

InDemand

Connecting today's students with the careers of tomorrow

Issue 2



Energize Your Career

You can join the next generation of workers who will lead the energy business.



CAREERVOYAGES

A shortcut on the path to your dream job.

Career Voyages provides information about career options that can help you choose your future and find education and training opportunities to needed to get there.

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Dear Student:

Do you like to work outdoors? ✦ Are you strong in mathematics or science and do you have fun with technology? ✦ Do you like figuring out problems and looking for new ways to do things?

No, this isn't a quiz...but if you answered yes to any or all of these questions... this publication is for you! It will tell you all about the energy industry, and it

might give you an idea for your future career. It talks about what you need to learn and do to get that first great job. Whether you want to be a skilled drilling rig operator...a nuclear engineer...or a renewable energy developer, there are lots of careers in energy that pay well.

I'm Emily DeRocco, Assistant Secretary of Labor, and I run the federal agency that helps American workers find rewarding jobs and build successful careers. Since you will soon be part of the work force, the U.S. Dept. of Labor's Employment and Training Administration wants you to have this publication, *In Demand: Careers in Energy*. It will let you know what this industry is all about and how you can build your future in it.

There's lots of great information in here! Please read it and share what you find with your parents, teachers and guidance counselor. They can help you find the right college or university to study for an energy career, or the right apprentice program to gain skills and experience!

So, what's *In Demand*? You are! Your knowledge...your energy...your creativity...and your skills are all *In Demand*—and so are the many high-growth jobs that you will learn more about in this

publication. Also look for other copies of *In Demand* that tell you about great careers in fields such as construction. You and your friends could also visit the web site careervoyages.gov to get electronic copies of this magazine and to explore all kinds of careers.

The sky is the limit! Tap your internal energy source and see how far YOU can go!



Assistant Secretary of Labor Emily Stover DeRocco helps workers build successful careers.

Emily Stover DeRocco
Assistant Secretary of Labor

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U.S. Department of Labor

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InDemand

Careers in Energy

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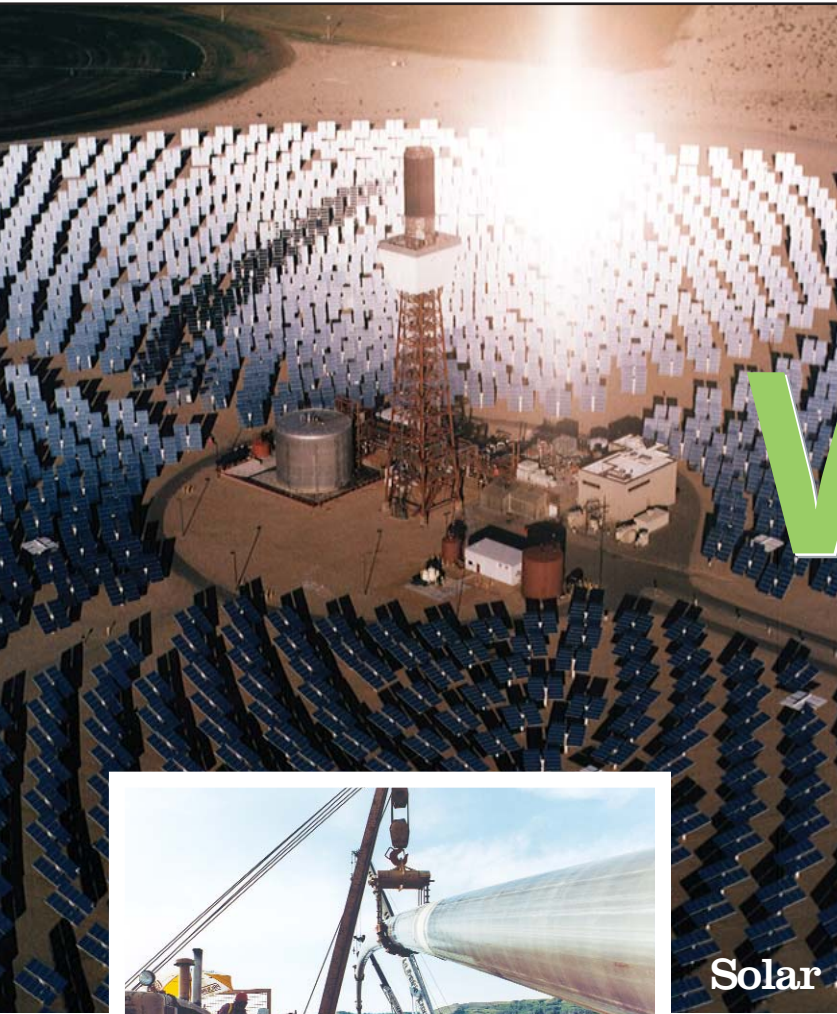
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Your World

of

En

Solar



Gas

There are thousands of people behind your light switch.
By David C. Wagman

If you're like most people, "energy" doesn't come to mind too often. It's largely out of sight and out of mind, although energy makes a big difference in how we live, work and play.

Let's say you're hungry for a snack. You pull something frozen from the freezer and heat it in the microwave. You used energy—first when you froze the snack and later when you reheated it.

Washing the dish after your snack uses hot water, which likely came from a tank heated by either electricity or natural gas. Energy is used there, too. Later, when it's time to drive to the game, you might stop to fill up the tank, either with gasoline or diesel. Energy again.

Something as common as turning on a light or filling the car with gas draws on the talents, skills and commitment of thousands of people, all of whom work in the energy industry. And the industry has jobs available for people with diverse interests and talents.

The energy we use comes from many different places. Fuels like oil, coal and natural gas are found underground. These are known as "fossil fuels." Other fuels are "renewable." That means they can be replaced more easily. Think of

PHOTO OF SOLAR ENERGY PLANT, NATIONAL RENEWABLE ENERGY LABORATORY; GAS PIPE, COURTESY OF ALLIANCE PIPELINE



Oil

energy

Energy at Home

Look for some of these energy users where you live.

- ✦ Air Conditioner
- ✦ Automobile
- ✦ Computer
- ✦ Dishwasher
- ✦ DVD Player
- ✦ Flashlight
- ✦ Furnace
- ✦ Hot Water Heater
- ✦ Lamps/Lights
- ✦ Lawn Mower
- ✦ Microwave Oven
- ✦ Portable Music Player
- ✦ Refrigerator
- ✦ Stove/Oven
- ✦ Television/Radio
- ✦ Toaster
- ✦ Trash Disposer

What other energy-using products can you find where you live and play?

the wind and the sun when you think of major forms of renewable energy. Also, crops such as soybeans can be made into biodiesel to power vehicles. These biomass energy sources are renewable because they can be planted and harvested year after year.

Water can be an energy source too. If you've ever seen a picture of Niagara Falls you know how much water spills over the falls. Not surprisingly, hydroelectric power stations use the energy from rushing water to spin turbines, which make electricity.



Hydropower

All of these energy sources let us do many different things.

Electric lines and power poles are common in cities and towns around our country. But places exist in the world where electricity is just now becoming available. One solution for these areas may be rooftop solar panels or wind generators. No power lines, no pollution, just the simple power of the sun and wind. And the creativity of people working in the energy industry who want to make a difference.

And the creativity of people working in the energy industry who want to make a difference.



The energy industry needs workers and it pays well

Tap

By Housley Carr



into

Solar Panel Technician

Photovoltaic panels being installed on a building in Atlanta (above) may be the product of a materials engineer working with an electron microscope (right).



Materials Engineer

En

Some jobs require scientific and analytical skills.

The power is out at your house, so you can't watch TV. Your iPod's battery is dead, and the fuel gauge on the car reads empty. Life without energy would not be cool.

Electricity, gasoline and other energy sources are a major part of our lives. But, for the most part, the energy that fuels our lives is out of view. We take it for granted—until we don't have it.

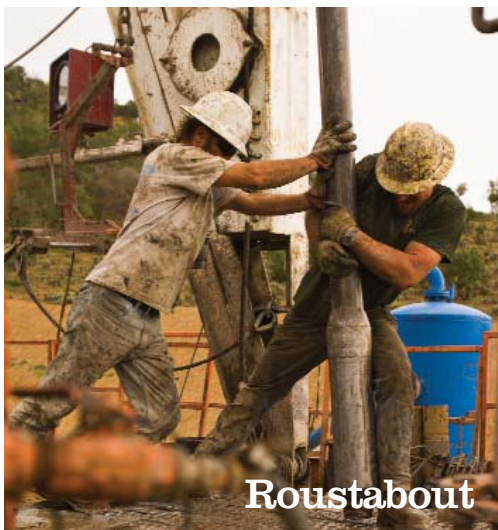
Luckily, a large and growing part of the work force in the United States—and across the world, for that matter—is involved in keeping energy available day in and day out.

These jobs involve things like finding oil and natural gas, extracting and delivering them to their end uses, whether it is heating a home with gas or refining crude oil into gasoline. They also involve finding and mining coal, operating the power plants and maintaining and repairing the power lines that deliver electricity to homes, schools and offices.

Best of all, the demand for energy around the world is growing. And the number of jobs to keep the energy industry

humming isn't just growing, it's booming.

"We can't produce enough graduates" to meet the needs of oil, natural gas and coal companies, says Tom Motel, a recruiter at Pennsylvania State University's Department of Energy and Geo-



Roustabout

Jobs are out there for people who like hard work and being outside.



Geoscientist

Environmental Engineering.

"A lot of young people don't realize the tremendous opportunities that are out there for them" in the energy industry, Motel says. "The jobs are definitely there, the pay is very good, and if you want, you can travel the world." Starting salaries for Penn State graduates with energy-related engineering degrees, he says, typically range from the "upper fifties to the low sixties."

Within a few years, engineers with four-year degrees may earn six-figure salaries. According to a recent survey by the Society of Petroleum Engineers, petroleum engineers with a Bachelor's degree and 11 to 15 years of experience can earn nearly \$90,000 a year. Those with 16 to 20 years of experience can earn more than \$109,000. Petroleum engineers with Master's degrees can earn about \$109,000 a year with 11 to 15 years of experience, and nearly \$116,000 with 16 to 20 years of work experience in their profession.

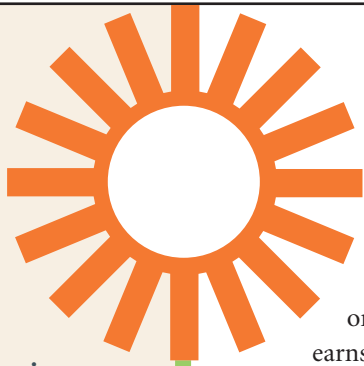
The energy industry also needs civil, chemical, environmental, geological, mining, nuclear and seismic engineers. With big-name companies like ExxonMobil and Chevron looking to hire the best graduates in these specialties, the pay—and job security—can be very good.

In fact, energy-industry career prospects haven't been this good for 30 years. Because of a lull in interest in energy-related careers in the 1980s and '90s, the industry "is missing an entire generation of people," says Bill Young, director of enrollment management at the Colorado School of Mines.

