



SOLAR ENERGY INTERNATIONAL

Why Renewable Energy?

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At Solar Energy International (SEI) we love renewable energy! We believe wholeheartedly in the technology and its feasibility, and we believe renewable energy can help the world in many vital ways.

RENEWABLE ENERGY

Learning Objectives

- ✦ Define renewable energy
- ✦ Compare renewable and non-renewable energy



WHAT IS RENEWABLE ENERGY?

★ Energy generated from sources that naturally replenish themselves

- ✧ Virtually inexhaustible, but flow-limited
- ✧ Low- or no-emissions



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Renewables are the fastest growing source of energy worldwide, but what do we mean when we say “renewable energy”? It’s defined as an energy source that is naturally replenished and does not decrease in supply when it’s used. For example, when solar photovoltaic panels convert sunlight into electrical energy, the sunlight isn’t “used up;” there’s still just as much sun shining as there was before, and the sun will rise tomorrow, too.

Some forms of renewable energy, such as biomass generation, do consume fuel – wood or other organic material – which then must be replaced. In this case, what makes the fuel source renewable is the fact that it can be regenerated in a relatively short span of time, as opposed to the millions of years that it takes for fossil fuels to be formed underground.

One aspect of renewable energy sources to consider is that they are flow-limited, which means they are limited in the amount of energy that is available per unit of time. In other words, there is only so much sunlight energy available in each minute of the day. We can install more solar panels to capture more of the sun’s energy or erect more wind turbines to capture more of the wind’s kinetic energy, but we can’t make the sun shine brighter or make the wind blow harder.

The best part about renewable energy sources like solar, wind, and hydroelectric power is that once they are installed they essentially produce no emissions of carbon dioxide or other greenhouse gasses!

WHAT ARE FOSSIL FUELS?

- ★ Coal, oil, and natural gas
 - ✧ Created over millions of years
 - ✧ Hydrocarbons from plants and animals buried in the earth
 - ✧ Finite, decreasing supply
- ★ Burned as fuel for heat, transportation, and electricity
 - ✧ Freed carbon latches onto oxygen, which forms carbon dioxide (CO_2)
 - ✧ CO_2 traps heat from the sun
 - ✧ Accelerates climate change



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While renewables are growing at an unprecedented rate, we still get most of our energy today from fossil fuels like coal, oil, and natural gas. These fuels were created millions of years ago when plants and animals died, decayed, and were compressed under extreme weight. An enormous amount of energy was captured and stored in this process.

To use fossil fuels as an energy source, they first must be extracted from the earth. Then they're processed and oxidized (burned), which generates heat and CO_2 . In a power plant, the heat is used to create steam which operates large steam turbines, resulting in electrical energy. Unfortunately, the carbon that is released in this process finds its way into the atmosphere, combines with oxygen, forms CO_2 , and contributes to climate change through the greenhouse effect.

