2016

VIRGINIA SOLAR CAREER PATHWAYS PLAN

Virginia Solar Pathways Project

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NOVA | Northern Virginia Community College

HIGHLIGHTS FROM CENSUS 2015

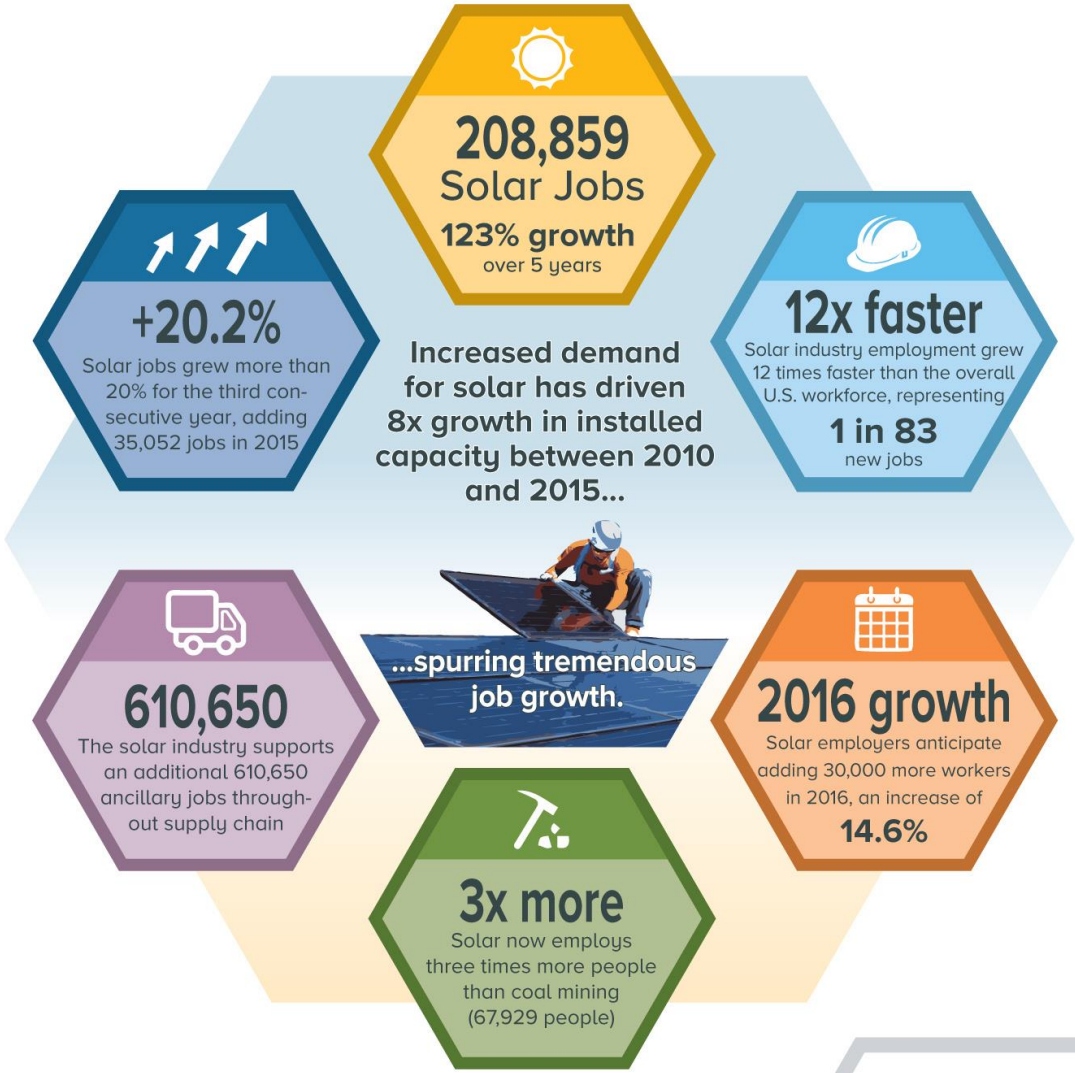
Over the next 12 months, employers surveyed expect to see total employment in the solar industry increase by 14.7% to 239,625 solar workers.

One out of every 83 new jobs created in the U.S. since Census 2014 was created by the solar industry – representing 1.2% of all new jobs.

Of the 208,859 solar workers in the United States, approximately 188,000 are 100% dedicated to solar activities.

The SOLAR FOUNDATION
RESEARCH & EDUCATION TO ADVANCE SOLAR ENERGY

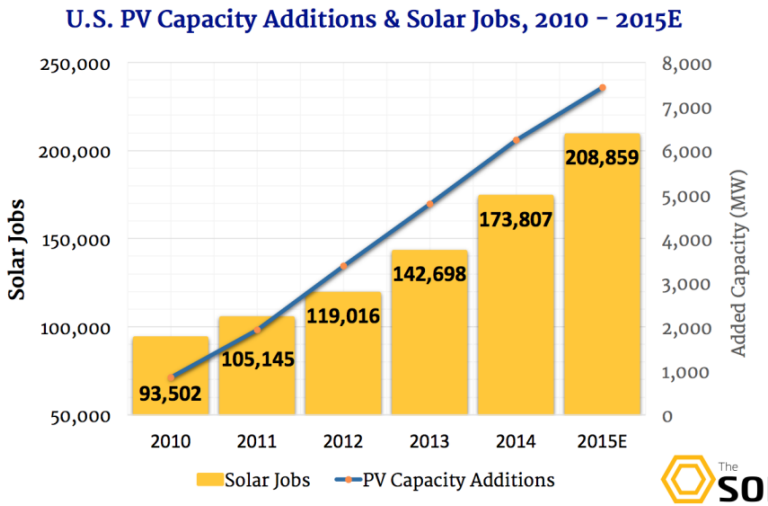
2015 National Solar Jobs Census



Read More at TSFCensus.org

SOLAR JOBS NATIONWIDE

With 119,931 solar workers, the Installation Sector remains the single largest solar employment sector. The installation sector grew by almost 24% since November 2014 and will grow by 173% by 2010.



The SOLAR FOUNDATION™

208,859	Solar jobs
119,931	Installation jobs
30,282	Manufacturing jobs
24,377	Sales and distribution jobs
22,422	Project development jobs
11,848	Other solar jobs

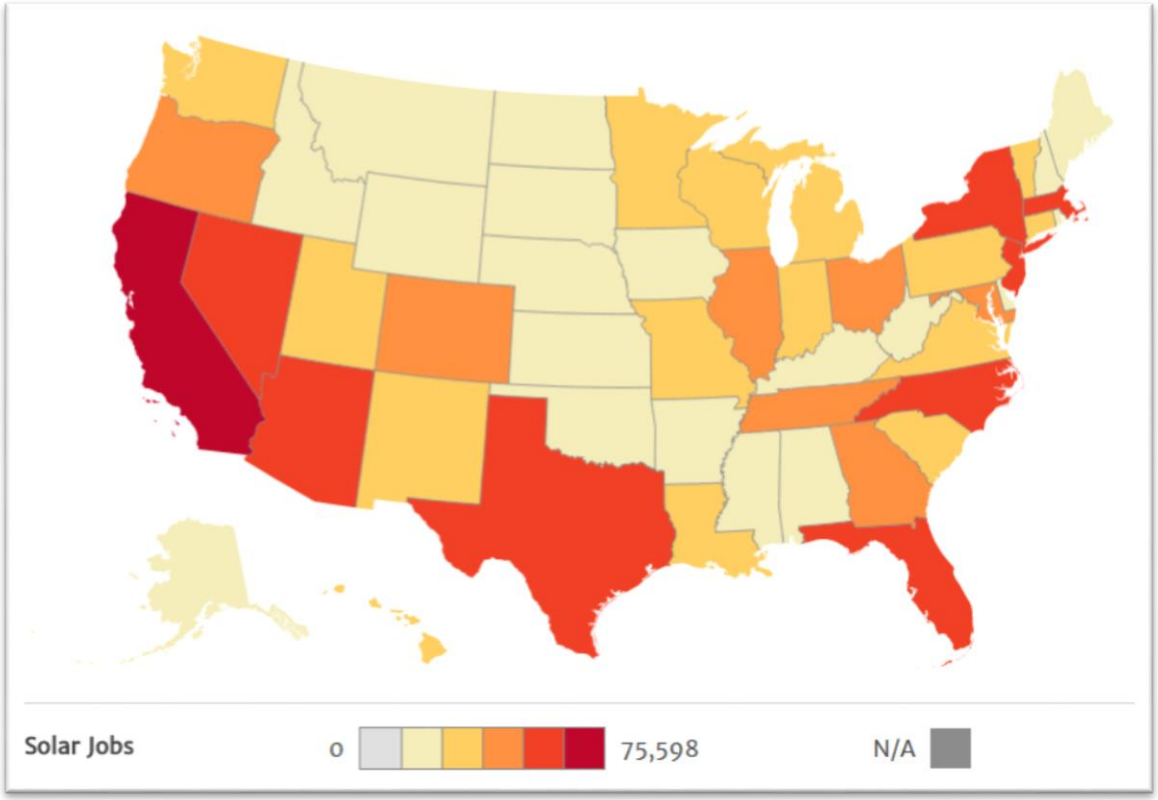
57.4%	Installation
14.5%	Manufacturing
11.7%	Sales and Distribution
10.7%	Project Development
5.7%	Other

