

SIGNIFICANT POINTS

- Persons with college training in advanced technology will have the best opportunities.
- Employment in water and sewage systems is projected to grow, while other segments of the industry are projected to decline.
- Because the utilities industry consists of many different companies and products, skills developed in one segment of the industry may not be transferable to other segments.
- Production workers' earnings are significantly higher than in most other industries.

Nature of the Industry

The simple act of walking into a restroom, turning on the light, and washing your hands, uses the products of perhaps four different utilities. Electricity powers the light, water supply systems provide water for washing, wastewater treatment plants treat the sewage, and natural gas or electricity heats the water. Some government establishments do the same work and employ a significant number of workers; however, information about them is not included in this statement. Information concerning government employment in utilities is included in the *Career Guide to Industries* statements on Federal Government and State and local government, except education and health. Each of the various segments within the utilities sector is distinctly different.

Electric power generation, transmission, and distribution. This segment includes firms engaged in the generation, transmission, and distribution of electric power. Electric plants harness highly pressurized steam or some force of nature to spin the blades of a turbine, which is attached to an electric generator. Coal is by far the dominant fuel used to generate steam in electric power plants, followed by nuclear power, natural gas, petroleum, and other energy sources. Hydroelectric generators are powered by the release of the tremendous pressure of water existing at the bottom of a dam or near a waterfall. Scientists also are conducting considerable research into renewable sources of electric power—geothermal, wind, and solar energy.

Legislative changes and industry competition have created new classes of firms that generate and sell electricity. Some industrial plants have their own electricity generating facilities, capable of producing more power than they require. Those that sell their excess power to utilities or to other industrial plants are called nonutility generators (NUGs). A type of NUG, termed an independent power producer, is an electricity generating plant designed to take advantage of both industry deregulation and the latest generating technology to compete directly with utilities for industrial and other wholesale customers.

Transmission or high voltage lines supported by huge towers connect generating plants with industrial customers and substations. At substations, the electricity's voltage is reduced and made available for household and small business use via distribution lines, which usually are carried by telephone poles.

Natural gas distribution. Natural gas, a clear odorless gas, is found underground, often near or associated with crude oil reserves. Exploration and extraction of natural gas is part of the oil and gas extraction industry, covered elsewhere in the *Career Guide to Industries*. Once found and brought to the surface, it is transported throughout the United States, Canada, and Mexico by gas transmission companies using pressurized pipelines. Local distribution companies take natural gas from the pipeline, depressurize it, add its odor, and operate the system that delivers the gas from transmission pipelines to industrial, residential, and commercial customers. Industrial customers, such as chemical and paper manufacturing firms, account for nearly half of natural gas consumption. Residential customers who use gas for heating and cooking, electric utilities, and commercial businesses—such as hospitals and restaurants—account for most of the remaining consumption.

Water, sewage, and other systems. Water utilities provide about 100 gallons of fresh, treated water every day for each person in this country, or close to 40 billion gallons per day nationwide. Water is collected from various sources such as rivers, lakes, and wells. After collection, water is filtered, treated, and sold for residential, industrial, agricultural, commercial, and public use. Depending on the population served by the water system, the utility may be a small plant in a rural area that requires the occasional monitoring of a single operator or a huge system of reservoirs, dams, pipelines, and treatment plants, requiring the coordinated efforts of hundreds of people. Sewage treatment facilities operate sewer systems or plants that collect, treat, and dispose of waste from homes and industries. Other utilities include steam and air-conditioning supply utilities, which produce and sell steam, heated air, and cooled air.

Utilities and the services they provide are so vital to everyday life that they are considered “public goods” and are typically heavily regulated. Formerly, utility companies operated as “regulated monopolies,” meaning that in return for having no competition, they were subject to control by public utility commissions that ensured utilities acted in the public interest and regulated the rates they were allowed to charge. However, legislative changes in recent years have established and promoted competition in the utilities industry. The electric utilities industry, for

example, is currently restructuring in an effort to promote efficiency, lower costs to customers, and provide users with an increased number of service options.

Many utility companies are municipally owned. For example, of the roughly 2,000 gas distribution companies in the United States, about 1,000 are municipally owned. In general, utilities serving large cities have sufficient numbers of customers to justify the large expenditures necessary for building plants, and are operated by private, investor-owned companies. In rural areas, where the small number of customers in need of services would not provide an adequate return for private investors, the State or local government funds the plant construction and operates the utility.

The various segments of the utilities industry vary in the degree to which their workers are involved in production activities, administration and management, or research and development. Industries such as water supply that employ relatively few workers employ more production workers and plant operators. On the other hand, electric utilities generally operate larger plants using very expensive, high technology equipment, and thus employ more professional and technical personnel.