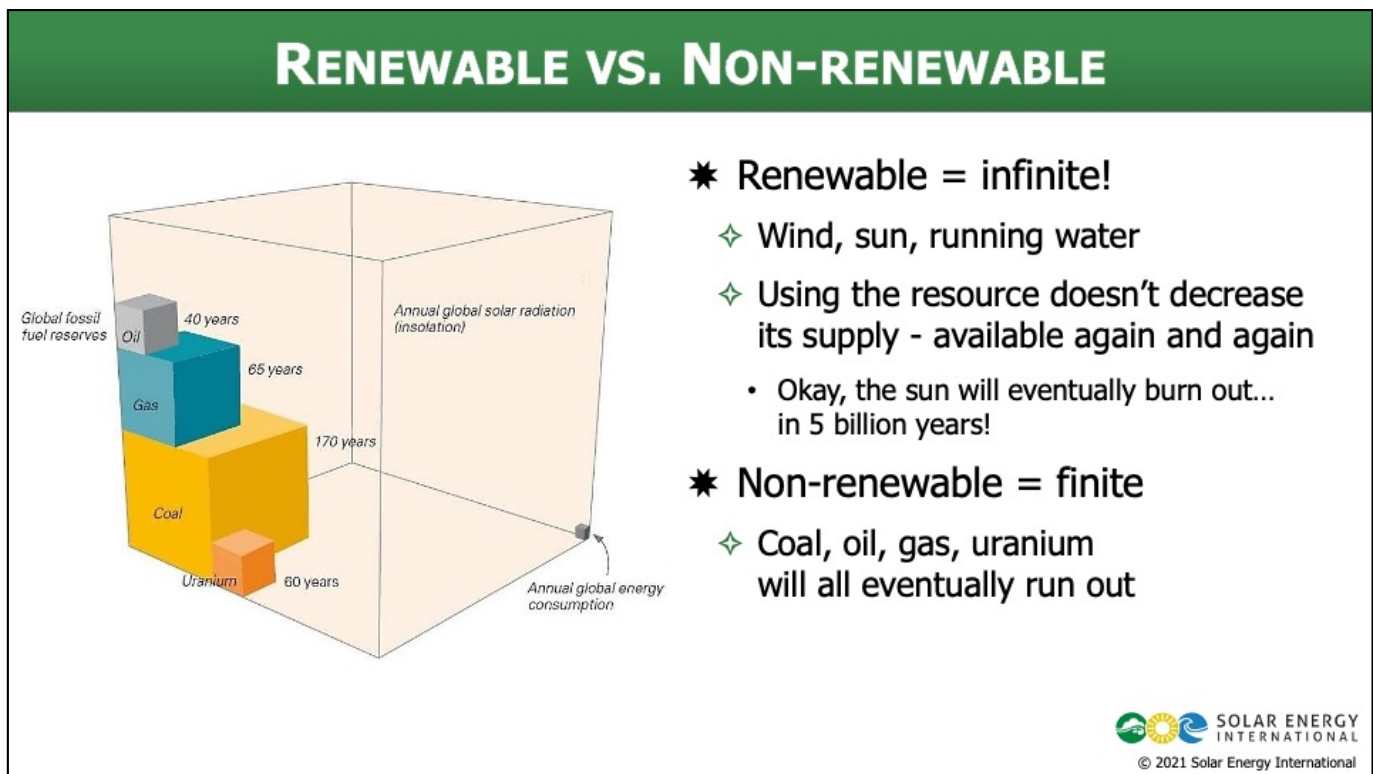
One of the consequences of extensive use of fossil fuels over the last roughly 200 years, is a significant increase in CO_2 in our atmosphere.

Just before the industrial revolution, there were less than 300 parts per million (ppm) of CO_2 in Earth's atmosphere. Today, it is over 400 ppm and rising. These changes to the atmosphere are causing the planet to warm through the greenhouse effect: by releasing huge quantities of greenhouse gases into the sky – where those gases trap heat from the sun – the temperature on and around earth's surface is increasing.

Although there is some debate about exactly how much we are heating things up, the scientific community agrees that we are increasing global temperatures. Not coincidentally, if you are 13 years old or older, then you've lived through the ten hottest years in recorded history. The dense quantities of energy we've found in fossil fuels has allowed our society to develop at an unprecedented rate. It has also altered the environment more than its early users ever imagined. Our challenge now is to reduce fossil fuel use as quickly as possible and to find our energy sources elsewhere. It's time to stop looking for energy beneath our feet and start looking for energy from

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sun, wind, and water.



Because fossil fuels take millions of years to form underground, it is a given that the supply will eventually run out: it's only a matter of time.

In fact, for some sources, the end of supply is closer than you might think. Oil, for example, is near its peak production now. A peak in production means the amount of oil that can be extracted from the earth will eventually dwindle as the years march on. As oil becomes rarer and more difficult to retrieve, the price will swing up and down as supply and demand fluctuates, and eventually become ever more expensive.

Whether it is coal, natural gas, oil, or uranium, these energy sources buried in the earth will eventually run out. Renewable energy can help provide a stable supply into the future because the fuel source is renewed daily.

RENEWABLE ENERGY = DOMESTIC ENERGY

- ✳ In many countries, the majority of fossil fuel is imported
- ✳ Competition for a dwindling resource
- ✳ Renewable energy is produced "in-country"
 - ✧ Fuel
 - ✧ Infrastructure
 - ✧ Job creation



Most countries rely on fossil fuels that come from outside of their borders, making them reliant on imports from a variety of countries. And in the countries doing the exporting, the extraction and refinement of the fuel has harmful impacts on local environments and people. Extraction and bringing fossil fuels to market has been a cause of numerous global problems for decades; when renewable sources are developed in-country, there could be less reliance on outside entities and unstable regions of the world.

