



PV Installation Labor Market Analysis and PV JEDI Tool Developments



Barry Friedman

**NREL Strategic Energy
Analysis Center**

May 16, 2012

**World Renewable
Energy Forum**

Denver, Colorado

NREL/PR-6A20-55130

Disclaimer

DISCLAIMER AGREEMENT

These information (“Data”) are provided by the National Renewable Energy Laboratory (“NREL”), which is operated by the Alliance for Sustainable Energy LLC (“Alliance”) for the U.S. Department of Energy (the “DOE”).

It is recognized that disclosure of these Data is provided under the following conditions and warnings: (1) these Data have been prepared for reference purposes only; (2) these Data consist of forecasts, estimates or assumptions made on a best-efforts basis, based upon present expectations; and (3) these Data were prepared with existing information and are subject to change without notice.

The names DOE/NREL/ALLIANCE shall not be used in any representation, advertising, publicity or other manner whatsoever to endorse or promote any entity that adopts or uses these Data. DOE/NREL/ALLIANCE shall not provide any support, consulting, training or assistance of any kind with regard to the use of these Data or any updates, revisions or new versions of these Data.

YOU AGREE TO INDEMNIFY DOE/NREL/ALLIANCE, AND ITS AFFILIATES, OFFICERS, AGENTS, AND EMPLOYEES AGAINST ANY CLAIM OR DEMAND, INCLUDING REASONABLE ATTORNEYS' FEES, RELATED TO YOUR USE, RELIANCE, OR ADOPTION OF THESE DATA FOR ANY PURPOSE WHATSOEVER. THESE DATA ARE PROVIDED BY DOE/NREL/ALLIANCE "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DISCLAIMED. IN NO EVENT SHALL DOE/NREL/ALLIANCE BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO CLAIMS ASSOCIATED WITH THE LOSS OF DATA OR PROFITS, WHICH MAY RESULT FROM AN ACTION IN CONTRACT, NEGLIGENCE OR OTHER TORTIOUS CLAIM THAT ARISES OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THESE DATA.

This work was supported by the U.S. Department of Energy under Contract No. DE-AC36-08-GO28308 with the Nation

Acknowledgement

This work was supported by the U.S. Department of Energy under Contract No. DE-AC36-08-GO28308 with the National Renewable Energy Laboratory.

Outline

NREL PV Installation Labor Market Analysis (LMA)*

- Primary Audience: Solar Instructor Training Network
- Purpose of Report
- Report Highlights

PV JEDI

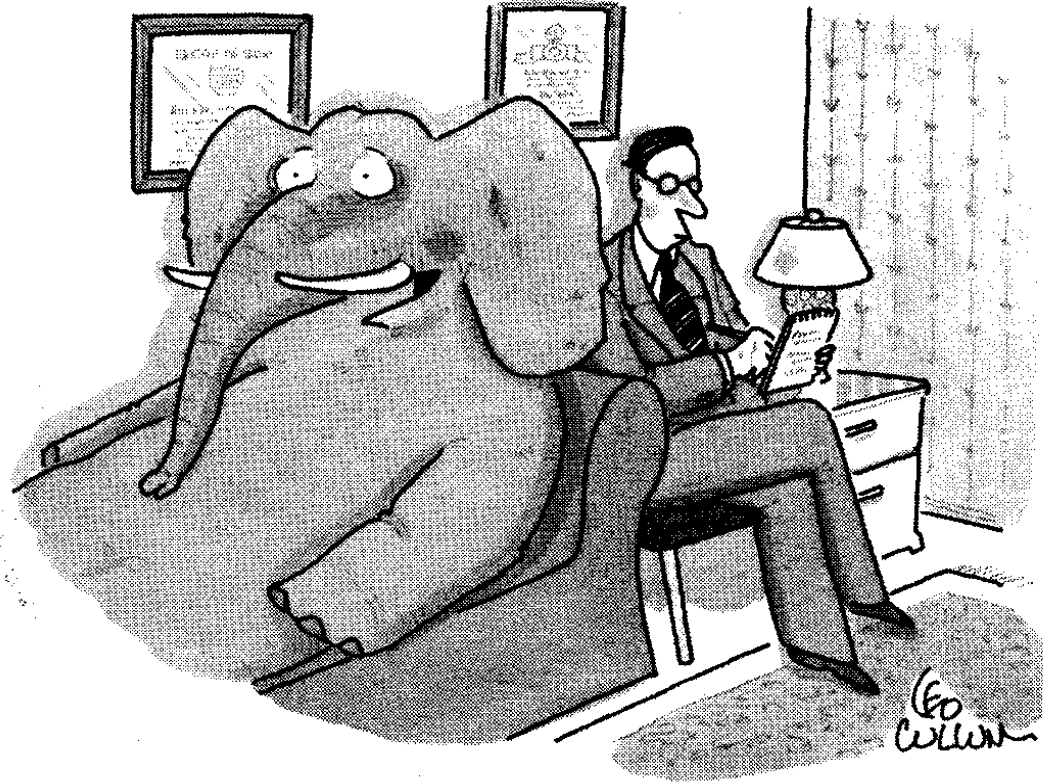
- What is PV JEDI ?
- Purpose, Audience, Use Overview
- Recent Developments
- Q&A

*Friedman, Jordan, Carrese. (December 2011), "Solar Installation Labor Market Analysis," TR NREL/TP-6A20-49339, <http://www.nrel.gov/docs/fy12osti/49339.pdf>.

Your Riddle for the Day: What is a 4 Letter Word, Oft-Spoken, 3 Times Straight?

