

CAREER CURRENTS

Booming Solar Energy Field Offers Wide Variety of Career Opportunities

If you're thinking of a possible career in the solar energy field and want to learn how the various solar technologies work, you can visit www.need.org and read the April, 2006 issue of *Career Currents* for some good explanations of solar systems.

The principles described in that issue four years ago still pretty much work the same way today. If you want hot water, for example, put a solar collector on the roof of your home, pipe cold water through it and let the sun heat it, then let it flow back into your house where you can use it for cleaning, bathing, or other purposes. Want to produce electricity from the sun? You can do that, too. Mount some photovoltaic solar panels on or near a building where the sun can shine on them, wire them so they connect to an inverter that turns the DC power the system produces into AC current to power your home appliances, and sit back and watch your electric meter run backwards while the system is producing more electricity than you are using.

But even though the basic principles of using the sun to collect energy really haven't changed much over the years, there have been huge changes in the quality of the materials, the abilities of the installers, and the knowledge of the designers, along with tremendous price drops caused by a combination of business factors such as increased demand and the many financial incentives available for homes and businesses.

The result of these factors is a solar industry today that has grown tremendously in the past few years, and is poised for even more dramatic increases in the coming years, opening up an immense job market where workers with a huge range of skills and interests will be needed to keep pace with the demand for solar products and services.

Consider what's going on right now. According to the Solar Energy Industries Association (SEIA), solar energy has the potential of creating tens of thousands of jobs around the country, including thousands of new jobs for electricians, construction workers, plumbers, roofers, engineers and others throughout the construction industry in addition to the specialized solar field. SEIA also notes that the global market for solar electric (called photovoltaics or PV) systems has grown an average of 25 percent every year for the last 10 years – with the last five years averaging growth of more than 35 percent! To quantify this explosive growth, they estimate that at the end of 2008, there were about 1,000 megawatts of photovoltaics installed in the U.S., 418 megawatts of utility-scale concentrating solar power, more than 485 megawatts thermal equivalent of solar water heating systems, and more than 7,000 megawatts thermal equivalent of solar pool heating systems, and as you'll read in this issue, industry experts think the real explosion in use of the technologies is only now about to begin.

To help you give thought to a career in this field, we asked three of the country's most respected authorities on solar energy to comment on some of the reasons the field offers such huge job potential, and to give their advice to students on how to plan for a role in this industry. In addition, we have interviews on pages 5-7 of this issue with people actively working in the field who specifically discuss their jobs and offer their advice on careers in the solar energy field.

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Workers from renewable energy company enXco install panels on a 1-megawatt solar array on a turkey farm near Wilton, CA. The array provides power to subscribers of the Sacramento Municipal Utility District's SolarShares program. Photo courtesy of SMUD.

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In this issue, you will see why there has been so much growth in this industry since we wrote about solar careers four years ago. In that time, there have been significant changes in the technologies and the marketplace that created a thriving industry offering today's students tremendous career opportunities.

Brad Collins, Executive Director of the American Solar Energy Society (ASES) since 2001, said that the market for solar energy has exploded during the past few years. "It had really taken off in California about three years ago," he explained, "but since then, there has been a huge increase in solar installations in places like Pennsylvania, Connecticut, New Jersey, Colorado, Oregon, and other places that you wouldn't necessarily think were hot solar markets. I'd estimate that four years ago, about 85 percent of the solar market was in California, but that's not true anymore. It's really now all over the country."



Brad Collins

Collins noted that the costs of solar systems have dropped significantly, and are actually down about 30 percent from what they were just a few years ago. He added that "An interesting effect of the world's current economic problems is that we have gone from a looming global silicon shortage to global excess supply of finished solar panels. In addition, many governments such as Portugal and Spain that were firmly committed to massive nationwide incentives have withdrawn those incentives because of the economy at the same time that manufacturers and installers have geared up. As a result, products are available

and trained installers are ready, and companies are hiring more people. We're seeing increases in the number of companies and employment in the dozen or so states that are the most vibrant markets, such as in North Carolina."

He estimated that growth in the solar market is at a double digit level this year, and is up about 30 percent in the past 12 months. "What really pleases me," he said, "is that there is a growing market for all forms of renewable energy all around the country, and I see more and more people 'getting it' in more and more different places. They understand that solar works where they are – in Ohio, New Hampshire, Oregon, and in other areas outside of the sunbelt states. Though they may be a small but vocal and informed group, these knowledgeable consumers are helping create markets for solar products."