With a fraction of our current investment in oil, we can build the technology and infrastructure necessary to replace our fossil fuel infrastructure with renewable energy infrastructure. And while we're at it, there will be 100's of thousands of job opportunities!

CENTRALIZED VS. DISTRIBUTED ENERGY

★ Centralized generation

- ✧ Fuel is mined or drilled and transported
- ✧ Large power plants generate electricity
- ✧ Electricity is distributed to users, often over great distances



★ Distributed generation

- ✧ Energy production spread out
- ✧ Production closer to point of use
- ✧ Flexible in size and scale
- ✧ Think solar panels on every roof!



Historically, most of our electric power has come from centralized power plants. These are large facilities – which may be hundreds of miles away from your home or city – that generate large amounts of electricity. The electricity is distributed over transmission lines – and large distances – before it is used in homes and businesses. There is a significant amount of loss due to the long transmission distances, and fuel for these large power plants usually must be transported or piped into them.

One of the greatest advantages of renewable energy systems, especially solar photovoltaic (PV), is that it can be installed at many locations throughout the utility grid, not just in large centralized power plants. This is called “distributed energy,” and it offers several advantages. First, it can avoid the energy losses that occur from sending power over long transmission lines – the power is produced much closer to the point of use. Second, generating electricity throughout and across the grid can improve the quality and reliability of the power grid.

The flexibility to install renewables in a distributed fashion at large- or small-scale can also help bring power to parts of the world that lack access to large central power plants.

RENEWABLE ENERGY

Key Points

- ★ Renewable energy
 - ✧ Supply does not decrease with use
 - ✧ Can be added to the existing electric utility grid
 - ✧ Can help mitigate climate change



GROWTH AND CAREERS

Learning Objectives

- ★ Identify policies and incentives that encourage renewables
- ★ Identify pathways for careers and education



INCENTIVES TO PROMOTE RENEWABLE ENERGY

- ✦ Subsidies and tax credits
 - ✧ May be available from federal, state, or local governments
- ✦ Utility rebates and incentives
 - ✧ Upfront or pay for performance
 - ✧ Net metering = surplus production allowed to feed into grid and offset energy costs from utility
- ✦ Feed-in tariffs
 - ✧ System owners receive a higher price for the electricity produced by renewables

Great things are expected of renewable energy (RE), and the RE industries have been growing amazingly fast. But the industry needs to continue to grow fast, and to do so renewable energy products must continue to become more affordable (though prices have come down dramatically in the past decade or so, to the point that they are competitive with, or even cheaper than, “conventional” sources). This requires increasing economies of scale: manufacturing, distributing, and selling equipment in much larger quantities to meet demand. In many countries, federal, state and local governments (as well as utilities) provide a variety of incentives which can help the renewable energy industry reach higher economies of scale. Public demand, government mandates, and economics drive these programs.

Subsidies - Grants and tax breaks given to the industry by governments. Research and development can require large outlays before products hit the market.

Tax Credits - Tax breaks for installing renewable energy system(s). For example, there is a U.S. federal tax credit of 26% of the system cost, which is set to be reduced to 20% in 2023; other state and local credits may be available too.

Utility Incentives - Some utilities offer monetary incentives for those installing renewable energy systems, because those systems help them meet demand and increase the percentage of the electricity on their grid that comes from renewable energy. These may be in the form of upfront rebates, or rebates paid over time. Net metering is an important component of this, which basically means that if you have a solar electric system on your roof, its production cancels out an equal amount of electricity you would have bought from the electric utility.

Feed-in Tariffs - Governments interested in rapidly scaling up renewables sometimes pay elevated prices – above the normal price per kilowatt-hour (kWh) – for each kWh of electricity produced by renewables. System owners are paid a premium for the energy the system produces, and this incentive structure has been highly successful in promoting rapid growth of renewables in some

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areas.

ENCOURAGING GROWTH

- ✱ Renewable portfolio standards (RPS)
 - ✧ A minimum percentage of energy from utility must be renewably sourced
- ✱ Renewable energy credits (RECs)
 - ✧ Placing added value on “green-ness” of electricity
- ✱ CO₂ reduction programs, carbon taxes



Here are other ways that RE growth has been encouraged:

Renewable Portfolio Standards – Enacted by various governmental bodies, these require electric utilities to get a certain percentage of the energy they provide from renewable sources; this encourages them to either build or buy renewable energy systems (such as large solar farms), or provide incentives for home and business owners to install solar electric systems.

