

Career *currents*

Exploring Today's Energy Careers with the NEED Project

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Career Chat with Dwayne Alley Power Plant Superintendent

Career Currents: Tell us about yourself.

Dwayne Alley: Hi *Career Currents*, my name is Dwayne Alley. I am employed by the U.S. Army Corps of Engineers at the Wolf Creek Dam in Jamestown, Kentucky. I work as the **Power Plant Superintendent** in charge of the operation and maintenance of the plant.

Career Currents: What is a typical day of work like for you?

Dwayne Alley: I am in charge of the operation and maintenance of the plant, which means that I am responsible if something goes wrong. The typical day consists of scheduling unit outages, locating repair parts, placing orders for materials, doing performance ratings for employees, ensuring that generation schedules are met, and whatever else comes along.

Career Currents: What's the most rewarding part of your job?

Dwayne Alley: The most rewarding part of my job is being a part of a team of professionals that takes a natural resource--the water in Lake Cumberland--and converts it into useful energy in the form of electricity.

Career Currents: Why is your career unique?

Dwayne Alley: This career is unique because there are limited opportunities to work in a hydroelectric plant.

Career Currents: What type of training do you have?

Dwayne Alley: My background is in machine shop and welding. I choose to work in the hydropower field because of my interest in mechanics. My training was provided by the Army Corps of Engineers through the Nashville District Hydroelectric Training Program. The program consisted of four years of detailed training in a hydroelectric power plant.

Career Currents: Any advice for students?



Wolf Creek Dam and hydroelectric power plant. Photo Credit: U.S. Army Corps of Engineers Nashville District.

Dwayne Alley: Students interested in the electrical field should study math, both electrical and mechanical physics, as well as all other general subjects.

I have a very interesting job. It has provided a good income and self-satisfaction for me.

Career Currents: Thanks for sharing your career with us, Dwayne.

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

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Sponsor Spotlight: Hydro Research Foundation

First established in 1994, the Hydro Research Foundation, Inc. (HRF) became an independent 501(c)(3) nonprofit corporation in 1996. The foundation has two principal objectives: to facilitate research and to promote educational opportunities that communicate the value of hydropower as a domestic energy source. Research supported by the foundation seeks to advance knowledge about hydroelectric technology, both conventional and wave, hydrokinetic and tidal energy, including efficiency improvements, environmental mitigation and non-power benefits.

Hydropower is an efficient, economical producer of emissions-free, renewable energy and is an important part of our nation's energy mix. Hydropower presently accounts for approximately 10 percent of the electricity supply in the United States. Like any energy generating resource, however, hydropower can have an impact on the environment. The HRF was formed to build support for, and facilitate partnerships among industry, government and others for projects that would preserve and enhance the viability of hydropower as a climate-friendly, renewable and reliable provider of energy. Industry research demonstrates that state of the art technology can significantly mitigate environmental impacts. The HRF believes technological improvements are the best approach to addressing environmental issues associated with this valuable energy resource.

For more information visit: www.hydrofoundation.org or www.eere.energy.gov.

First Woman Engineer, Bertha Lamme Feicht

Although no one knows for sure, **Mechanical Engineer** Bertha Lamme Feicht (1869-1943) probably helped develop the Niagara Falls Power Plant, completed in 1895. A marvel in its day, the plant harnessed the power of the Niagara River and provided electricity to the city of Buffalo, New York, located 26 miles away.

In 1893, Bertha became the first woman to earn an engineering degree in the United States, from The Ohio State University. She went to work for Westinghouse Company doing machine design. Her brother Benjamin also worked for Westinghouse as the Chief Engineer. Together, they worked in a design group that did early research in transmitting electricity. In 1905, Bertha married a colleague, Russell Feicht. Her husband went on to become Director of Engineering for Westinghouse, but Bertha's professional career came to an end with her marriage, as company rules stated they could not work together.

Many suspect that Bertha didn't stop working in engineering, though. She may have influenced her brother and husband with their Westinghouse projects while she did engineering work at home in addition to her role of wife and mother.

Sources: Sybil E. Hatch, *Changing Our World, True Stories of Women Engineers*, American Society of Civil Engineers, c.2006, pgs 130-131, and www.ieee.org/web/aboutus/history_center/biography/lammeb.html.