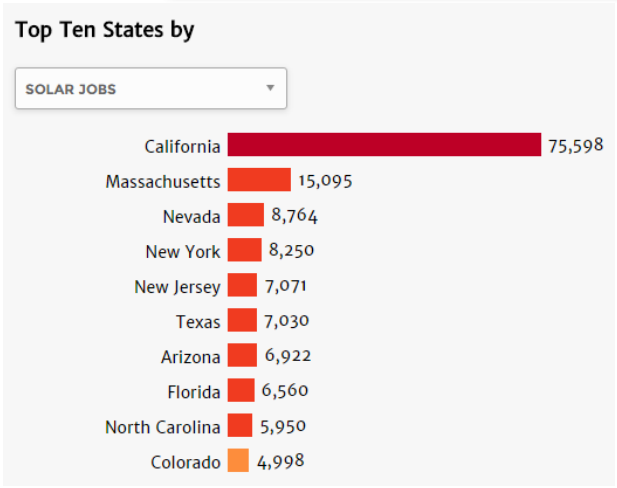
9,929	Total solar companies
2,095	Solar patents (2010 – 2015)
5,311,791	Homes powered by solar
10.51 cents/kWh	Average electricity price

Solar Worker Demographics

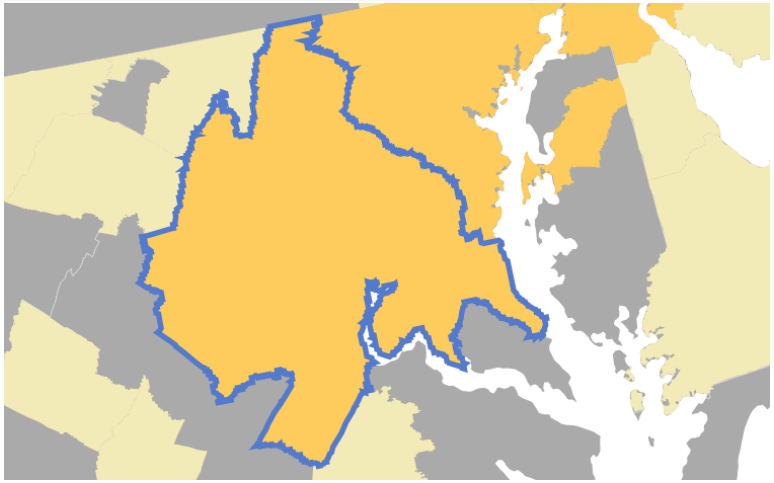
Women	23.8%
African-American	5.1%
Latino or Hispanic	11.3%
Asian or Pacific Islander	8.6%
Veterans of the U.S. Armed Forces	8.1%

2014



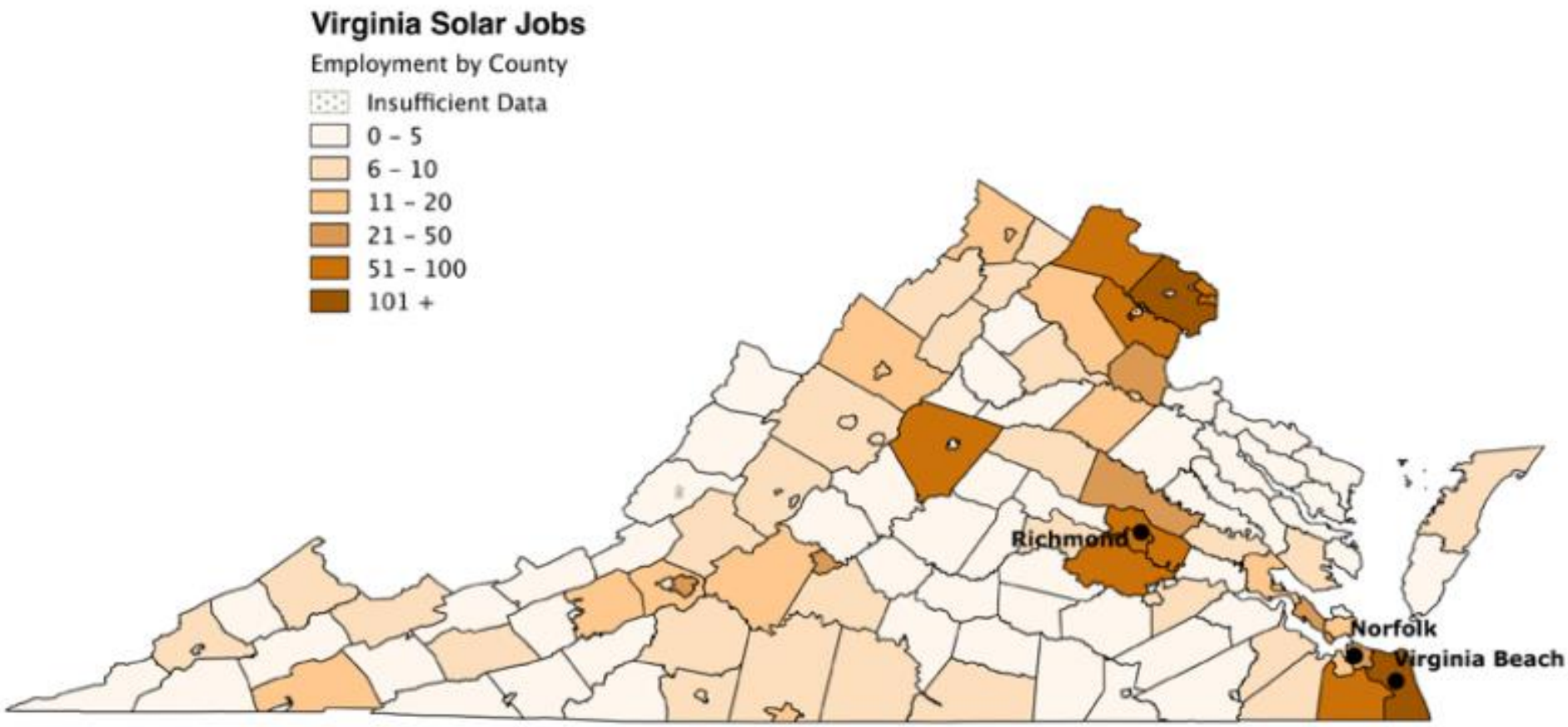


Solar Jobs Nationwide: 208,859



Solar Jobs in DC Metro Area : 2,711

2015



TOP 3 SOLAR SECTORS BY EMPLOYMENT

INSTALLATION
MANUFACTURING
SALES & DISTRIBUTION

VIRGINIA

Virginia saw a 25% increase in solar installations in 2015.

