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ABSTRACT

Focusing on public utilities occupations, this document is one in a series of forty-one reprints from the Occupational Outlook Handbook providing current information and employment projections for individual occupations and industries through 1985. The specific occupations covered in this document include occupations in the electric power industry, power plant workers, transmission and distribution occupations, customer service occupations, and occupations in the telephone industry (telephone crafts occupations, central office equipment installers, line installers, cable splicers, telephone and PBX installers/repairers, and telephone operators). The following information is presented for each occupation or occupational area: a code number referenced to the Dictionary of Occupational Titles; a description of the nature of the work; places of employment; training, other qualifications, and advancement; employment outlook; earnings and working conditions; and sources of additional information. In addition to the forty-one reprints covering individual occupations or occupational areas (CE 017 757-797), a companion document (CE 017 756) presents employment projections for the total labor market and discusses the relationship between job prospects and education. (BM).

Public Utilities Occupations

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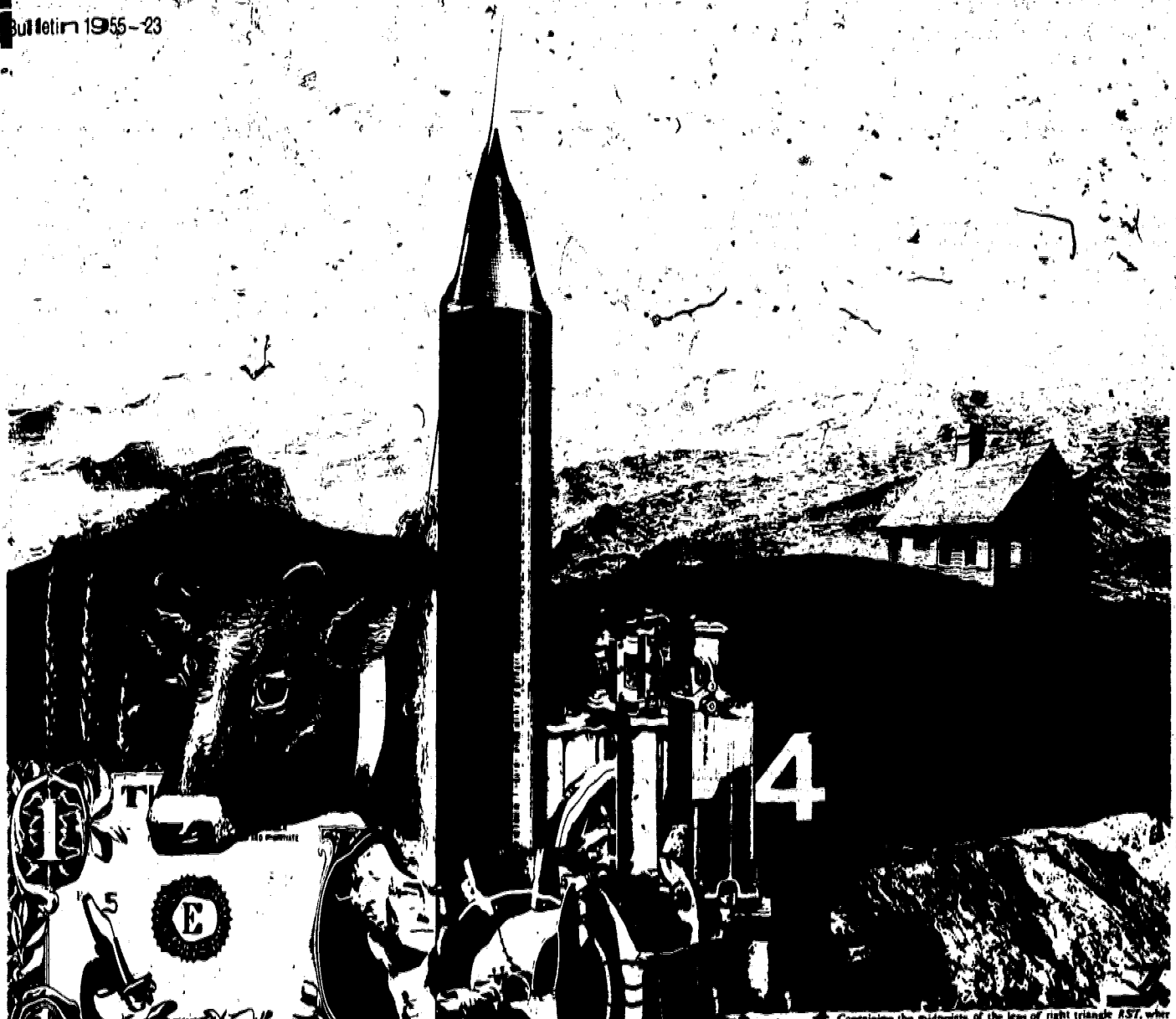