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As for advice he would give to a middle-school or high-school student who was thinking about careers, he said that “If I were a student right now, I would want to know what my prospects might be 10 years from now for jobs. The short answer I’d give to them is that we at ASES are positively convinced that the economic driver for the 21st century will be renewable energy, and it will be the fastest growing portion of our economy. Today’s students really ought to pay attention to it. The other message I share with

students is that you don’t have to be a mechanical engineer or a physicist, for example, to find a great career in this green economy. The companies such as solar manufacturers or installers need secretaries, truck drivers, accountants, facility managers, and all the other jobs used by any type of business, and just because their main work is selling solar, don’t lose sight of the fact that the other 80

percent of the jobs are important. If someone is a truck driver at a coal plant that no longer mines coal, he can drive the truck that carries the solar panel along the interstate. The secretary at the natural gas company can do the same type of work she’s doing now for the solar installation company. The transition to renewable energy will affect very few people in the long term, and the growth of the industry will create all kinds of job opportunities.”

Collins offered one final bit of advice for students interested in this field: “Clearly, our companies will need salespeople, marketing staff, public relations experts, and people to do all kinds of work. Watch the trends. There ought to be plenty of jobs ranging from manufacturing and sales to installation and maintenance, as well as work with the energy service companies who do weatherization and energy upgrades to upgrade the nation’s buildings. Find the type of work you’d like to do, and check out the renewable energy field for the opportunities to use those interests and skills.”

Donald Aitken, *President of Donald Aitken Associates, consultants in Sustainable Energy Policy and Architecture*, said that solar technology has changed significantly in just the past couple of years. “What I see happening is that many new applications are available today, especially in the solar electric field. For example, thin-film technology has come of age and we can now use it in many flexible

ways, from roof membranes on a home to military field packs. Solar is simply more accessible to more situations today than ever before. This has created a dramatic increase in solar applications, from roof-top installations on homes and buildings in all parts of the country to very large-scale solar field projects surfacing around the world with giant fields of photovoltaic arrays.”



Donald Aitken

He explained that “Personally, I think the most exciting applications are directly in buildings with building-integrated uses such as putting the panels on shading

overhangs, using them as skylights, on top of carports, integrated into curtain-wall facades, and so many other uses that just weren’t technically possible three or four years ago. The applications are just now taking off in buildings because there is such as immense convenience to their use, and the building can now supply its own energy. It wasn’t too long ago that PV was primarily for remote applications, but now we find much more use in grid-integrated situations.”



Many people think of solar water heating systems as a couple of panels on the roof of a home, but there are many large systems like this one that provide hot water to college dorms, factories, and other large facilities. Photo courtesy of Johnson Controls, Inc.

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The NEED Project

NATIONAL ENERGY

EDUCATION DEVELOPMENT

P.O. Box 10101, Manassas, VA 20108

Phone: 800-875-5029

Fax: 800-847-1820

Email: info@need.org

Web: www.need.org

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NEWSLETTER STAFF

Mary Spruill

Executive Director

Hallie Mills

Curriculum Director

Ken Sheinkopf

Editor/Designer

Career Currents provides educators and students with resources to introduce energy careers. Each issue focuses on a different sector of the energy industry. No single issue is meant to be all-inclusive to either the sector profiled or all careers in energy.

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When students ask him about job opportunities in the solar energy field, Aitken usually tells them “If you have an engineering or science interest, there’s a lot of room out there for improving what we have today. We need to hear from young people with creative new ways to harness solar. I think that, in general, solar research and development has been played down lately, but that really is what got us to where we are and more will be needed as we find new materials to use and unique ways to solve energy problems by matching solar capabilities with consumer needs. At the same time, though, if you’re more interested in the construction field, electricity, plumbing, or any of the other conventional trades, solar energy has moved into your field, and you’ll find it being taught and discussed in many trade-related courses in community colleges and vocational schools.”