Virginia's solar job market, however, is still behind most of the country, ranking 37th in jobs per capita at a total of 1,963 solar jobs in 2015.

In June, Amazon announced plans to build an 80 MW solar farm in Virginia that is projected to create 300-400 local solar jobs.

Most recently, in December 2015, Governor McAuliffe announced that Virginia will work with the state's largest utility to procure 110 MW of solar in the next 3 years, bolstering future local solar job potential.

The SOLAR FOUNDATION™
RESEARCH & EDUCATION TO ADVANCE SOLAR ENERGY

Sector	VA Solar Jobs	% VA Solar Jobs	% U.S. Solar Jobs
Installation	1,193	60.8%	57.4%
Manufacturing	161	8.2%	14.5%
Sales & Distribution	142	7.3%	11.7%
Project Development	277	14.1%	10.8%
Other	189	9.7%	5.7%

Demographic	% VA Solar Jobs	% VA Overall Jobs†	% U.S. Solar Jobs
Women	23.9%	47.3%	23.8%
African-American	9.7%	18.0%	5.1%
Asian or Pacific Islander	6.5%	7.1%	8.6%
Latino or Hispanic	17.7%	7.8%	11.3%
Older Workers (55+)	28.8%	23.1%	18.6%
Union Members	-	-	5.5%
Veterans of the U.S. Armed Forces	8.9%	12.1%	8.1%

STATE SOLAR JOBS CENSUS 2015

VIRGINIA

Total Solar Jobs, 2015

1,963

Projected Solar Jobs Growth, 2016

342
(17.5%)

Solar Jobs Rank

#24

Solar Jobs Per Capita Rank

#37

Cumulative Installed Capacity thru Q3 2015 (MW)

18.3

Total Solar Companies**

180

SOLAR INSTALLATION

Sector	VA Solar Jobs	% VA Solar Jobs	% U.S. Solar Jobs
Installation	1,193	60.8%	57.4%

PV Installer Career Pathway

Jobs 5 Years Later

Solar Panel Installer	Construction Manager	Construction Foreman	Roofer	Solar Energy/ Power Engineer
$41,300	$67,900	$45,200	$32,800	$72,600
Typical Degree High School Education	Typical Degree Bachelor's Degree	Typical Degree High School Education	Typical Degree Less than High School	Typical Degree Bachelor's Degree
Certificates - NABCEP Entry Level Certificate of Knowledge - NABCEP Solar PV Installer Certification	Certificates - OSHA 30 Hour - OSHA 10 Hour - LEED Accredited Professional (LEED AP) - Project Management Certificate - Occupational Safety & Health Administration - Project Management Professional (PMP)	Certificates - Occupational Safety and Health Administration (OSHA) - OSHA Forklift Operator Certification - OSHA 30 Hour - Commercial Driver License (CDL)- Class A	Certificates - OSHA Forklift Operator Certification - OSHA 10 Hour - Commercial Driver License (CDL)- Class B	Certificates - NABCEP Solar PV Installer Certification - Certified Professional Engineer (PE)

Solar Panel Installer

$33,200	Typical Degree High School Education	Certificates NABCEP Entry Level Certificate of Knowledge NABCEP Solar PV Installer Certification	Skills Solar Energy/Solar Power Electronic Troubleshooting

Jobs 5 Years Before

Solar Panel Installer	Construction Laborer	Electrician	Roofer	Construction Foreman	Construction Manager
$33,200	$27,000	$33,900	$28,400	$41,000	$51,600
Typical Degree High School Education	Typical Degree High School Education	Typical Degree Certificate	Typical Degree Less than High School	Typical Degree High School Education	Typical Degree Bachelor's Degree
Certificates - NABCEP Entry Level Certificate of Knowledge - NABCEP Solar PV Installer Certification	Certificates - OSHA 10 Hour - OSHA Forklift Operator Certification - Commercial Driver License (CDL)-Class A - Occupational Safety and Health Administration (OSHA)	Certificates - General Journeyman Electrician - Master Electrician - Apprentice Electrician - Journeyman's Certificate in Non-Destructive Testing	Certificates - OSHA Forklift Operator Certification - OSHA 10 Hour - Commercial Driver License (CDL)- Class B	Certificates - Occupational Safety and Health Administration (OSHA) - OSHA Forklift Operator Certification - OSHA 30 hour - Commercial Driver License (CDL)- Class A	Certificates - OSHA 30 hour - OSHA 10 Hour - LEED Accredited Professional (LEED AP) - Project Management Certificate - Occupational Safety & Health Administration - Project Management Professional (PMP)

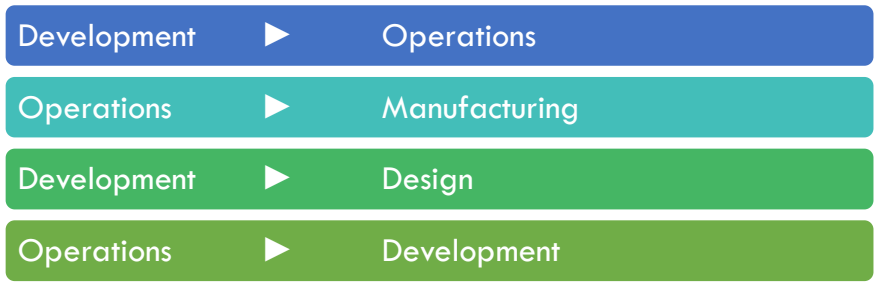
IREC SOLAR CAREER MAP

MANUFACTURING

- Materials Scientist
- Environmental Engineer
- Mechanical Engineer
- Electrical Engineer
- Industrial Engineer
- Process Control Technician
- Quality Assurance Specialist
- Instrumentation and Electronics Technician
- Advanced Manufacturing Technician
- Computer Numerical Control (CNC) Operator

PROJECT DEVELOPMENT

- Lawyer with Solar Expertise
- Solar Project Developer
- Solar Utility Procurement Specialist
- Electrical Inspector with Solar Expertise
- Code Official with Solar Expertise
- Building Inspector with Solar Expertise
- Solar Marketing Specialist
- Solar Sales Representative
- Solar Site Assessor



