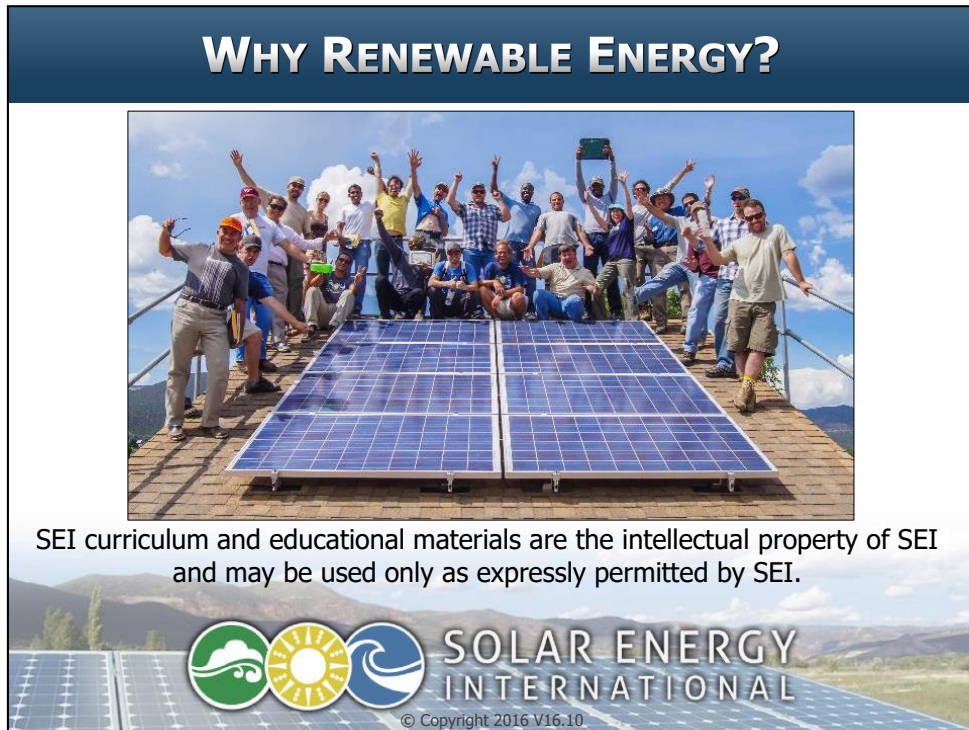


Why Renewable Energy



Let us begin this course in all honesty: at Solar Energy International (SEI) we are biased towards renewable energy! We believe wholeheartedly in the technology and its feasibility, and we believe renewable energy can help the world in a number of vital ways.

WHY RENEWABLE ENERGY?

*Why? Because we envision a world
powered by renewable energy!*


SEI's mission is to provide industry-
leading technical training and expertise in
renewable energy to empower people,
communities, and businesses worldwide




In this course you will read, see, and learn good things about renewable energy. SEI has been teaching people about renewable energy for over 25 years. With over 45,000 alumni, we see student after student become curious, then convinced, and finally committed to renewable energy in their homes, their communities, and their careers. Renewable energy is addictive – you have been warned!

WHAT ARE FOSSIL FUELS?

- Coal, oil, and natural gas are fossil fuels
 - Created over millions of years
 - Hydrocarbons from plants and animals buried in the earth
 - Finite, decreasing supply
- Burned as fuel, for heat, and for electricity
 - Freed carbon latches onto oxygen and CO₂ is released into the atmosphere
 - Carbon dioxide traps heat from the sun
 - Climate change results