Containing the midpoints of the legs of right triangle *RST*, wher pt. $(-3, 5)$, S is pt. $(1, 1)$, and T is pt. $(3, 4)$.

Containing the longer diagonal of a quadrilateral whose vertic pts. $(2, 2)$, $(-2, -2)$, $(1, -1)$, and $(6, 4)$.

Show that the equations $y - 1 = \frac{1}{2}(x + 3)$ and $y - 4 = \frac{1}{2}(x$ are equivalent.

An equation of the line containing pts. $(-2, 3)$ and $(4, -1)$ c written in the form $y - 3 = -\frac{2}{3}(x + 2)$ or in the $y + 1 = -\frac{2}{3}(x - 4)$, depending upon which point you take (x_1, y_1). Show that the two equations are equivalent.

Show that the equations are equivalent.

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) \qquad y - y_2 = \frac{y_1 - y_2}{x_1 - x_2}(x - x$$

State the equation of a line through pt. (p, q) and parallel to containing pts. (a, b) and (c, d) $(a \neq c)$.

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Electricity has become so much a part of our daily lives that most people take it for granted. But just imagine not being able to ride the elevator to your apartment and instead having to walk up all those flights of stairs. Or think about having no lights, television set, or radio in your home. Today, it would be difficult to get used to living without electricity.

Bringing electricity into our homes and places of work and recreation is not as simple as just turning on a switch. There are thousands of employees working in the electric power industry to make all this possible.

Nature and Location of the Industry

The delivery of electricity to users at the instant they need it is the unique feature of the electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase the use of electric power at any time by merely flicking a switch, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

An electric utility system includes powerplants that generate electric power, substations that increase or decrease the voltage of the power, and vast networks of transmission and distribution lines. Electric utilities range from large systems serving broad regional areas to small power companies serving individual communities. Most electric utilities are investor-owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. While some utilities generate, transmit, and distribute only electricity, others distribute both electricity and gas. This chapter is concerned with employment relating only to the production and distribution of electric power.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to the users.

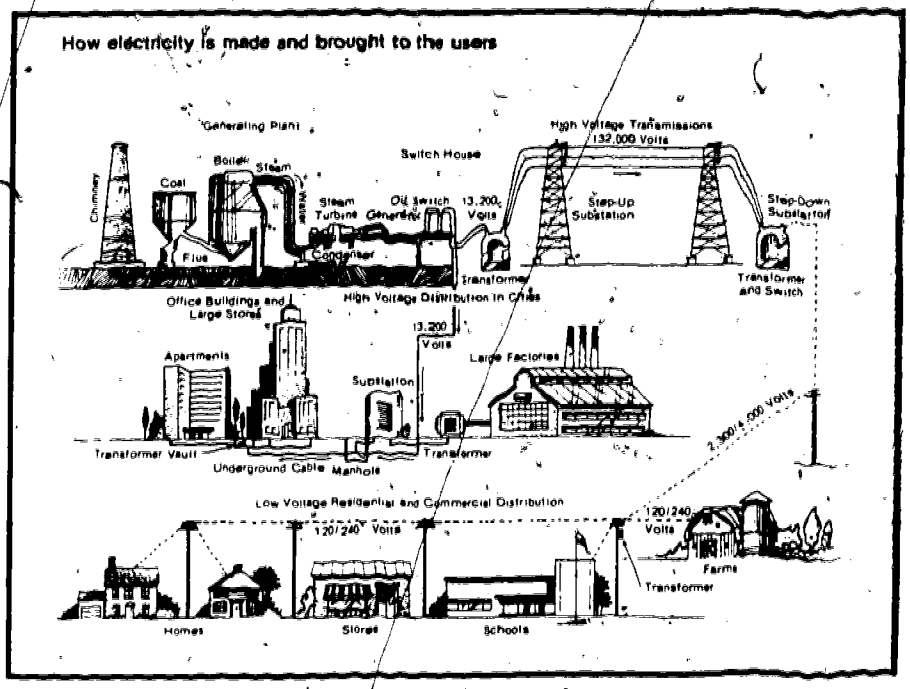
The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants that use coal, gas, oil, or nuclear energy for fuel. In addition, a considerable amount of electricity is produced in hydroelectric generating stations that use water power to operate the turbines. Still other generators, primarily for use in standby service or to provide electricity for special purposes, are powered by diesel engines or gas turbines.

