

# Career *currents*

Exploring Today's Energy Careers with the NEED Project

Vol. 1, No. 1 Oct. 2005

## Make a Difference! Be a Petroleum Engineer

### On the Job

The world demands clean, safe, affordable energy. To meet our needs, **Petroleum Engineers** find new oil and natural gas reservoirs.

Once they find the reservoirs, they study underground rocks. They decide which drilling methods to use, and monitor drilling and production.

Petroleum engineers design drilling equipment and determine the best way to recover the most oil and natural gas from reservoirs. Because even the best techniques in use today recover only a portion of the oil and gas in a reservoir, petroleum engineers research and develop new ways to increase recovery and lower drilling and production costs.

### Options and Opportunities

Opportunities exist for petroleum engineers to explore the world while developing oil and gas reserves. Many people live and work in other countries.

Work environment options provide another benefit. Petroleum engineers work outdoors "in the field." They work on land and miles offshore on oil rigs. Jobs exist in small companies and in global corporations.

### Education

Thinking about a career in the petroleum industry? To prepare for college, you need to take courses emphasizing math, chemistry and physics. Also take courses that improve communication and management skills, such as English, writing, economics and history.

Careers in petroleum engineering require a Bachelor of Science degree. During a four-year program, early courses focus on math, science and engineering. Later, courses specialize in petroleum engineering topics such as geology, petroleum production, well drilling and reservoir analysis. Petroleum engineers start at an average salary of \$74,000 per year.

### A Career that Makes a Difference

Petroleum engineers find and produce our oil and gas supplies. They fuel our transportation systems and keep



*About 14,000 petroleum engineers work in oil and gas extraction and refining, with a median annual income of \$109,000.*

our industries operating. They keep energy flowing to light and heat our homes. They create thousands of products, from medicines and plastics to textiles and cosmetics. They do all of this while protecting the environment. If you want to make a difference in the world, choose a career in petroleum engineering.

*Summarized from the Bureau of Labor Statistics' Occupational Outlook Handbook. For more information on careers, educational requirements and salaries for petroleum engineers, visit the Society of Petroleum Engineers' website at [www.spe.org](http://www.spe.org).*

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## The NEED Project

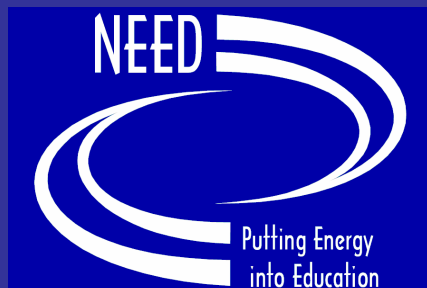
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NEED welcomes your questions, comments, and suggestions. Please contact [info@need.org](mailto:info@need.org).

## Sponsor Spotlight

### NOIA Develops Offshore Oil & Gas

When you think about people working in the oil and natural gas industry, you picture offshore oil rigs and refineries, right? Would you consider a scuba diver, construction worker or banker a person working in the oil and natural gas industry?

A long time NEED sponsor, the National Ocean Industries Association (NOIA), is the only national trade association representing all segments of the offshore industry dedicated to exploring and producing hydrocarbon resources on the nation's Outer Continental Shelf. NOIA's membership includes more than 270 companies engaged in business activities such as:

- design, construction, and management of drilling rigs and platforms
- drilling, production and transmission
- equipment manufacture and supply
- shipping and shipyards
- navigation
- marine and air transportation
- telecommunications
- geophysical surveying
- research and technology
- engineering and consulting services
- professional services such as banking, finance, investment firms, law firms and insurance underwriters
- diving for salvage, safety inspection, photography and pipe/cable installation
- environmental safety

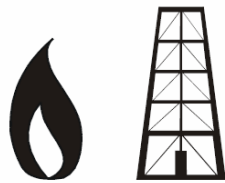
*NOIA's mission is to secure reliable access to the nation's valuable offshore hydrocarbon resources in order that they may be developed, produced and supplied in an environmentally responsible manner.*

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*NOIA President Tom Fry (left), and Director of Public Affairs Michael Kearns (right), discuss careers in the offshore oil and gas industry during NEED's Passport to Energy Careers Fair.*

## What's New in the Petroleum and Natural Gas Industry?



We benefit from oil and natural gas in many ways. From powering our cars and heating our homes to producing plastics and medicine, oil and natural gas support our daily lives. To meet the increasing demand for these resources, the industry continually develops new technologies, which according to NOIA, “rivals the space program in complexity and intensity.” Leading edge offshore technology keeps energy abundant, affordable and efficient.