 SOLAR ENERGY INTERNATIONAL
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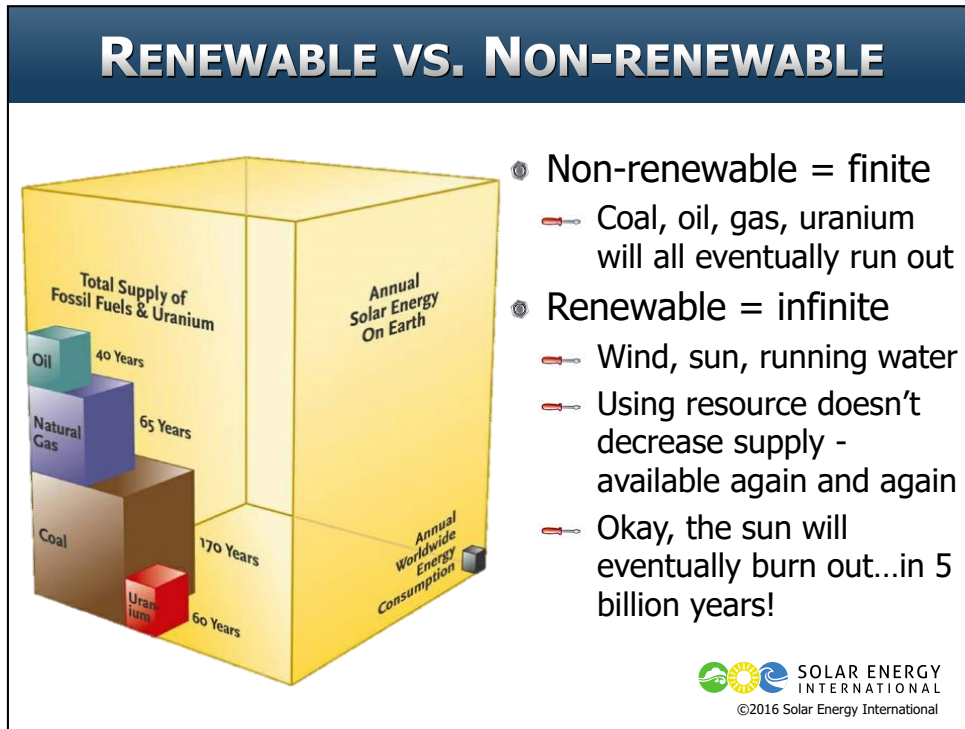
Currently, when we want energy for just about any purpose, we look down beneath our feet and start digging or drilling. We get the vast majority of our energy from a finite and dwindling supply of fossil fuels such as coal, oil and natural gas. These fuels were created millions of years ago when plants and animals died, decayed and were compressed under weight as they piled higher. A practically inconceivable amount of energy was captured and stored in this process.

Once we dig up fossil fuels (the fancy word is hydrocarbons), we burn them (the fancy word is oxidize them). This reaction produces energy, which is harvested to power our cars/toasters/computers/air conditioners/cell phones/refrigerators/etc. It also frees carbon (C) atoms, which latch on to two oxygen (O) atoms, and voila: CO₂. Carbon dioxide.

Just before the industrial revolution there were less than 300 parts per million (ppm) of CO₂ in Earth's atmosphere. Today, it is about 400 ppm and rising. These changes to the atmosphere are causing the planet to warm through the greenhouse effect. We are spewing huge quantities of greenhouse gases into the sky, where those gases trap heat from the sun – heat that would have bounced back into space if greenhouse gases weren't there.

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 treasure trove 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 could ever have imagined. Our challenge now is to get away from fossil fuels 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 sun, wind and rain.

Why Renewable Energy



We have worked very hard since the industrial revolution began to build extensive infrastructure for mining, drilling, transporting, refining, and distributing fossil fuels. We work equally hard on the demand side. For example, last year about 50 million cars were built to run on fossil fuels. Not to mention countless furnaces, hot water heaters, airplanes, and power plants.

But we know that the fossil energy sources will run out, it's inevitable given the finite supply. Oil, for example, is near its peak production, although new extraction technologies have moved the peak further into the future than was predicted just a few years ago. A peak in production means the amount of oil 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.



So where does that leave us today? We are developing solutions, one of which is renewable energy, a term that explains itself. This is energy which can be renewed again and again. It is energy that is readily available in sunlight, in wind, in running water, and in other natural sources. Renewable energy is out there to be harvested and it can be collected with a relatively small investment of energy – using current technology. When the sun sets today we can rest well knowing the sun will come up tomorrow and provide usable energy to us again.