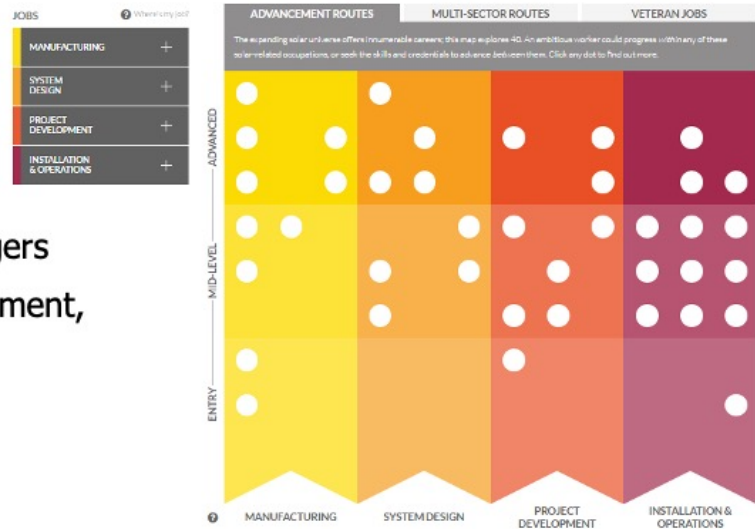
Renewable Energy Credits (RECs) - Tradable certificates representing 1,000 kWh (1 megawatt-hour) of electricity generated by a green energy system. RECs are bought and sold separately from the energy itself, and are often used to “offset” energy use by companies or to be able to say they are powered by renewable energy without actually owning renewable energy systems.

Carbon Dioxide (CO₂) Reduction Strategies and Carbon Taxes - These are large-scale proposals for putting a price on the production of CO₂. When implemented, fossil fuel use becomes more expensive, CO₂ emissions are reduced, and carbon-free renewable energy sources become even cheaper as compared to fuels with high carbon content.

RE CAREER PATH: STARTS WITH TRAINING

★ Lots of opportunity!

- ✧ Designers, engineers
- ✧ Installers, technicians
- ✧ Sales, marketing
- ✧ Construction and project managers
- ✧ Manufacturing, product development, and technical support
- ✧ Project developers, finance
- ✧ Operations and maintenance
- ✧ Policy and advocacy
- ✧ And much more!