As for the availability of jobs in the field, Aitken feels that “There is more opportunity today than ever before because solar really does create jobs. In the renewable energy field, you convert the cost of fuel into support for jobs, and the situation today is basically that we make jobs rather than buy fuel. I’ve seen studies that show that there are about five more jobs in renewable energy for each job available in the conventional fuel area. Consider the situation in Germany, for example. They are currently getting about 30 percent of their power from nuclear energy, and only about eight percent of their power from renewable energy, but the renewables work actually surpasses nuclear in the number of jobs it creates. So whether you would like to be an architect or engineer, installer or repairman, or in any other business-related position, you’ll find opportunities in the growing field of solar energy.”

Travis Bradford, President of *The Prometheus Institute for Sustainable Development*, a nonprofit organization that helps to promote solar energy, said that “I really think that people don’t fully appreciate how important solar energy is going to be in the world. It’s partly because they don’t see it yet and so they just can’t imagine it. But in the past four or five years, we’ve begun to see it a lot more and people can now better understand it and envision what is yet to come. Over our lifetimes,

solar will end up being almost everywhere. You’ll see it on buildings, farms, homes, and even on other devices like cars, computers, and just about everywhere because the sun is everywhere. Going forward, people will use it more because it will be the cheapest way to get the energy we need. The reason that things have really changed in the last few years has a lot to do with two things. One is that technology has gotten better. Take a look at things like computers and ipods and televisions, and you see that electronics gets better and cheaper the more you make. New versions come out in new product cycles. It’s the same in solar technology. Also, the people who know how to use solar have gotten smarter about putting it in. What I mean is that a lot more people have learned how to install solar and use it in their buildings. That’s going to continue, and the more people that learn, the more they can train other people how to do it.”



Travis Bradford

Bradford predicted in his book *Solar Revolution: The Economic Transformation of the Global Energy Industry*, that as the energy crisis escalates, and the price of gas and electricity with it, in the next two decades solar will become the cheapest energy source for most applications, and will be widely adopted by consumers in both the developed and developing worlds. “The solar field is going to need more and more jobs in the coming years, and if we will see solar in as many places

as we use electricity,” he explained, “we will need a lot of people to put that solar up. While some types of jobs come and go, some stay around for a long, long time and actually grow, and solar is one of those areas that will offer good job opportunities for a long time. I like to describe this by saying that solar is ‘non-outsourcable.’ In other words, in a world where unemployment is frequently in the news and so many jobs seem to go overseas, putting solar on your home or school or business is not a job that can be sent overseas. Solar offers what I call ‘fundamentally not-exportable’ jobs.”

His advice to today’s students is that the “most obvious jobs in solar are the ones where you take the solar and install it on a building or in a solar farm. Far more jobs are created through solar than just those jobs that you can see. There are many more jobs working in stores and factories and warehouses, opportunities for accountants and inventory control and quality control people, and many different kinds of jobs that are created from solar but don’t actually involve bolting solar to a frame. I believe that the vast majority of jobs created from the current energy revolution will look just like jobs that exist today, but there will be many more of them. Almost any job you want can find a way to work toward supporting the solar energy solutions to our energy problems.”

For an excellent overview of solar energy technologies, see NEED’s *Secondary Energy Infobook* (www.need.org/needpdf/Secondary%20Energy%20Infobook.pdf), beginning on page 40.

Q&A

Allison Gray, National Renewable Energy Laboratory



Allison Gray is an engineer in the Concentrating Solar Power (CSP) Group at the National Renewable Energy Laboratory in Golden, CO. She has been with NREL since March, 2008.

Tell us a little about your job and what you do.

I work in the Concentrated Solar Power (CSP) Group at NREL. CSP is a type of renewable energy that concentrates the sun's light to generate electricity. Lenses or reflective surfaces such as a mirror are typically used to concentrate a large area of sunlight onto a small one. This concentrated light is then focused onto a PV cell or a receiver. If the technology uses a PV cell, electricity is generated at the cell, but if the technology uses a receiver, the energy is used as a heat source for a conventional power plant. I work in the optics area assisting in maximizing the amount of energy that gets concentrated to assist in maximizing efficiency. I assist in characterizing the reflective surface of mirrors and determining how close the surface is to the ideal shape. The closer it is, the better light is being concentrated.

How did you decide to go to work in this field?

When I was in college at the University of Nevada, Las Vegas, I was looking for an industry that sparked my interest. I looked online at the research centers that were on the campus and found the Center for Energy Research (CER) that specialized in renewable energy technologies and was doing a lot of concentrated solar power work. Once I had started working there, I knew I had found something that I was really interested in.