With large numbers of energy-industry professionals in their forties and fifties thinking about retirement, young people graduating with energy-related engineering degrees over the next few years "will have huge opportunities," Smith says.

energy

Pay Day



Average annual salaries for energy professional staff

Accountants and Auditors	\$56,880
Budget Analysts	\$59,100
Business Operations Specialists	\$57,660
Civil Engineers	\$66,930
Computer Operators	\$32,850
Continuous Mining Machine Operators	\$36,840
Customer Service Representatives	\$29,130
Derrick Operators, Oil and Gas	\$34,810
Electrical Engineers	\$74,220
Environmental Engineers	\$68,350
Financial Analysts	\$70,500
Gas Plant Operators	\$50,660
General and Operations Managers	\$92,010
Industrial Engineers	\$66,660
Lineworkers	\$48,570
Management Analysts	\$72,730
Mechanical Engineers	\$68,460
Meter Readers	\$31,260
Mining Machine Operators	\$35,710
Nuclear Power Reactor Operators	\$63,880
Petroleum Engineers	\$91,820
Power Distributors and Dispatchers	\$58,300
Power Plant Operators	\$52,030
Rotary Drill Operators, Oil and Gas	\$38,860
Roustabouts, Oil and Gas	\$26,500
Service Unit Operators, Oil, Gas, and Mining	\$33,380
Stationary Engineers and Boiler Operators	\$45,060
Statistical Assistants	\$31,600
Surveying and Mapping Technicians	\$32,780

According to the U.S. Department of Labor's Bureau of Labor Statistics, a "roustabout"—that is, a laborer on an oil or natural gas rig—earns \$12.75 an hour, on average.

A derrick operator can earn \$16.75 an hour and a rotary drill operator can earn almost \$18.70 an hour.

Good-paying jobs also exist at electric utilities. "It's not uncommon for someone with our two-year Associate's degree in energy technology to earn up to \$15 an hour in their first job and \$25 an hour within three or four years," says Barbara Hins-Turner, executive director of the Center of Excellence for Energy Technology at Centralia College, a community college in Centralia, Wash.

Centralia's program trains students with good math skills to be power plant control operators, technicians and me-

The jobs are definitely there, the pay is very good, and if you want, you can travel the world.

chanics, Hins-Turner says.

You can get your foot in the door at oil and natural gas companies without a college degree. "Workers can enter the oil and [natural] gas extraction industry with a variety of educational backgrounds," the Bureau of Labor Statistics says. The most common entry-level field jobs usually require little or no previous training or experience. Other entry-level positions, such as engineering technician, usually require at least a two-year Associate's degree in engineering technology.

It also helps to be technically savvy,

says Denise McCourt, who helps manage work force issues at the American Petroleum Institute, a trade group in Washington, D.C. She says that the energy industry is wide open to everyone. "It's your talent that will determine how far you can go."

And the range of jobs is almost unlimited. Some electric utilities now are building their first new power plants in years. Coal-mining companies like Massey Energy say that one of their biggest problems is finding enough coal-mining equipment operators to keep up with the demand for coal. Oil and natural gas companies face a similar need for workers to keep up with demand and create the next generation of energy professionals.

Emerging renewable energy technologies like wind turbines also need more workers. In West Texas where the wind blows consistently, hundreds of turbines are being installed to generate



Lineworker

power that is "clean," meaning power that is generated without releasing very many pollutants into the environment.

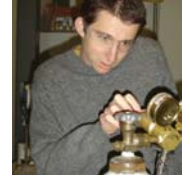
"There is tremendous potential for young people in renewable energy," says Herman Schellstede, president of Wind Energy Systems Technology of New Iberia, La. He is planning one of the first offshore wind "farms"—with 50 turbines each 300 feet tall—in the Gulf of Mexico near Texas.

"Energy is the powerhouse of the United States," he says. "And we will always need young people" to keep that powerhouse running.

There's something for everyone in the



Energy Industry



Job titles range so broadly they almost make it from A to Z

Account Executive + Accountant + Administrative Assistant + **Asset Analyst** [10]

+ Billing Associate + Biologist + CAD Drafter + Chemical Engineer + Civil Engineer

+ Coal Miner + **Commodity Trader** [11] + **Construction and Well Driller** [12]

+ Customer Service Associate + Economist + **Electrical Lineworker** [13] + **Electrical Engineer** [14]

+ **Electrician** [15] + Energy Cost Analyst + **Electrical & Instrumentation Field Technician** [15]

+ Energy Scheduler and Trader + **Environmental Engineer** [18] + Facilities Manager

+ Farmer + Financial Analyst + General Maintenance Worker + **Geoscientist** [19]

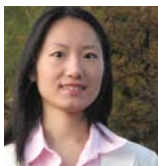
+ Instrument and Control Room Operator + Marketing and Sales + **Mechanical Engineer** [20]

+ Meter Reader + **Nuclear Engineer** [21] + Permitting Manager + **Petroleum Engineer** [22]

+ Pipe Fitter + Power Plant Engineer + Powerhouse Supervisor + Product Developer + Real Estate Attorney

+ Refinery Engineer + Right-of-Way Agent + Risk Management Director + Roustabout + Safety Engineer +

Systems Technician + Statistician + Truck Driver + Utility Regulator + Weather Forecaster + Wildcat Driller



You'll find careers of all kinds in the energy industry—dozens of different job titles from asset analyst to weather forecaster. There is something for almost everyone, from hands-on (electric lineworker or oil field roustabout) to nature lover (environmental engineer) to number-cruncher (financial analyst) to scientist (renewable energy researcher) to high-tech (nuclear engineer or geoscientist). You can get your boots dirty working outdoors, but other jobs are as clean as working at an electric supply dispatch center or in a meeting room negotiating deals. You can work for a major energy utility or oil company that employs thousands of people. Or you can work for a small company looking for new energy resources. You can travel the world or settle down near your own home town. We profile 12 different career paths in energy on the following pages and answer some of the questions you may have about these careers.



Asset Analyst

What will I do?

Auditors, asset analysts and accountants are an organization's money keepers. They update and maintain accounting records, including records of expenses, receipts,

particularly for jobs that require a knowledge of accounting. Demand for financial managers is expected to increase, because they are called on to handle a wider variety of financial transactions. People with several years of accounting experience, or accounting certification, will have the best job prospects.

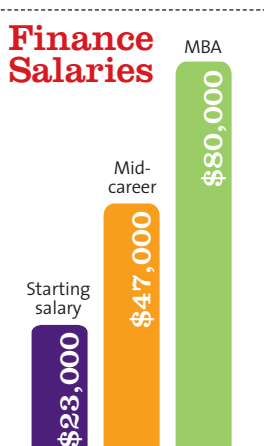
Demand for financial managers is expected to grow, because they can handle a variety of transactions.

accounts payable and receivable, and profit and loss. They have a wide range of skills and knowledge, from financial managers, who manage an entire company's financial books, to accounting clerks responsible for specific accounts.

training also may be needed, such as training in specific computer software. Some people choose to become certified in their field. This lets an employer know that they have completed specific training and passed a series of tests to handle a range of tasks.

What training will I need?

Most financial clerks are required to have at least a high school diploma. However, having completed some college is becoming more important, par-



How much will I earn?

The salaries paid in the finance field vary, depending on the part of the country where you live and the type and size of the business you work for.



Q&A

Sara Trujillo, 28

Public Service Company of Colorado, Denver, Colo.

Asset Analyst

Q: How did you become interested in the energy industry?

A: When I was a student at the University of Denver I became involved in a program for minority students in business. The program looked at my interests and paired me with a company that seemed a good match. I started out in corporate auditing with Colorado Public Service Company and fell in love with the power plants.

Q: What do you do in your job?

A: My primary job is to look at how we spend money at our Colorado power plants. I look at capital projects and operating and maintenance projects. Any time a power plant wants to spend money I get involved to analyze budgets and finances. I also deal with an area called replacement power. If my company has extra power to sell to another utility or needs to buy power, I act as a link between our plants and other energy suppliers.

Q: What is your favorite part about your job?

A: The best part about my job is acting as a liaison between two sides, say, on replacement power. There is lots of conversation between my company and the other company we are buying power from or selling power to. Part of my job is to make sure that all ideas are represented. As for career advancement, there are so many different areas I can move to. The good thing about my job is it exposes me to many different parts of the company. When you see the big picture, it really becomes intriguing.

PHOTO BY RAY NG

CHART SOURCE: U.S. DEPT OF LABOR, BLS

Commodity Trader

What will I do?

Commodity traders buy and sell large volumes of energy products such as crude oil, natural gas and heating oil for big corporations and large investors. People who buy and sell securities and commodities may have one of the most hectic jobs of any profession. Often called traders, market makers, dealers or floor brokers, they work on the floors of exchanges or at a computer

Successful traders have an aptitude for numbers and a keen interest in investing.

linked to other traders. They take “buy and sell” orders from clients and try to get the best price. They also must keep an eye on market changes and stay in touch with other traders and brokers to know what prices are being offered.

What training will I need?

The most successful workers at all levels have an aptitude for numbers and a keen interest in investing. A number of professionals in

this industry begin as brokerage clerks. Depending on the job, brokerage clerks can be high school or college graduates. People usually need more specific training to earn a securities license, which allows them to buy and sell commodities.

How can I get it?

There are no hard and fast educational or job prerequisites for selling commodities.

However, you may be required to get a license, depending on your job. Look for internship opportunities, too. Many firms offer summer jobs to outstanding students.

This can help you

get experience and make connections. Visit company web sites to research internships.

What will I earn?

Salaries can range widely for traders and can include both a base amount and commission,

especially early in your career. Later, you will probably earn a sales commission or incentive. This is truly a job where the harder you work the more you can earn.

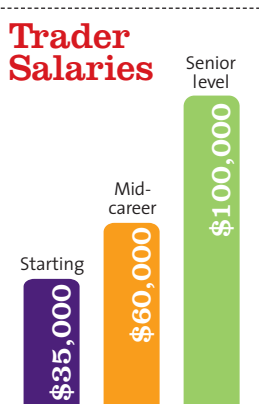


CHART SOURCE: U.S. DEPT. OF LABOR, BLS

Q&A

Remy Wagman, 30

Paragon Energy, New York, N.Y.

Crude-Oil Trader

Q: How did you become interested in your job?

A: I started as a summer intern when I was 18. I was a clerk and worked in a circular pit on the trading floor. Traders would make a trade, quickly write it on a card and throw the card into the pit. Now I work for Paragon Energy. I buy and sell crude-oil future contracts.

Q: What do you do on a typical day?

A: The trading day is from 10 a.m. to 2:30 p.m. I usually come in early to look at reports and charts. These help me understand the factors that may affect prices and trading during the day. I also take time to make sure all of my accounts are correct. Once the trading day starts, I have customers who call and place orders. I handle their transactions. Prices can change on a second-by-second basis. I usually spend 4 ½ hours yelling at the top of my lungs to make the trades. There's even pushing and shoving. It's hectic.

Q: What do you like best about your job?

A: I like how exciting it is. I don't sit at a desk. I don't know what the markets are going to be like. There's the excitement about what's to come. Because my voice is such an important part of my work, I took voice lessons to learn how to protect it.



Construction & Well Driller

What will I do?

Construction and well drillers use equipment to drill holes to take rock or soil samples or to insert pipes. It is the construction and well

driller, you need a high school diploma or GED. You can prepare to become a construction and well driller by taking courses at a professional technical or a two-year school.