### Seismic and Visualization Technology

Geologists use **seismic imaging technology** to search for oil and natural gas deposits buried deep in the earth's crust. Did you know that deepwater exploration wells may cost tens of millions of dollars? That's why petroleum companies rely on highly skilled scientists to find new deposits.

Seismic data is gathered by emitting low-frequency sounds into the water and analyzing the reflection of sound waves off of rock formations deep underground. Technicians use computers to create three-dimensional (3-D) images of the subsurface. Geologists analyze these 3-D seismic images to “map” what lies beneath the surface. They can see the height, width and depth of the earth's crust. Scientists can view full-color, 3-D images of the sea floor in visualization theaters that simulate “stepping into” an underground reservoir. 3-D seismic technology improves the success rate of exploratory wells, yielding fewer dry holes, lowering costs, reducing waste and environmental impact.

Scientists are currently developing an emerging technology called **multi-component seismic**, also known as 4-C. Sensors moving across the surface of the water and stationary sensors on the sea floor measure sound waves reflected from subsea rock formations. This process reveals movement of oil and gas within the rock, enabling greater production efficiency.

### Drilling Technology

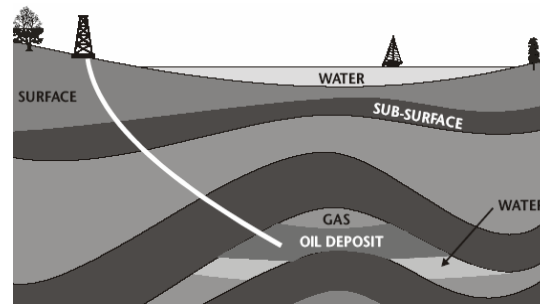
**Extended reach drilling**, also known as **directional drilling**, can drain a reservoir miles away from a drilling rig. Imagine one person in the lunch room able to slurp down everyone else's drinks through one long straw. Drilling horizontally through a reservoir provides 20 times more oil than a vertical well.

**Steerable drilling** enhances extended reach drilling accuracy and makes it possible to drill many side wells

off of a horizontal well. Sensors in the drill bit transmit data on the drill bit's position underground, so that scientists can steer the drill bit toward its target. This very accurate technology can target an area the size of a car located over five miles from the well and over a mile below the surface.

**Expandable tubulars** are currently under development to improve oil flow. The tubulars are inserted into a well and expanded, so that each section of tube is the same diameter. In traditional wells, the tubing becomes narrower as it goes deeper into the earth, until it is so narrow the hydrocarbons can not flow to the surface. Expandable tubulars allow for better production efficiency, lowered costs and less environmental impact.

**Dynamic positioning technology** allows deepwater drill ships to access oil and gas deposits without anchors. Guided by global positioning satellites, rotating propeller systems known as “thrusters” compensate for the effects of wind, waves and current. Today's positioning technology can keep a 200-yard-long, 30-story-high drill ship within 50 feet of a station, well within the tolerance needed for drilling. This technology enables drilling for oil and natural gas in water over 10,000 feet deep.



*Directional drilling collects oil and natural gas deposits from places vertical drilling can't reach.*

### Undersea Vehicle Technology

In water too deep for divers, tethered undersea robots known as **remotely operated vehicles (ROVs)** monitor, maintain and repair pipelines, platforms and wellheads. A skilled operator on the surface uses video cameras to guide the ROVs' robotic arms that can lift 200 pounds, tie a knot in a rope, and use cutting and welding tools.

Now under development are **autonomous underwater vehicles (AUVs)**. AUVs are untethered, and can operate off of fuel cell batteries for up to two days. Hybrid versions are under development too. AUVs are used for mapping, simple repairs and maintenance tasks such as opening and closing valves.

*Information from the National Ocean Industries Association and American Petroleum Institute. For more information about these technologies, visit [www.noia.org](http://www.noia.org) or [www.energyprofessions.org](http://www.energyprofessions.org).*

## Energy Career Chat with Sally Safety\*

**NEED:** Hey Sally, thanks for the tour of the oil rig. What a unique place to work! But I'm not so crazy about swinging from a basket to board the rig. What do you call that thing?

**SS:** That's a Billy Pugh. It's the only way to board the rig when you travel on the crew ship. When you arrive by helicopter, you land right on the deck.