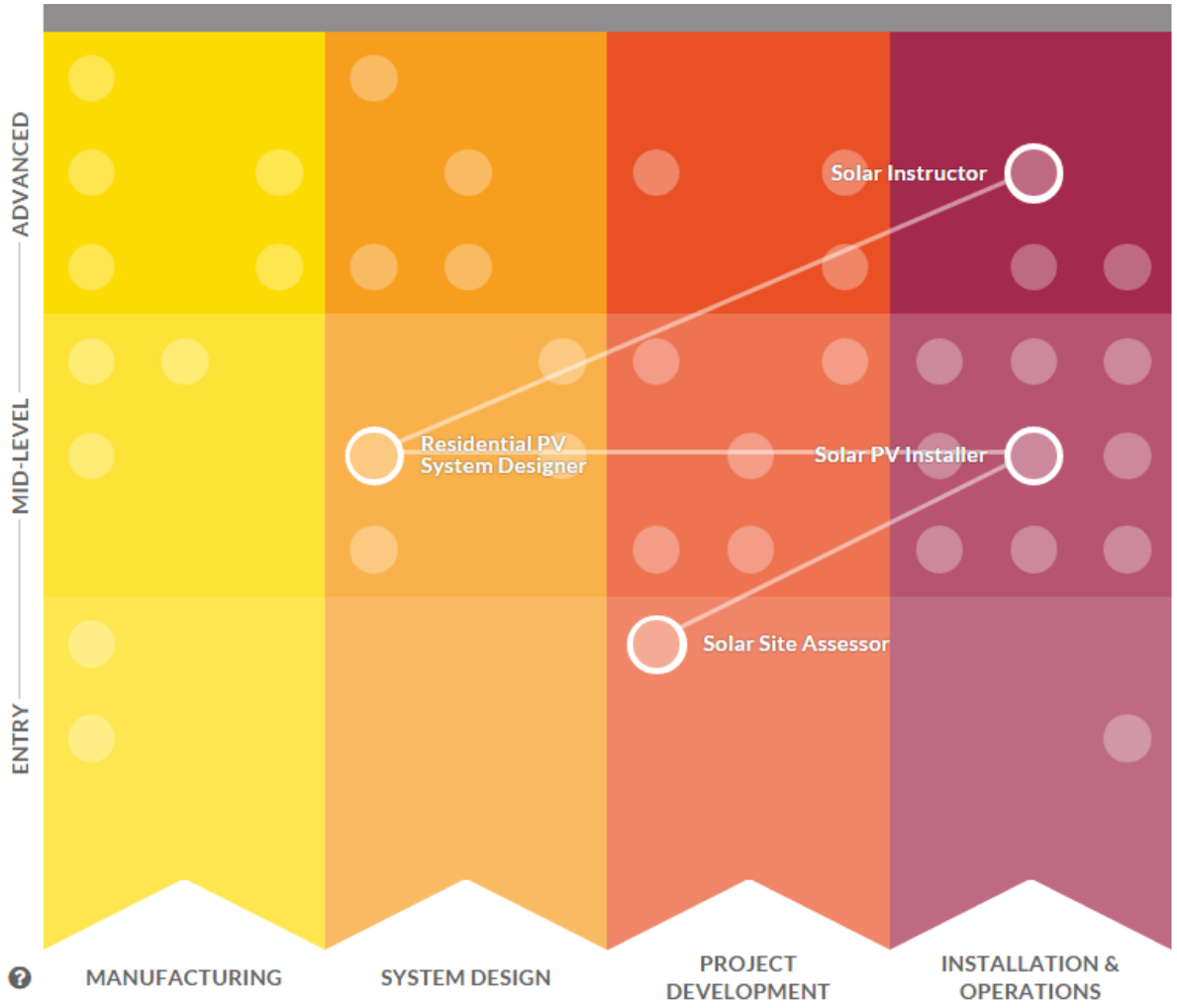
SYSTEM DESIGN

- Software Engineer
- Solar Energy Systems Designer
- Power Systems Engineer
- Structural Engineer
- Utility Interconnection Engineer
- Residential PV System Designer
- Engineering Technician
- IT Specialist

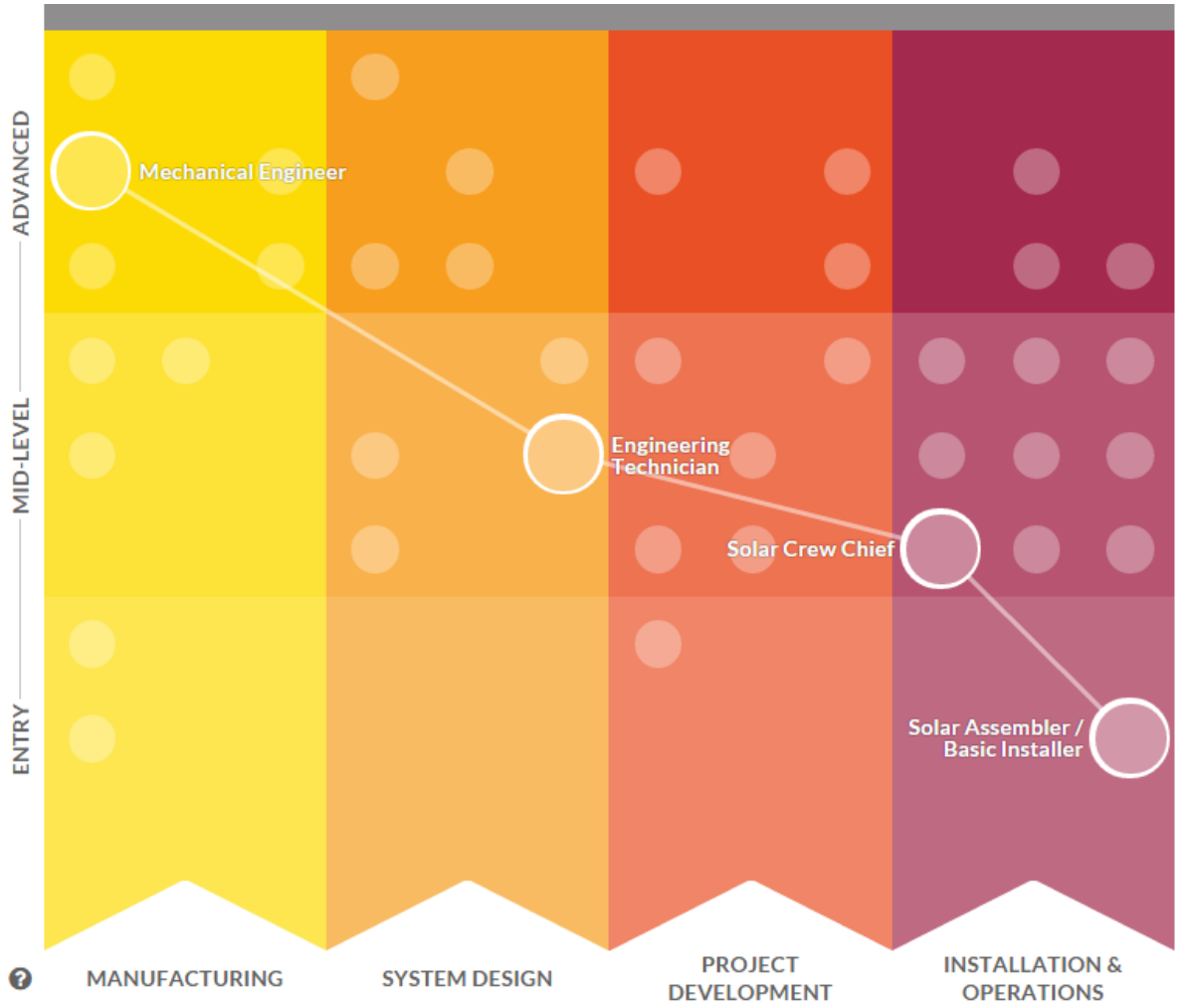
INSTALLATION & OPERATIONS

- Solar Instructor
- Solar Installation Contractor
- Solar Fleet Manager
- Electrician with Solar Expertise
- Solar PV Technician (commercial/utility)
- Solar Project Manager
- Solar Service Technician (residential)
- Solar PV Installer
- HVAC Technician with Solar Expertise
- Plumber with Solar Expertise
- Roofer with Solar Expertise
- Solar Crew Chief
- Solar Assembler / Basic Installer