Most well drillers learn skills on the job. You may start as a helper and learn as you go.

Courses in math and drafting may be helpful. Most well drillers learn skills informally on the job.

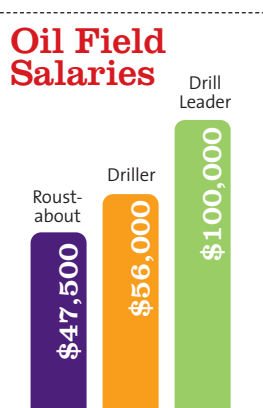
How can I get it?

The most common entry-level field jobs are as roustabouts or rough-necks. These jobs usually need little or no training. A basic requirement, however, is that you must be physically fit. Specific skills usually can be learned quickly through on-the-job training. Oilfield operations are becoming more technical, so some employers may look for a higher level of skill.

drillers' job to get the drill placed, leveled, and stabilized. Drillers control the speed of the drill and start and stop the drill. Drillers monitor how deep the drill has gone and decide when to add length to the drill. Drilling rigs operate continuously. On land, drilling crews usually work six days, eight hours a day, and then have a few days off. In offshore operations, workers may work 14 days, 12 hours a day, and then have 14 days off.

What training will I need?

To work as a construction and well



What will I earn?

Entry level oil field jobs can pay \$47,500 a year. For more technical jobs, the pay can start at \$70,000 a year and go up from there.

CHART SOURCE: U.S. DEPT. OF LABOR, BLS



Q&A

Josh DeMond, 27

Schlumberger, Rock Springs, Wyo.

Drilling Field Specialist

Q: How did you become interested in your job?

A: When I graduated from high school in Louisiana I decided college wasn't for me. So I joined the Army and learned to repair electronics. When I left the military I contacted different companies, and took a job as a field operator with Schlumberger, a company that drills for oil and natural gas around the U.S. and worldwide.

Q: What do you do on a typical day?

A: I have moved up from field operator—where I was responsible for maintaining and repairing drilling tools—to field specialist. I get to talk with clients, manage a three-person crew and have responsibility for making sure wells are drilled properly. Some of my work involves computers. We use them to position the tools that drill into the rock formations that hold the natural gas. I spent six weeks in company-provided training classes.

Q: Are there opportunities for career advancement?

A: I'm on track to become a service quality specialist within two to three years. If I get the promotion I want, my time will be split pretty evenly between office and field work. That means I'll spend even more time working with clients, which I enjoy. To help me reach the next level I'm working not only with my boss, but also with a service quality coach. That person is a mentor within Schlumberger who offers me advice, support and guidance.

PHOTO COURTESY OF SCHLUMBERGER

Electrical Lineworker

What will I do?

Line installers add new lines by building utility poles, towers and underground trenches to carry the wires and cables. When construction is complete, line installers string wire along the poles, towers, tunnels and trenches. Line installers and repairers also are responsible for maintaining electrical lines. Many line in-

complete formal apprenticeships or employer training programs. These are sometimes administered jointly by the employer and any trade union representing the workers. Apprenticeship programs last up to five years.

How can I get it?

Lineworkers are trained on the job. Because the work entails lifting heavy objects, climbing and other physical activity, people thinking about this career should have stamina, strength and coordination. The ability to

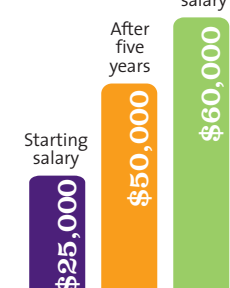
distinguish colors is also important because wires and cables are color-coded.

What will I earn?

Wages for line installers and repairers range between \$13.25 and more than \$32 an hour. For lineworkers in electric-power generation, transmission and distribution, average wages are around \$25 an hour.

Most line installers and repairers belong to unions such as the Communications Workers of America or the International Brotherhood of Electrical Workers.

Electrical Lineworker Salaries



stallers and repairers work a 40-hour week but emergencies may require overtime work.

What training will I need?

Line installers and repairers are trained on the job, and employers require at least a high school diploma. Employers also prefer a technical knowledge of electricity, electronics, and experience obtained through vocational/technical programs, community colleges, or the Armed Forces. Electrical line installers and repairers

“You can go as far in this company as you want to go.”

Q&A

Christopher Cook, 20

Entergy Corp., Warren, Ark.

Apprentice Lineworker

Q: What do you do?

A: As a first-year apprentice lineman, I am involved with anything that has to do with power lines. At this point, my basic responsibility is to be able to climb a pole and do basic repairs. After four years of apprentice training, I can become a journeyman lineman. Then, I can do about everything myself. I need to work four years before I reach that level.

Q: What is your job like every day?

A: I had no idea in high school that I would do this. A friend's father works in a power plant. I hired on with Entergy in March 2005 and went to Little Rock, Ark., for the start of apprentice training. In July, I went to work and by September I was in New Orleans working to restore power after Hurricane Katrina. After that, I went to Florida to help with Hurricane Wilma recovery. Restoring power after storms of this magnitude is more technical than when I am working at my home base in Arkansas.

Q: What do career opportunities look like for you?

A: Oh, wow, they're vast. You can go as far in this company as you want to go. I was on active duty in the U.S. Air Force so both the GI Bill and the company will take care of my college later on. Right now, I am working to make myself an asset to the company.

PHOTOS: CREDIT ENTERGY CORP.



Electrical Specialist

What will I do?

In the power industry, electrical engineers research, design, review and lay out electrical systems in buildings and power delivery networks. This includes designing, supporting and troubleshooting power system construction, modifications, upgrades and retrofits. Electrical engineers specialize in different areas such as power generation, transmission and distribu-

tion. Electrical engineers write performance requirements, develop maintenance schedules, test equipment, solve operating problems and estimate the time and cost of engineering projects.

pected to roughly equal the supply of graduates. People choosing electrical engineering as a career must be computer literate. They also must have good skills in project management and in written and oral communication.

How can I get it?

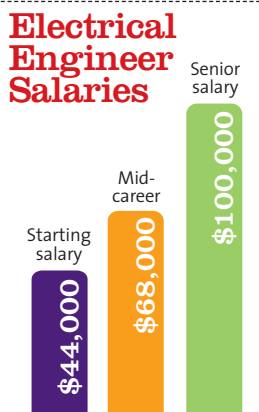
A Bachelor's degree in electrical engineering is required for almost all entry-level jobs.

Most college engineering programs involve focused study in a specialty, along with courses in math and science. Many colleges also offer two- or four-year degrees in engineering technology. These prepare students for practical design and production work. Engineering technology graduates usually need more study, however, before they can take licensing exams to become professional engineers. Everyone also needs work experience.

Demand looks strong for people with electrical engineering degrees.

What training will I need?

Electrical graduates should have bright job opportunities. The number of job openings from employment growth is ex-



What will I earn?

Electrical engineers can earn between \$44,000 and \$100,000 a year, depending on experience, size of the company and level of education.



Q&A

JoAnne Sheng Zheng, 24

Plug Power, Albany, N.Y.

Electrical Integrator

Q: What is your job?

A: I am an electrical integrator. The products we make are used by companies to back up other supplies of electricity. A phone company might have one of our fuel cells at a hard-to-reach location in case the power goes out. Our fuel cell provides backup power until the lights come on again. A big part of my job is working with product designers, mechanical engineers, manufacturing engineers and product marketing people to build the electrical systems that make fuel cells run.

Q: What training do you have for your job?

A: I have a degree in Electrical Engineering from Rensselaer Polytechnic Institute. Much of my background is in math and sciences. I worked as an intern with Plug Power when I was in school. That introduced me to the team I work with today. It's important to be a good communicator and a good team player, too. That means I gain a lot of technical know-how working with other engineers and managers.

Q: What do you like best about your job?

A: I like coming up with solutions to problems. It feels good to see something I've helped design being built on the manufacturing floor. There are also great opportunities to travel. We work hard, but we still have fun.

PHOTO COURTESY OF PLUG POWER



Ryan Ahlschlager, 26

The Dakota Gasification Co., Beulah, N.D.

Electrical & Instrumentation Field Technician

Q: What training do you have for your job?

A: I come from Beulah, a town of 3,500 people. Both my dad and my brother work for the company. We have power plants all over this area of North Dakota. I went to Bismarck State College. It is one of the few colleges that has built a curriculum which includes power- and process-plant technology. I have a degree in computer science.

Q: What do you like best about your job?

A: I learn something new every day. We're combining old technology with new technology and I like that. We take coal and convert it to gas, which makes it burn better and with fewer pollutants. I learn something new every day. Our company has 720 employees and it's very family-oriented. North Dakota is like that. Everybody knows everybody else and we like working together, but in this industry you can move just about anywhere.

Q: How does the technology help the environment?

A: We send carbon dioxide to Canada where it's injected into the oil fields. That makes it easier to get oil out of the ground. It also reduces emissions because the carbon dioxide is pumped into the Earth instead of being released into the air.

Q: Where do you see yourself in five or ten years?

A: I'm so new to this job, but I work with a guy who knows the ins and outs of everything. I just want to become a clone of him.



James Leach, 29

Xcel Energy, Amarillo, Texas

Electrical Apprentice

Q: How did you get interested in your field?

A: I started in the electrical field when I was 19 years old. I was what is called an "inside wireman." I worked mostly on construction jobs. I started at around \$7 an hour. I worked my way up and became a journeyman electrician making \$21 an hour. Then I switched jobs to work in a power plant and started my apprentice training over again.

Q: What do you do every day?

A: The team I belong to works on the generators and maintains all the transformers at the power plant. We maintain all our own elevators, ventilating systems, cranes and blowers. We just came out of a maintenance outage where we worked six 10-hour days for six weeks.

Q: What do you like most about your job?

A: The people. Before I came to the power plant, I worked with a bunch of partyers. Here, it's different. One guy just had a new baby and everyone took up a collection. It's like a family.

Q: What advice would you give a teen thinking about a similar career?

A: When you apprentice, get behind someone who doesn't mind explaining what they're doing. I had a mentor in my fourth or fifth year as an apprentice who took me under his wing.

PHOTO OF RYAN AHSLSCHLAGER COURTESY OF BASIN ELECTRIC; PHOTO OF JAMES LEACH BY MICHAEL LEMMONS



How It All Fits Together

The energy industry has many parts to it and just as many career possibilities! You don't have to go far to find people working in some aspect of the industry. This guide shows some career possibilities. Read the career sketch numbered in the illustration. Then turn to the page at the end of each sketch to read more about someone who has that job.

1 Asset Analyst

One key area for any business is its finances. Projects have to be done within budgets. A financial analyst at an energy company keeps track of how money is spent. Sara Trujillo works as part of an eight-person financial analysis team for an electric utility (page 10).