Why Renewable Energy

RENEWABLE ENERGY = DOMESTIC ENERGY

- ① In many countries, the majority of fossil fuel is imported
- ② Competition for a dwindling resource
- ③ Renewable energy is produced "in-country"

- Fuel
- Infrastructure
- Job creation



While U.S. production of fossil fuels has grown in recent years – think fracking and shale oil – much non-coal fossil fuel (oil) is still imported from other countries. Currently, about 30% of the oil used in the U.S. comes from outside of its borders, although as much as 60% has been imported in past decades, depending upon prices and resources.

That figure represents oil flowing into the U.S. at a rate of more than 6 million barrels per day. In the world of diplomacy, energy means power. Today, those with abundant fossil fuels have power to make demands and the power to raise prices. Worldwide competition for dwindling supplies of oil leads to deadly and expensive wars.

This is the case in many countries – the majority of the fossil fuels used comes from outside of their borders, making them reliant on imports from a variety of countries. And in the countries doing the exporting, questions abound regarding the profits from extraction, as well as the impacts it has on the landscape and people. Many renewable energy advocates see these conflicts as unnecessary. 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. This transition will create a new energy-based economy requiring people to fill millions of new jobs.


The source of energy for the new renewable energy infrastructure is the sun. To be fair, the sun's energy will not last forever either. Scientists predict the sun will be around for another 5 billion years or so.

Why Renewable Energy

CENTRALIZED VS. DISTRIBUTED ENERGY


Centralized

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



Distributed

- Energy production spread out
- Production closer to point of use
- Flexible in size and scale



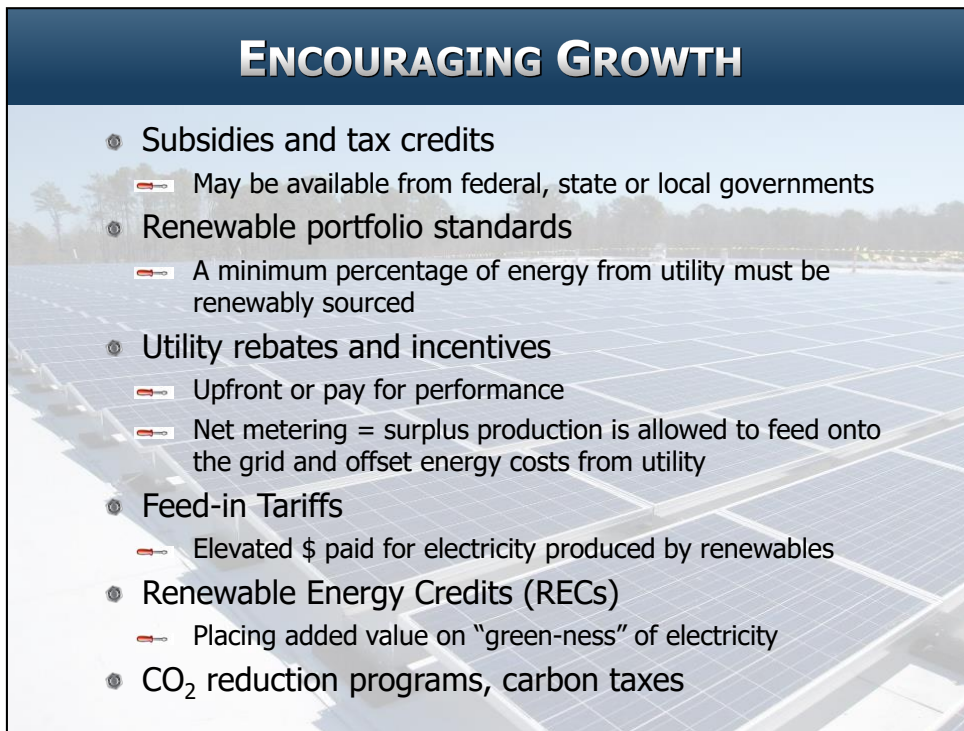
Since a large amount of electricity in the U.S. comes from coal, we'll look at how that system works. First, heavy diesel machinery digs up coal in massive quantities, crushes it and loads it into a diesel train bound for a power plant. Often, that power plant is many hundreds of miles away. There, the coal is burned to release heat – along with CO₂ and several other nasty pollutants. The heat boils water, which creates steam, which turns a turbine, which generates electricity. The electricity is then pushed through high-voltage lines, often for hundreds of miles more. Finally, the voltage is 'dropped down' at a substation and sent through wires to your house where it runs your toaster and other appliances.