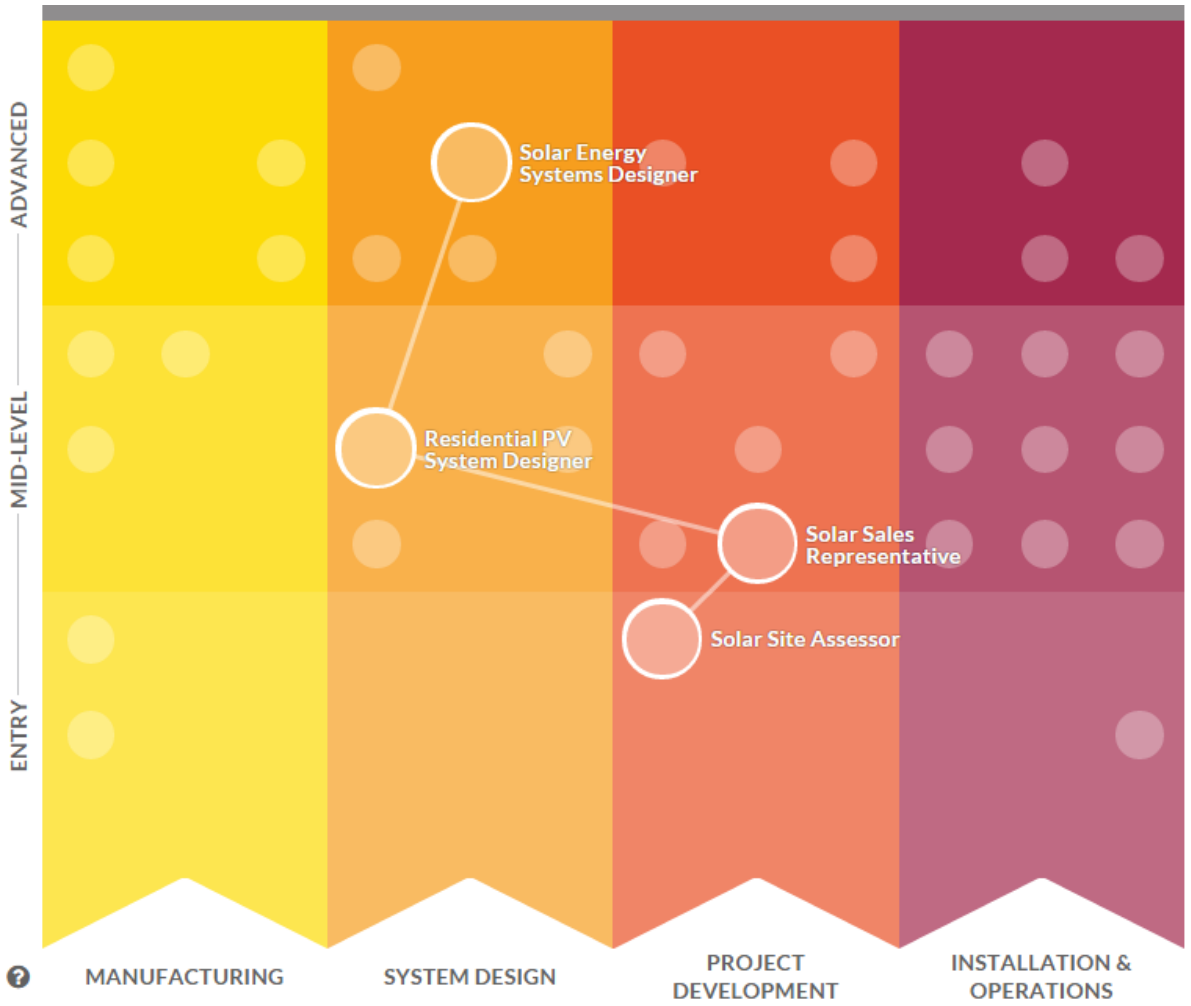
DEVELOPMENT ▶ OPERATIONS



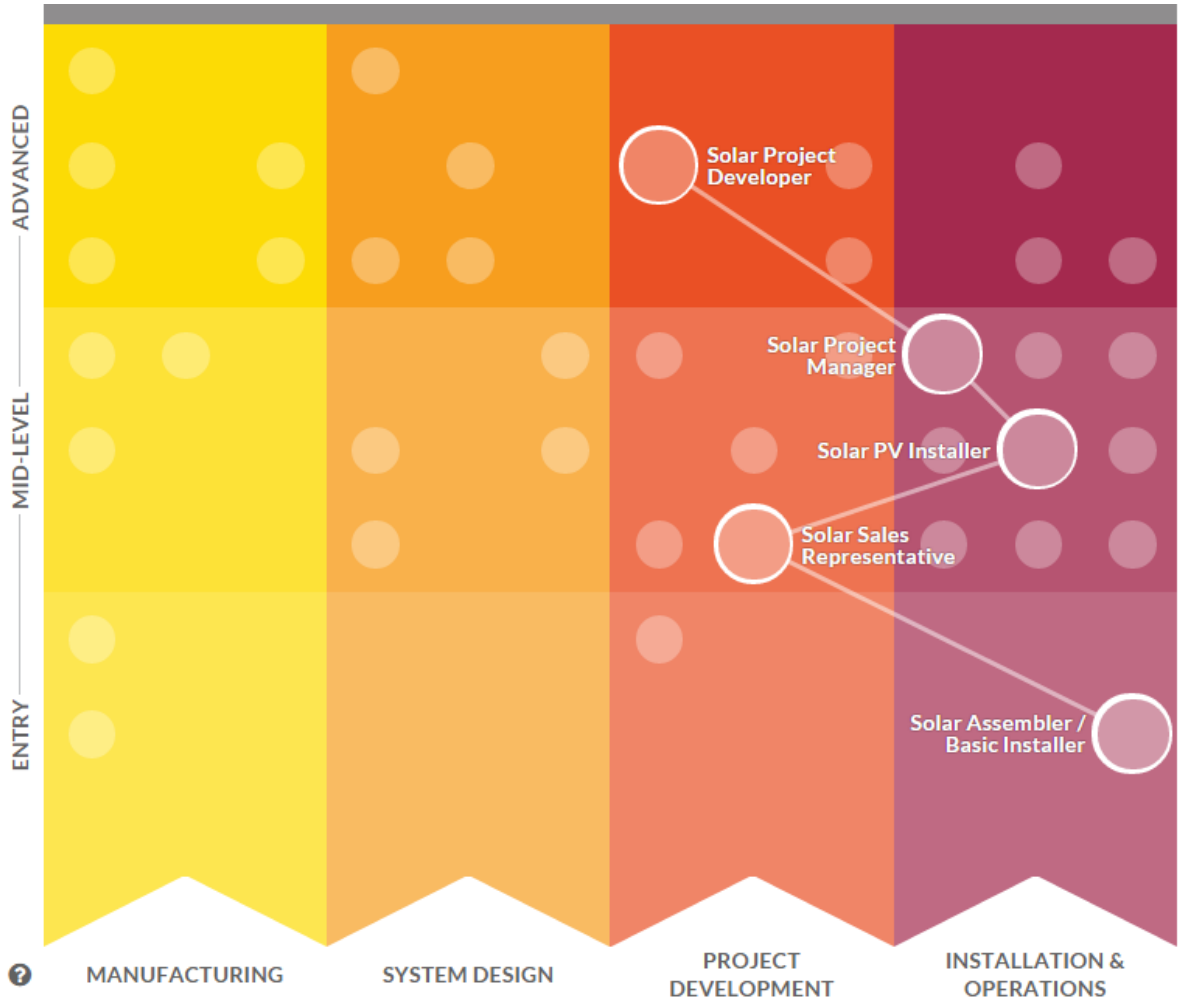
OPERATIONS ▶ MANUFACTURING



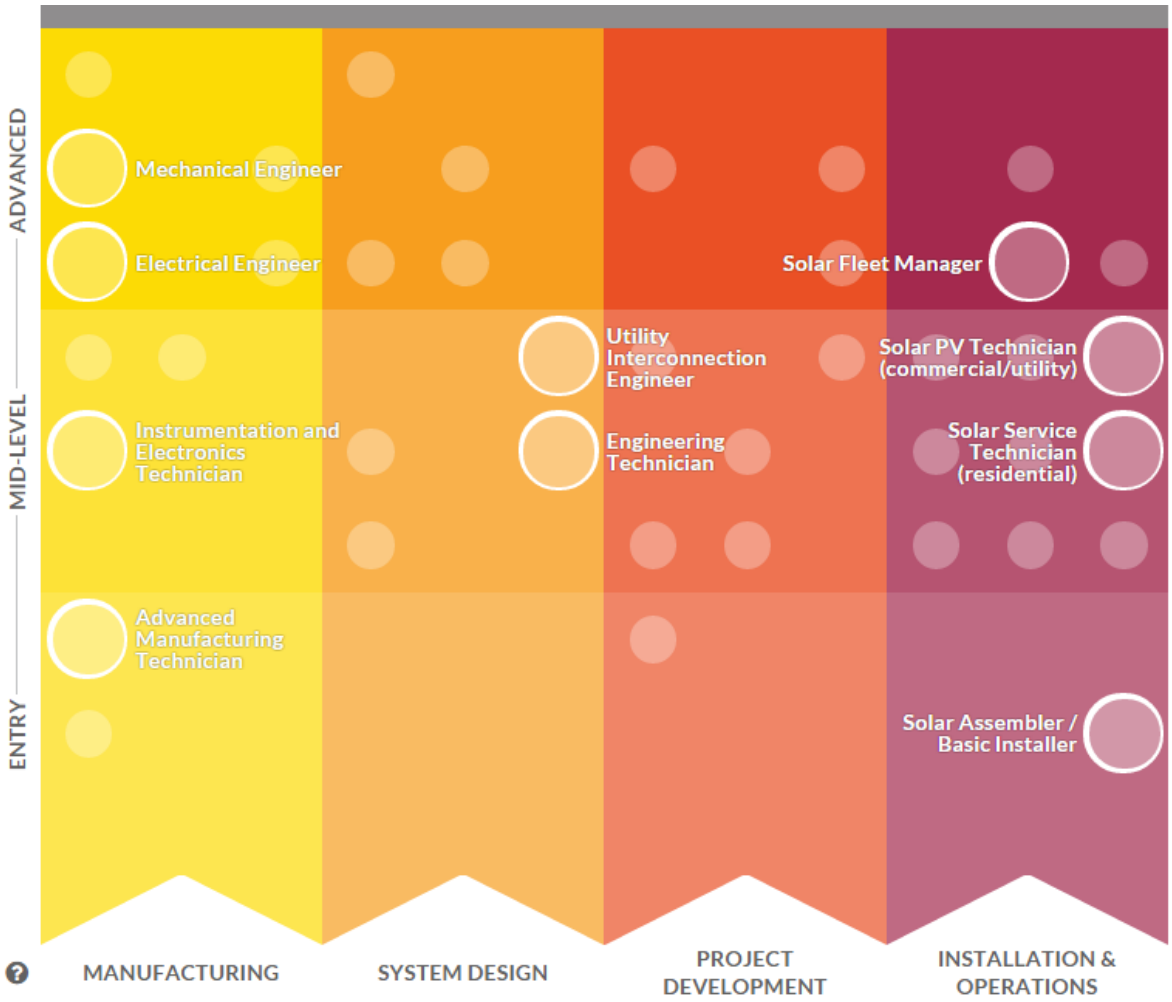
DEVELOPMENT ▶ DESIGN

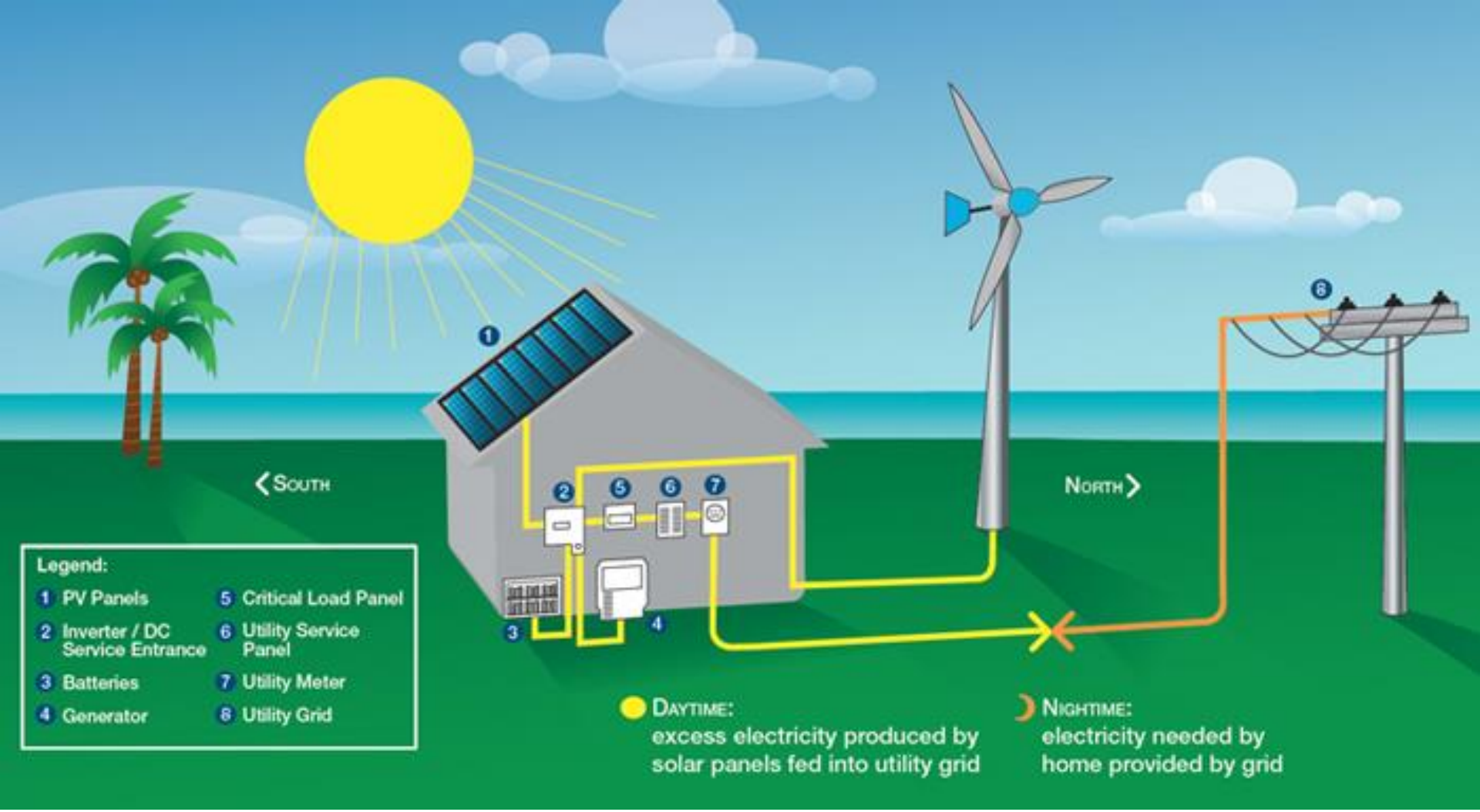


OPERATIONS ▶ DEVELOPMENT



VETERAN JOBS





Examples - Northern Virginia Job Supply and Demand Report for:

Solar PV Installer

Power System Engineer

TALENTSTREAM TECHNOLOGIES

CareerBuilder Supply & Demand Report

SOLAR JOB FORECAST

Supply & Demand Report

Job Title: Solar PV Installer

Location: Fairfax, VA (within a 50 mile radius)

Timeframe: February 2015 to January 2016

Report Date: February 24, 2016

Top Line Results

32	249
Active Candidates	Job Postings

TALENTSTREAM TECHNOLOGIES

CareerBuilder Supply & Demand Report

SOLAR JOB FORECAST

Hiring Indicator

How difficult is it to recruit?

Job Posting Trends

Is the demand for this job increasing or decreasing?

In what cities do active candidates live?