2 Commodity Trader

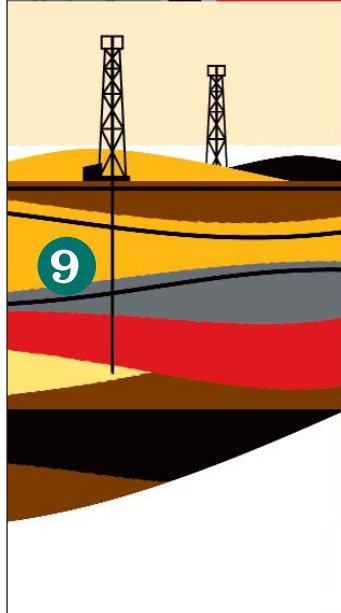
Traders buy and sell large volumes of energy products such as crude oil, natural gas and heating oil for large corporations and investors. Remy Wagman began working at the New York Mercantile Exchange in high school. Today, he's a crude-oil trader (page 11).

3 Construction & Well Driller

Much of the fuel we use to heat our homes and run our appliances comes from fossil sources. Many jobs involve looking for and recovering fossil fuels. Josh DeMond works for a company that drills for natural gas (page 12).

4 Electrical Lineworker

Lineworkers install or repair power lines. After a storm, lineworkers repair any damage. They also maintain existing lines and expand or upgrade networks to meet changing demands. Christopher Cook traveled from his home in Arkansas to Louisiana and later to Florida to help repair hurricane damage to electrical lines (page 13).



5 Electrical Engineer

Hydrogen is an energy source that offers many career choices. One such career involves hydrogen fuel cells. JoAnne Sheng Zheng works for a company that designs and builds fuel cell power generators (page 14).

6 Electrical & Instrumentation Field Technician

Coal gasification takes coal and converts it to gas, which then may be used as fuel in a power plant. Many people see this as an emerging technology for the coal

industry. Ryan Ahlschlager works in a coal gasification plant (page 15).

7 Electrician

Like any machine, a power plant needs regular care and upkeep. The power plant where James Leach works in Texas has almost 90,000 moving parts. James keeps the power plant's electrical systems running (page 15).

8 Environmental Engineer

Electric power plants emit less pollution



than they did 30 years ago. One job focuses on the environmental systems that a power plant must operate. Sarah Butrymowicz works on environmental engineering issues (page 18).

9 Geoscientist

Oil, gas and mineral resources are found underground. Geoscientists study rock formations to solve the puzzle of where resources might be found. Ingrid Cordon uses technology that lets her hunt for energy almost anywhere in the world, from her office (page 19).

10 Mechanical Engineer

Chris Van Dyke and Ed McCullough were friends and classmates at Stanford University. Both now work for a company called H2Gen Innovations, near Washington, D.C. The company is involved in hydrogen technology, an emerging energy source for the future (page 20).

11 Nuclear Engineer

Nuclear engineers work in power plants whose fuel is the energy released by splitting atoms. As interest grows for

nuclear as an energy source for the future, some are working on next-generation designs. Sama Bilbao y Leon works at a Virginia nuclear plant (page 21).

12 Petroleum Engineer

Coaxing oil or natural gas to flow out of the ground combines science and creative thinking. Petroleum engineers figure out how to make oil and gas wells as productive as possible for as long as possible. Mike Lattibeaudiere works as part of a team to make oil and natural gas wells top producers (page 22).

Environmental Engineer

What will I do?

Environmental engineers use science to develop solutions to environmental problems. They are involved in water and air-pollution control, recycling, waste disposal and public health issues. They conduct research on proposed environmental projects, analyze scientific data and perform quality-control checks. More

field, biology or chemistry from a four-year university. The field has been expanding in recent years and is emerging as a well-known specialty of its own.

How can I get it?

Admissions requirements for undergraduate engineering schools include a background in math (algebra, geometry, trigonometry and calculus) and science (biology, chemistry and physics) and courses in English, social studies and computer and information technologies. Bachelor's degree programs in engineering typically last four years. In a typical four-year curriculum, the first two years are spent studying math, basic sciences, introductory engineering, humanities and social sciences. In the last two years, most courses are in engineering, usually with a focus in one branch.

What will I earn?

Salaries for environmental engineers range from \$38,000 to \$95,000. In a recent survey, Bachelor's degree candidates received starting offers averaging almost \$45,000 a year.

Environmental Engineer Salaries



What training will I need?

People interested in an environmental engineering career usually earn at least a Bachelor of Science degree in an engineering

This career is emerging as a well-known specialty of its own.

environmental engineers will be needed to comply with clean air and water regulations. A shift in emphasis toward preventing problems will also spur demand in these careers. Employment is expected to increase much faster than average through 2012.



Q&A

Sarah Butrymowicz, 30

Xcel Energy, Minneapolis, Minn.

Environmental Analyst

Q: How did you become interested in your career?

A: Growing up in the Twin Cities area of Minnesota, I loved outdoor activities and was good in math and science in school. When I started to think about college majors, I put together the two interests I liked the most and settled on environmental engineering as a career.

Q: What do you do?

A: My main job is to help make sure that the company's power plants make electricity as environmentally friendly as they can. On a typical work day, I call the power plants I am responsible for. I ask if the power plants have any projects coming up that may need permits to comply with clean air and water rules. I also write reports, which are submitted to government agencies that track compliance with environmental laws.

Q: What do you like best about your job?

A: The best part of my job is seeing a project through from start to end. The project might be to install new equipment at a power plant. I help evaluate the equipment to make sure it meets all the rules. I also get permission from government agencies to do the project and make sure the equipment is installed properly.

PHOTO BY STEPHANIE RAU

Geoscientist

What will I do?

Geoscientists study the physical aspects of the Earth. They often use sophisticated technology to look for oil and gas. There is more than one type of geoscientist. For example, petroleum geologists look for oil and gas by studying and mapping the subsurface of the ocean or land. They use computers and other visualizing

mit issues is valuable for people who plan to work in mining and oil and gas extraction. Courses in mineralogy, petrology, paleontology, stratigraphy and structural geology are useful for most geoscientists.

How can I get it?

In choosing a college or university, look at course listings for departments of geology, geoscience, earth-systems science or environmental science. The American Geological Institute's publication *Professional Career Pathways in the Geosciences* may be

I like it that I am able to have a direct impact on the global economy.

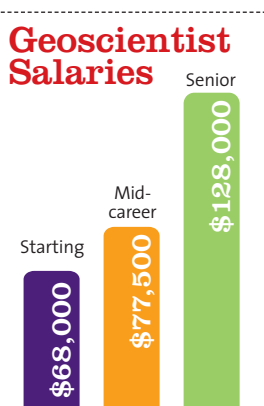
tools to interpret geological information. Some geoscientists spend most of their time in an office, but many others divide their time between field work and office or laboratory work. Because oil and natural gas deposits are found all around the world, many geophysicists have the chance to work abroad.

helpful. Look for it online at www.agiweb.org. The *Directory of Geoscience Departments* lists more than 800 degree-granting geoscience departments in North America. Getting acquainted with professionals in the field will help you get started. Developing a network of contacts will be valuable to help you throughout your career.

What training will I need?

A Bachelor's degree is adequate for entry-level positions, but geoscientists increasingly need a Master's degree to advance. An understanding of environmental regulations and government per-

What will I earn?



On average, geoscientists earn about \$70,000 a year. Salaries start at about \$68,000. Some of the highest-paid workers can earn more than \$128,000 a year.

Q&A

Ingrid Cordon, 25

Anadarko Petroleum, Houston, Texas

Geophysicist

Q: What do you do?

A: I work on a team that looks for oil and gas. We have a special room called a visualization lab. It's like a video game. I can look at rock formations in 3-D and move the images on a screen to find out where oil and gas may be. I can look for oil and gas anywhere in the world without leaving my office.

Q: What training do you have?

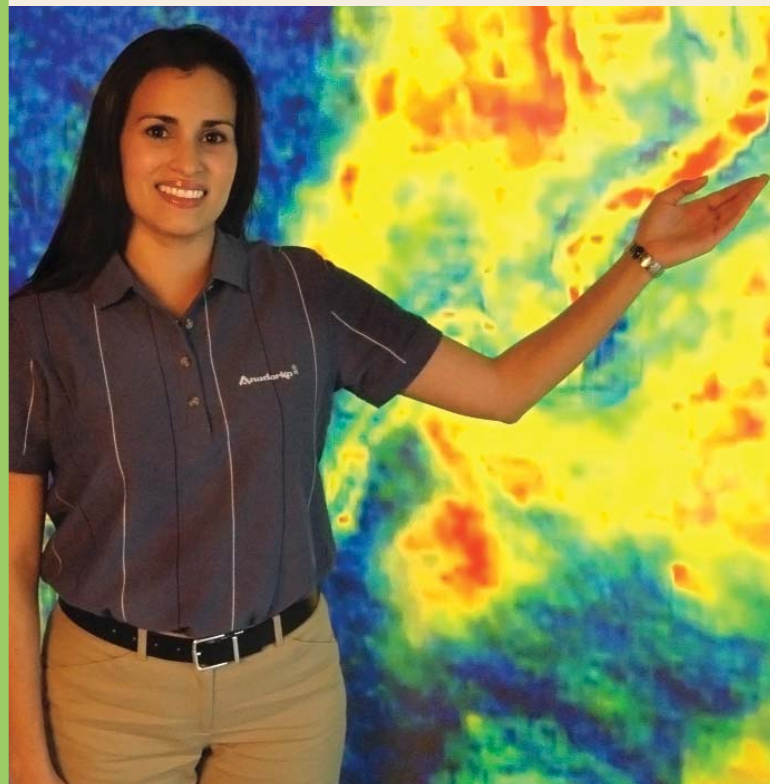
A: I had a total of five internships starting when I was a senior in high school. I worked through a program called Inroads. It helps minority students get work experience. I have a degree in geophysics from Texas A&M University and a Master's degree from Stanford University. I also get training through my company. I was in London for one session. And I am going to Calgary, Canada in a couple of months.

Q: What do you like best about your job?

A: I like the fact that I am able to have a direct impact on the global economy. The technology is pretty amazing, too. You can take snapshots in 3-D and visualize different geologic formations.

Q: What advice would you give a teen thinking about a similar career?

A: There is a huge demand right now. Universities are recruiting, and some will pay your tuition. Also, look into internships and professional organizations that have student chapters. It's a very rewarding field.



Mechanical Engineer

What will I do?

Mechanical engineers research, develop, design, manufacture and test tools, engines, machines and other mechanical devices. They work on power-producing machines

and maintenance; pressure vessels and piping; and heating, refrigeration, and air-conditioning systems. Mechanical engineering is one of the broadest engineering disciplines.

Mechanical engineering is one of the broadest fields.

such as electric generators, internal combustion engines and steam and gas turbines. Computers aid mechanical engineers by doing complex math problems, and by modeling and simulating new designs. Computer software known as Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) is used for turning designs into a product.

What training will I need?

Mechanical engineers work in many industries, and their work varies by industry and function. Some specialize in energy systems; applied mechanics; manufacturing; materials; plant engineering

How can I get it?

Beginning mechanical engineers usually work under the supervision of a more experienced engineer.

In larger companies, they may also receive formal classroom or seminar-type training. Mechanical engineers should be creative, inquisitive, analytical and detail-oriented. As engineers gain experience, they take on more difficult projects with greater independence to develop designs, solve problems and make decisions.