**NEED:** What a strange way to get to work! Explain your energy career to us.

**SS:** I'm a **Safety Engineer**. I work in the Gulf of Mexico. Every day, hundreds of thousands of oil and gas personnel work around highly flammable materials, yet our safety record continues to be one of the best among industries in the U.S. Even the design of a hand-railing on a staircase becomes very important when you're on an offshore platform miles from shore.

Safety engineers work as members of project teams, advising on proper handling of chemicals, conducting safety drills for personnel, and doing other tasks that assure the safety of industry personnel and nearby residents.

**NEED:** Sounds like an important job. Who else works on the rig?



*Offshore oil rigs offer many career opportunities.*

*\*Note: this fictional interview is based on petroleum industry career research.*

**SS:** So many different people work here. Some hold advanced degrees, such as our engineers.

**Drilling Engineers** design and carry out the process of drilling a well as cheaply and safely as possible. **Reservoir Engineers** determine the natural energy sources in a reservoir and estimate the amount of oil or gas that can be recovered, plus the best method of recovering it. **Production Engineers** determine the best way to develop fields using a system of surface equipment that will separate the oil, gas and water, and explore additional technologies to enhance production from old wells. **Well-Log Analysts** take measurements and core samples during and after drilling to evaluate a well's production potential.

Some rig workers begin their careers in entry level positions, such as drillers.

**Rotary Drillers** operate the machinery that controls drilling speed and pressure. **Rotary-Driller Helpers** guide pipes to well openings and connect pipe joints and drill bits. **Rotary-Rig Engine Operators** run the engines that provide the power for drilling and hoisting. **Derrick Operators** work on small platforms high above the rig to help run pipe in and out of well holes and operate pumps that circulate mud.

**NEED:** I heard you live with some roughnecks! What does that mean?

**SS:** A **Roughneck** is a drill deck worker. There are some weird nicknames in this industry. A **Roustabout** does the drilling on an oil rig and a **Blow-Out Specialist** controls the well's pressure and oil flow.

**NEED:** Any other jobs on the rig?

**SS:** To run a rig like this we need lots of different workers. There are **Hospitality Service Providers**, **Cooks**, **Maintenance Workers** and **Boat Captains** ferrying us to shore.

**NEED:** You sure need a lot of different workers to produce oil and natural gas.

**SS:** Anyone who cares about the world's energy resources will like this career path. No matter what your education level or where you live in the country, you have an opportunity to work in the petroleum industry.

**NEED:** One last question, how did you get interested in working in the petroleum industry?

**SS:** Well, I am from Texas, the number one petroleum-producing state!

3. Natural Gas Appliance Repair Technician  
2. Energy Economist  
1. Seismologist

Answers to Career Challenge on page 6:

## Career Choices in the Petroleum and Natural Gas Industry

The petroleum industry offers a wide-range of career choices. Cutting-edge technology makes it possible to recover oil and gas from areas several miles below the surface of our oceans and from remote locations far from existing roads, cities or supplies. The technology and ingenuity that make this industry successful comes from many disciplines working together to produce the energy that powers our world.

**Geophysicists** study the earth's surface and internal composition, ground and surface waters, atmosphere, oceans, and magnetic, electrical and gravitational forces.

**Geologists** study rock formations and use microscopes to examine rock cuttings from new wells. Geologists use data from existing wells to make subsurface maps of reservoir rocks. By matching rock layers between wells, they draw cross sections to find petroleum traps.



*A Global Positioning System (GPS) satellite sends radio signals to Earth, aiding navigation.*

**Photogrammetrists** use aerial photos and Global Positioning System (GPS) technology to make drawings of the earth's surface and subsurface. **Geophysical Prospecting Surveyors** help photogrammetrists develop maps to locate oil and natural gas deposits.

A **Petroleum Landman** handles legal paperwork, obtains permits from government agencies and signs leases with private land owners before drilling can begin. Permits make sure the drilling company restores the land after use. Petroleum landmen deal directly with farmers, ranchers and other surface owners, and may need to research ownership records in government offices.

**Facilities Engineers** design and build all of the buildings and equipment needed to separate, process, and transport oil and natural gas. This includes the surface processing equipment for a field, natural gas processing plants, pipelines and offshore platforms.

**Environmental/Regulatory Specialists** typically work in teams to meet environmental protection laws, such as finding new ways to manage wastes or emissions. They often work closely with government agencies.

**Petroleum Accountants** determine the monetary value of oil and natural gas still in the ground and its worth to the company producing it.

**Chemical Engineers** design and operate processing plants, determine optimum fluids for drilling and keep wells free from contaminants.