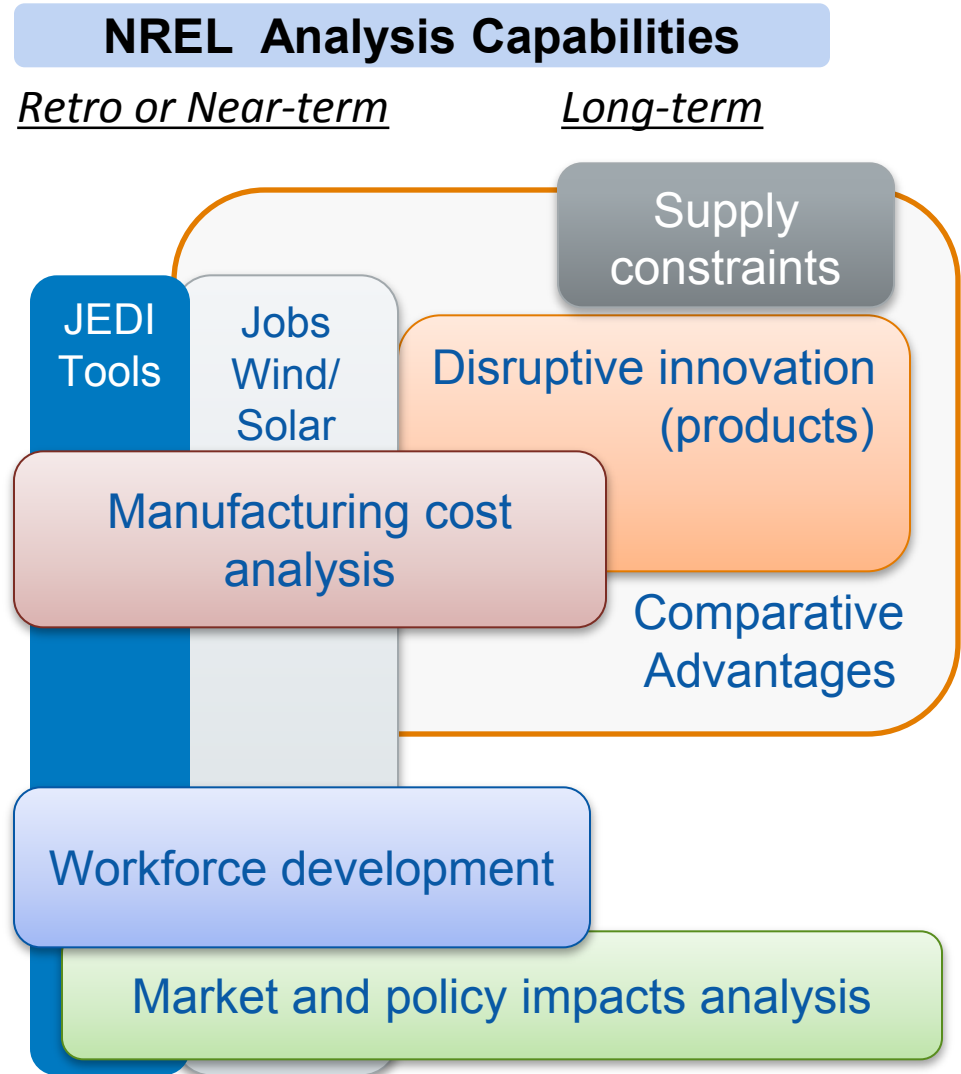


THE NEW YORKER



"I'm right there in the room, and no one even acknowledges me."

NREL's Capabilities in Economic Benefits Analysis



Supply chain

Materials: cast iron, forgings, polysilicon.

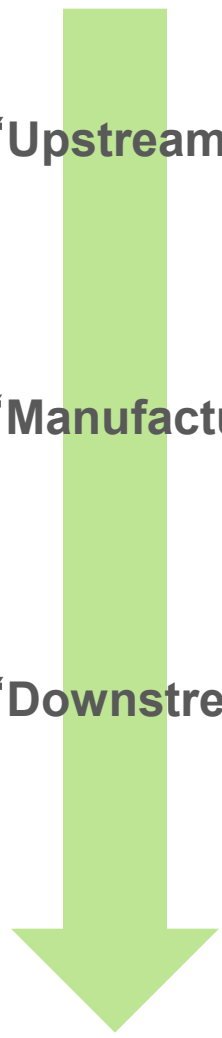
Components, processes, and equipment: Towers, blades, gearboxes, wafers, cells, modules, BOS

Systems deployment and post-deployment: System design, financing, logistics, construction, O&M.

“Upstream”

“Manufacturing”

“Downstream”



Downstream Solar Labor Market Analysis

Project Purpose:

To conduct a statistically valid regional and national solar photovoltaic (PV) Installation job count and assess the dynamics of labor supply and demand for key occupations in the U.S. solar installation industry.

Goal:

To complete interviews with statistically valid (n=1425 completed interviews) employer sample representing 8 U.S. regions and 6-8 key occupations and industry sectors for PV and solar thermal markets, to inform the Solar Instructor Training Network and other stakeholders.

For Eight U.S. Regions Designated by DOE's Solar Instructor Training Network:

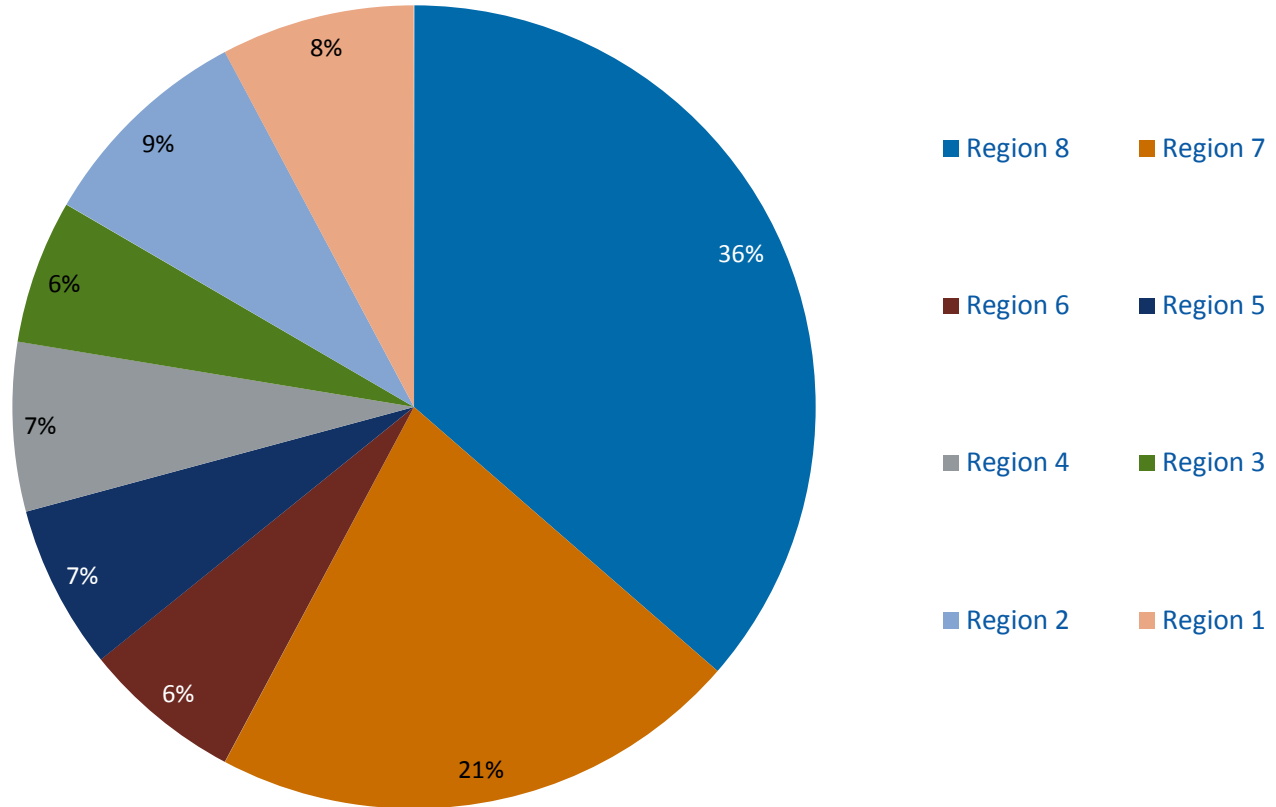
- Jobs by occupation type (installer, designer, site assessor, etc.)
- Solar incidence rate
- Relative difficulty finding employees (entry and non-entry)
- Workforce skill deficiencies
- Employers' preferred experience/ certifications
- On-the-job training (e.g. internships/ apprenticeships)
- First pass labor supply

Six Sectors Traditionally Engaged in Solar Installation, by NAICS Code

NAICS Code	Description
236118	Residential Remodelers
238160	Roofing Contractors
238210	Electrical Contractors and Other Wiring Installation Contractors
238220	Plumbing, Heating, and Air-Conditioning Contractors
238190	Other Foundation, Structure, and Building Exterior Contractors
238990	All Other Specialty Trade Contractors

LMA Completed Installer Interviews

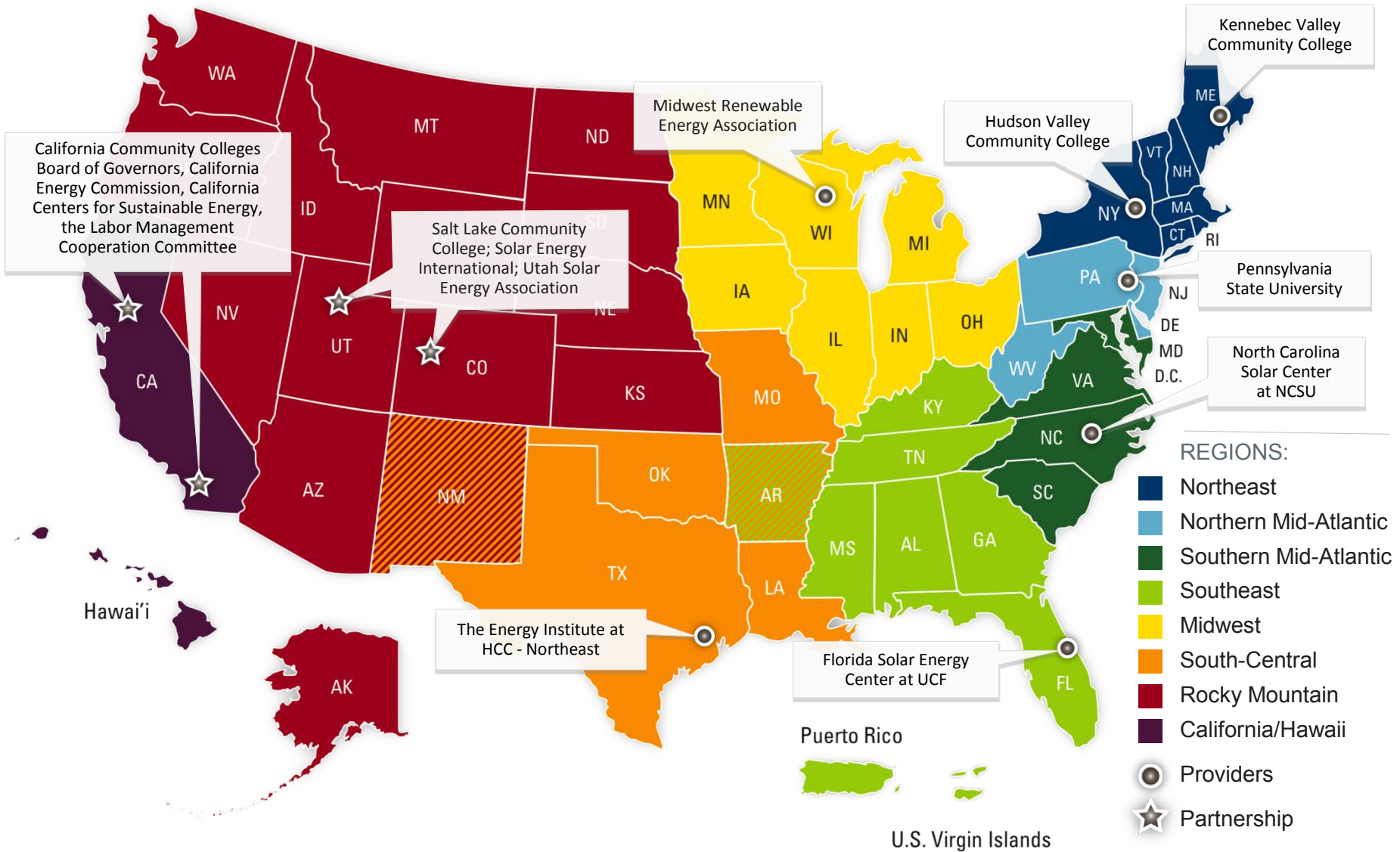
Regional Distribution of Employers



DOE Solar Instructor Training Network

- Sponsors professional development of local instructors
- Enables capacity building of local educational institutions
- Develops materials, tools and resources