A unique feature of the utilities industry is that urban areas with many inhabitants generally have relatively few utility companies. For instance, there were about 53,400 community water systems in the United States in 2002 serving almost 268 million people. The 45,000 small water systems served only 25 million people while the 8,400 largest systems served more than 242 million. Alaska, with a 2002 population about 10 percent of that of Massachusetts, had about 3 times more electric generating plants than Massachusetts. These examples show that economies of scale in the utilities industry allow one or two large companies to serve large numbers of customers in metropolitan areas more efficiently than many smaller companies. In fact, some utility companies, predominately serving large metropolitan areas, offer more than one utility to their customers.

Unlike most industries, the utilities industry imports and exports only a small portion of its product. In the natural gas industry, for example, this reflects the fact that the country has a sizable, proven resource base that can be used economically to meet the country's needs. This is the result of a National policy that utilities should be self-sufficient, without dependence on imports for the basic services our country requires. However, easing trade restrictions, increased pipeline capacity, and shipping natural gas in liquefied form have made importing and exporting natural gas more economical. In 2002, about 18 percent of the natural gas consumed was imported, mostly from Canada. A small portion of natural gas is exported in liquefied form, primarily to Japan.

Working Conditions

Electricity, gas, and water are produced and used continuously throughout each day. As a result, split, weekend, and night shifts are common for utility workers. The average workweek for production workers in utilities was 40.9 hours in 2002, compared with 33.6 hours for all trade, transportation, and utilities indus-

tries, and 33.9 hours for all private industries. Employees often must work overtime to accommodate peaks in demand and to repair damage caused by storms, cold weather, accidents, and other occurrences. The industry employs relatively few part-time workers.

The hazards of working with electricity, natural gas, treatment chemicals, and wastes can be substantial, but generally are avoided by following rigorous safety procedures. Protective gear such as rubber gloves with long sleeves, nonsparking maintenance equipment, and body suits with breathing devices designed to filter out any harmful fumes are mandatory for work in dangerous environs. Employees also undergo extensive training on working with hazardous materials and utility company safety measures.

In 2002, the utilities industry reported 5.0 cases of work-related injury or illness per 100 full-time workers, compared with an average of 5.3 cases for all private industries, and 7.2 cases for manufacturing industries.

Employment

Utilities employed about 600,000 workers in 2002. Electric power generation, transmission, and distribution provided almost 3 in 4 jobs, as shown in table 1.

Table 1. Distribution of wage and salary employment in nongovernment utilities, 2002
(Employment in thousands)

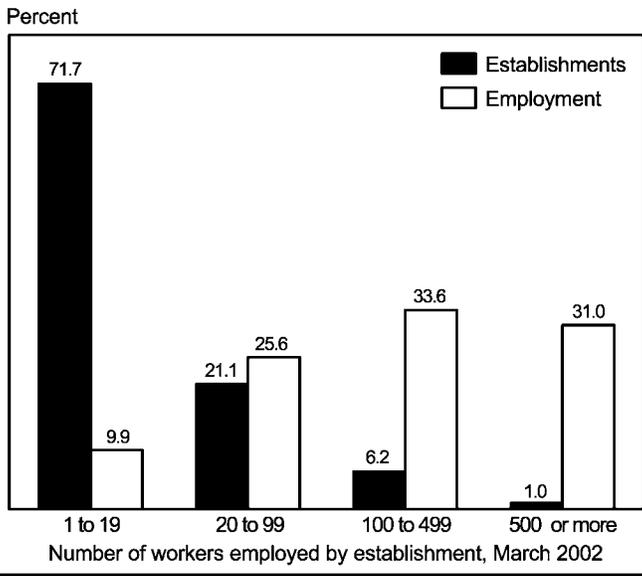
Industry	Employment	Percent
Total, all utilities	600	100.0
Electric power generation, transmission, and distribution	436	72.6
Natural gas distribution	116	19.3
Water, sewage, and other systems	48	8.1

The diversity of production processes in the utilities industry was reflected in the size of the establishments that made up the industry. For example, the electric power and natural gas distribution sectors consisted of relatively large plants. In 2002, electric power generation, transmission, and distribution plants employed an average of about 55 workers per establishment. On the other hand, the water, sewage, and other systems sector employed an average of only 8 workers per establishment (table 2).

