

N A B C E P

PV Technical Sales



Job Task Analysis

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North American Board of
NABCEP
Certified Energy Practitioners®

NABCEP PV Technical Sales Examination Specifications



N Items	Content Domain
15	Qualify the Customer
10	Site Analysis
14	Conceptual Design
5	Financial Costs, Incentives, and Savings
4	Financial Benefit Analysis and Financing
3	Non-financial Benefit Analysis
5	Performance Analysis
4	Prepare Proposals
60	(total)

Job Description:

A PV Tech Salesperson is a solar electric professional with demonstrated expertise in the siting, design, analysis and performance of PV systems who gathers site specific information, analyzes customer needs and energy usage for the purpose of advising and providing customers with the most appropriate solution for their situation.

NABCEP PV Technical Sales Content Outline

A. Qualify the Customer

1. Analyze electric bill

- Gather bills
- Look for seasonal patterns
- Look at different fuel sources being used
- Review utility rates
- Explain why solar may not be appropriate

2. Perform remote site assessment

- Determine house orientation
- Determine roof tilt/angle, available area

- Determine shading
- Evaluate obstructions
- Inquire about type and condition of roof
- Determine ownership status
- Determine type of property (residential commercial, non-profit)

Knowledge of:

- How site conditions impact feasibility of solar system
- Internet tools
- The limitations of remote tools
- Magnetic declination

3. Identify customer needs

- Ask about reasons for going solar
- Evaluate future energy usage
- Determine desired time frame
- Determine whether customer needs financial assistance
- Determine electric usage pattern, time of day
- Discuss pros/cons of battery backup vs. generator

Knowledge of:

- Basic sales skills
- Financial tools
- The use electric rates function
- Batteries
- Electrical terminology
- Correlating usage to specific appliances

4. Perform ball park estimate

- Estimate array size based on kWh consumption and available array area
- Price array size based on average \$/watt
- Evaluate potential price adders
- Factor in incentives
- Develop price range
- Develop savings estimate
- Develop preliminary economic analysis
- Present (verbally/brief) initial ballpark proposal and benefits
- Discuss customer budget limits

Knowledge of:

- Price adders
- Roof type
- Licensing requirements
- How the height of building impacts installation costs
- Impact of long runs of conduit, wiring on costs
- Steepness
- Distance from load center

5. Identify jurisdictional issues

- Determine zoning
- Determine fire marshal awareness
- Determine reservation issues
- Check city, county and utility requirements
- Identify utility
- Identify homeowner association

Knowledge of:

- Zoning issues for your area
- Codes for your area
- Utilities process, interconnection procedures, rules
- Laws relating to homeowner's associations
- Insurance limitations

6. Manage customer expectations

- Advise customer that system doesn't provide backup power; when grid is down, it won't work
- Explain differences between battery and non-battery systems
- Explain that PV does not heat water, space, or pools
- Explain that PV generates electricity, does not offset gas loads
- Explain seasonal variations in output
- Explain required level of routine maintenance
- Explain system equipment manufacturer warranties
- Review life expectancy of equipment
- Discuss aesthetics
- Discuss ROI
- Explain emerging vs. existing technologies
- Explain expected output vs. system capacity
- Explain instantaneous power vs. annual energy production
- Explain installation warranties
- Explain manufacturer warranties
- Explain insurance issues, workers' comp, liability
- Explain effects on homeowner's insurance
- Explain potential impact on roof warranty
- Explain performance validation methods

Knowledge of:

- Basic solar system knowledge
- General financial understanding
- Product knowledge
- Knowledge of return on investment
- Product limitations

B. Site Analysis

1. Inspect electrical service

- Determine service rating current and voltage
- Identify buss bar and main breaker
- Identify line tap vs. panel upgrade
- Determine available breaker space
- Determine grounding
- Identify manufacturer of panel
- Determine method of interconnection
- Determine limits (max back fed breaker) based on local electrical code
- Inform customer of potential additional costs related to utility hardware, transformers
- Discuss findings with customer

Knowledge of:

- Electrical safety
- OSHA
- Electrical principles
- Electrical codes

2. Identify locations for system components

- Identify inverter location
- Identify array location options
- Identify AC & DC disconnects
- Identify junction box
- Locate conduit runs
- Identify utility disconnect if applicable
- Determine lengths of conduit runs

Knowledge of:

- NEC and manufacturer clearance requirements
- Solar exposure
- Hazards (e.g., power lines, gas lines, meters)
- The difference between AC & DC disconnects
- Voltage ratings on fuses, AC & DC switches
- Utility differences on requirements for disconnects
- Tape measure
- Laser level

3. Assess mounting location

- Identify roofing material
- Identify framing
- Identify spacing and spans
- Determine if there is an attic space vs. flat roof
- Assess structural integrity of roof (look at underside)
- Document condition of roof (photos, notes, etc.)
- Determine soil composition for ground/pole mounts
- Identify underground obstructions (septic, gas lines)
- Determine solar exposure
- Measure roof area or ground area

Knowledge of:

- Roofing materials
- Basic framing
- Standard building practices (spacing)
- Roofing terminology
- Risks of falling
- Walking on roofs without causing damage
- Reading blueprints
- Angle gauge
- Safety harness

4. Perform shade analysis

- Identify existing shading obstructions
- Consider future shading obstructions
- Perform inter-row shading analysis
- Complete shade study
- Analyze annual loss from shading
- Analyze seasonal/daily variations in shade
- Determine whether rooftop analysis is necessary
- If safe, proceed with rooftop analysis
- If necessary, bring in crew for rooftop analysis
- If rooftop analysis is not feasible, incorporate buffer
- Calculate within acceptable limits of third-party audit, 3-5%
- Prepare the report

Knowledge of:

- The impact of shade on solar systems
- The proper use of the available tools

C. Conceptual Design

1. Select appropriate equipment

- Explain module aesthetic options to customer
- Explain efficiency, cost, aesthetic differences
- Consider geographic location, climate
- Select the module(s)
- Match inverter to array
- Match inverter to service voltage

Knowledge of:

- Product
- Voltage windows
- Websites that provide insolation data

2. Determine equipment location

- Avoid locations that will expose modules to salt water
- Comply with manufacturer specifications for inverter location
- Discuss potential sites for inverter with customer
- Ask customer about long term plans for renovations, etc.
- Consider type of monitoring system, broadband vs. wired
- Discuss conduit runs

Knowledge of:

- Noise level generated by equipment
- Risks of damage to equipment
- NEC requirements and local codes (AHJ)
- Cooling requirements
- Manufacturer's clearances
- Fire department requirements



3. Plan system layout

- Determine module layout
- Determine electrical layout
- Determine which faces of roof to use
- Sketch system layout

Knowledge of:

- String layout
- Roof setbacks
- Geometry
- Computer skills
- Spacing between modules

4. Perform string sizing

- Select string sizing method
- Consider min, max temperatures, site
- Stand off distance (re: airflow)
- Match array voltage to inverter voltage with applicable temperature conditions
- Consider module voltage degradation over time

Knowledge of:

- Applying temperature coefficients
- Correlation between temperature and voltage

5. Determine breaker size or supply side connection

- Determine max inverter output given buss bar
- Evaluate whether there is room for a breaker
- Evaluate the service amperage
- Determine whether new electrical service is needed
- Determine whether line side tap can be used

Knowledge of:

- Spacing between modules
- Electrical service sizes
- Current ratings
- Line side tap

6. Determine mounting method and tilt angle

- Evaluate roof type and material
- Evaluate roof pitch
- Evaluate structural members (wood, steel, trusses, rafters)
- Determine space required under modules
- Consider impact on roofing warranties
- Select racking
- Determine number and type of roof penetrations, flashing
- Evaluate performance and aesthetic impact of various tilt angles
- Identify trenching considerations
- Determine local height restrictions

Knowledge of:

- Roofing
- Product
- Mounting systems

D. Financial Costs, Incentives, and Savings

1. Explain types of incentives and net cost

- Explain local net metering policies
- Explain feed-in tariffs
- Identify utility financial models
- Explain state, city and federal tax credits, treasury grants, depreciation, property tax exemptions, RECs, PBIs, rebates, tax deductions, transfer credits, sales tax exemptions
- Calculate net cost after incentives

2. Explain types of utility rates and net electric bill savings

- Explain time of use
- Explain tiered rate structures
- Explain what energy and demand charges are
- Explain how solar impacts demand charges
- Explain how solar impacts energy charges
- Discuss possibility of switching from one rate structure to another
- Explain potential future rate escalations, decreases
- Calculate electric bill savings



E. Financial Benefit Analysis and Financing

1. Calculate financial analysis

- Calculate cash flow analysis
- Calculate bill savings
- Calculate maintenance expenses
- Calculate replacement/repair costs for inverter
- Develop multi-year timeline detailing costs/benefits

- Calculate internal rate of return (exclude financing costs)
- Calculate simple return on investment
- Calculate years to payback
- Explain pre-tax and after-tax benefits
- Calculate theoretical resale value increase on property
- Explain to customer potential property equity impact
- Explain degradation rate
- Calculate net savings
- Inform customer that projections are not legally binding, disclaimer

Knowledge of:

- Financials
- Compound interest calculations

2. Evaluate appropriate financing options

- Cash up front
- Home equity loan
- Leasing
- Power Purchase Agreement (PPA)
- Consumer loans
- Community based financing, PACE
- Utility loans

Knowledge of:

- Financing options

F. Non-Financial Benefit Analysis

1. Calculate/quantify environmental benefits proportional to estimated production

- Calculate Co2 avoidance
- Calculate tons of coal saved
- Calculate water saved
- Calculate miles not driven in car
- Calculate acres of trees saved
- Calculate barrels of oil saved

2. Describe non-financial non-environmental benefits

- Articulate/calculate energy independence
- Articulate social benefits
- Articulate other non-environmental benefits

G. Performance Analysis

1. Calculate production

- Consider insolation data
- Review temperature data for the area
- Consider microclimate data if available
- Consider impact of dust and dirt
- Module name plate rating
- Consider time of use
- Consider shading
- Consider wire losses
- Consider module operating temperature, regional ambient temperatures and air flow
- Consider component efficiencies (e.g., inverter, DC modules)
- Consider tilt
- Consider azimuth
- Consider diodes and connections
- Consider module mismatch
- Consider system availability
- Consider tracking, dual or single axis
- Consider system age or degradation

Knowledge of:

- Sites that can provide data
- PVWATTS or SAM
- RETScreen
- How various factors impact production

2. Identify factors that degrade system performance over time

- Module degradation over time
- Landscaping issues, tree growth
- New construction

H. Prepare Proposals

1. Create minimum acceptable proposal

- Include production estimate
- Include STC DC system power rating (and CEC AC or other rating as applicable)
- Include average monthly electric bill savings estimate
- Include total cost, rebates, tax incentives, and net cost
- Identify and estimate permit fees, interconnection fees, taxes and other foreseeable costs
- Identify variable or unknown costs and provide estimated range of cost
- Include payment schedule
- Identify incentives paid over time (PBI, FIT, SRECs)
- Include construction timeline and milestone dates
- Include major equipment list, power ratings, and part count
- List assumptions, special factors, and locations for equipment installation

Knowledge of:

- Reading manufacturer data sheets
- Rating specs
- Documents required for completing the sale

2. Include additional elements as applicable and/or appropriate

- Include financial benefit and/or financing discussion as applicable
- Include non-financial benefit discussion as applicable
- Include energy efficiency and conservation discussion as applicable

PV Technical Sales Certification Requirements

Eligibility Requirements for the PV Technical Sales Certification

To become certified and maintain certification, the applicant must minimally:

- Be at least 18 years of age
- Meet prerequisites of related experience and/or education as outlined below
- Complete an application form documenting requirements
- Sign and agree to uphold a code of ethics
- Pay application and exam fee
- Pass a written exam
- Complete continuing education and installation requirements within the recertification timeframe

Education, Training and Experience Requirements

To qualify to sit for the NABCEP PV Technical Sales Certification examination, the candidate must demonstrate that he/she meets at least one of the following minimum entry requirement tracks outlined at right.