What technology have you used that has helped you the most in your work?

Early in my career, what helped me the most was books. I read a lot on optics and thermal energy systems so that I could have a good understanding for CSP basics. In addition, reading helped me understand what was done in the past and how well or not it worked. More recently, I have found myself using computer programs like MATLAB to help me solve problems mathematically.

What is a typical day at work like for you?

I spend about half of my time in the lab testing different companies' mirrors or reflector panels and half working in the office. In the lab, I start my day prepping for a test which can take one to two hours, and then spend the rest of the day testing. The time in the office is used for meetings, catching up on email, and reviewing the data that I collected in the lab. Once the data is analyzed, I talk to the company that sent the test pieces and go over the data and help them understand the results. Every company that I work with needs different support when it comes to testing since some are in a prototyping phase developing manufacturing techniques while others are trying to improve their process and are checking to see if pieces are being manufactured consistently.

What is the most rewarding part of your job?

The most rewarding part of my job is that I get to help companies improve their product. It feels really good to work closely with someone and talk about areas of concern and potential methods for improvement.

What advice would you give to a young person wanting to work in this industry?

I think that renewable energy is a rewarding field to work in. Like in every industry, there are still so many areas of that can be studied to improve efficiency in all of the different technologies. This industry needs people working in areas such as manufacturing, optics, heat transfer, marketing, financing, etc. No matter what your interests are, you can make a difference.

What other comments do you have for students?

My passion is in CSP and that was how I found my job. I enjoy my work because it is something that I care about. You should find something you're interested in, no matter what it is, and search for a career in that area.

Q&A



Claudia Wentworth, Quick Mount PV

Claudia Wentworth is President of Quick Mount PV, a California company that manufactures mounting systems for the photovoltaic and solar thermal fields (domestic and pool water).

How did you decide to go to work in this field?

My husband and I were general building contractors specializing in “green” high-end homes. We focused on re-use, energy efficiency, low waste, and efficient design while maximizing comfort and beauty of the home. We were following the improvements of photovoltaic installations and their ability to be tied directly to the electrical grid, bypassing the need for batteries and a separate electrical distribution system on a micro-level of the home. We saw this as a revolution in the ability to produce clean energy on site of the building. We put a grid-tied photovoltaic system on our home along with a domestic solar water heating system and proceeded to get licensed California for this type of installation. When we went to install the PV system on our house, we realized that there was no quality product in the building supply industry for attaching these solar panels to our home. We then went into our metal shop and designed a mount that would follow all the building codes and roofing manufacturing specifications nationwide. We built some prototypes and tested them with engineers while simultaneously processing our first patent application. We then began using them on all of our customer home installations and could see a need industry-wide so we started to sell them to other installers. One thing led to another and we now sell throughout the U.S. and Canada, and are a leader in the solar industry for mounting products. To make all of this type of growth happen, a strong business foundation was necessary, so I put my business skills to work as an entrepreneur to build a manufacturing-based company.

What technology have you used that has helped you the most in your work?

All of the basic office and computer skills are necessary, including Excel, Word, database, specialized software, and the basic understanding of our server and IT system. We need to search, read and understand building codes and technical writing, both in the libraries as well as online. I need to use and to understand the machines in our facility and the specifications and tolerances that

need to be adhered to for a consistent and quality set of products. And, of course, a good working knowledge of my iPhone.

What is a typical day at work like for you?

I work closely with management and know all of our employees personally. Having started the company with my husband, I have personally done all of the different jobs at different times. I now spend my days overseeing the work being done and solving problems that come up in all areas of the workplace. The typical workday includes all aspects of running a business, including HR issues, product design and patents, accounting, sales, marketing, product positioning, and growth.

What is the most rewarding part of your job?

Creating paying jobs for other people. I am very lucky to be working with people I enjoy and who enjoy working for our company and doing their best to help us succeed. I am rewarded by the fact that the work we do will help an industry that creates a good environment on earth and will be positive for future generations. I am exhilarated by the caliber and greatness of the many people I come in contact with in the sustainable and renewable industry.

What advice would you give to a young person wanting to work in this field?