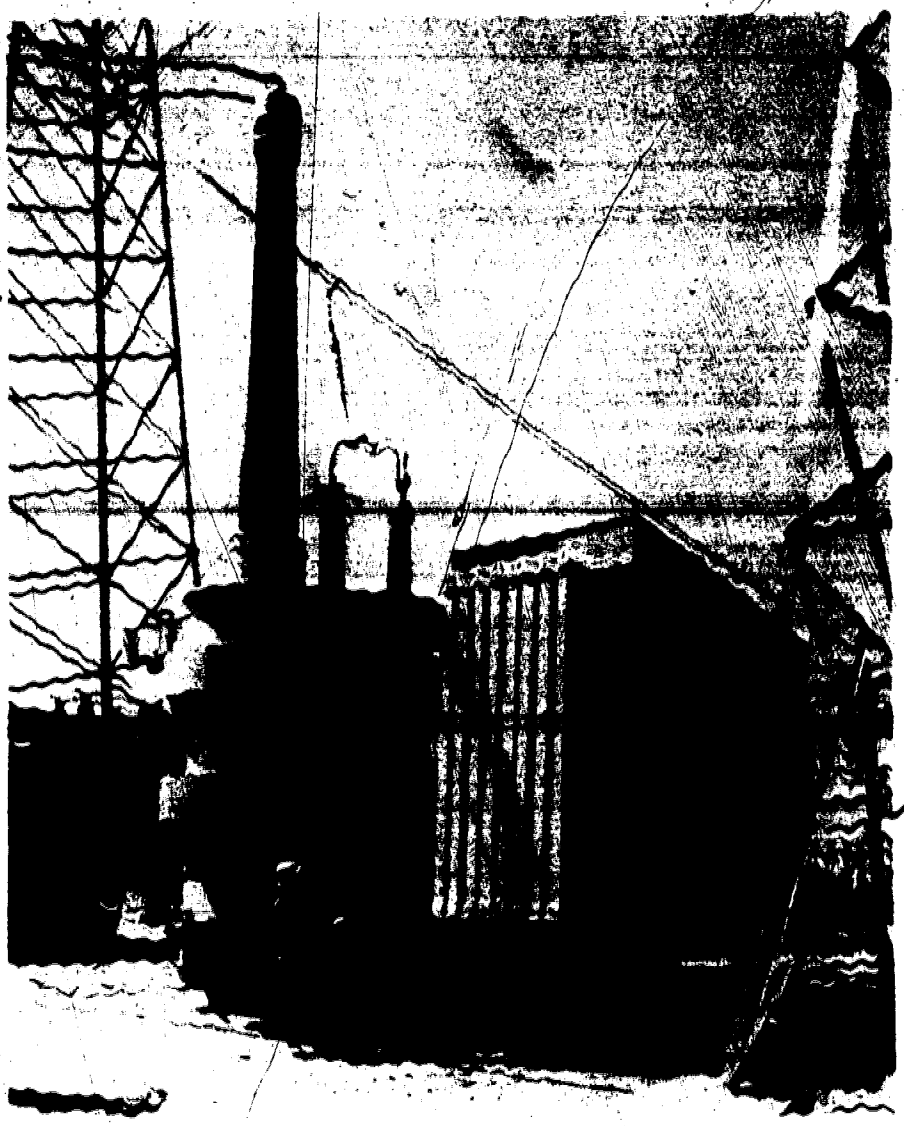
After electricity is generated, it passes through a "switchyard," where the voltage is increased so that the electricity may travel long distances without excessive loss of power. Next the electricity passes onto transmission lines that carry it from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