Table 2. Nongovernment establishments in utilities and average employment per establishment, 2002

Industry	Number of establishments	Employment per establishment
Total, all utilities	16,400	36
Electric power generation, transmission, and distribution	7,800	55
Natural gas distribution	2,900	39
Water, sewage, and other systems	5,600	8

Most utilities jobs are in establishments employing 100 or more workers



Although many establishments are small, most utilities jobs were in establishments with 100 or more workers (see chart).

Occupations in the Industry

About 227,000 jobs—almost 38 percent of all wage and salary jobs in the utilities industry—were in production or installation, maintenance, and repair occupations (table 3). About 23 percent of jobs were in office and administrative support occupations; almost 14 percent were in professional and related occupations; and about 13 percent were in management, business, and financial occupations. The remaining jobs were in construction, transportation, sales, and service occupations.

Workers in production and installation, maintenance, and repair occupations install and maintain pipelines and powerlines, operate and fix plant machinery, and monitor treatment processes. For example, *electrical powerline installers and repairers* install and repair cables or wires used in electrical power or distribution systems. They install insulators, wooden poles, and light-duty or heavy-duty transmission towers. *First-line supervisors and managers* directly supervise and coordinate the activities of production and repair workers. These supervisors ensure that workers use and maintain equipment and materials properly and efficiently to maximize productivity.

Production occupations include *power plant operators*, *power distributors and dispatchers*, and *water and liquid waste treatment plant operators*. *Power plant operators* control or operate machinery, such as stream-driven turbine generators, to generate electric power, often using control boards or semi-automatic equipment. *Power distributors and dispatchers* coordinate, regulate, or distribute electricity or steam in generating stations, over transmission lines to substations, and over electric power lines. *Water and liquid waste treatment plant and system operators* control the process of treating water or wastewater, take samples

of water for testing, and may perform maintenance of treatment plants.

Industrial machinery mechanics install, repair, and maintain machinery in power generating stations, gas plants, and water treatment plants. They repair and maintain the mechanical components of generators, waterwheels, water-inlet controls, and piping in generating stations; steam boilers, condensers, pumps, compressors, and similar equipment in gas manufacturing plants; and equipment used to process and distribute water for public and industrial uses.

General maintenance and repair workers perform work involving a variety of maintenance skills to keep machines, mechanical equipment, and the structure of an establishment in repair. Generally found in small establishments, these workers have duties that may involve pipefitting, boilermaking, electrical work, carpentry, welding, and installing new equipment.

Office and administrative support occupations account for about a quarter of jobs in the utilities industry. *Customer service representatives* interview applicants for water, gas, and electric service. They talk with customers by phone or in person and receive orders for installation, turn-on, discontinuance, or change in service. *General office clerks* may do bookkeeping, typing, stenography, office machine operation, and filing. *Utilities meter readers* read electric, gas, water, or steam consumption meters visually or remotely using radio transmitters and record the volume used by residential and industrial customers. Financial clerks, such as *bookkeeping, accounting, and auditing clerks*, compute, classify, and record numerical data to keep financial records complete. They perform any combination of routine calculating, posting, and verifying duties to obtain primary financial data for use in maintaining accounting records.

Professional and related occupations in this industry include *engineers* and *computer specialists*. *Engineers* develop technologies that allow, for example, utilities to produce and transmit gas and electricity more efficiently and water more cleanly. They also may develop improved methods of landfill or wastewater treatment operations in order to maintain compliance with government regulations. *Computer specialists* develop computer systems to automate utility processes; provide plant simulators for operator training; and improve operator decision making. *Engineering technicians* assist engineers in research activities and may conduct some research independently.

Managers and administrators in the utilities industry plan, organize, direct, and coordinate management activities. They often are responsible for maintaining an adequate supply of electricity, gas, water, steam, or sanitation service.

Training and Advancement

Utilities provide career opportunities for persons with varying levels of experience and education. However, because the utilities industry consists of many different companies and products, skills developed in one segment of the industry may not be transferable to other segments.

High school graduates qualify for most entry-level production jobs. Production workers may start as laborers or in other unskilled jobs and, by going through an apprenticeship program and gaining on-the-job experience, advance into better-paying positions that require greater skills or have greater responsibil-

Table 3. Employment of wage and salary workers in utilities by occupation, 2002 and projected change, 2002-12
(Employment in thousands)