Right, the American Falls, Bridal Veil Falls, and the Maid of the Mist boat at Niagara Falls. Photo Credit: Wikipedia.org.



Fish Use “Ladders” to Swim Around a Dam

Salmon spawn, or lay their eggs, in fresh water rivers and streams. Young fish migrate downstream to salt water bays where they spend several years growing in the ocean. After reaching maturity, adult salmon swim back upstream to fresh water to spawn.

As young salmon journey down the Lower Columbia River toward the Pacific Ocean, they encounter the Bonneville Lock and Dam, which spans the Columbia River linking Portland, Oregon and Vancouver, Washington. The U.S. Army Corps of Engineers operates and maintains Bonneville Lock and Dam for hydropower production, fish and wildlife protection, recreation and navigation. Since 1938, Bonneville Dam has supplied the region with clean, inexpensive electrical power.



Bonneville Dam. Photo Credit: Brett Hansen.

Laurie Ebner (b. 1957) works for the U.S. Army Corps of Engineers as a **Hydraulic Engineer**. She studies the hydraulics, or flow of water, in the Columbia River. Laurie shares her findings with a team of **Biologists**, and together, they figure out ways to help adult salmon reach upstream spawning grounds, and juvenile salmon swim downstream to the ocean around Bonneville Dam.

As salmon near the dam structure on their downstream journey, underwater screens guide fish away from the dam and into a channel. They re-enter the river just below the dam. The dam also features fish ladders that help salmon and several other kinds of fish get past the dam on their journey upstream to spawn.



One of several fish ladders located at Bonneville Dam on the Columbia River, looking down the approximately 60 1-foot steps of the "ladder." Photo Credit: Eric Guinther.

See fish migrating through the ladder at Bonneville Dam's Oregon Shore counting station by visiting this link: www.nwp.usace.army.mil/op/b/fishcam.asp.

Source: Sybil E. Hatch, Changing Our World, True Stories of Women Engineers, American Society of Civil Engineers, c.2006, pg 61 and www.nwp.usace.army.mil/op/b/home.asp.



Aerial view of the Columbia River and Bonneville Dam. Photo Credit: U.S. Army Corps of Engineers.

According to the U.S. Department of Transportation, it takes more than 100 people to operate and maintain Bonneville Lock and Dam each year. The work force includes **Engineers, Powerhouse and Lock Operators, Office Administrators, Skilled Laborers, Warehouse Workers, Biologists and Park Rangers.**

Source: The America's Byways® website, www.byways.org.

Make a Splash as a Hydrologist

Water is one of our most important natural resources, but its supply is limited by nature. Hydrology, the study of water, has evolved as a science in response to the need to understand the complex water systems of the earth and help solve water problems. Hydrologists provide important data to hydropower plants.

What Do Hydrologists Do?

Hydrologists research the distribution, circulation, and physical properties of underground and surface waters, and study the form and intensity of precipitation, its rate of infiltration into the soil, movement through the earth, and its return to the ocean and atmosphere.

Hydrologists apply scientific knowledge and mathematical principles to solve water-related problems in society--problems of quantity, quality and availability. They may be concerned with finding water supplies for cities and irrigated farms, or controlling river flooding and soil erosion. They may also work in environmental protection--preventing or cleaning up pollution and locating sites for safe disposal of hazardous wastes. The work of hydrologists is as varied as the uses of water and may range from planning multimillion dollar interstate water projects to advising homeowners about backyard drainage problems.

Working Conditions

Entry-level hydrologists spend the majority of their time in the field, while more experienced workers generally devote more time to office or laboratory work. A hydrologist may spend considerable time doing field work in remote and rugged terrain. They often take field trips that involve physical activity, and work in all kinds of weather. In the field, they may collect basic data, oversee testing of water quality, direct field crews and work with equipment. They travel often to meet with prospective clients or investors.



Left, a hydrologic technician drills through ice to measure stream flow. Photo Credit: U.S. Geological Survey.

As part of their work at the office, hydrologists interpret data and perform analyses to determine possible water supplies. Much of their work relies on computers for organizing, summarizing and analyzing masses of data, and for modeling studies to predict flooding,

the consequences of reservoir releases or the effects of leaks from underground oil storage tanks.

Right, a hydrologic technician analyzes a water sample. Photo Credit: U.S. Geological Survey.