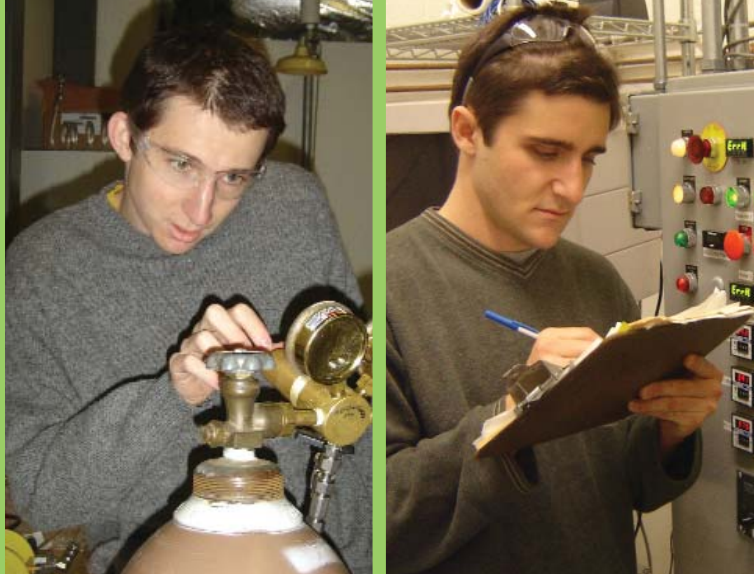
What will I earn?

Median annual earnings are about \$63,000 a year. Salaries range from \$40,000 to more than \$90,000. According to a recent salary survey, Bachelor's degree candidates in mechanical engineering received starting offers averaging almost \$50,000 a year.

Mechanical Engineer Salaries



CHART SOURCE: U.S. DEPT. OF LABOR, BLS



Q&A

Chris Van Dyke and Ed McCullough, both 24

H2Gen Innovations, Alexandria, Va.

Mechanical Engineers

Q: How did you get interested in the energy industry?

Chris: Energy seemed like a good field to be an engineer doing creative technology development, and also having a positive impact on the environment. Hydrogen seemed like the best option. It looked like a really exciting and profitable field to work in as a mechanical engineer.

Ed: After I graduated, I worked with the National Park Service in California for a year and then I was interested in getting back into engineering. I wanted to do something that had an environmental “good” attached to it. It happened that Chris was working at H2Gen Innovations already, so I came to visit and ended up working here, too.

Q: What do you do each day?

Ed: The mechanical design team is three people. We make up two-thirds of it!

Chris: We are responsible for designing the places where these complicated reactions that the Ph.D.s have come up with will actually happen. We’re also responsible for making sure the designs can be built, and built cost-effectively, and then finding someone to build them.

Q: What do you find most challenging about your job?

Chris: The fact that the people here are willing to give me responsibility. When our machine absolutely needs to work, I am the person who will be the most to blame if it fails.

Ed: If I can come up with the best idea and convince everybody else, then we go ahead and do it.

PHOTOS COURTESY OF H2GEN

Nuclear Engineer

What will I do?

Nuclear engineers operate nuclear power plants. They also conduct research on nuclear energy. Some nuclear engineers direct the operation and maintenance of nuclear power plants. With renewed interest

years, you focus on nuclear engineering courses.

How can I get it?

You may want to consider participating in an engineering internship while in college. It offers you a chance to apply what you have learned in the classroom to a work situation. It also allows you to make professional contacts with people already working in the nuclear engineering field.

Job openings should roughly equal available new workers through 2012.

in nuclear energy in recent years, some are even working on new power plant designs. Nuclear engineers also work on what is known as the “nuclear fuel cycle.” This refers to producing, handling and using nuclear fuel, and safely disposing of spent fuel.

What training will I need?

Most students prepare for this field by earning a Bachelor’s degree in nuclear engineering. Many nuclear engineers have a Master’s or doctoral (Ph.D.) degree. In a typical four-year program, courses include math, basic science, introductory engineering and social science. In your last two

What will I earn?

Although little or no growth in overall employment is expected for this field through 2012, good job opportunities should exist as the number of nuclear engineering graduates roughly equals the number of openings. Annual salaries range between \$58,000 and \$111,000. Salaries vary by employer and area of the country. The engineer’s level of education and responsibility also

affect wages. According to a recent survey, Bachelor’s degree candidates in nuclear engineering received starting salary offers of around \$58,000 a year.



Q: What is your specialty? Where did you attend college?

A: My area of expertise is in an area called thermal hydraulics and heat transfer. I also have experience in energy and environmental policy.

I have a Bachelor’s degree in mechanical engineering and a Master’s degree in energy technologies from the Polytechnic University of Madrid in Spain. I have a second Master’s degree and a Ph.D. in nuclear engineering from the University of Wisconsin.

Q: What do you do on your job?

A: I currently am a nuclear safety engineer at Dominion Electric in Virginia. That makes me part of the team of engineers in charge of day-to-day safety at a nuclear power plant. Some of the things I do are routine evaluations. Others things include finding ways to improve our plant’s long-run capabilities. I just led a team of engineers in developing a new thermal-hydraulics method based on a new computer code. It’s complex, but it will give our company a big competitive advantage.

Q: How do you see your prospects for career advancement?

A: The prospects for me to advance within the company and the industry are good. I have worked for Dominion for only four years, but I have already been given large responsibilities and opportunities.



Petroleum Engineer

What will I do?

Petroleum engineering isn't just one job. You can be a drilling engineer and work with geologists and contractors to design and supervise drilling operations, many of which are multimillion-dollar ventures. You can work as a production engineer and develop processes and equipment to optimize oil and gas production. Or you can be-

My job is to design a way for gas or oil to flow to the surface.

come a reservoir engineer and help figure out how to recover the resource, estimate the number of wells that can be economically drilled and simulate future performance using computer models.

What training will I need?

At some universities you will study for a Bachelor of Science degree, concentrating on basic engineering courses during your first two years. At other schools, you may focus on math,

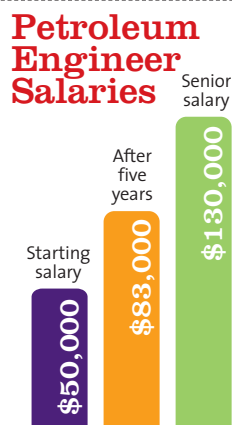
science and engineering fundamentals your first two years. After that, you can begin to specialize in petroleum engineering by taking courses in geology, properties of reservoir fluids, formation evaluation and petroleum production.

How can I get it?

A Bachelor's degree in engineering is required for almost all entry-level jobs. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both math and science. Most programs include a design course, sometimes accompanied by a computer or laboratory class or both. Bachelor's degree programs typically last four years, but many students find it takes four to five years to complete their studies.

What will I earn?

The average annual salary for a petroleum engineer is around



\$83,000. Salaries range between \$50,000 and nearly \$130,000 a year. Starting salaries in petroleum engineering average about \$56,000 a year.



Q&A

Mike Lattibeaudiere, 27

ConocoPhillips, Houston, Texas

Senior Completions Engineer

Q: How did you become interested in your job?

A: I grew up in Midland, Texas, which is in the heart of the oil and gas industry. I always knew I wanted to be an engineer. I started as a contract employee with ConocoPhillips when I was 18. That helped introduce me to a multitude of ideas for my career. I studied Petroleum Engineering at the University of Texas at Austin.

Q: What do you do every day?

A: I never have a typical day. My job is to come in after an oil or natural gas well has been drilled and figure out how to make the well productive for a long time. Many people think there are big gas and oil pools underground. That's not so. Fossil fuels are trapped in rocks. My job is to design a way for the gas or oil to flow out of those rocks to the surface. Last year I worked on 150 wells, mostly in Texas and New Mexico. I travel quite a bit.

Q: Do you work independently or as part of a team?

A: Both. I work with reservoir engineers and geologists to study the rock formations. Then I work independently to design what we call a "stimulation" process. After that I go on site and work with the drillers and safety engineers to stimulate the well and get the oil or gas flowing.

PHOTO COURTESY OF CONOCOPHILLIPS

CHART SOURCE: U.S. DEPT. OF LABOR, BLS

Solar-Powered Adventure

Choose your own adventure, says Jeff Lyng. He should know. He has had quite an adventure for the past two

and a half years.

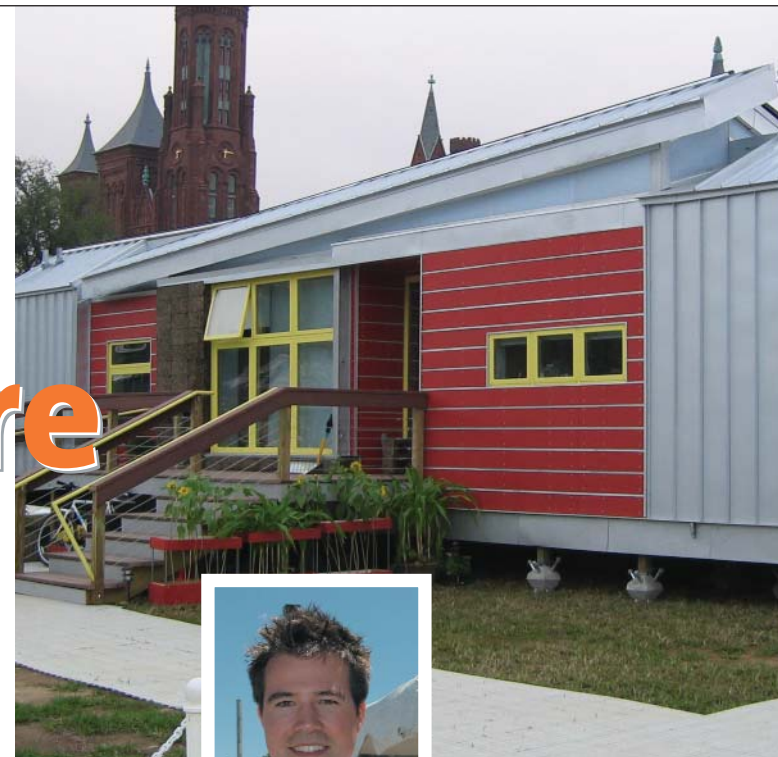
Jeff is 26 and attends the University of Colorado (CU) in Boulder. He's getting a Master's degree in civil engineering. But you might say he's really been studying Solar Decathlon.

Jeff led 20 other CU students who designed, built and tested a house that uses as many renewable energy systems as it can. The systems make power for lights, hot

water, cooking and even to run a battery-powered car. The students took their house to Washington, D.C., and competed against 17 other colleges from the U.S., Puerto Rico, Canada and Spain in the 2005 Solar Decathlon.

Really Home Grown!

The CU house is made from renewable materials, which include soy, corn, sunflower,



The winning CU Solar Decathlon house (above). Jeff Lyng (inset) led a team of 20 students.

canola and coconut. The house uses 32 rooftop solar panels, which make electricity using energy from the sun. The students even made sure the house was pulled from Colorado to Washington with a truck that ran on biodiesel fuel. Biodiesel is made of the same kind of vegetable oil that's used to cook french fries.

Racing Solar Cars

The American Solar Challenge is a competition for college students to design, build and race solar-powered cars in a cross-country event. The Challenge, held annually, is a "hands-on" chance for students and engineers to develop and demonstrate their abilities.

In 2005, the race was run on 2,500 miles of roads between Austin, Texas, and Calgary, Alberta, Canada. A team from the University of Michigan placed first. Its car finished in a time of 53 hours, 59 minutes and 43 seconds.