This is not a simple system, though your bread does get toasted! Because of all the energy used by machinery, or leaked out through power lines along the way, your toaster will receive less than 30% of the original energy contained in the coal. This is what's called a centralized generation system, where electricity is generated centrally in large amounts and then sent out through power lines to a large number of houses and businesses.

Imagine instead a neighborhood where every house is covered in solar panels, making each one into a small power plant capable of powering itself and even helping the neighbors when they need a bit of extra electricity. This is distributed generation, and it is one of the advantages of renewable energy systems on a domestic scale. It works in conjunction with the utility grid, but provides some (or all) of the energy used closer to the point of use.

Renewable energy is very flexible because it can be used in small systems for distributed generation or in truly massive installations for centralized generation. Or in any size of system in between. Of course, fossil fuels can be used in either type of system as well, but you don't see many people trying to run their homes using a private coal plant (or even a diesel generator) due to the cost, the noise and the smell.

Why Renewable Energy



ENCOURAGING GROWTH

- ❶ Subsidies and tax credits
 - ✂ May be available from federal, state or local governments
- ❷ Renewable portfolio standards
 - ✂ A minimum percentage of energy from utility must be renewably sourced
- ❸ Utility rebates and incentives
 - ✂ Upfront or pay for performance
 - ✂ Net metering = surplus production is allowed to feed onto the grid and offset energy costs from utility
- ❹ Feed-in Tariffs
 - ✂ Elevated \$ paid for electricity produced by renewables
- ❺ Renewable Energy Credits (RECs)
 - ✂ Placing added value on "green-ness" of electricity
- ❻ CO₂ reduction programs, carbon taxes

Great things are expected of renewable energy, 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. 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) (currently there is a U.S. federal tax credit of 30% of the system cost, which is set to be reduced in 2020; other state and local credits may be available).

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 rooftop solar electric systems.

Utility Incentives - Many 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 production. 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 for the energy the system produces, not for the system itself, which is regarded as a better way to ensure quality system design and installation, as opposed to upfront rebates based on system size. This incentive has been highly successful in promoting rapid growth of renewables in Germany, Spain, and Ontario, Canada.

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.

Carbon Dioxide (CO₂) Reduction Strategies and Carbon Taxes - These are large-scale proposals for putting a price on the production of CO₂. If implemented, fossil fuel use will become more expensive, CO₂ emissions may be reduced, and the playing field between renewables and fossil fuels could become level. One way would be to tax the production of CO₂, however, this also faces significant political hurdles.

Why Renewable Energy



The renewable energy industry is growing rapidly, and a renewable energy career path starts with training. The U.S. Department of Energy (DOE) has built the Solar Career Map, which describes jobs, career paths, and average compensation in the solar energy industry, and also identifies the training necessary to get those jobs. The Solar Career Map can be found at <http://irecsolarcareermap.org/>

Solar Energy International specializes in training the renewable energy workforce! Contact us for more information on beginning, or furthering, your career in the renewable energy industry.

Why Renewable Energy

SEI'S SOLAR PROFESSIONALS CERTIFICATE PROGRAM



The logo is a circular emblem. The outer ring contains the text 'SOLAR ENERGY INTERNATIONAL' at the top and 'SOLAR PROFESSIONALS CERTIFICATE PROGRAM' at the bottom, separated by dots. Inside the ring is a shield divided into four quadrants: top-left (green with a white wrench and screwdriver), top-right (blue with a white globe), bottom-left (yellow with a white sun), and bottom-right (yellow with a white sun). Above the shield, it says 'Est. 1991'.