Solar Instructor Training Network

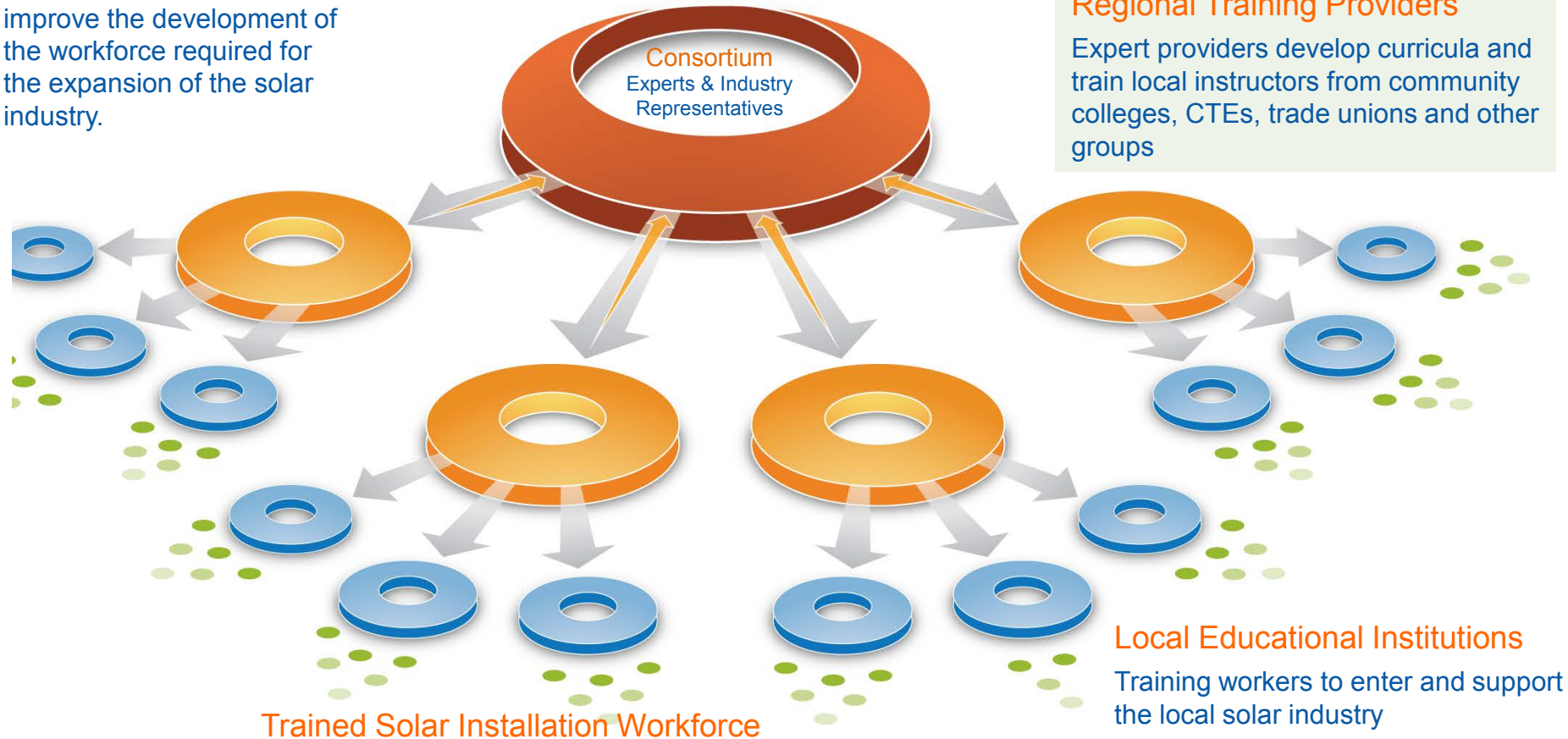


Solar Instructor Training Network

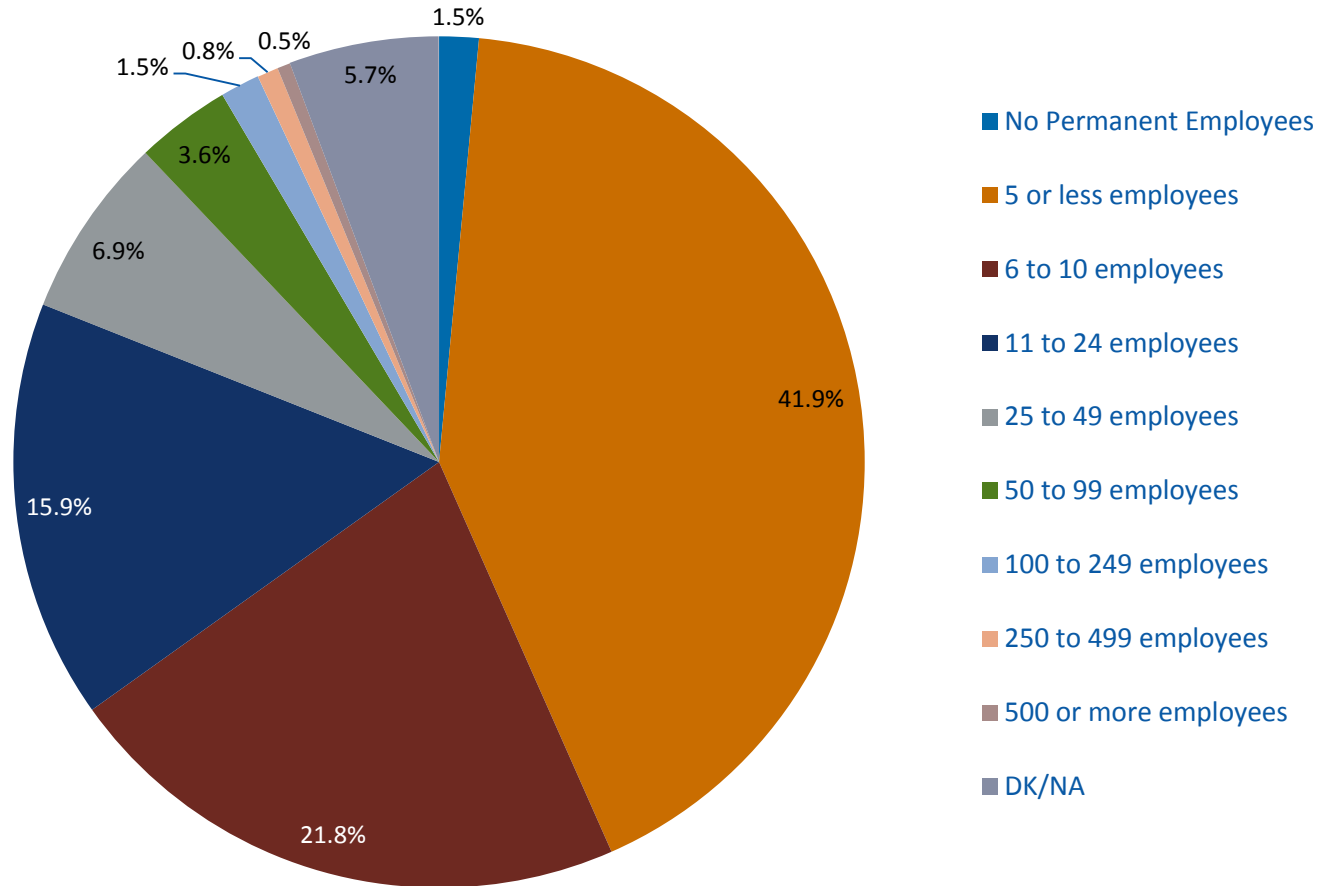


What is SITN?

DOE funds a system of centers to accelerate and improve the development of the workforce required for the expansion of the solar industry.



Solar Installer Respondents by Firm Size



Job Count Regional Breakout

	Total Employment by U.S. Companies Engaged in Solar Installation	Solar Employment (>50% Solar Focus)
Installer	147,501	43,934
Region 1: NY, VT, RI, CT, MA, NH, ME	4,932	2,282
Region 2: WV, PA, DE, NJ	10,356	4,888
Region 3: SC, NC, VA, DC, MD	8,664	3,995
Region 4: MS, AL, GA, TN, KY, FL	12,793	2,101
Region 5: MN, IA, WI, IL, IN, MI, OH	15,885	1,303
Region 6: NM, TX, OK, LA, AR, MO	9,769	4,309
Region 7: AK, AZ, NV, UT, CO, KS, NE , WY, SD, ND, MT, WA, OR, ID	22,858	7,521
Region 8: CA, HI	56,044	15,592
Other/ Data provided across regions (more than one location)	6,201	1,944
Total	147,501	43,934