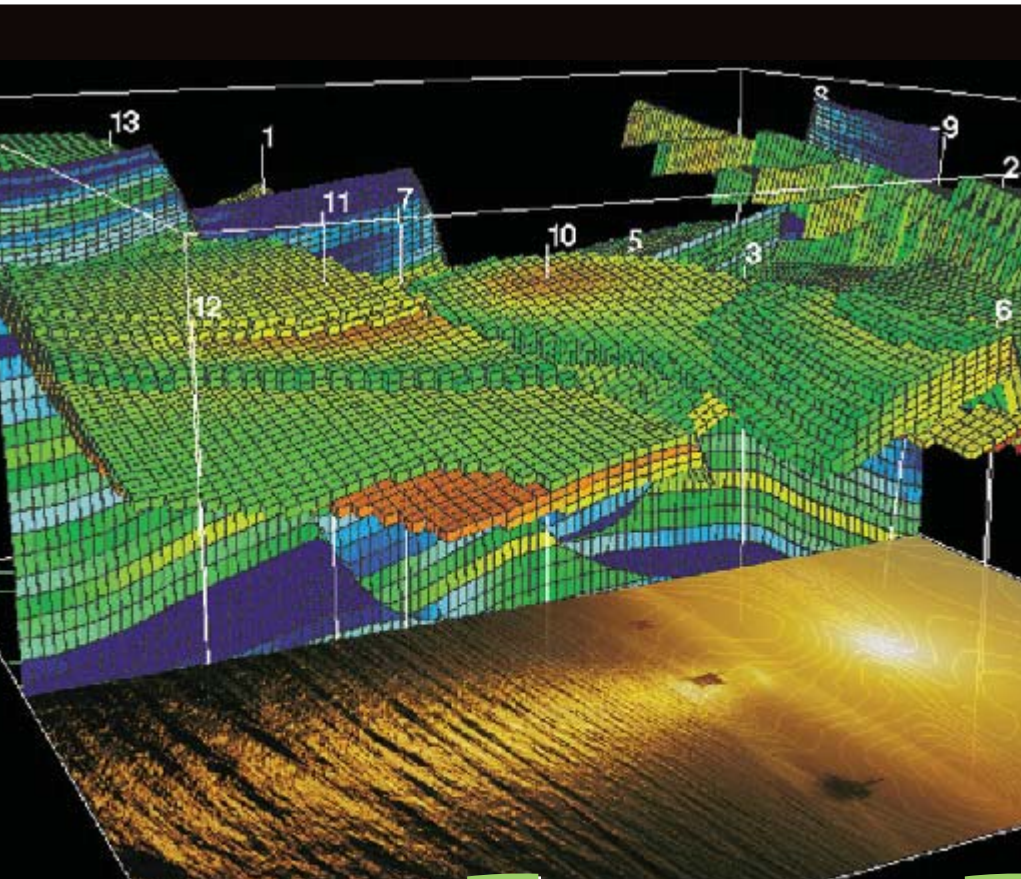


Driven To Win

Teams also competed in a "getting around" contest. Using power from their houses' solar panels, they charged up electric cars and earned points based on how far the cars traveled.

The CU team car traveled the farthest. A student drove 325 miles around the streets of Washington, D.C., at an average speed of about 15 mph.

So, after all that work did Jeff earn an "A" for leading the winning team? He laughs and says he wasn't graded at all. The adventure was worth it.



Technology

is Changing the

Energy Industry

From soybeans to tidal power, researchers are looking for new energy sources By Douglas Page

Big changes are coming to the energy industry, and technology is leading the way.

Picture this: Geologists who are looking for oil and natural gas use computers to take 3-D pictures of rocks they think may hold the resource. These pictures help them “see” where to drill, boosting the chances of finding natural gas or oil. Once the fossil fuel is found, drillers can use directional drilling technology to make as small a mark as possible on environmentally delicate areas.

Now think about technologies that are changing how electricity is made. Solar, wind, biomass and other renewable fuels are getting lots of attention. There even are some forms of energy you may never have thought about, like hydrogen and ocean tidal power.

Sound interesting? Here are some of the technologies that are changing the energy industry.

Hybrid Electric Vehicles

Some vehicles don’t burn gasoline at all, helping us reduce how much oil we use. Cars and trucks moved by electric motors have low emissions, cost less to run and cut our need for oil, says Ron Freund, of the Electric Auto Association.

Researchers at the National Renewable Energy Laboratory in Colorado are helping refine three major electric motor technologies:

- ✦ Fuel-cell vehicles (FCVs)
- ✦ Hybrid-electric vehicles
- ✦ Plug-in-hybrids

Researchers are taking the plug-in idea

one step farther. A special two-way plug allows car owners to sell extra electricity made by their cars' batteries. They can sell it to the local utility!

Hydrogen

One path to energy independence may lead through hydrogen power, an almost never-ending, pollution-free fuel that could power a new type of car—the hydrogen fuel-cell vehicle. Scientists think wind power one day may be the best way to make hydrogen. Almost any site with steady and strong winds could potentially host a hydrogen-production facility.

Hydrogen can also be made from waste aluminum (soda cans) through a chemical reaction with lye, an ingredient used in soap, according to the Hydrogen Energy Center.

Fuel Cells

The U.S. space program first used hydrogen fuel cells in the 1960s to make electricity for its spacecraft.

Here on Earth fuel cells could one day replace standard engines in cars and trucks because they are energy-efficient and clean, says Renée Nault, of Argonne National Laboratory.

Scientists at the U.S. Department of Energy are working with universities and private industry to make fuel cells widely available. Their research is aimed at cutting fuel cells' cost and size. One day soon items like portable music players, laptops and even cell phones could get their power from miniature fuel cells.

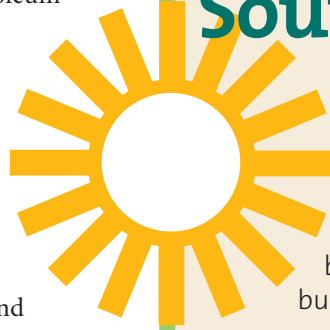
Biodiesel

Cleaner-burning alternative fuels may eventually become as common as petroleum. One such fuel is biodiesel, made from common vegetable oil.

Biodiesel fuel has no petroleum in it, but it can be blended to create fuel for use in diesel engines, says Amber Thurlo Pearson of the National Biodiesel Board. Biodiesel is simple to use, biodegradable, nontoxic and largely free of odor. Nearly 100 production plants could be up and running within a few years, she says.

From new ways to make fuels, to high-tech tools to help engineers look for hidden resources, to futuristic ideas for using sun and wind power, technology is changing our energy world. One thing is certain. There will be more change ahead as the next generation of workers start energy careers.

Other Renewable Energy Sources



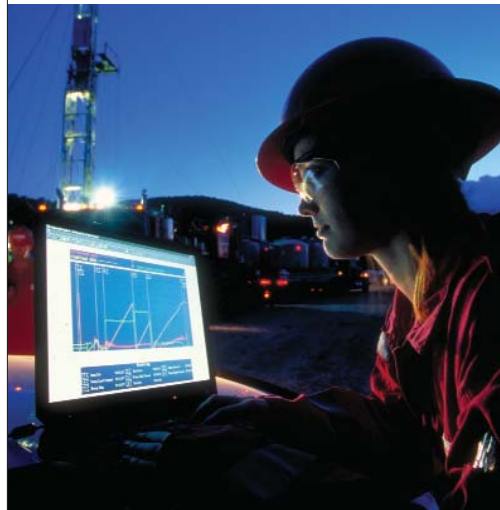
✦ **Solar** Energy from the sun can be used to make electricity. Solar panels already may be seen on many buildings and signs.

✦ **Wind** Wind energy technologies convert wind into electricity. Some experts think this source could supply 20 percent of our nation's electricity.

✦ **Ocean** In addition to tidal energy, there's energy from the ocean's waves, which are driven both by the tides and the winds.

✦ **Geothermal** Energy plants tap the Earth's interior heat to warm homes, offices, greenhouses, fish farms, and other facilities. In California, geothermal power plants make electricity.

✦ **Biomass/Methane** Methane extracted from trash landfills or from farm crops can be used to heat homes.



Soybeans like these in a Wisconsin field (left) can be made into biodiesel fuel. Computers can help reduce the impact oil and natural gas drilling has on wildlife (above). Super-hot water from deep in the Earth can be used to heat and light cities (right).



Fun Facts

about Energy



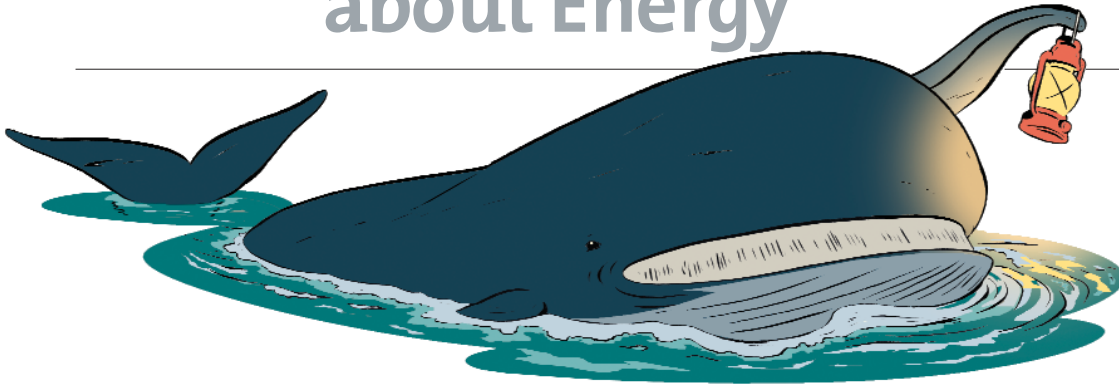
8. How much energy is packed into a hurricane with 90-m.p.h. winds?

Answer: About 100 times more energy than is produced by all the world's electric power plants combined.

SOURCE: NATIONAL GEOGRAPHIC/NOAA

9. What city uses geothermal energy (naturally occurring steam and hot water from far beneath the ground) to heat and light its homes, schools, stores and offices?

Answer: Reykjavik, the capital of Iceland, uses the same super-hot water that spouts out of geysers like Old Faithful.



1. What energy discovery in Pennsylvania in 1859 helped save several species of whale?

Answer: Petroleum! In the early 1800s, many American homes were lit with lamps that burned whale oil. Finding crude oil and inventing kerosene and oil lamps probably saved some species of whales from being completely wiped out.



2. Why does natural gas stink?

Answer: Actually, it doesn't. Natural gas is odorless. The gas company adds a chemical called "mercaptan" to give it a rotten-egg smell so leaks can be easily found.

3. One barrel of crude oil could fill how many soft drink cans?

Answer: Around 400. (But don't drink the stuff.)

4. Who holds the record for the longest journey by a solar-powered vehicle?

Answer: The record was set in 2004 when a team of students from the University of Waterloo in Canada spent 40 days traveling more than 9,370 miles in a solar car. That's like driving from New York to California three times.