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

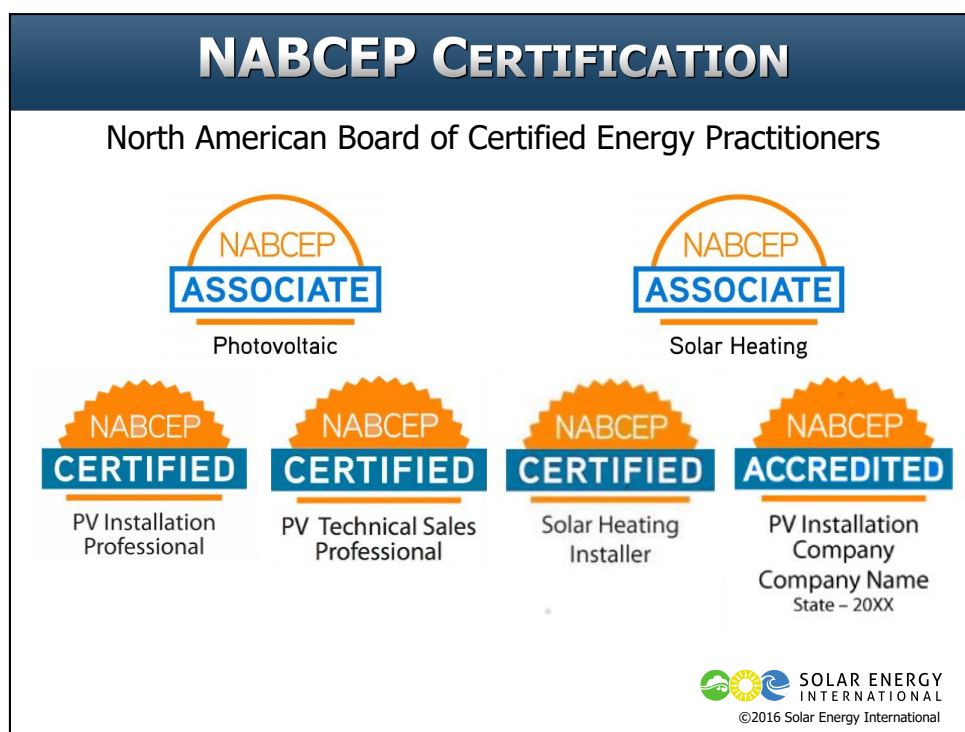
The Solar Professionals Certificate Program (SPCP):
Going beyond a "test prep" training to take participants to a higher level of education and truly prepare them for a career in the solar industry.

The SEI Solar Professionals Certificate Program (SPCP) has been designed to serve a national and international audience of solar professionals. The intent of the SEI Solar Professionals Certificate Program is to go beyond a "test prep" training format and take participants to a higher level of educational experience to truly prepare them for the solar industry and a career.

The SEI Solar Professionals Certificate Program is a selective admissions program to help ensure the success of our students and provide a quality workforce for the solar industry. To determine a candidate's likelihood of program completion, alignment of career goals and overall good fit for this professional training program, we require a certificate program application to be completed by every student candidate. This is required for any certificate path and acceptance into the overall program. Multiple certificates can be earned by adding courses to your original certificate path.

There are different tracks depending on your desired industry focus. Students who graduate from SEI's Certificate Program are recognized for their commitment and dedication to attain a career in this field.

Why Renewable Energy



The North American Board of Certified Energy Practitioners (NABCEP) provides industry certifications – note this is not a contractors license. Many employers look for NABCEP certification when searching for candidates for a position.

NABCEP certification is based on training and experience. Solar Energy International (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, and company accreditation programs to renewable energy professionals 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

THANKS FROM SEI!



For more training in renewable energy, please visit:
www.solarenergy.org



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Thanks from Solar Energy International!