Occupation	Employment, 2002		Percent change, 2002-12
	Number	Percent	
All occupations	600	100.0	-5.7
Management, business, and financial occupations	79	13.2	-3.4
Top executives	13	2.2	-0.1
Engineering managers	4	0.7	-4.4
Accountants and auditors	8	1.4	-4.9
Professional and related occupations	83	13.9	-4.9
Computer specialists	17	2.8	-1.0
Electrical and electronics engineers	9	1.4	-10.9
Nuclear engineers	7	1.2	-9.0
Electrical and electronic engineering technicians	8	1.3	-6.4
Nuclear technicians	3	0.5	-15.0
Service occupations	8	1.3	-7.8
Sales and related occupations	9	1.5	-9.4
Office and administrative support occupations	139	23.2	-15.7
Bookkeeping, accounting, and auditing clerks	7	1.2	-12.6
Customer service representatives	37	6.1	-7.1
Meter readers, utilities	23	3.8	-22.3
Secretaries and administrative assistants	16	2.7	-17.6
Office clerks, general	13	2.2	-15.0
Construction and extraction occupations	40	6.6	0.9
Electricians	10	1.6	3.8
Plumbers, pipefitters, and steamfitters	11	1.8	-1.4
Installation, maintenance, and repair occupations	153	25.6	-4.8
First-line supervisors/managers of mechanics, installers, and repairers	16	2.7	-4.6
Electrical and electronics repairers, powerhouse, substation, and relay	14	2.3	-6.1
Control and valve installers and repairers, except mechanical door	18	3.0	-1.4
Industrial machinery mechanics	10	1.6	1.8
Maintenance and repair workers, general	11	1.8	2.0
Electrical power-line installers and repairers	55	9.2	-6.2
Production occupations	74	12.3	4.9
First-line supervisors/managers of production and operating workers	12	2.0	-0.7
Nuclear power reactor operators	3	0.5	-5.4
Power distributors and dispatchers	5	0.9	-5.9
Power plant operators	22	3.6	-5.4
Water and liquid waste treatment plant and system operators	9	1.5	67.8
Gas plant operators	5	0.8	8.3
Transportation and material moving occupations	14	2.3	-8.0
Laborers and freight, stock, and material movers, hand	3	0.5	-17

NOTE: May not add to totals due to omission of occupations with small employment.

ity. Substantial advancement is possible even within a single occupation. For example, power plant operators may move up through several levels of responsibility until they reach the highest-paying operator jobs. Advancement in production occupations generally requires mastery of advanced skills on the job, usually with some formal training provided by the employer or through additional vocational training at a 2-year technical college. Additional formal education from an outside source is sometimes needed.

Most computer, engineering, and technician jobs require technical education after high school, although opportunities exist for persons with degrees ranging from an associate degree to a doctorate. These workers are usually familiar with company objectives and production methods which, combined with college education, equip them with many of the tools necessary for advancement to management positions. Graduates of 2-year technical institutes usually fill technician positions. Sometimes, graduates of engineering programs will start as technicians until an opportunity to advance into an engineering position arises.

Managerial jobs generally require a 4-year college degree, although a 2-year technical degree may be sufficient in smaller plants. Managers usually can advance into higher-level management jobs without additional formal training outside the workplace. Competition is expected to be keen for management positions, as industry restructuring is forcing utility companies to shed excess layers of management to improve productivity and competitiveness in the new deregulated environment.

Earnings

Overall, production workers in the utilities industry had average weekly earnings of \$978 in 2002. Earnings varied by industry segment within utilities (table 4). Average weekly earnings for production workers were highest in natural gas distribution (\$1,009) and electric power generation, transmission, and distribution (\$1,000); and lowest in water, sewage, and other systems (\$689).

Table 4. Average earnings and hours of production workers in nongovernment utilities by industry segment, 2002

Industry segment	Earnings		Weekly hours
	Weekly	Hourly	
Total, private industry	\$506	\$14.95	33.9
Nongovernment utilities	978	23.94	40.9
Natural gas distribution	1,009	23.58	42.8
Electric power generation, transmission, and distribution	1,000	24.56	40.7
Water, sewage, and other systems	689	18.67	36.9

Earnings in utilities were generally higher than earnings in other industries. The hourly earnings for production workers in utilities averaged \$23.94 in 2002, compared with \$14.95 in all private industry. This was due in part to more overtime and weekend work—as utility plant operations must be monitored 24 hours a day—which commands higher hourly rates. Earnings in selected occupations in utilities appear in table 5.

In 2002, almost a third of workers in utilities were union members or covered by union contracts, more than double the proportion for all industries.