5. What's so special about "hybrid" cars?

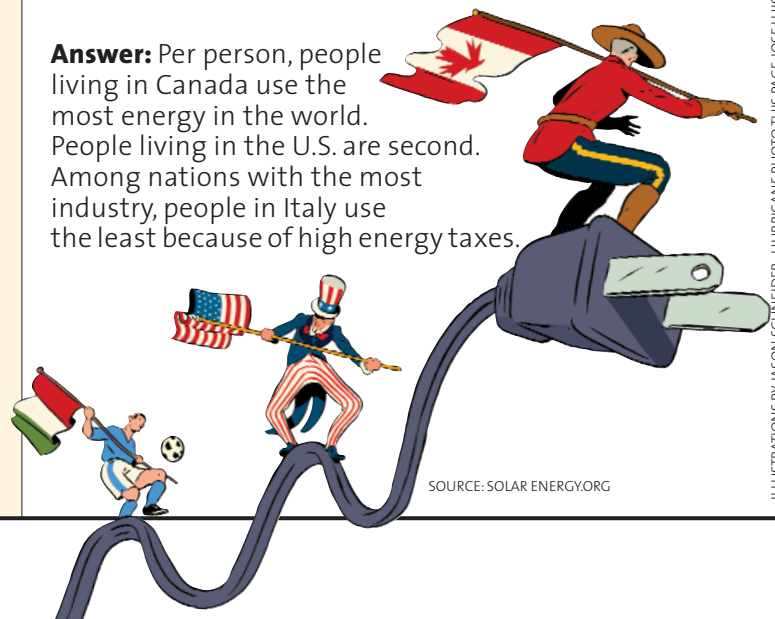
Answer: It's what goes on under the hood. The cars use two sources of power—gasoline and electricity. The combination gives hybrid car owners 20 to 30 more miles per gallon of gas than a standard car.

6. Where does the word "petroleum" come from?

Answer: The word is Greek. It means "rock oil" or "oil from the earth."

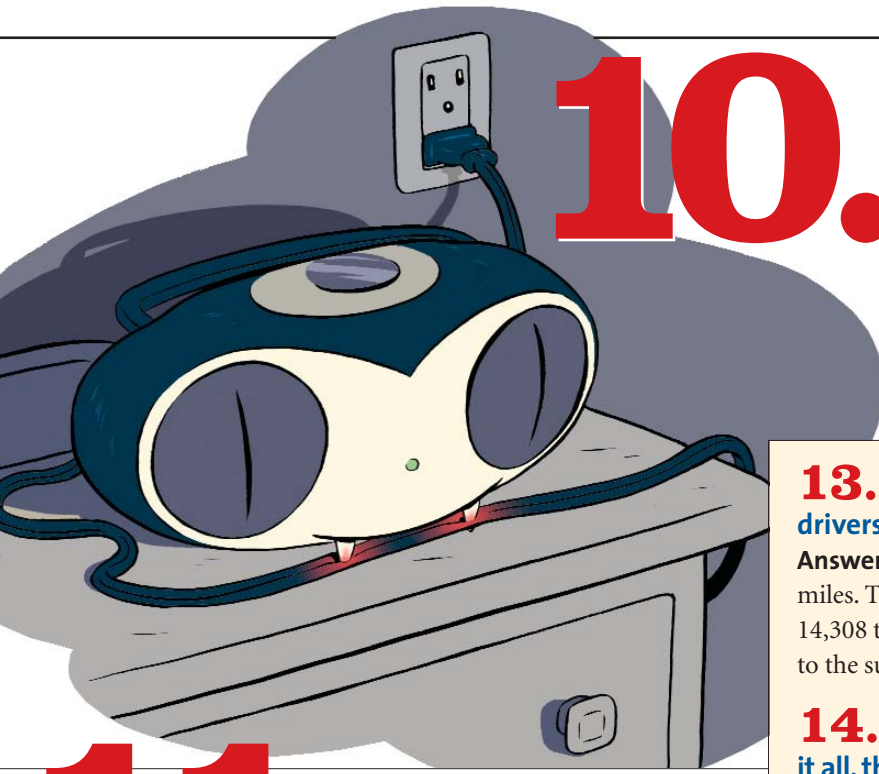
7. Which countries use the most energy per person?

Answer: Per person, people living in Canada use the most energy in the world. People living in the U.S. are second. Among nations with the most industry, people in Italy use the least because of high energy taxes.



SOURCE: SOLAR ENERGY.ORG

ILLUSTRATIONS BY JASON SCHNEIDER; HURRICANE PHOTO THIS PAGE: JOSE LUIS PELAEZ, INC./CORBIS



10. How much energy do electronic gadgets consume when they are not in use?

Answer: Clocks and other gadgets that stay lit when you turn off your DVD, CD player and other devices use around 5 percent of our energy.

11. How much solar energy reaches the Earth every hour?



Answer: The sun delivers more energy in 60 minutes than the entire world uses in a single year.

13. How far do U.S. drivers travel every year?

Answer: About 1.7 trillion miles. That equals roughly 14,308 trips from the Earth to the sun...and back again!

14. If we could collect it all, the sun's energy output would meet the demands of how many planet Earths?

Answer: Around 31,000 billion of our own planet.

15. What common cooking ingredient goes into biodiesel fuel?

Answer: Researchers have found a way to turn used french-fry oil into fuel for diesel engines. When burned, it smells like cooking french fries!

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION



16. What did Alessandro Volta invent 200 years ago that we use today in cell phones and portable gadgets?

Answer: The electric battery! We still measure battery power in "Volts."

17. How does a fuel cell work?

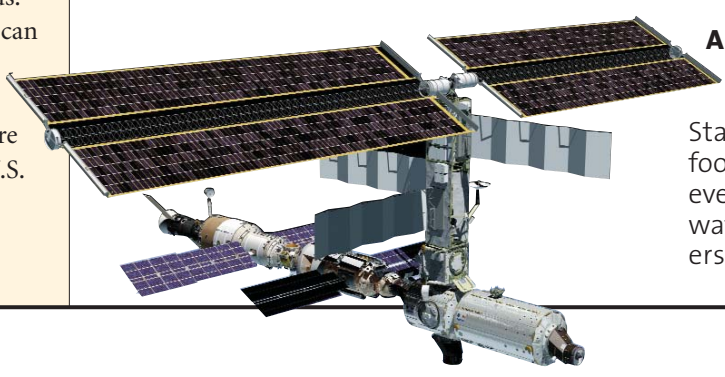
Answer: It produces electricity by converting hydrogen and oxygen into water.

12. Out of every 100 pounds of garbage thrown away, how much could be reused to generate electricity?

Answer: About 80 pounds. Burning a ton of garbage can generate enough electricity to heat an office building for one day. There now are more than 100 U.S. trash-to-energy plants.

SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

18. How many solar cells cover the International Space Station?



Answer: More than 262,000, or enough to cover 27,000 square feet of the Space Station—about half the size of a football field! Solar power runs everything from the Space Station's water systems, to its lights, computers and communications gear.

PHOTOS THIS PAGE: GIRL WIPOD; ROY MEHTA-PHOTONICA/GETTY IMAGES; SPACE STATION: TIME LIFE PICTURES/GETTY IMAGES

Resource Guide

Dozens of professional organizations, government web sites and trade unions exist to help you learn more about energy and energy careers. Here is a sampling of resources to get you started.

PROFESSIONAL AND INDUSTRY ORGANIZATIONS

American Academy of Environmental Engineers

(410) 266-3311
www.aaee.net

The Academy was founded in 1955 to improve the practice, elevate the standards, and enhance public recognition of environmental engineering through a certification program for qualified engineers.

American Association of Petroleum Geologists

(918) 584-2555
www.aapg.org

American Association of Professional Landmen

(817) 847-7700
www.landman.org

American Coal Foundation

(202) 463-9785
www.teachcoal.org

American Gas Association

(202) 824-7000
www.aga.org

American Geophysical Union

(202) 462-6900
www.agu.org

American Nuclear Society

(708) 352-6611
www.ans.org

American Petroleum Society

(202) 682-8000
www.energyprofessions.org

American Public Gas Association

(202) 464-2742
www.apga.org

American Public Power Association

(202) 467-2900
www.appanet.org

American Public Works Association

(202) 408-9541
www.apwa.net

American Society of Civil Engineers

(800) 548-2723
www.asce.org

American Society of Mechanical Engineers

(800) 843-2763
www.asme.org

American Society for Engineering Education

(202) 331-3537
www.engineeringk12.org

American Solar Energy Society

(303) 443-3130
www.ases.org

American Welding Society

(800) 443-9353
www.aws.org

American Wind Energy Association

(202) 383-2500
www.awea.org

Association of Energy Engineers

(770) 447-5083
www.aeecenter.org
Members nationwide help companies increase energy efficiency, enhance environmental management programs, upgrade plant operations and improve equipment performance.

Association of Energy Services Professionals

(512) 864-7200
www.aesp.org

Association for Women Geoscientists

www.awg.org

Edison Electric Institute

(202) 508-5000
www.eei.org

Electric Power Research Institute

(650) 855-2000
www.epri.com

Gas Technology Institute

(773) 399-8100
www.gastechnology.org

Geological Society of America

(303) 447-2020
www.geosociety.org

Geothermal Energy Association

(202) 454-5261
www.geo-energy.org

Independent Petroleum Association of America

(202) 857-4722
www.ipaa.org

Inroads

(314) 241-7488
www.inroads.org
Non-profit that helps train and develop minorities.

Institute of Electrical and Electronics Engineers/IEEE

(212) 419-7900
www.ieee.org



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International Association of Drilling Contractors
(713) 292-1945
www.iadc.org

Junior Engineering Technical Society/JETS
(703) 548-5387
www.jets.org
Non-profit education organization founded in 1950 to inform young people about careers in engineering. JETS serves more than 30,000 students and 5,000 teachers and holds programs on more than 150 college campuses each year. Around 34% of JETS members are female; 22% are from groups traditionally under represented in engineering and technology.

National Association of Minority Contractors
(202) 347-8259
www.namconline.org

National Hydropower Association
(202) 682-1700
www.hydro.org

National Electrical Contractors Association
(301) 657-3110
www.necanet.org

National Heavy & Highway Alliance
(202) 347-1660
www.heavyhighway.org

National Rural Electric Cooperative Association
(703) 907-5500
www.nreca.org

National Society of Professional Engineers/NSPE
(703) 684-2800
www.nspe.org

National Utility Contractors Association/NUCA
(703) 358-9300
www.nuca.com

Partnership for Environmental Technology Education/PETE
(207) 771-9020
www.ateec.org/pete

Sloan Career Cornerstone Center
www.careercornerstone.org
Non-profit center for careers in science, technology, engineering and math.

Society for Mining, Metallurgy and Exploration
(303) 973-9550
www.smenet.org

Society of Automotive Engineers
(724) 776-4841
www.sae.org

Society of Exploration Geophysicists
(918) 497-5500
www.seg.org

Society of Petroleum Engineers
(972) 952-9393
www.spe.org

Society of Women Engineers
(312) 596-5223
www.swe.org
Founded in 1950, SWE is a not-for-profit educational and service organization that seeks to promote engineering as a highly desirable career goal for women.