In 1976, 544,000 people worked in the electric power industry. Most of them, 461,000, worked in investor-owned utilities and cooperatives and 80,400 worked in Federal and municipal government utilities. A few large manufacturing establishments, which produce electric power for their own use, also employ electric power workers.

Since electricity reaches almost every locality, jobs in this industry are found throughout the country. Although hydroelectric power projects have created jobs in relatively isolated areas, most utility jobs still are found in heavily populated urban areas.

Electric Utility Occupations. Many different types of workers are required in the electric power industry. About 40 percent of the industry's employees work in occupations related to the generation, transmission, and distribution of electricity, and in customer service occupations. (These occupations are discussed in detail later in this chapter.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion on these occupations is given below. Further information can





Jobs in the electric power industry are found throughout the country.

be found in statements covering individual occupations elsewhere in the *Handbook*.

Engineering and Scientific Occupations. Engineers plan generating plant construction and additions, interconnections of complex power systems, and installations of new transmission and distribution systems and equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers help select plantsites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power. For example, they may demonstrate how to modernize a chemical manufacturing plant or how to remodel a store or hotel, suggesting changes that would use electricity more effectively.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping required, electric utilities employ many administrative and clerical personnel. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by computers. This generally results in more clerical work being done either by fewer or by the same number of employees. The use of this equipment also creates a need for programmers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Maintenance Occupations. A considerable number of workers test, maintain, and repair equipment. The duties of these skilled craft workers are similar to those of maintenance workers in other industries. It may be necessary to replace a switch or transformer, for example, or a weak section in a boiler may have to be repaired. Among the more important skilled workers are electricians, instrument repairers, industrial machinery repairers, machinists, pipefitters, welders, and boilermakers.

Employment Outlook

Employment in the electric power industry is expected to increase about as fast as the average for all industries through the mid-1980's. The greater use of electric power in industrial processes, growth of commercial centers such as shopping malls, and population growth all will contribute to an increased demand for electricity. However, due to the growing use of automatic controls, employment will not increase as fast as electric power production.

Trends in growth will differ from one occupation to another in the industry. The need for scientific, engineering, and technical employees is expected to increase sharply as construction of power generating plants increases and as research into developing more efficient energy usage to combat shortages and higher prices of fossil fuels becomes necessary. Much of this increase in employment will be in the development and construction of new nuclear power facilities.

In many other occupations in this industry, only slight increases in employment are expected. Larger, more efficient powerplants will limit growth of employment of powerplant

employees. The increased use of electronic data processing equipment for billing and recordkeeping will restrict growth in some clerical jobs. In occupations that will experience little or no growth, most job openings will result from the need to replace workers who die, retire, or leave the electric power industry for other reasons.

People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

Earnings in the electric utility industry are relatively high. In 1976, nonsupervisory employees in private electric power companies averaged $6.60 an hour. By comparison, the average for all nonsupervisory workers in private industry, except farming was $4.87 an hour.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends, usually on rotating shifts. Most union contracts with electric utilities provide a higher rate of pay for evening and nightwork than the basic day rate.

Overtime work often is required, especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report for work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1 1/2 times the basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions that affect pay, electric utilities provide other employee benefits. Generally, annual vacations are granted to workers according to length of service. A typical contract or employee benefit program provides for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, and 3 weeks for 10 to 20 years. Some contracts and programs provide for 4 weeks after 18 years, 5 weeks after 25 years, and 6 weeks after 30 years. The number of paid holidays ranges from 6 to 12 a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices. This has resulted in an injury rate lower than in most manufacturing industries. However, some occupations, especially those on linecrews, are more subject to accidents than others.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Independent unions represent some utility workers.