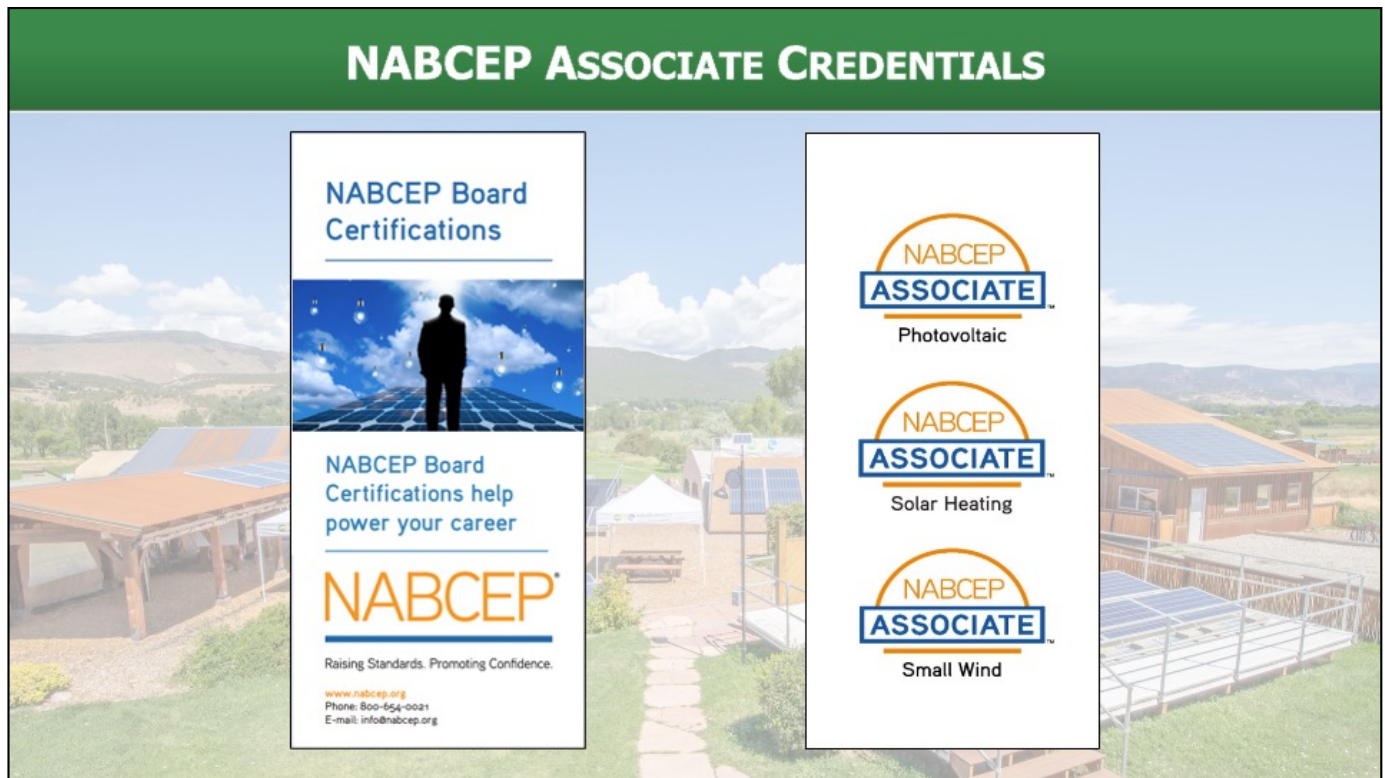
www.irecsolarcareermap.org

As the world moves to a clean-energy future and to increase the adoption of renewable energy, career opportunities in the industry abound, some of which are listed above.

The U.S. Department of Energy (DOE) Solar Career Map describes many jobs, career paths, and average compensation in the solar energy industry. The interactive map also identifies the training pathways leading to each of these exciting careers. The Solar Career Map can be found at <http://irecsolarcareermap.org/>

Solar Energy International (SEI) specializes in training the renewable energy workforce! Contact us for more information on beginning or advancing your career in the renewable energy industry.

Why Renewable Energy



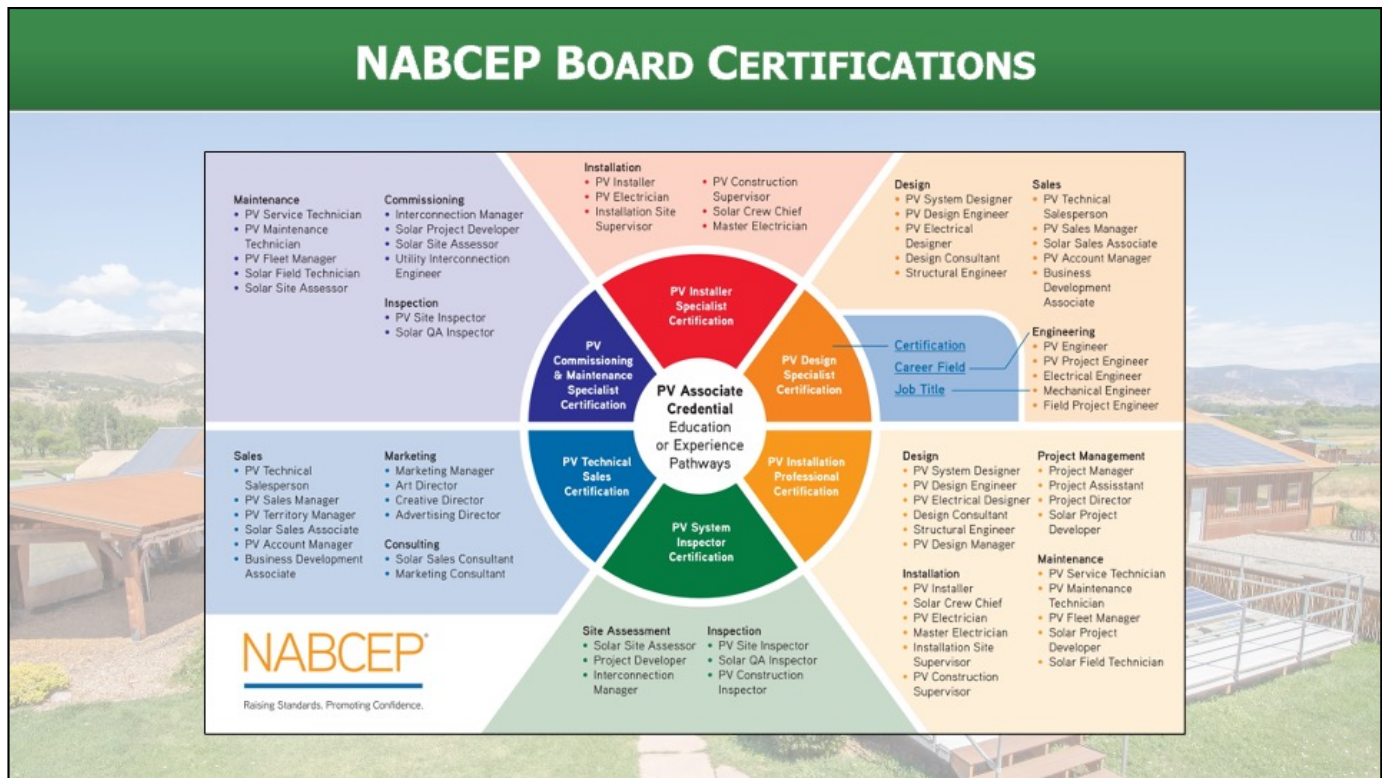
NABCEP provides industry certifications at both the Associate and Certification levels. Note, this is not a contractor's license, but certification demonstrates proficiency in certain knowledge areas and a dedication to ethics and quality in the chosen specialty. Many employers look for NABCEP certification when searching for candidates for a position.