**Natural Gas Processing Workers** include **Wellhead Pumpers**, who operate power pumps and auxiliary equipment to produce the flow of oil or natural gas from wells in oil fields. **Gas Treaters** tend automatically controlled treating units that remove water and other impurities from natural gas. **Gas Compressor** and **Gas Pumping Station Operators** operate steam, gas, electric motor or internal combustion engine driven compressors. They transmit, compress or recover gases such as butane, nitrogen, hydrogen and natural gas. **Gas Plant Operators** operate gas liquefying equipment, operate compressors to control gas pressure in transmission pipelines, and coordinate injections and withdrawals at storage fields.

**Maintenance Workers** in large natural gas processing plants include **Welders**, **Electricians**, **Instrument Repairers** and **Laborers**. In contrast, many small plants are automated and are checked at periodic intervals by maintenance workers and operators, or monitored by instruments that alert operators if trouble develops.

**Gas Service Dispatchers** monitor natural gas lines and send out service trucks and crews to take care of emergencies.

**Heating Equipment Technicians** follow blueprints to install heating systems, fuel and water supply lines, air ducts and vents, pumps, connect electrical wiring and check for proper operation. They also perform routine maintenance and repair work to keep furnaces running efficiently.

Oil and gas companies need a range of other occupations as well, such as **Human Resources**, **Public Relations**, **Information Technology**, **Lawyers** and **Administrative Assistants**. Because of their highly technical and well-paid workforce, oil and gas companies provide good opportunities for almost any career choice.

*Information from the Society of Petroleum Engineers, Bureau of Labor Statistics's Occupational Outlook Handbook and National Grid. Visit [www.spe.org](http://www.spe.org), [www.bls.gov.oco](http://www.bls.gov.oco) or [www.ngridsafetyworld.com](http://www.ngridsafetyworld.com) for more information.*

## Career Challenge

**You'll need to do some research to solve the career challenge. Answers are on page 4.**

1. I analyze patterns from sound waves forced through the earth. The way the sound waves bounce back shows rock formations holding oil and natural gas. What's my career?
2. I analyze business conditions, predict the future value and price of oil and natural gas, and determine how much oil and gas we will use in the future. What's my career?
3. I inspect gas appliances and figure out why they don't work. I take appliances apart to look for wear, check electrical systems, and replace or repair defective parts and electronic components. What's my career?

D E R R I C K O P E R A T O R E  
 A N H T L I B R O C P L J K N T  
 C Y P E T R O L E U M B R I V P  
 N T H I W L A G L O B A L C S M  
 L O E O R E X E F H R E N Y D U  
 C G L L E W B O P O P L A L R P  
 V R C D F H I L G I E L T G I S  
 L F U G I C T O P T S Y U L C E  
 E D G D N E N G I N E E R O A R  
 R R Y W E P R I P U R D A B R V  
 R I T G R O R S G R A M L F E O  
 A L O E Y W I T P E P P G E E I  
 B L H O P D E L M N O I A C R K  
 N E P L W C L D E T R P S N A T  
 O R E S E R V O I R E R B C S O  
 T S I R T E M M A R G O T O H P

**Can you find these words above?**

BARREL	NATURAL GAS
CAREER	NOIA
CRUDE OIL	PETROLEUM
DERRICK OPERATOR	PHOTOGRAMMETRIST
DRILLER	PIPELINE
ENGINEER	PUMP
GEOLOGIST	REFINERY
GLOBAL	RESERVOIR
	WELL