Sources of Additional Information

Information about jobs in the electric power industry is available from local electric utility companies, from industry trade associations, or from the local offices of unions that represent electric utility workers. Additional information also may be obtained from:

Edison Electric Institute, 90 Park Ave., New York, N.Y. 10016.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America, 815 16th St. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of the Work

Powerplants employ many different types of workers to produce electricity. All equipment in the plants must be kept in good running order; thus the machinery must be regularly cleaned and serviced, and all operations carefully checked and controlled. Maintenance personnel, including electrical, instrument, and mechanical repairers, inspect and repair this equipment. For example, an instrument repairer may notice that a gauge connected to a turbine does not register properly. The repairer may disassemble the gauge, locate the specific problem, and replace a part if necessary.

Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and guards. In steam generating plants using coal for fuel, coal handlers also are employed. In hydroelectric plants, gate tenders open and close the headgates that control the flow of water to turbines. Supervision of powerplant operations is handled by chief engineers called operations supervisors, and by their assistants, watch engineers (also called shift supervisors).

Operators are the key workers in a powerplant. They include four basic classes of workers—switchboard, boiler, turbine, and auxiliary equipment operators. Their job is to observe and regulate the various kinds of powerplant equipment, keep records of all operations to make certain that equipment functions efficiently, and to detect any trouble that may arise. In this way, operators ensure that power production will not be interrupted.

Switchboard operators (D.O.T 952.782) control the amount of electric power flowing from generators to outgoing powerlines by watching instrument panels and by operating switchboards. Switches control the movement of electric current through the generating station circuits and onto the transmission lines. Instruments mounted on panelboards show the power demand on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage.

The operators use switches to distribute the power demands among the generators, to combine the current from two or more generators, and to regulate the flow of the elec-

tricity onto various powerlines according to the changing needs of consumers. When power requirements change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Boiler operators (D.O.T. 950.782)—employed only in steam-powered generating plants—are responsible for maintaining the proper steam pressure needed to turn the turbines. They note and regulate the fuel, air, and water supply used in the boilers using control valves, meters, and other instruments which are mounted on panel boards. The size of the generating unit determines the number of boilers used; thus a boiler operator may be responsible for operating one or several boilers.

Turbine operators (D.O.T. 952.138) control the turbines that drive the generators. In small plants, they also may operate auxiliary equipment or a switchboard. Since modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures, the operator must give close attention to the pressure gauges, thermometers, and other instruments showing the operations of the turbo-generator unit. Turbine operators record the information shown by these instruments and check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers that change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.782) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Precise operation of this machinery is directly related to the proper functioning of boilers and turbines. For example, after steam goes through the turbines, it enters the condensers. Here the steam becomes water. This operation of the condensers provides some of the force that drives the turbines. Since auxiliary equipment may occasionally break down, these operators must be able to detect trouble quickly, and sometimes make minor repairs. In small plants which do not employ auxiliary equipment operators, these duties are performed by turbine operators.

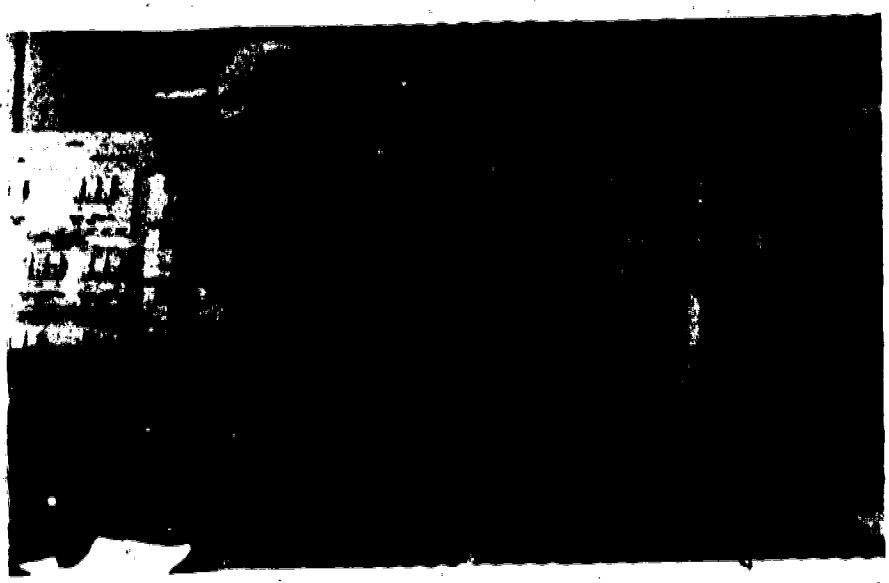
In most powerplants constructed in recent years—including nuclear—the operation of boilers, turbines, auxiliary equipment, and the switching required for balancing generator output has been centralized in a single control room. From here, central *control room operators* (D.O.T. 950.782) or powerplant operators regulate all the generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. When equipment is not operating properly, operators report problems to the plant superintendent or a watch engineer.