There are many opportunities in the renewable and clean energy field and it is a growth industry. Find your passion, whether it be in an area of installation or manufacturing, building design, construction, installation, a technical or scientific job or in field implementation. There is room for all kinds of careers. Much more still needs to be invented and created to grow the clean energy industry, and interest is focused on the future. We will rely heavily on engineers, accountants, sales people, marketing specialists, installers, educators, scientists, statisticians, and skilled labor.

What other comments do you have for students?

Remember the key things you learned in kindergarten: play fair, work hard, be kind, do your best, and don't forget that the harder you work, the luckier you become.

Q&A

William Guiney, Johnson Controls, Inc.



Bill Guiney has been Program Manager for Renewable Energy Solutions for Johnson Controls, Inc., in Milwaukee, WI, since 2007. He has worked for Solargenix Energy/Duke Solar, the Florida Solar Energy Center, and in his own business in the solar field.

Tell us a little about your job and what you do.

I was hired by Johnson Controls as a technical expert on solar technologies to assist them in building their Solar Thermal and PV business. There was a strong need at the company at the time to educate our account executives and project development engineers on ways to integrate solar solutions into our Performance Contracting business. As the work grew, they separated the technologies so I could focus on the solar thermal systems, which is my area of real expertise. I am mostly involved right now in program development, but I stay involved in specific projects where my expertise is needed. For example, I'm working on a solar cooling project for a military base in Texas and I work with our senior mechanical engineers to make sure we are doing everything to turn it into a business instead of a one-time project.

How did you decide to go to work in this field?

I left the air traffic control industry in 1981 and was interested in solar energy so I started out by knocking on doors for a small solar retail company to generate leads for salesmen. I ended up getting into sales and was just terrible at it, so I went into the operations side and learned how to install systems. I eventually bought a small struggling solar distribution company in Florida and was able to build it into a \$5 million annual business.

What technology have you used that has helped you the most in your work?

There are a number of technologies that are critical in my work. Primarily, I need to have familiarity with computers, of course, because of the sizing and economics programs related to our solar projects. Computer-aided design and drafting (CADD) programs and other tools allow me to prepare documents for permitting. Other computer tools

related to site assessments and various aspects of solar equipment are essential in my work.

What is a typical day at work like for you?

Every day involves checking email, checking voicemails, and meetings or phone calls all day long. I get a lot of project-related phone calls that let me monitor events and activities, and I spend a lot of time checking out and approving vendors to become suppliers. Any extra time goes into the actual design and development of pre-engineered systems for our program.

What is the most rewarding part of your job?

No doubt about it, it's the teaching I do. On average, I put on 40 workshops a year for a number of organizations as well as webinars and online training courses for our Service and Solutions business, and I like that a lot. We have more than 400 engineers in the field who must be educated and brought up to competency. There's a satisfaction I get from the training that is just unbelievable.

What advice would you give to a young person wanting to work in the solar field?

Don't limit your opportunities. Don't choose a career path until you are ready so you won't have to go back and take classes you should have taken in the first place. Keep up with the field to be aware of opportunities and then get into a program that will prepare you for what you want.

What other comments do you have for students?

There are going to be more and more jobs in the solar field that will be specific to individual technologies like PV or solar thermal, but also many jobs that deal with the integration of renewables into buildings. I think it would be great for students to study building systems and how buildings operate, where the energy is consumed, and the renewable solutions that can impact actual reduction of power in residential and commercial buildings. It all goes together hand-in-hand.



In this issue: Careers in Solar Energy

With all the talk these days about using solar and other forms of renewable energy to help meet our country's growing energy needs, people are finding expanding job opportunities in all aspects of the solar industry. Jobs range from solar-specific ones like system designers, installers, maintenance technicians and others, to the typical jobs that support any business such as accountants, secretaries, office workers, and dozens of other needs.

This issue looks at the technologies and markets in the solar field, focussing primarily on job opportunities working with solar thermal (water heating) and photovoltaic (solar electricity) systems. There is also advice and ideas from a number of people actively working in various areas of solar energy.



One reason solar energy offers big job potential is that the technologies work so well. For example, the solar panels on the roof of the Armijo pool/water park in El Paso, TX, will save more than \$133,000 annually in natural gas costs for heating water in the competition and wading pools, paying back the cost of the system in less than seven years. Photo courtesy of Johnson Controls, Inc.

For a detailed calendar of upcoming NEED events and workshops, visit www.need.org/calendar.