Solar Energy Industry Association
(202) 682-0556
www.seia.org

U.S. Dept. of Education, Office of Vocational and Adult Education/ OVAE
(800)-872-5327
www.ed.gov

U.S. Department of Energy
(202) 586-5000
www.energy.gov

Energy Information Administration
(202) 586-8800
www.eia.doe.gov

U.S. Environmental Protection Agency
(202) 272-0167
www.epa.gov

ENERGY-RELATED LABOR GROUPS

Electrical Workers Minority Caucus
www.ibew-ewmc.org
(510) 848-6714
The Caucus serves as a support and networking system, and provides education and training for its members. The membership reflects a broad-based coalition of people who work within the International Brotherhood

of Electrical Workers union structure to create changes that will benefit minorities.

Independent Electrical Contractors
(703) 549-7351
www.ieci.org

International Brotherhood of Electrical Workers
(202) 833-70000
www.ibew.org

National Joint Apprenticeship and Training Committee
www.njatc.org

Utility Workers Union of America
(202) 974-8200
www.uwua.net

ENERGY EDUCATION

National Energy Education Development Project
(703) 257-1117
www.need.org
Promotes the design of objective energy education programs.

National Renewable Energy Laboratory
(303) 275-3000
www.nrel.gov/education
Helps students explore renewable energy options.

National Energy Foundation
(800) 616-8326
www.nefl.org
Provides curriculum, training and materials in energy.

National Science Foundation
(703) 292-5111
www.nsf.gov
Funds basic research at colleges and universities.

Calling All Mentors

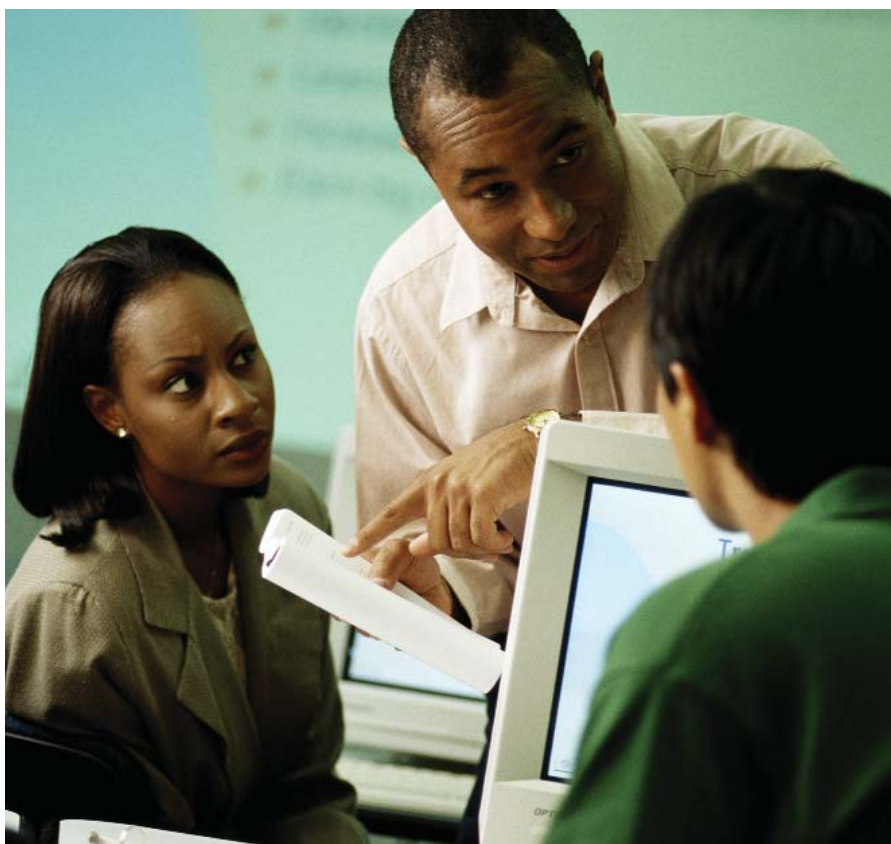
Parents, Teachers and Counselors Can Help Students Learn More about Energy Careers

Tips for Guidance Counselors...

Give your advisees something new and exciting to consider: a future in the energy industry. Energy is one of the most in-demand sectors and opportunities are growing every day. Many employers are turning to high school guidance counselors to tell a new generation of workers about this area of career opportunity. A great place to start is www.careervoyages.com/careeradvisors-main.cfm.

If you have students interested in pursuing college degrees in the field, a helpful list of academic programs and institutions in the country can be found at www.eere.energy.gov/education/higher_education_programs.html.

You don't have to spread the word alone! Guest speakers are a great way for students to connect to the energy industry. Students can relate to a person who works in the energy field, and they can answer specific and experience-based questions. The internet can be helpful in making these contacts. Or, you can start in your own town. Try contacting your local energy utility. Students' family members may be



in the business, or they may have connections to it. Just asking the right person can help with the search. Speakers may be able to visit your school, or you could organize a trip to a power plant or other nearby energy-related facility. Take a look at web sites such as <http://www.need.org/up-events.htm>.

Show Them What You've Got

There are many ways to present information, depending on your space, time and funds. You might post "...of the Day" messages (for example, career of the day, scholarship of the day, internship of the day and so on). These may help encourage students to stop by your office more frequently. Bulletin boards

are good ways to post a lot of information at once, but things sometimes get lost beneath new additions. Make sure flyers are taken down after the deadlines they advertise have passed. Checking in often could also inspire students to spend a little time each day working on applications, essays and research.

Earn While They Learn

Students may be able to work in energy jobs and get paid for it while they pursue training. A first step might be for them to find internships or volunteer opportunities to gain experience and try different aspects of the industry. For a government listing of related internships, check out <http://www.eere.energy.gov/education/internships.html>. This is one of many online sources for student internships, fellowships, and scholarships in energy.

Staying on Top of It All

Make contacts with schools and companies and learn what they are looking for. Expand your knowledge of emerging and changing careers. Good sources are publications such as Scientific American (www.sciam.com), the Wall Street Journal (www.wsj.com) and Business Week (www.businessweek.com). If your school offers career and technical education classes, spend some time in them. Getting to know the fields you're promoting will make them come alive to students. Remind students that there is a clear link between what they're learning in high school today and their future success. Offer examples of practical, real-world ways in which students will be able to use what they learned that day.

Where Do I Go from Here?

A great jumping off point is www.careervoyages.com/careeradvisors-main.cfm. This web site is maintained by the Department of Labor and has a great deal of useful information for students and mentors alike.

Attention Teachers...

Gathering resources for your students is a big job, but you don't have to do it alone. Many websites are available that will help you develop classroom activities that will raise your students' energy awareness levels. A good place to download information booklets on different sources of energy is the National Energy Education Development Program (NEED) website

www.need.org/info-books.htm.

You can find still more curriculum aids at the Energy Information Administration web site www.eia.doe.gov/kids. Browse the site for many classroom activity ideas

including solar-powered cooking, natural refrigeration, undersea petroleum recovery and measuring electricity.

Look also for good ideas at the National Science Teachers Association website www.nsta.org. There you will find an "energy primer," which discusses energy in general, sources of energy, fossil fuels, renewable energy, and so forth. Also included are lesson plans for educators and experiments that your students can try on their own.

Encourage Their Thinking

Help your students design and conduct experiments with a glow-in-the-dark object to answer the following questions related to energy:

- ✦ Does the intensity of the light emitted by a glow-in-the-dark object depend on the intensity of the absorbed light?
- ✦ Does the color of the light emitted by a glow-in-the-dark object depend on the color of the absorbed light?

- ✦ Does the length of exposure to light have an effect on the length of time a glow-in-the-dark object emits light?
- ✦ Which kind of light (incandescent, fluorescent, infrared, ultraviolet or black) produces the highest intensity of emitted light from a glow-in-the-dark object?
- ✦ What effect does temperature have on the intensity and persistence of the emitted light?

Internships may be one way your students can gain experience in the energy industry.

Raising Awareness

Have a group of students each evaluate an energy source using a 1-to-5 rubric, which includes knowledge of the energy source, content of the presentation, level of participation in the research and presentation, and design and creativity of the presentation.

Discuss findings, emphasizing the idea that every energy source has advantages and disadvantages.

NEED Can Help



National Energy Education Development (NEED) is a non-profit organization promoting an understanding of energy's scientific, economic and environmental impacts. www.need.org.

Dear Parents,

Going to college is not necessary to have a successful career in energy. But an important starting place for your child is a high school diploma. Encourage your teen to take as many courses in math and science as possible. Help them learn to speak and write effectively.

You'll find dozens of helpful career resources.

Some students choose to show a college they are ready to pursue a degree in energy by taking a college course in high school. Summer programs are sometimes available that are geared toward high school students. Talk to your school's guidance counselor or look online to see what nearby colleges offer. Try the Department of Energy web site: humancapital.doe.gov/pers/SPEM/summary.htm. Doing a basic word search for "energy" on a site like www.studentjobs.gov may give you more good ideas.

Get a copy of the "Occupational

Outlook Handbook" published by the U.S. Dept. of Labor's Bureau of Labor Statistics. The handbook is a good source of career information designed to help people making decisions about their future work lives. Revised every two years, the handbook describes what workers do on the job, working conditions, the training and education needed, earnings and expected job prospects in a wide range of occupations. Look for more information online at www.bls.gov/OCC.

Make good use of your local public library, career center and school guidance office. These sources

maintain a wealth of up-to-date material. Librarians can be a great resource and can save you time by directing you to valuable information.

Take time to visit the Dept. of Labor's web site CareerOneStop. This site includes America's Job Bank, America's Career InfoNet and America's Service Locator. Look for all three online at www.careeronestop.org.

Also look online for federal grant, loan and work-study programs for college. Visit www.ed.gov/offices/OSFAP/Students.

Talking Points

- ✦ **When I Was Your Age**
Talk about your experiences with job searches. Share what you found helpful after high school and what you wish you had done differently. Having open and honest conversations with your teen will encourage him or her to come to you with questions.
- ✦ **Love What You Do**
A good way to start is to get a sense of your child's interests. Think of three things that your teen is really good at and some things he or she loves to do. Ask your child to do the same. Focus on the areas where skills match.
- ✦ **What Is the Best Job?**
Talk to your teen about what makes the best job. Is pay the most important thing? How about job satisfaction? Maybe the most important factor is the chance to benefit humankind? What makes your teen happy? Having this kind of talk will show you both that different people have different ideas about what makes the "best job."

Surf the Web



Parents will find lots of career information at <http://www.careervoyages.com/parents-main.cfm>.

This site provides:

- + different types of careers
 - + information on training and skills
 - + advice on how to pay for more specialized training
- "College Is Possible" www.collegeispossible.org.** The U.S. Dept. of Education and the Coalition of America's Colleges and Universities prepared this guide to help students prepare for, choose and pay for college. It includes information on scholarships and is available in English and Spanish. Phone (800) 433-3243 for a copy.



Work Hard.
Play Hard.

Job Corps is your opportunity. Take the next steps to career success.

Job Corps offers training for **100 careers** in a variety of industries ranging from construction and computers to healthcare, hospitality and more. Through career counseling, training and job placement programs, we help you achieve financial success and independence. Find out how by visiting the Job Corps center near you or going to **<http://jobcorps.doleta.gov>**.