Note: All USA applicants must have OSHA 10 Hour Construction Class Card. Applicants from other countries must provide an equivalent safety training credential from your jurisdiction as a prerequisite for the exam.

Additionally training in sales techniques and customer management is strongly recommended for all candidates.

Qualifying Categories for the PV Technical Sales Certification Examination

- a) A minimum of sixty (60) hours cumulative training covering the PV Technical Sales Job Task Analysis; AND a minimum of one (1) year of verifiable sales experience; AND have successfully passed the NABCEP Entry Level PV Exam; OR
- b) A minimum of thirty-two (32) hours cumulative training covering the PV Technical Sales Job Task Analysis; AND a minimum of two (2) years of verifiable sales experience; AND have successfully passed the NABCEP Entry Level PV Exam; OR
- c) Two (2)-year renewable energy technology or technician degree from an accredited educational institution; AND a minimum of one (1) year verifiable experience; AND have successfully passed the NABCEP Entry Level PV Exam; OR
- d) Four (4)-year degree from an accredited educational institution; AND one (1) year verifiable sales experience; OR

NOTE: A minimum of 30 hours of additional training in all aspects of the PV Technical Sales Job Task Analysis is strongly recommended.

- e) Be a NABCEP Certified Solar PV or NABCEP Installer Emeritus; OR

NOTE: A minimum of 30 hours of additional training in non-installation aspects of the PV Technical Sales Job Task Analysis is strongly recommended.

- f) Hold Journeyman or licensed Electrician credentials; AND have successfully passed the NABCEP Entry Level PV Exam; OR

NOTE: A minimum of 30 hours of additional training in all aspects of the PV Technical Sales Job Task Analysis is strongly recommended.

- g) A minimum of five (5) years verifiable sales experience.

NOTE: A minimum of 30 hours of additional training in all aspects of the PV Technical Sales Job Task Analysis is strongly recommended.

Definition of Verifiable Sales Experience

For purposes of this process, verifiable sales experience selling PV systems requires being in a responsible role in sales and or design process for the job. This includes titles including (but not limited to), sales manager, site analyst, financial analyst, system designer, technical support person, etc.

Definition: 1 year verifiable sales experience = being the lead sales person, analyst or designer of a minimum of 4 PV systems occurring at some point in the 12 months prior to submitting an application for the exam*. At least 2 of the 4 PV systems must be larger than 2 kW DC (peak). At least one (1) installation must be a system that is grid connected.

All systems claimed must have accompanying documentation including proposal, electrical permitting and inspection records, and customer confirmation that the system sold met their expectations. The candidate is asked to describe the scope of work they were responsible for on each installation. (All proposals and related proprietary information will be treated as strictly confidential.)

In regions where electrical inspection is not possible, the Application Review Committee will judge experience based on supplied documentation.

*If applying through track (G), you will need to submit documentation for 20 verifiable system sales or proposals that have occurred in the last 5 years. 10 of the 20 systems must be larger than 2kW DC (peak) and at least 5 systems must be grid connected.

Training Requirement for the PV Technical Sales Certification

Candidates applying through categories that require training (A or B) must document that they have received the minimum hours of training specified. This training must cover the PV Technical Sales Job Task Analysis (JTA).

While additional training is not required for each qualifying category it is strongly recommended. The exam is such that some level of training on all aspects of the PV Technical Sales Job Task Analysis will likely be necessary for most applicants to achieve a passing score. Candidates are therefore encouraged to seek training classes as needed.

It is recommended that applicants look for training courses accredited by the Institute of Sustainable Power Quality (ISPQ) or taught by instructors certified by ISPQ. Please visit www.IRECusa.org for full listings. *NOTE: The minimum of 10 hours of OSHA or equivalent training is in addition to the training hours specified for each qualifying category.*

NABCEP will accept training to meet the requirements when the training meets the following outcomes: Have a formal training format, with a teacher-learner structure. This implies a connection between a learner and a learning source. It can include classroom time led by an instructor and/or discussion leader. It can also include activities in which a learner is engaged in a planned learning event in which he/she is separated from faculty and other students but where the learner receives some sort of feedback and the learner's progress is monitored.