## Energy Career Resources

- An interactive learning experience from the American Petroleum Institute is available at [www.adventuresinenergy.org](http://www.adventuresinenergy.org). This website provides an overview of oil and gas formation, uses of cutting-edge technologies and environmental practices to find and develop these resources, and innovative products made from oil and natural gas.
- A resource list of oil and natural gas educational websites is provided by the American Petroleum Institute. Click on "Online Energy Resources" at the website [www.classroom-energy.org](http://www.classroom-energy.org). The website includes interactive quizzes, games and lesson plans.
- Minerals Management Services is dedicated to informing the public about employment opportunities across the country. "ROARS" is their web-based resume and online application referral system. Visit [www.mms.gov/ooc/jobopp.html](http://www.mms.gov/ooc/jobopp.html).
- American Association of Petroleum Geologists [www.aapg.org](http://www.aapg.org)
- American Geologic Institute - [www.agiweb.org](http://www.agiweb.org)
- Bureau of Labor Statistics - [www.bls.gov](http://www.bls.gov)
- Oil Rig Jobs - [www.oil-rig-jobs.com](http://www.oil-rig-jobs.com)
- Society of Petroleum Engineers - [www.spe.org](http://www.spe.org)
- At the Canadian website [www.centreforenergy.com](http://www.centreforenergy.com), click on "Careers in Energy" for descriptions of occupations in the energy industry, including management, professional, technical, sales and service, trades and laborers.
- JETS is dedicated to exciting young people about careers in engineering. The JETS' website, [www.jets.org](http://www.jets.org), includes resources, articles, and activities about engineering and technology careers.
- Pictures of Southern California offshore oil platforms and the gorgeous sea life inhabiting them can be found at <http://diver.net/kathy>. California Artificial Reef Enhancement provides information on artificial reefs on offshore platforms at [www.calreefs.org](http://www.calreefs.org).
- The website <http://papertoys.com/images/rig.pdf> contains a four page template of the Ocean Star, a jack-up oil rig in Galveston, Texas. Enlarge the patterns on a photocopier and cut them out. The finished product is a 3-D jack-up oil rig.

# Teacher's Guide for using *Career Currents*

## BACKGROUND

Teachers and members of the energy industry have recognized a need for comprehensive energy career information aimed at middle school and high school students. Each issue of *Career Currents* will focus on careers in a specific energy source.

## GOALS

- To present students with a broad spectrum of energy careers and corresponding occupations so that students are informed about employment options they have for their future.
- To profile occupations with a wide range of educational requirements and salaries.
- To help students realize that the career they want to pursue several years from now will be affected by their current skills and attitudes about science and math.
- To show the application of energy knowledge in “non-traditional” career paths (e.g. accounting, mathematics, law).

## NATIONAL SCIENCE STANDARDS

Content Standard G: History and Nature of Science  
Science as a Human Endeavor

- Many people choose science as a career and devote their entire lives to studying it. Many people derive great pleasure from doing science. (K-4)
- Women and men of various social and ethnic backgrounds - and with diverse interests, talents, qualities, and motivations - engage in the activities of science, engineering, and related fields such as the health profession. Some scientists work in teams, and some work alone, but all communicate extensively with others. (5-8)
- Individuals and teams have contributed and will continue to contribute to the scientific enterprise. Doing science or engineering can be as simple as an individual conducting field studies or as complex as hundreds of people working on a major scientific question or technological problem. Pursuing science as a career or as a hobby can be both fascinating and intellectually rewarding. (9-12)

## EXTENSION IDEAS

- Survey students at the beginning and end of the school year, ranking the following questions. Compare rankings to analyze how students' attitudes and perceptions have changed over the year.
  1. When you become an adult, what are your top three career choices?
  2. How important is your knowledge of science to your career choices?
  3. How important is getting an education to your career choices?
  4. When do you think you should begin preparing for your future career?
- Have students brainstorm a list of energy careers at the beginning and end of the year. Compare the variety/quantity of answers.
- Using the interview model on page four, divide students into teams of two. Each student chooses (or is assigned) an energy career to research. Students will present the results of their research with a mock interview between the two team members. As the energy professional being interviewed, the students might want to use props related to their career. Use these questions as a guide.
  1. What is your energy career? Describe your typical work day.
  2. What kind of education do you need in this job? Do you have any special degrees or certifications?
  3. What are your working conditions like? Do you work in an office or out in the field?
  4. Where are most people in this career employed?
  5. What is the average salary for this career?
- Have small groups choose a career, research it, and write a skit/play about a day in the life of a person in that career. Gather costumes and props, and perform for younger grades.
- Challenge students to think of people in your community who work in the energy industry and invite them to speak to your students.
- Practice job interviewing skills. To model the actual interview process, invite industry professionals to “interview” students for potential employment with their companies.

Photo credit: Brian Welchko



*Texas produces more oil than any other state. The other top producing states are Alaska, California, Louisiana, and Oklahoma. In all, 31 states produce petroleum.*

## Newsletter Survey

Welcome to *Career Currents*, a new publication by the NEED Project. The goal of this newsletter is to provide educators and students with a resource that introduces them to careers in the energy industry. This issue focuses on careers in the petroleum and natural gas industries.

Please take a moment to let us know what you think. Send your comments to [info@need.org](mailto:info@need.org). Thank you!

- Does this newsletter meet your classroom needs?
- Is this newsletter an effective way to present careers to your students?
- Suggestions for improvement?
- Would you like to receive additional issues of *Career Currents* in the future?