Training and Skills

A bachelor's degree is adequate for entry-level positions. Students who plan to become hydrologists should take courses in the physical sciences, geophysics, chemistry, engineering science, soil science, mathematics, computer science, aquatic biology, atmospheric science, geology, oceanography, hydrogeology, and the management or conservation of water resources. In addition, some background in economics, public finance, environmental law, and government policy is needed to communicate with experts in these fields.

Hydrologists need excellent oral and written communication skills. They should work well with people, not only as part of a team with other scientists and engineers, but also in public relations, whether advising government leaders or informing the public on water issues.



Left, a hydrologist prepares a current meter for stream measurement. Photo Credit: U.S. Geological Survey.

Employment, Job Outlook and Earnings

In 2004, hydrologists held about 8,000 jobs, with a median annual income of \$61,510. Demand for hydrologists will be spurred largely by public policy requiring companies and organizations to comply with complex environmental laws and regulations, particularly those regarding ground-water decontamination, clean air, and flood control.

Source: Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2006-07 Edition, Environmental Scientists and Hydrologists, on the internet at www.bls.gov/oco/ocos050.htm, www.careervoyages.com and <http://ga.water.usgs.gov/edu/hydrology.html>.

Dams Offer Recreational Opportunities and Jobs in Public Safety and Entertainment

When Hoover Dam (near Boulder City, Nevada) was built on the Colorado River, it created two huge lakes—Lake Mead and Lake Mohave. Together, they form the Lake Mead Reservoir which offers almost unlimited water-based recreation on a year-round basis, catering to boaters, swimmers, sunbathers, and fishermen.

National Park Rangers working at Lake Mead National Recreation Area (NRA), part of the National Park Service, are responsible for visitors' safety.



*A Ranger patrols the Lake Mead reservoir.
Photo Credit: National Park Service.*

The National Park Service employs over 20,000 individuals. Ranger salaries begin at \$20,908-\$31,680, based on education and experience.

For more information on working as a National Park Ranger, visit www.nps.gov/personnel/index.htm.



Right, Rangers at Lake Mead NRA present educational programs and lead guided hikes. *Photo Credit: National Park Service.*

The Army Corps of Engineers operates Summersville Dam as a flood control project on the Gauley River in West Virginia. The Summersville Reservoir is a center for powerboat recreation during the summer months, but at the end of the season, the Corps must lower the lake 75 feet to make room for the next spring's floods. Water is released from the lake through a 1,555-foot long, 29-foot diameter tunnel.

Thousands of whitewater enthusiasts come to the Gauley every fall season, to paddle what is considered by many to be the one of the best whitewater rivers in the country. Gauley Season begins the first weekend after Labor Day, and continues for six weekends, for a total of 23 release days.



*Kayaker getting some air on the Gauley River.
Photo Credit: National Park Service.*

Dropping more than 668 feet through 28 miles of rugged terrain, the Gauley River's complex stretch of whitewater features more than 100 rapids with a steep gradient, technical runs, an incredible volume of water and huge waves.

In 2001, a two-year project was completed to convert the dam to hydroelectric power generation. The power plant has a capacity to generate 80 MW of electricity and is operated by a subsidiary of Enel North America, Inc., a private-sector power producer.

In addition to the people who work directly with the power plant, dam and reservoir, producing power and maintaining public safety through flood control, the Gauley River provides jobs for the local economy. **Small Business Owners** run specialty sporting goods stores and white water rafting and kayaking expeditions. **Store Managers** and **Salespeople** run these businesses. **Raft Guides** lead groups of rafters and kayakers down the river and **Shuttle Bus/Van Drivers** transport customers to drop-off and pick-up points.



*Summersville Dam and power plant.
Photo Credit: U.S. Army Corps of Engineers.*

Source: www.lrh.usace.army.mil/projects/lakes/sum.

Career Opportunities in the Hydropower Industry

Energy Industry Analysts assess the significance of developments and trends in the energy industry and use this information for current and future regulatory policies. Energy industry analysts require a degree in finance, management or other business, industrial, mechanical or other engineering field.

Accountants establish accounting policy, providing guidance to energy companies for reporting issues. **Auditors** review financial information about energy companies to ensure that they are in compliance with government regulations. Accountants and Auditors require a bachelor's degree in accounting.

Economists closely follow and analyze trends in the various energy industries to make sure a healthy competitive market is in place. They consult with experts in energy economics, market design, anti-trust and other issues, and use economic theory on real-world problems and situations. Economists require a bachelor's degree in economics.