Beltsville, MD	10
Columbia, MD	7
Baltimore, MD	5
Waldorf, MD	5
Oxon Hill-Glassmanor, MD	2
Annapolis, MD	1
Clarksburg, MD	1
Lansdowne, MD	1

Top Job Titles In Job Postings

Solar Pv Installer	82
Solar Jr. Installer	80
Commercial Solar Jr. Installer	33
Senior Solar Pv Installer	31
Solar Site Technician - Columbia, Md	9
Commercial Solar Apprentice Installer	4
Construction Site Technician-Columbia, Md	3
Site Technician - Columbia, Md	2
Construction Site Technician - Columbia, Md	1
Solar Installer	1

TALENTSTREAM TECHNOLOGIES

CareerBuilder Supply & Demand Report

SOLAR JOB FORECAST

Supply & Demand Report

Job Title: Power System Engineer

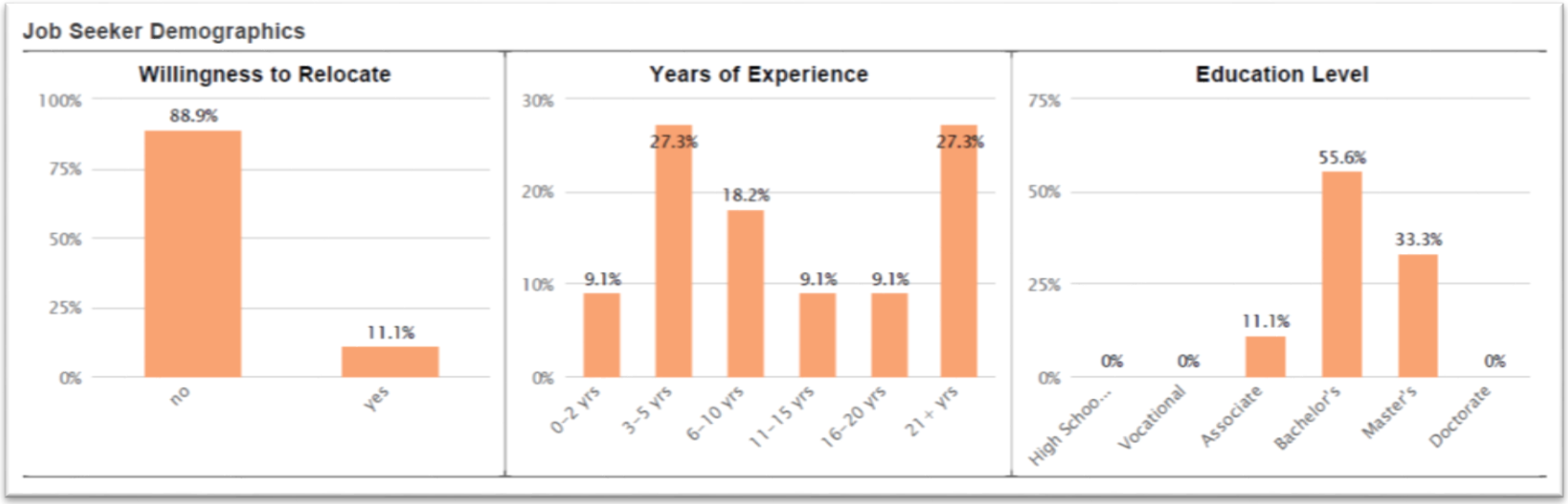
Location: Fairfax, VA (within a 50 mile radius)

Timeframe: February 2015 to January 2016

Report Date: February 24, 2016

Top Line Results

11	102
Active Candidates	Job Postings



TALENTSTREAM TECHNOLOGIES

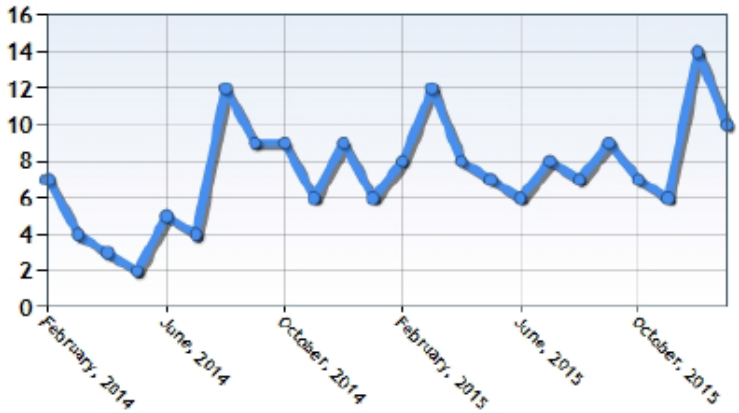
CareerBuilder Supply & Demand Report

SOLAR JOB FORECAST

Your search criteria are too narrow to display the Hiring Indicator. Conduct a new search and either broaden your location, expand your timeframe, or use more general keywords.

Job Posting Trends

Is the demand for this job increasing or decreasing?



In what cities do active candidates live?

Alexandria, VA	2
Annapolis Junction, MD	1
Ashburn, VA	1
Baltimore, MD	1
Mechanicsville, MD	1
Occoquan, VA	1
Rockville, MD	1
Silver Spring, MD	1
Sterling, VA	1
Vienna, VA	1

Top Job Titles In Job Postings

Senior Pv Designer	6
Certified Energy Manager	5
Energy Engineer	5
Solar Project Engineer	5
Espc Project Manager Us Virgin Islands...	4
Field Project Development Engineer -...	4
Renewable Energy Systems Engineer	4
Renewable Energy Utility Engineer	4
Solar Energy Engineer	4
Associate Project Manager For Building...	3

SOLAR TRAINING RECOMMENDATIONS

Recommendations are in these three categories:

1. National Certificates
   - National certification provides a set of national standards by which solar industry workforce with skills and experience can distinguish themselves from their competition.

2. College Certificates and Degrees
   - There are many certificates offered in Virginia colleges that prepare students for a solar or renewable energy career. Some of these certificates are similar or even have the same name, even though they offer different curriculums.
   - Standardized certification and degrees help employers understand the knowledge and skill levels of candidates/employees and makes the hiring process easier.
   - Virginia state recognized certifications/degrees are more attractive to workforce and businesses.

3. Credit and Non-Credit Courses
   - These courses are to complement existing degrees and can be implemented into programs or offered as electives or minors.

NATIONAL CERTIFICATES

1. Energy Industry Fundamentals (EIF): CEWD
2. NABCEP
   - PV Technical Sales
   - PV Installation Professional
   - Solar Heating Installer Certification
3. LEED
   - LEED GA
   - LEED AP Homes
   - LEED AP BD+C
   - LEED AP ID+C
   - LEED AP O+M
   - LEED AP ND
4. Safety
   - OSHA 10
   - OSHA 30
5. Certified Solar Roofing Professional (CSRP)
   - Manufacturers
   - Roofing/Solar professionals

North American Board of
NABCEP
Certified Energy Practitioners

OSHA®
Occupational Safety and Health Administration
www.osha.gov

Center For ENERGY Workforce Development
Energy Industry Curriculum Center

ENERGY INDUSTRY FUNDAMENTALS (EIF)

The purpose of the Energy Industry Fundamentals Certificate is to ensure that potential workers gain an understanding of the energy industry as a prerequisite to occupation-specific training. It also ensures that they gain an understanding of the careers available in the energy industry, as well as the education and training to enter and advance in those careers.

The Energy Industry Fundamentals Certificate was developed by CEWD and the U.S. Department of Labor. As such, it covers such basics as emerging principles and concepts that impact the energy industry; compliance with safety and health procedures; how electric power and natural gas generation, transmission, and distribution work; a range of entry-level energy careers; and "hot topics" in energy.

There are seven course modules which may be offered separately or as a certificate program totaling approximately 130 hours of instruction

Center For ENERGY Workforce Development

Energy Industry Curriculum Center

NABCEP

North American Board of NABCEP Certified Energy Practitioners

NABCEP is the most recognized and esteemed certification the solar industry has to offer. There are many benefits that come with achieving NABCEP PV Installation Professional, PV Technical Sales, Solar Heating Installer Certification, and/or NABCEP Company Accreditation. Certificants and Accredited Companies gain increased credibility and marketing value, giving them a competitive advantage over other solar professionals that do not hold the same certification or accreditation. This in turn provides greater career mobility and peer recognition.

1. PV Technical Sales Certification
   - The target candidate for NABCEP certification is a person with job descriptions such as sales person, application engineer, financial or performance analyst, or site assessor.

2. PV Installation Professional Certification
   - The target candidate for this NABCEP certification is a range of installation personnel including but not limited to: installers; project managers; installation, foreman/supervisor, and designers.

3. Solar Heating Installer Certification
   - The target candidate for NABCEP certification is the person responsible for the system installation (e.g., contractor, foreman, supervisor, or journeyman).

LEED

LEED AP Building Design + Construction (LEED AP BD+C)

Suits professionals with expertise in the design and construction phases of green buildings, serving the commercial, residential, education and healthcare sectors.