Watch engineers or shift supervisors (D.O.T. 950.131) oversee the workers in the powerplant who operate and maintain the boilers, turbines, generators, transformers, switchboards, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant. In small plants, the watch engineer also may be the general plant supervisor.

Generally, a nuclear-powered plant requires about the same kind and number of employees as a steam-generating plant powered by coal. However, nuclear plants employ a few additional employees such as health and safety specialists.

Training, Other Qualifications, and Advancement

New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and the operations of a powerplant. They advance to the more responsible job of helper as openings occur.



Operators check and record the readings of instruments.

Formal apprenticeships in these jobs are uncommon. Applicants generally are required to have a high school or vocational school education.

It takes from 1 to 3 years to become qualified as an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work up to boiler repairer. Turbine operators advance from the ranks of auxiliary equipment operators.

Where a utility system has a number of generating plants of different size, operators usually first get experience in the smaller stations and then are promoted to jobs in the larger stations as vacancies occur. Thus, how rapidly a worker advances also may depend on the availability of openings. If these are few, it may take longer to obtain a particular job than just to learn it.

In many States and large cities, employees who operate equipment in powerplants must be licensed by local or State agencies. While licensing requirements often vary from place to place, the National Institute for the Uniform Licensing of Power Engineers (NIULPE) is attempting to standardize these requirements.

Some powerplant workers employed in atomic-powered electric plants must have special training to work with nuclear fuel, in addition to the knowledge and skills required for conventional steam-generated electric power. All control room operators, assistant control room operators, and some operators of high pressure auxiliary equipment in nuclear powerplants must be licensed by the Nuclear Regulatory Commission.

New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. Some utility companies promote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator usually are required to qualify for a watch engineer's job.

Employment Outlook

Employment of powerplant operators is expected to increase more slowly than the average for all occupations through the mid-1980's, even though the production of electrical energy will increase at a rapid rate. Although some new jobs will become available, most job openings will occur because of the need to replace workers who retire, die, or leave the industry for other work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy these companies seldom lay off employees.

Because of the increased demand for electric power, it will be necessary to build and operate many new generating stations. The use of larger and more efficient equipment, however, will result in a great increase in capacity and production without a corresponding increase in the number of powerplant operators. For example, it takes only one turbine operator to control a turbo-generator regardless of the generator's size. Also, automatic equipment makes it possible to control several boilers from a central control room.

Earnings and Working Conditions

The earnings of powerplant workers vary by occupation and locality. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately owned utilities in 1976.

	Average hourly earnings
Auxiliary equipment operator	$5.66
Boiler operator	7.44
Control room operator	8.26
Switchboard operator:	
Switchboard operator, Class A	7.56
Switchboard operator, Class B	7.03
Turbine operator	7.26
Watch engineer	8.67

A powerplant is typically well-lighted and ventilated, clean, and orderly, but there is some noise from the equipment.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the new powerplants. Since generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends, usually on rotating shifts.

Sources of Additional Information

For information concerning licensing of powerplant employees, contact State and local occupational licensing agencies in your area or write to:

National Institute for Uniform Licensing of Power Engineers, 176 W. Adam St., Suite 1914, Chicago, Ill. 60603.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fourth of the workers in the electric power industry are in transmission and distribution jobs. This phase of the utility system links the electric power produced in generating plants to individual customers according to their needs. The principal workers in these jobs are those who control the flow of electricity—load dispatchers and substation operators—and employees who construct

and maintain powerlines—line installers and repairers, cable splicers, troubles ground helpers, and laborers.