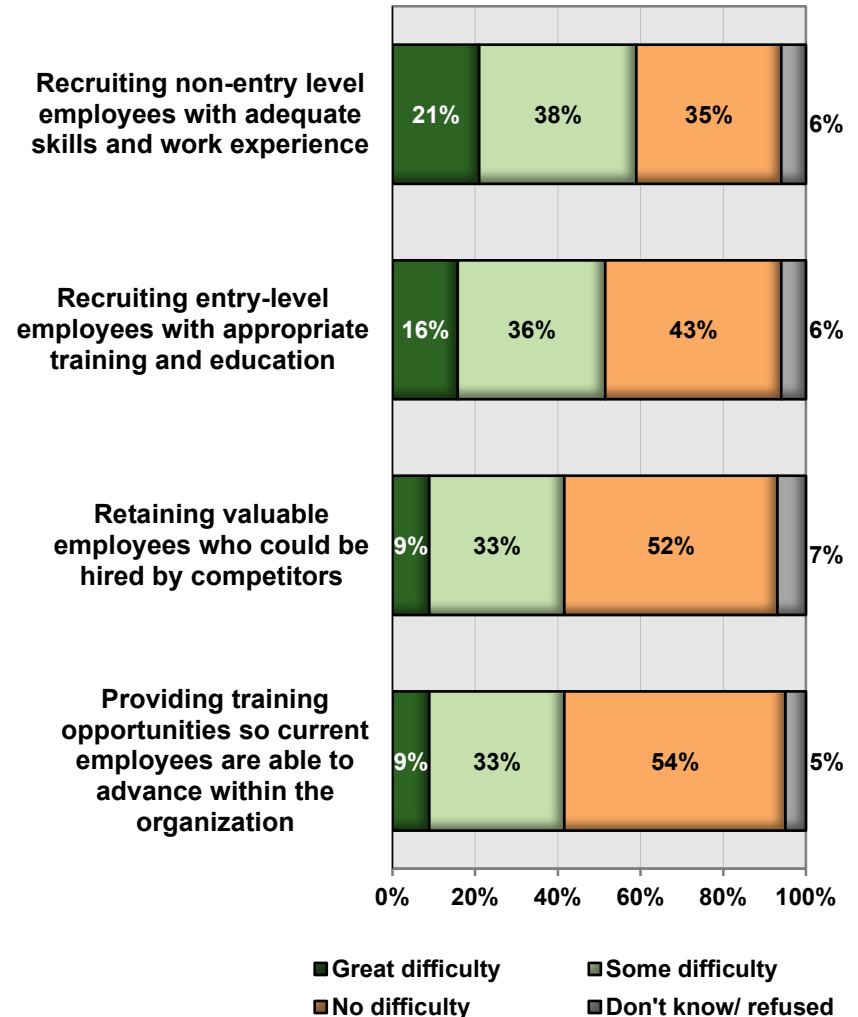
Growth Rate, Difficulty Hiring, and Wage Range by Occupation

Occupation	Difficulty Hiring	Firms that Employ	12-Month Growth %	Hourly Median Wage
Solar water- or pool-heating installers or technicians	65%	33%	29%	\$15–\$24
Solar photovoltaic installers or technicians	62%	72%	51%	\$15–\$25
Sales representatives or estimators	64%	70%	39%	\$19–\$32
Solar designers or engineers	67%	62%	33%	\$19–\$31
Solar installation managers or project foremen	65%	61%	32%	\$20–\$30
HVAC technicians with specific skills in solar installation	64%	11%	25%	\$14–\$25
Energy auditors	56%	20%	31%	\$17–\$25
Site assessors and remote evaluators	64%	37%	35%	\$16–\$25
Plumbers with specific skills in solar installation	59%	17%	25%	\$18–\$30
Electricians with specific skills in solar	62%	53%	42%	\$20–\$31
Roofers with specific skills in solar installation	47%	15%	36%	\$15–\$25

The range reflects the differences between entry-level and experienced workers.