The NABCEP Associate Program is intended for individuals working or seeking employment in the renewable energy industry, including students in renewable energy programs, workers at an early stage in their renewable energy career, experienced professionals new to the renewable energy field

NABCEP certification is based on training and experience. SEI offers training that qualifies people to sit for NABCEP exams. The NABCEP Certification Handbook is a very helpful resource in understanding the certification process. NABCEP offers the associate program for those just joining the solar industry, professional certification for advanced professionals, and company accreditation programs throughout North America. Raising industry standards and promoting consumer confidence, NABCEP is known as the "gold standard" for PV and Solar Heating Installation and PV Technical Sales Certifications. NABCEP is the most respected, well-established, and widely recognized certification organization for North American solar professionals.

SEI's course credit hours can be applied toward the educational requirements to sit for the NABCEP Exams. Learn more at www.nabcep.org

Why Renewable Energy



NABCEP Board Certifications are earned by demonstrating your training, experience, and passing a rigorous exam. Board Certifications can boost your career by giving you:

- Increased marketability
- Validation of knowledge
- Enhanced reputation & credibility

BECOME A SOLAR PRO



SEI SOLAR PROFESSIONALS CERTIFICATE PROGRAM

★ Includes 7 different certificate pathways

- ✦ Residential & Commercial Photovoltaic Systems Certificate
- ✦ Residential & Commercial Photovoltaic Systems Online Certificate
- ✦ Battery-Based Photovoltaic Systems Certificate
- ✦ Solar Business and Technical Sales Certificate
- ✦ International and Developing World Applications Certificate
- ✦ Renewable Energy Applications Certificate
- ✦ Solar Professionals Trainer Certificate



www.solarenergy.org



SEI's Solar Professionals Certificate Program (SPCP) is the industry's most rigorous program to prepare for the highly technical clean energy workforce. SPCP is a selective admissions program to help ensure the success of our students and provide a quality workforce for the solar industry. SPCP is a certificate program, not a certification program. A certificate program is a course of study, similar to a diploma. SEI, which is recognized by many employers as the leading solar training provider, offers a comprehensive certificate program for people wishing to enter the solar industry.

Certification is a credential that you earn to show that you have specific skills or knowledge. They are usually tied to an occupation, technology, or industry. SEI recognizes the North American Board of Certified Energy Practitioners (NABCEP) as the leading certifying authority in the solar industry. SEI requires a certificate program application to be completed by every student candidate. Please visit: <https://www.solarenergy.org/sei-solarprofessionals-certificate-program/> for more information.

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Key Points

- ★ Renewable energy is at highest levels of adoption, and growing
- ★ Training and career resources exist to help job-seekers at all levels



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