LEED AP Operations + Maintenance (LEED AP O+M)

Distinguishes professionals implementing sustainable practices, improving performance, heightening efficiency and reducing environmental impact in existing buildings through enhanced operations and maintenance.

LEED AP Interior Design + Construction (LEED AP ID+C)

Serves participants in the design, construction and improvement of commercial interiors and tenant spaces that offer a healthy, sustainable and productive work environment.

LEED AP Neighborhood Development (LEED AP ND)

Applies to individuals participating in the planning, design and development of walkable, neighborhoods and communities.

LEED AP Homes

Suited for those involved in the design and construction of healthy, durable homes that use fewer resources and produce less waste.

SAFETY

OSHA recommends Outreach Training Programs as an orientation to occupational safety and health for worker.

Who are These Courses For?

Construction Employees with Safety Responsibilities such as Foremen, Superintendents, Project Managers, Safety Coordinators, Safety Specialists

1. OSHA 10

- The OSHA 10 Hour Construction Industry Outreach Training Program is intended to provide an entry level construction worker's general awareness on recognizing and preventing hazards on a construction site.

2. OSHA 30

- The OSHA 30-hour Construction Industry Outreach Training course is a comprehensive safety program designed for anyone involved in the construction industry. Specifically devised for safety directors, foremen, and field supervisors; the program provides complete information on OSHA compliance issues.

CERTIFIED SOLAR ROOFING PROFESSIONAL (CSRP)

This is a certificate that benefits Manufacturers and Roofing/Solar Professionals.

Roof Integrated Solar Energy (RISE) Inc. was founded by the Center for Environmental Innovation in Roofing (Center) and the National Roofing Contractors Association (NRCA). Their mission, is to evaluate and certify solar energy installers for knowledge about critical roof system construction and maintenance practices necessary to support successful rooftop solar energy installations.

In order to qualify as a Certified Solar Roofing Professional (CSRP), candidates must pass a challenging examination and agree to remain current with changes in the field. Candidates must demonstrate basic knowledge about different PV system types and key components, benefits and risks applicable to building owners, PV systems' integration with a building's electrical system, installation guidelines, building codes, and any post-installation considerations.

RISE
ROOF INTEGRATED SOLAR ENERGY

COLLEGE CERTIFICATES AND DEGREES

ecotech INSTITUTE
College for Renewable Energy and Management

Virginia's Community Colleges

Recommendations for Solar/Energy Certificates and Degrees for Virginia colleges:

1. Ecotech Institute, College for Renewable Energy and Management

- Ecotech Institute in Aurora, Colorado (Denver metro area) is the first and only college entirely focused on preparing graduates for careers in the fields of renewable energy, sustainability, and energy efficiency. They offer associate's degree programs designed by experts in the industry for people seeking renewable energy jobs in the rapidly emerging clean tech economy.
- The two Associate of Applied Science Degree that benefit solar industry workforce are:
  - **AAS Renewable Energy Technology**
  - **AAS Solar Energy Technology**
- These could be offered at Virginia colleges as well as other states in Southeast region.
- Ecotech Institute is **nationally** accredited by the Accrediting Council for Independent Colleges and Schools (ACICS). ACICS is listed as a nationally recognized accrediting agency by the United States Department of Education and is recognized by the Council for Higher Education Accreditation.

2. Certificate of Solar PV Design and Installation

- This could be the standardized certificate for all Virginia colleges to offer as well as other states in Southeast region, it complements EIF certification and gives the students knowledge of all aspect of Solar PV Design and Installation.

ecotech INSTITUTE
College for Renewable Energy and Management

ASSOCIATE OF APPLIED SCIENCE DEGREE

AAS Renewable Energy Technology

Ecotech Institute's Renewable Energy Technology degree program provides a solid foundation in the fundamentals of clean renewable energy with a focus on engineering technology. Coursework includes:

- Sustainability, Energy Management, Best Practices in Energy Technology, Renewable Energy, Industrial Wiring, Power Generation and Transmission, Electives such as Wind Turbine Systems, Solar Thermal Installation and Repair, Energy Auditing, Cost and Investment Analysis, Water Resources, Digital Electronics, and Programmable Logic Controls

AAS Solar Energy Technology

The Solar Energy Technology degree program at Ecotech Institute prepares graduates for renewable energy jobs that are in high demand and gives them a solid foundation in fundamentals of solar energy technology. Coursework includes:

- Introduction to Sustainability, Fundamentals of Electricity, Health and Safety in the Field, AC Circuitry, Renewable Energy Fundamentals, Wiring, Schematics, and Blueprints, Power Generation and Transmission, Programmable Logic Controls, Electric Motors and Control Systems, Business Concepts for Renewable Energy, Introduction to Photovoltaics, Photovoltaic Installation and Repair, Solar Energy Technologies, Introduction to Solar Thermal, Solar Thermal Installation and Repair

CERTIFICATE OF SOLAR PV DESIGN AND INSTALLATION

The curriculum for this certificate needs to be carefully developed to prepare the solar workforce for solar industry careers. Some of the benefits of the certificate may include:

- A standardized state certificate for all Virginia colleges
- It complements EIF certificate and focuses on PV design and installation training
- It shows that students have achieved a higher level of expertise in solar work, and serves to differentiate them from competitors.

These are a few course topics that may fit in this certificate:

- **Introduction to Solar Energy for Non-Engineers**
- **National Electrical Code**
- **Energy Policy**
- **A.C. and D.C. Circuit Fundamentals**
- **Solar Power Installations**
- **Solar Power - Photovoltaic and Thermal**
- **Solar Thermal Active and Passive Technology**
- **Commercial/Industrial Photovoltaic Design and Installation**
- **Energy Economics**
- **And other**

SOLAR/ENERGY CREDIT COURSES

The courses below may align with these degrees:

1. Architecture/Interior Design/Architecture Technology
   - Solar/Energy Software Courses: Autodesk, Energy Plus, OpenStudio, Homer Energy or PV design and simulation software
   - Green Interiors (including material, finishes, green building design, …)
   - Net zero energy building courses
2. Technology/Engineering/Electrical Engineering
   - Renewable energy strategies (solar, wind, …)
   - Power Distribution Systems
   - Electric Power Utilities
   - PV Panel design and installation
   - Manufacturing
   - Engineering design
   - Installation and maintenance
3. Horticulture Technology – Landscape Design
   - Green walls
   - Green roofs
4. Environmental Studies
   - Environmental Policy
   - Environmental Law
5. Computer Programming/IT
   - Control systems for Energy storage
6. Business/Professional Services
   - Solar marketing and sales
   - Communication strategies
   - Sustainable Project Management
7. And more

VIRGINIA LICENSING

Department of Professional and Occupational Regulation

The Virginia Department of Professional and Occupational Regulation offers an Alternative Energy Systems (AES) specialty. As of December 2012, a special exam is required for this specialty in Virginia on a contractor's license. A licensed contractor (Class A, B, C) may declare the AES specialty. "Alternative energy system contracting" means that service which provides for the installation, repair or improvement, from the customer's meter, of alternative energy generation systems, supplemental energy systems and associated equipment annexed to real property.

It is important for colleges and other institutes to provide such contractor licensing training to ensure all contractors have the skills and knowledge to manage projects that involve alternative energy technologies.

Contractor Licensing Options:

1. **Alternative Energy System (AES) license specialty**
2. **Environmental Specialties Contracting specialty**

RESOURCES

http://solarstates.org/#states/jobs

http://www.thesolarfoundation.org/solar-jobs-census/solar-jobs-compendium/

http://www.dpor.virginia.gov/

http://www.irecsolarcareermap.org/

http://www.irecusa.org/workforce-education/training-resources/solar-licensing-database/

http://www.irecusa.org/workforce-education/training-resources/credentialing-bodies/

http://www.riseprofessional.org/roofing-certification.shtml

http://www.riseprofessional.org/manufacturers.shtml

https://www.ecotechinstitute.com/degrees/renewable-energy-degree-programs