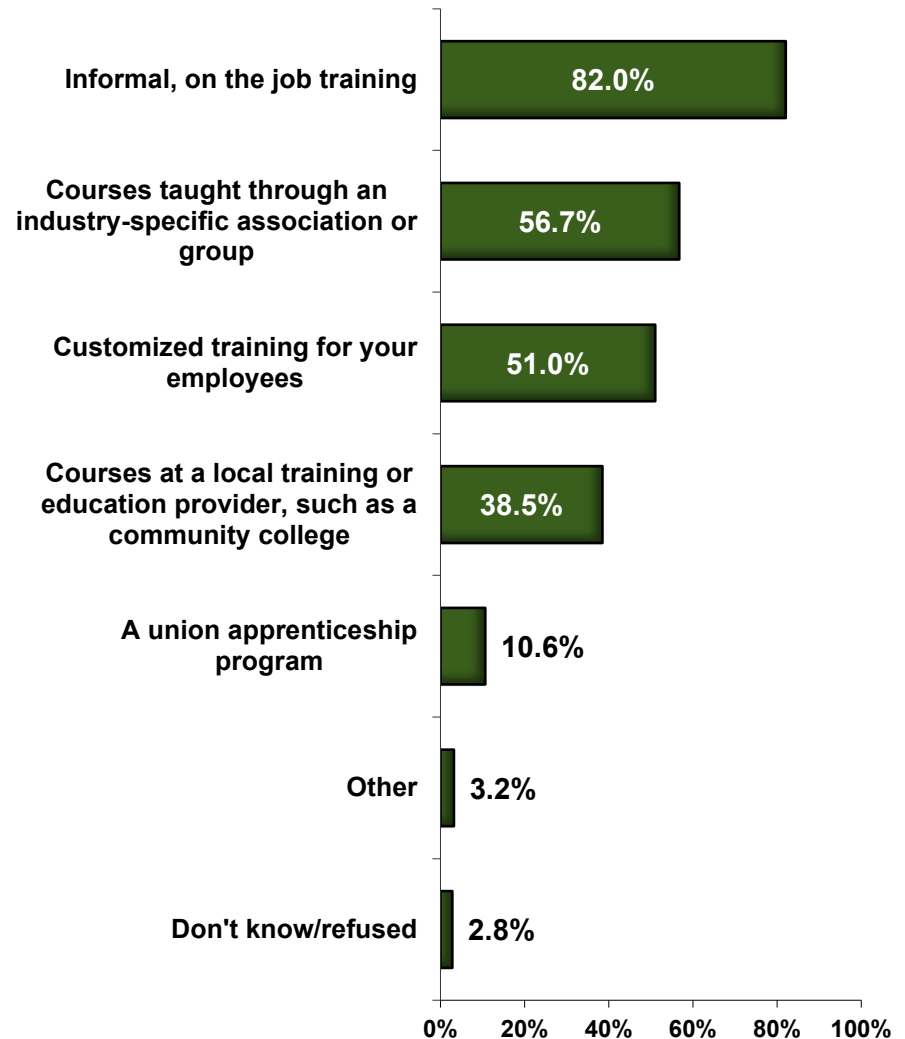
Employer Needs and Preferences

- 52% of firms reported difficulty in finding qualified entry-level candidates.
- 59% reported difficulty finding non-entry-level employees.
- Firms reported significant difficulty finding qualified applicants across all installation occupations.
- Companies are looking for experience with customer service, construction, and electrical projects.