Table 5. Median hourly earnings of the largest occupations in utilities, 2002

Occupation	Utilities	All industries
General and operations managers	\$41.58	\$32.80
First-line supervisors/managers of production and operating workers	34.01	20.64
First-line supervisors/managers of mechanics, installers, and repairers	31.45	22.87
Electrical and electronics repairers, powerhouse, substation, and relay	25.66	24.85
Power plant operators	25.20	24.00
Electrical power-line installers and repairers ..	24.98	23.33
Control and valve installers and repairers, except mechanical door	24.41	20.90
Customer service representatives	17.07	12.62
Meter readers, utilities	16.06	13.86
Office clerks, general	15.77	10.71

Outlook

Wage and salary employment in utilities is expected to decline 6 percent between 2002 and 2012, compared with an increase of about 16 percent for all industries combined. Projected employment change varies by industry segment, as shown in table 6. Although electric power and natural gas are essential to everyday life, employment declines will result from improved production methods and technology, energy conservation by consumers and more efficient appliances, and a more competitive regulatory environment.

Table 6. Projected employment growth in nongovernment utilities by industry segment, 2002-12

Industry segment	Percent change
Total, all nongovernment utilities	-5.7
Electric power generation, transmission, and distribution	-7.1
Natural gas distribution	-22.4
Water, sewage, and other systems	46.4

Reorganization of electric and gas utilities has increased competition and provided incentives for improved efficiency. For example, nonutility generators of electricity, such as a major industrial plant operating its own power generators, are permitted to sell their excess electricity to utilities at competitive rates. Also, independent power producers can build electric power generating plants for the sole purpose of selling their power to utilities. These producers generally build gas-turbine generating plants, which have lower construction and environmental costs, employ fewer workers, and usually can sell electric power more cheaply than the coal-powered steam-turbine generator plants.

In the gas transmission and distribution industry, regulatory changes now allow wholesale buyers to purchase gas at competitive rates from any producer and to use the gas pipeline transmission network to transport the gas. This process also is occurring at the distribution level. These changes have caused an increase in gas and electric utility mergers, workforce reductions, and the redesign and reallocation of job duties in a process that will continue through the 2002-12 projection period.

New and continuing energy policies also provide investment tax credits for research and development of renewable sources of energy and ways to improve the efficiency of equipment used in electric utilities. As a result, electric utilities will continue to increase the productivity of their plants and workers, resulting in a slowdown in employment opportunities. However, highly trained technical personnel with the education and experience to take advantage of new developments in electric utilities should face good prospects for employment.

In the water and sewage systems industries, regulatory changes have had the opposite impact. Regulations in these industries have not been designed to increase competition, but to increase the number of contaminants that must be monitored and treated and to tighten the environmental impact standards of these industries, resulting in increased employment.

Water and sewage systems services are projected to be the only growing segment of utilities, with employment projected to increase 46 percent from 2002 to 2012. This segment is expected to grow as a result of an increase in the amount of waste generated from a growing population. Also, newly constructed housing developments are more likely to have community water supplies and waste treatment facilities, increasing demand for these services.

Technology and automation will adversely affect natural gas distribution utilities employment. Although natural gas is an increasingly popular choice among homeowners, businesses, and electric utilities, the efficiency of natural gas furnaces has increased considerably, thereby reducing average home consumption. These energy-conserving technologies will likely continue to minimize the relative use of natural gas by most industries and by individual homes. In addition, utilities in colder climates have increasingly automated their meter reading and billing procedures. Combined, these developments are projected to result in a decrease in employment in natural gas distribution services.

In general, persons with college training in advanced technology will have the best opportunities in utilities industries. Computer systems analysts and network systems and data communications analysts are expected to be among the fastest growing occupations in the professional and related occupations group, as plants emphasize automation and productivity. Some office and administrative support workers, such as utilities meter readers and bookkeeping, accounting, and auditing clerks, are among those affected by increasing automation. Technologies including radio-transmitted meter reading and computerized billing procedures are expected to decrease employment.

Sources of Additional Information

General information on the utilities industry and employment opportunities is available from local utilities and from:

- American Water Works Association, 6666 West Quincy, Denver, CO 80235. Internet: <http://www.awwa.org>
- International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, DC 20005.
- American Public Gas Association, 11094-D Lee Hwy., Suite 102, Fairfax, VA 22030. Internet: <http://www.apga.org>

- American Public Power Association, 2301 M St. NW., Washington, DC 20037-1484.
Internet: <http://www.appanet.org>

Detailed information on many key occupations in the utilities industry, including the following, may be found in the 2004-05 edition of the *Occupational Outlook Handbook*.

- Computer systems analysts, database administrators, and computer scientists
- Construction laborers
- Electrical and electronics engineers, except computer
- Engineering technicians
- Industrial machinery installation, repair, and maintenance workers, except millwrights
- Line installers and repairers
- Nuclear engineers
- Power plant operators, distributors, and dispatchers
- Stationary engineers and boiler operators
- Water and liquid waste treatment plant and system operators