Load dispatchers (D.O.T. 950.168), also called system operators or power dispatchers, control the flow of electricity throughout the area served by the utility. They operate the plant equipment used to generate electricity and direct its flow. The load dispatcher's source of information for the entire transmission system is the pilot board. This board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the existing conditions at any point in the system. Often lights are connected to the pilot board, which show the positions of switches that control generating equipment and transmission circuits, as well as high-voltage connections with substations and large industrial customers. The board also may have meters and several recording instruments that make a graphic record of operations for future analysis and study.

Because it takes some time to change the level of electricity being produced, the load dispatcher must anticipate power demands so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm, for example, may cause a million lights to be switched on in a matter of minutes. Dispatchers telephone instructions to the switchboard operators at the generating plants and the substations, telling them when to start or stop additional boilers and generators so that power production will be in balance with power needs.

Dispatchers also direct the handling of any emergency situation, such as transformer or transmission line failure, and route current around the affected area. They also may be in charge of interconnecting their utility system with other systems and directing transfers of current between systems as the need arises.

Substation operators (D.O.T. 952.782) generally are responsible for the operation of the step-up or step-down substations. A step-up substation usually is located adjacent to the powerplant to raise the voltage of the electricity so it can travel long distances. A step-down substation, at the other end of the transmission lines, reduces power voltage before it is sent out to the customer. Under orders from the load dispatcher, these operators use a switchboard to direct the flow of current out of the station. Ammeters, voltmeters, and other types of instruments register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators, using switchboard levers that control the circuit breakers, connect or break the flow of current. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, substation operators check the operating condition of all equipment to make sure that it is working properly. They supervise the activities of the other substation employees on the same shift. In smaller substations, the operator may be the only employee.

Some utilities employ a mobile operator who drives from one automatic station to another, inspecting powerlines, operating controls, and assisting customers' electricians in large commerical or governmental installations.

Line installers and repairers (D.O.T. 821.381) make up the largest single occupation in the industry. They construct and maintain the network of powerlines that carries electricity from generating plants to consumers.

Installers bolt crossarms to transmission poles and then bolt or clamp insulators in place on the crossarms. Next, they raise wires and cables and attach them to the insulators. Other equipment, such as lightning arrestors, transformers, and switches, also must be attached to the poles. Any routine maintenance and replacements necessary are performed by line installers and repairers.

When wires, cables, or poles break, it means an emergency call for a linecrew. Line repairers splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most installers and repairers now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole at the touch of a lever.

In some power companies, linecrew employees specialize in particular types of work. Those in one crew may work on new construction only, and others may do only repair work.

Line installers constructing underground electric power lines.

Trouble shooters (D.O.T. 821.281) are experienced line installers and repairers who are assigned to special crews that handle emergency calls. They move from one job to another, as ordered by a central service office that receives reports of line trouble. Often troubleshooters receive their orders by direct radio communications with the central service office.

To do this job well, these workers must have a thorough knowledge of the company's transmission and distribution network. Upon reaching the location of the break, they first find and report the source of trouble, and then attempt to restore service by making the necessary repairs. For example, depending on the nature and extent of the problem, troubleshooters may have to install new fuses or cut down live wires. They must be familiar with all the circuits and switching points so that they can safely disconnect live circuits when lines break down.

Ground helpers (D.O.T. 821.887) assist in constructing, repairing, and maintaining the transmission and distribution lines. For example, they dig pole holes, and then help the line installers and repairers to raise the poles while positioning them into the holes.

Cable splicers (D.O.T. 829.381) supervise the installation of insulated cables on utility poles and towers, as well as those buried underground and those carried in underground conduits. When cables are installed, these workers direct the laying of the conduit and the pulling of the cable through it. The cables are joined at connecting points in the transmission and distribution systems. At each connection—or break in the system—insulation is wrapped around the wiring and the cable is sealed with lead sheathing. Most of the physical work in placing new cables or replacing old ones is done by laborers.