Examples include computer-assisted instruction, interactive video/CD/DVD and/or web site learning. Covers core competencies from the PV Technical Sales Job Task Analysis.

Acceptable training providers include:

- Any institution accredited by an agency recognized by the federal Department of Education (Universities, Community Colleges etc.);
- Dedicated independent Renewable Energy training programs (accreditation by ISPQ is strongly recommended);
- Apprenticeship training programs recognized by the Department of Labor or equivalent;
- Those approved by State or Provincial Contractor Licensing Boards; and;
- Vocational/Technical training programs.

Education Requirements for the PV Technical Sales Certification

If qualifying through entry track (C) or (D), you must submit a copy of your diploma or transcript from an institution accredited by an agency recognized by the federal Department of Education showing that you have obtained a two-year or four-year degree.

Documentation of Training, Education & Credentials

Formal education and training are optional depending on the Qualifying Category you chose, even though NABCEP believes that applicants will benefit from quality training when preparing to take the certification exam. If your Qualifying Category requires training, education or a specific credential, copies of official transcripts or diplomas will need to be attached to the application form.

If qualifying under category (A) or (B), a copy of your proof of completion the cumulative hours of required training will need to be attached to the application.

If qualifying under category (C) or (D), copies of official transcripts and diplomas attesting to your attendance and degrees earned will need to be attached to the application. If qualifying under category (A), (B), (C), (E) or (F), you will have to indicate in the application which

credential(s) you hold and attach a copy of your certificate or other proof of having achieved the credential(s) to this application.

About the NABCEP PV Entry Level Exam Requirement

Some of the pathways to qualify require that candidates pass the NABCEP PV Entry Level exam. Passing the PV Entry Level exam shows that individuals have achieved a basic understanding of PV system design and installation. The Entry Level exam is not a certification exam.

For information on how to become eligible to sit for the Entry Level exam and for the complete list of all current registered Entry Level Providers, please visit:

<http://www.nabcep.org/entry-level-certificate-program/for-students>



Documentation of Verifiable Sales Experience

Please view “Definition of Verifiable Sales Experience” above for the definition of verifiable sales experience and system requirements.

All systems claimed must have accompanying documentation including the proposal, electrical permitting and inspection records, and customer confirmation that the system sold met their expectations. If permits are not available a written explanation documenting your role and responsibilities in the sale process along with the outcome of the sales process may be submitted for review. Applicants may also attach photos as optional documentation. When completing the application, applicants will be asked to describe the scope of work they were responsible for on each installation. All proposals and related proprietary information will be treated as strictly confidential (See Section 15 of the Candidates Handbook for details on confidentiality of application documents).

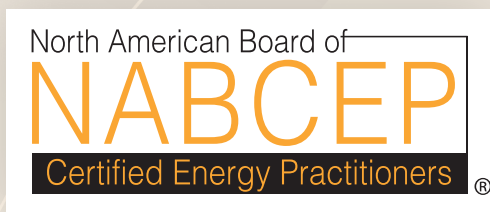
In addition, for each system, applicants will need to provide: a) location of the job site, including some combination of the following: dates during which the job was performed, system-owner contact information, size of the total system, system components, and

if required in the jurisdiction, copies of any inspection certificates or permits involved (including county & lot # if available).

NABCEP reserves the right to contact system owners/operators, permitting authorities, and responsible contractors to verify work listed in this section. The Application Form will prompt you to attach copies of any permits or inspection certificates acquired. In cases where no inspection or permitted process was required, the Application Review Committee will make decisions about eligibility based on supplied documentation. Optional documentation includes anything that you feel verifies the installation and demonstrates your successful role.

Licensure Requirement

If a license is required in the jurisdiction in which the work is performed, candidates must submit their license number—or the license number under which the work was performed.



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