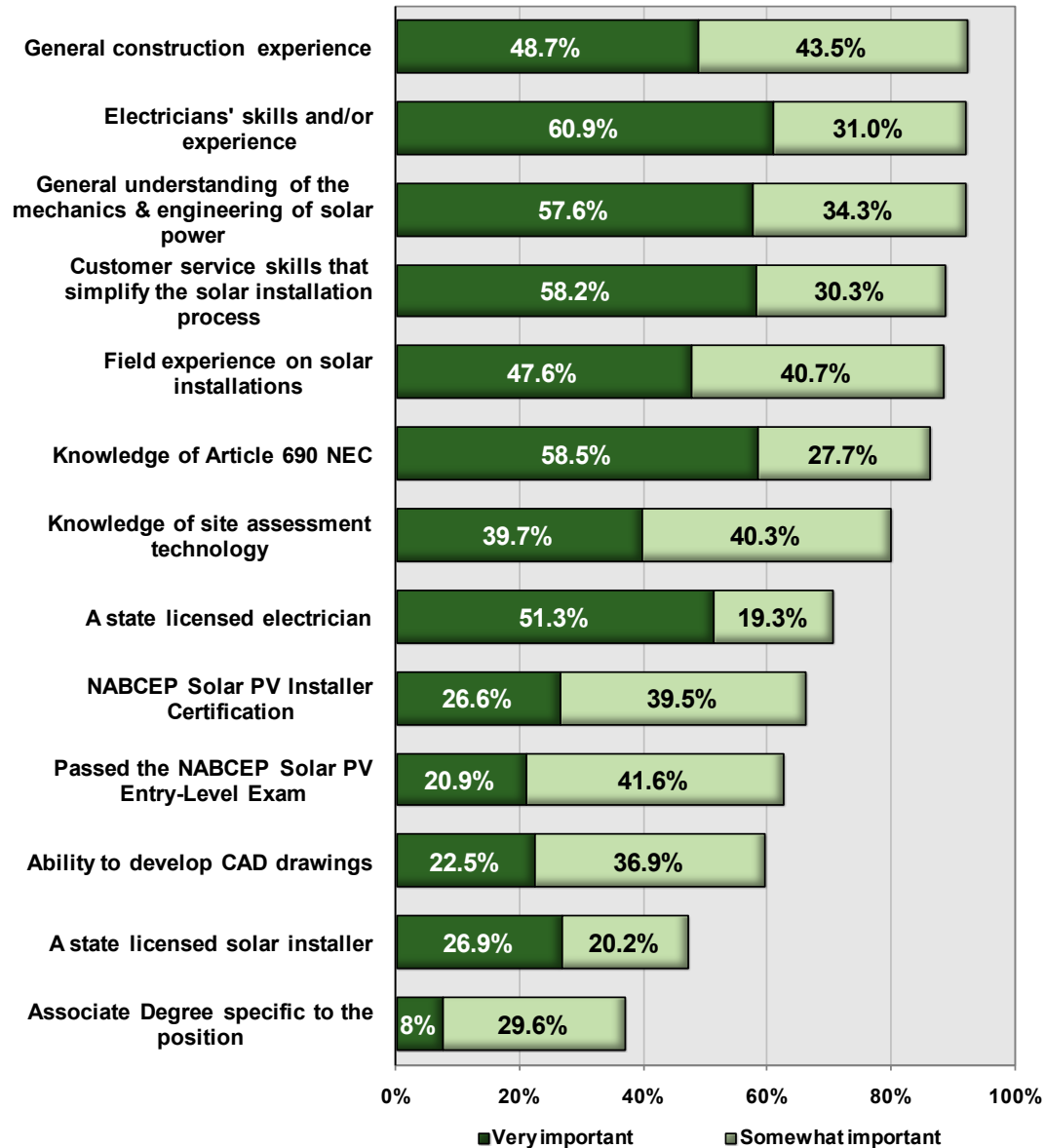


Employer Needs and Preferences

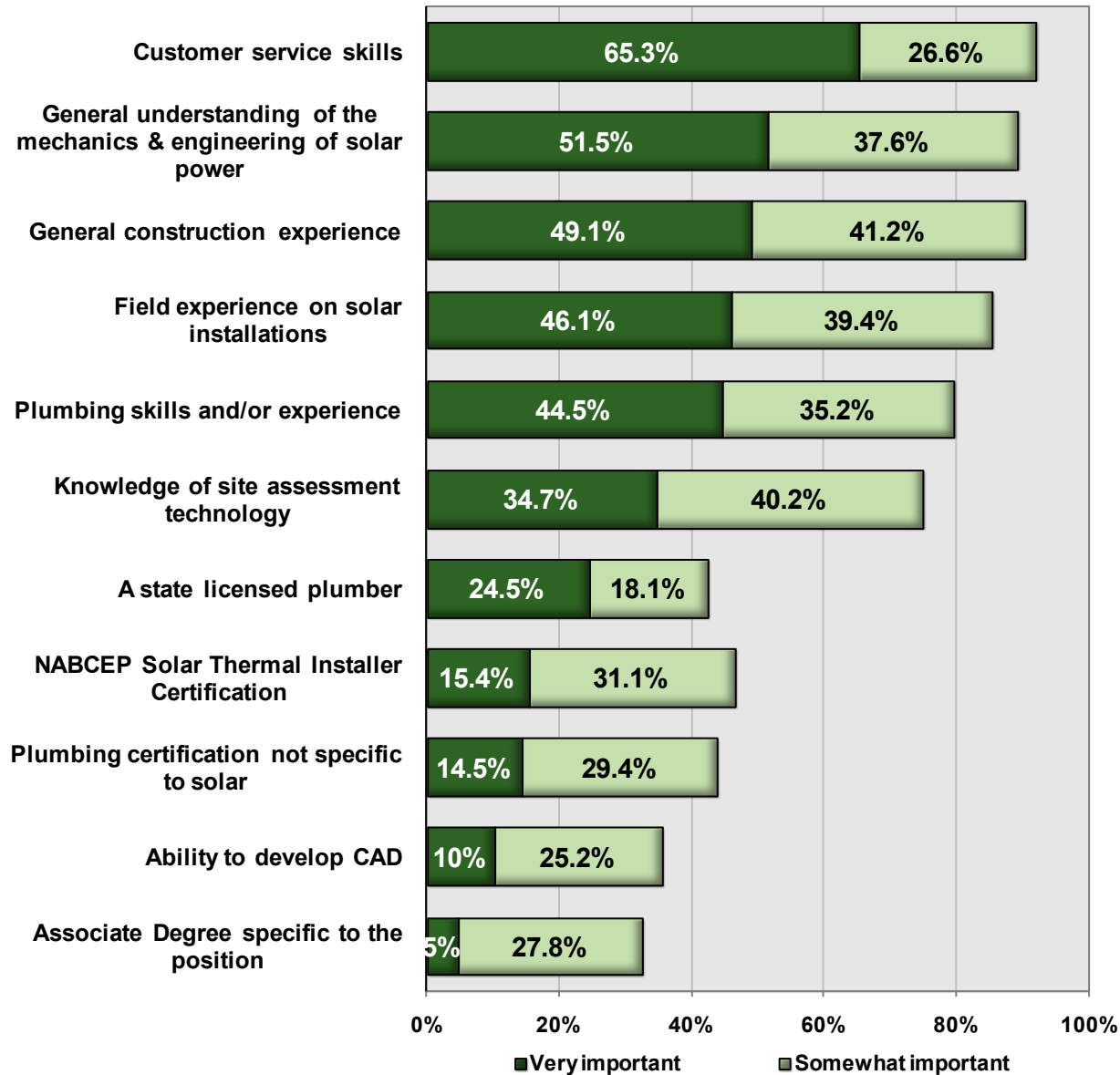
- Firms show preference for informal on-the-job training
- Over half use customized or existing training programs for their employees



Skills, Areas of Knowledge, and Educational Certifications Needed for Employment at Solar Photovoltaic Installations



Skills, Areas of Knowledge, and Educational Certifications Needed for Employment at Solar Heating or Cooling Installations



What is the PV Jobs and Economic Development Impact Model (JEDI)?