Administrators provide general office clerical support to professional, program, or technical staff members utilizing typing skills and a knowledge of office automation hardware and software systems. Administrative support staff may be responsible for timekeeping, government procedures and other personnel matters.

Communications Professionals must possess excellent writing and speaking skills, a customer service attitude and the ability to respond quickly in a dynamic environment. Communications professionals require a bachelor's degree in communications or English.

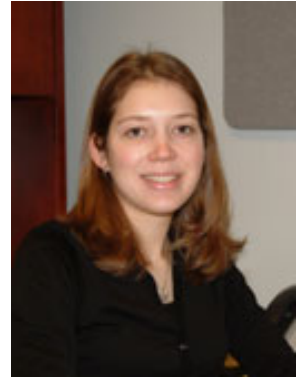
Civil Engineers make site visits, prepare engineering studies, and design or evaluate various types of hydroelectric dams, powerhouses, and other project structures. They develop graphs, charts, tables, and statistical curves relating to these studies for inclusion in environmental impact statements and assessments and dam safety reports. Civil engineers require a bachelor's degree in engineering.

Environmental Engineers of proposed hydroelectric projects review environmental reports and exhibits. A main component of the job is to study aspects of environmental impact issues, determine the scope of the problem, and propose recommendations to protect the environment. They perform studies to determine the potential impact of changes on the environment. Environmental engineers require a bachelor's degree in engineering.

Environmental Biologist, Brittany Schoenen, started working for the Federal Energy Regulatory Commission's

Office of Energy Projects in 2003 after graduating with a bachelor's degree in Environmental Resource Management from Penn State University.

Brittany says, "I ensure that hydropower project owners are meeting the requirements of their licenses in the areas of recreation and environmental compliance. This includes reviewing recreation plans and monitoring reports, as well as amendments to project licenses. Travel to projects is sometimes necessary. I've also been working on developing GIS maps of FERC hydropower projects in various states.



"I joined the Federal Government because I wanted a stable work environment that would allow me to advance in a short amount of time. I like working in DC because it's a very energetic city that always has events going on. Besides the cultural and educational opportunities of the city, the nightlife and restaurants provide a good time."

Electrical Engineers design and develop electrical systems and equipment, evaluate electrical systems, and ensure stability and reliability. Electrical engineers require a bachelor's degree in engineering.

Information Technology Specialists do systems programming, off-the-shelf software management, database administration, network and telecommunications operations/administration, security implementation, disaster recovery, electronic filing, and customer service support. Information Technology specialists require a bachelor's degree in Information Technology.



*An IT worker in a network room.
Photo Credit: careervoyages.gov.*

Hydropower Engineers work with interdisciplinary teams of environmental scientists and engineers, to review, analyze, and resolve engineering and environmental issues associated with proposals to construct and operate hydroelectric projects, including major dams, reservoirs and

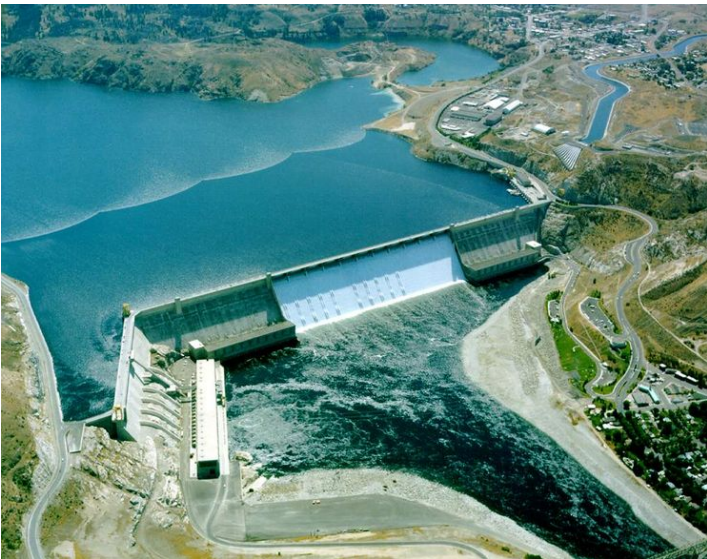
power plants. Hydropower engineers require a bachelor's degree in engineering.

