAC Accreditation Committee



## ANSI/ISO/IEC 17024 (Accredited)

#	Organization	ID
51	<a href="#">National Registry of Food Safety Professionals</a> Certified Food Safety HACCP Manager International Certified Food Safety Manager (ICFSM)	0656
52	<a href="#">North American Board of Certified Energy Practitioners</a> Certified Solar PV Installer Solar Heating Installer Certification	0702
53	<a href="#">Project Management Institute</a> Project Management Professional, PMP	0705
54	<a href="#">Qualified Elevator Inspector Training Fund</a> Certified Elevator Inspection Supervisor Certified Elevator Inspector	1090
55	<a href="#">Refrigerating Engineers &amp; Technicians Association</a> Certified Assistant Refrigeration Operator Certified Industrial Refrigeration Operator	0738
56	<a href="#">Society for Maintenance and Reliability Professionals Certifying Organization</a> Certification for Maintenance and Reliability Professionals (CMRP)	0739
57	<a href="#">Society of Certified Senior Advisors</a> Certified Senior Advisor	1204
58	<a href="#">Society of Industrial Security Professionals</a> Industrial Security Professional	0860
59	<a href="#">The International Certification Board (ICB)</a> ICB FLS Level 1 Supervisor ICB FLS Level 1 Technician ICB FLS Level 2 Supervisor ICB FLS Level 2 Technician ICB TABB Supervisor ICB TABB Technician	0728



- Certification program meets minimum quality criteria
- Assures competence and reliability
- Allows for ongoing quality evaluation (audits)
- Promotes continual improvement of processes and procedures

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