Project Descriptive Data

Project Location: ARIZONA

Population (only required for County/Region analysis):

Year of Construction or Installation: 2009

System Type: Residential New Construction Typically 5 KW or smaller

Average System Size - DC Nameplate Capacity (KW): 2.5

Number of Systems Installed: 400

Total Project Size - DC Nameplate Capacity (KW): 1,000.0

Base Installed System Cost (\$/KW_{DC}): \$7,093

Annual Direct Operations and Maintenance Cost (\$/kW): \$10.00

Money Value - Current or Constant (Dollar Year): 2008

Utilize Project Cost Data default values? Choose "Y" to accept default values below or "N" to over-ride default values and utilize new user defined values as entered below.

If desired, default values (in cells below - based on Project Descriptive Data entered above) may be restored by pressing the 'Restore Default Values' button. Note: it is not necessary to restore defaults to incorporate default Project Cost Data in system analysis (simply enter a "Y" in cell B27 above).

JEDI - PHOTOVOLTAICS

Jobs and Economic Development Impact Model

This demonstration model is designed to estimate the statewide economic impacts associated with developing photovoltaic systems for distributed generation capabilities. The economic impacts identified include annual jobs, earnings, and output for the installation period and once the systems are up and running. A user defined "add-in" location (e.g., county or region) option is also available.

Steps to complete an economic impact analysis:

1. Enter project descriptive data
2. Choose to accept default project cost data (based on project description and average cost data for photovoltaic systems) or review and enter new project cost data.
3. If you accept default values, go directly to SUMMARY RESULTS to view and/or print results.
4. If you choose to enter new values make sure to enter an "N" in the designated cell before proceeding.

To begin analysis press Start button

Economic Impact Analysis

Project Cost Data

Installation Costs	Cost	Cost Per KW	Percent of Total Cost	Purchased Locally (%)	Manufactured Locally (Y or N)
Materials & Equipment					
Mounting (rails, clamps, fittings, etc.)	\$70,929	\$71	1.0%	100%	N
Modules	\$3,191,787	\$3,192	45.0%	100%	N
Electrical (wires, connectors, breakers, etc.)	\$70,929	\$71	1.0%	100%	N
Inverter	\$354,643	\$355	5.0%	100%	N
Subtotal	\$3,688,287	\$3,688	52.0%		
Labor					
Installation	\$354,643	\$355	5.0%	100%	
Subtotal	\$354,643	\$355	5.0%		
Total	\$4,042,930	\$4,043	57.0%		
Other Costs					
Permitting	\$70,929	\$71	1.0%	100%	
Other Costs	\$709,286	\$709	10.0%	100%	
Business Overhead	\$2,269,715	\$2,270	32.0%	100%	
Subtotal	\$3,049,930	\$3,050	43.0%		

PV JEDI is a web and spreadsheet-based tool designed to calculate local economic impacts associated with the installation and annual operations of photovoltaic systems.

Who Uses PV JEDI?

- Project Developers
- Renewable Energy Advocates
- Resource Planners and Analysts
- Local Planning Depts.
- State and Local Economic Development Commissions
- Researchers (government, university, etc.)



JEDI Photovoltaic Economic Impacts

PV's economic "ripple effect"

Onsite Impacts

These are jobs related to project development and onsite installation expenditures; including **system installers, electricians, designers, engineers, and other installation service providers.**

Module and Supply Chain Impacts

These are offsite jobs at support businesses, such as **banks** financing the installation, **retail and wholesale material and equipment suppliers,** and at **manufacturers and their suppliers.**

Induced Impacts

These jobs are at local retail stores, grocery stores, gas stations, banks, child care centers, and other services and industries benefitting from the household spending (of wages) by people directly and indirectly supported by the project.

New Bifurcated Versions of PV JEDI

- PV Project JEDI – Used for assessing jobs and economic impacts at the project level. This year a web-version was created at <https://jedi.nrel.gov/>.
- PV Scenario JEDI – Will be released later this year. Models state or regional-level jobs and economic impacts over a multi-year target period for an entire policy or market size. Spreadsheet version only.



PV Project JEDI User Inputs

Minimum Information

or

More Detailed Information

Location (State or County*)

Year of construction

System Type

- Residential New
- Residential Retrofit
- Small Commercial
- Large Commercial
- Utility-Scale

Size of PV system (KW)

Installation

Materials and Equipment Costs
(modules, mounting, electrical, etc.)

Labor Costs

Other Costs (permits, services,
overhead, etc.)

Annual Operating & Maintenance

Labor Costs

Materials and Equipment Costs

Other Parameters (Financial, Tax,
and Payroll)

*County requires additional input-output data

PV Project JEDI Summary Results

Project Data

Project Installation Costs
(total and local share)

Annual O&M Spending

Debt Payments

Property Taxes

Impacts

Construction Period

Jobs

Earnings

Output

Operating Years (annual)

Jobs

Earnings

Output

PV Scenario JEDI

- Unlike the project version, provides total jobs, earnings, and economic output for an entire market size over a multi-year period.
- There was a prevalent need for a PV model designed for policy planning. Some users were using the Project version for this purpose, though it was not designed for scenario modeling.
- Allows the user to input scenarios in virtually any format, for a proposed policy or projected market scale-up, with start date and target end date, via a drop-down list that includes:
 - capacity (MW),
 - energy (GWh),
 - investment (\$m)
 - % retail consumption
 - # of systems



PV Scenario JEDI Decision-Support Resources

- Contains a wealth of new decision-support resources within the model. For example:
 - Solar PV companies by state
 - Tax information
 - Map of U.S. Manufacturing facilities
 - Expected RPS-related build-out by state



Thank You



Barry Friedman
Strategic Energy Analysis Center
National Renewable Energy Laboratory
<http://www.nrel.gov/analysis/>
Jedi.nrel.gov
Barry.friedman@nrel.gov