Power Plant Operators control machinery that makes electric power. They control and monitor boilers, turbines, and generators and adjust controls to distribute power demands among the generators. They also monitor the instruments that regulate the flow of electricity from the plant. When power needs change, they start or stop the generators, and connect or disconnect them from the circuits. Many operators use computers to keep records of switching operations, to track the loads on generators and lines, and to prepare reports of unusual incidents, malfunctions or repairs that occur during their shift.

Power Distributors and **Dispatchers** operate equipment that controls the flow of electricity from a power plant through transmission lines to substations that supply customers' needs. They operate converters, transformers, and circuit breakers. Dispatchers monitor the equipment and record readings at a pilot board--a map of the transmission grid system. It shows the status of circuits and connections with substations and industrial plants.

Dispatchers also anticipate power needs, such as those caused by changes in the weather. They call control room operators to start or stop boilers and generators. They also handle emergencies such as line failures and route electricity around the affected areas. In addition, dispatchers operate and monitor the equipment in substations. They step up or step down voltage and operate switchboard levers, which control the flow of power in and out of the substations.

Source: www.ferc.gov/industries/hydropower.asp.



Grand Coulee Dam, a hydroelectric gravity dam on the Columbia River in Washington, is the largest electric power producing facility and the largest concrete structure in the U.S. Photo Credit: U.S. Bureau of Reclamation.

Hydropower Resources and Career Information

- The National Hydropower Association's website, www.hydro.org covers basic information (see Fact Sheets under Hydro Facts) about hydropower in all of its forms, both conventional and new technologies, as well as hydropower issues as they relate to legislative and regulatory issues. The website also includes many links to other hydropower resources and is a great place to start for everything that is hydro.
- On The Hydro Research Foundation's website, www.hydrofoundation.org, learn about hydropower as a renewable energy resource, and take a Hydro Venture, an excellent resource that explores all aspects of hydropower using real life photos.
- On the Federal Energy Regulatory Commission's website, visit the Students' Corner at www.ferc.gov/students/index, to learn more about hydropower. This website includes games, photos of dams and hydropower plants, and a resource section for teachers.
- On the Foundation for Water and Energy Education website, www.fwee.org, watch a video of hydroelectric power production, take a virtual tour of a hydroelectric plant and a generator, and learn how a hydroelectric project can affect a river.
- At www.pbs.org/wgbh/buildingbig/dam/index.html, the PBS Building Big website, there is a section on dams. After learning about the different types of dams, take the dam challenge. As a consulting dam engineer, you decide whether to repair, take down, or leave alone several different dams.
- The Bureau of Land Reclamation's website, www.usbr.gov/lc/hooverdam/index, explores the Hoover Dam. Learn how the dam was built, view construction era photographs, and learn how the dam operates as one of the largest hydroelectric power plants in the country. The site includes educational resources for teachers.
- [Careervoyages.gov](http://careervoyages.gov) offers two great resources:
 - Watch "In Demand Occupation Videos" at www.careervoyages.gov/careervideos-main.cfm. This website features short videos for occupations found in the Bureau of Labor Statistics' Occupational Outlook Handbook. This is an excellent place to see careers in action.
 - Click on "InDemand Magazine" to view or download several magazines with an introduction to the different career paths in construction, energy, advanced manufacturing, and health care and the young professionals who have chosen those careers.

MAGIC Robot Inspects Power Generators On-Site

Routine maintenance of a power plant includes inspecting generators for wear and damage. Thanks to a robot invented and patented by GE Power Systems, the power generation industry can inspect its generators on site, a faster, low cost alternative to traditional “field out” inspections of the past, in which the generators had to be physically removed from their placements to be inspected.

When a person can not fit inside a generator for a visual inspection, a company can send a robot with a remote access camera. A trained specialist uses GE’s Miniature Air Gap Inspection Crawler, known as MAGIC, to visually inspect inside a generator. The robot is a precision crawler carrying two high resolution video cameras. It crawls through the gap between the stator core and field. The remote access camera performs visual inspections of normally inaccessible areas of the generator. The high resolution video provides the specialist with a clear view of all the working parts of the generator, so he or she can complete the inspection.

Source: www.gepower.com/prod_serv/serv_for/generators/en/downloads/gen_insitu_inspect.pdf



*Generators at Hoover Power Plant.
Photo Credit: Bureau of Reclamation.*