Cable splicers spend most of their time repairing and maintaining cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. When making repairs, they must make sure that the continuity of each line is maintained from the substation to the customer's premises. Cable splicers also periodically check insulation on cables to make sure it is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from experienced switchboard operators and from operators of large substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must have thorough knowledge of the entire utility system. Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training.

About 4 years of on-the-job training are needed to qualify as a skilled line installer and repairer. New workers usually begin training as ground helpers, and assist the line installers and repairers. For example, they may help set poles in place or pass tools and equipment. Some companies have formal apprenticeship programs for line employees. Apprenticeship programs combine on-the-job training with classroom instruction in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical energy. After about 6 months, apprentices begin to do simple linework under close supervision, and progress to more difficult work as they gain experience. A line installer and repairer may advance to troubleshooter after several years of experience.

Candidates for linework should be strong and in good physical condition because climbing poles and lifting lines and equipment is strenuous. They also must have steady nerves and good balance to work at the top of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the mid-1980's. Most of these opportunities will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work. Workers hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Some increase in the employment of transmission and distribution workers is expected, although employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of line installers and repairers and troubleshooters is expected to increase only slightly because of the use of more mechanized equipment. A limited increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for regular substation operators, however, will be reduced substantially, since the introduction of improved and more automatic equipment makes it possible to operate more substations by remote control.

Earnings and Working Conditions

Wages for transmission and distribution workers vary by occupation and geographic location. The following tabulation shows estimated average hourly earnings for major transmission and distribution occupations in privately owned utilities in 1976.

	Average hourly earnings
Ground helper	$5.37
Line installer and repairer	7.97
Load dispatcher	8.38
Substation operator	7.14
Trouble shooter	9.15

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Line installers and repairers, troubleshooters, and ground helpers work outdoors, and in emergencies, may work in all kinds of weather. Cable splicers do most of their work beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have greatly reduced the hazards of these jobs. Workers stringing high voltage lines, for example, protect themselves by wearing rubber gloves. Also, barricades and specific warning signs usually are posted where workers lay conduits or run wires underground.

Meter readers go to customers' homes to record electricity used.

CUSTOMER SERVICE OCCUPATIONS

Nature of the Work

Workers in customer service occupations include people who read, install, test, and repair meters so that the utility company can accurately charge customers for their consumption of electric power. Also included are workers who represent the utility company in rural areas, and appliance repairers who work in company-operated shops, fixing customers' electrical equipment.

Electric meter repairers (D.O.T. 729.281) are the most skilled workers in this group. Their main duties are to maintain and repair meters, although they also may install and test meters. Some of these workers specialize in repairing simpler types of meters, such as those in homes. Others can handle all kinds of meters, including the more complicated ones used in industrial plants where large quantities of electric power are consumed. Often, some of the large systems require specialists, such as *meter installers* (D.O.T. 821.381) who put in and take out meters, and *meter testers* (D.O.T. 729.281).

Meter readers (D.O.T. 239.588) go to customers' premises to check the meters that register the amount of electric energy used. They record the amount used during the current billing period and watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts that are too small to justify more specialized workers and in localities where the utility company does not have an office. They collect overdue bills; make minor repairs; and read, connect, and disconnect meters. They receive service complaints and reports of line trouble from customers, and send them to a central office.

Appliance repairers are discussed in a separate chapter elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Meter repairers begin their jobs as helpers in the meter testing and repair departments. Persons entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become thoroughly familiar with all types of repairs. Some companies have formal apprenticeship programs in which the trainee progresses according to a specific plan.

Inexperienced workers can qualify as meter readers after a few weeks of training. Beginners accompany the experienced meter reader on the rounds until they have learned the job.

The duties of district representatives also are learned on the job. An important qualification for this occupation is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Employment in customer service occupations is expected to show little change through the mid-1980's. The need for meter readers will be limited because of the trend toward less frequent readings. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for meter repairers and meter readers will occur each year because of the need to replace workers who retire, die, or transfer to other fields of work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have and the section of the country in which they work. The following tabulation shows estimated average hourly earnings for major customer service jobs in privately owned utilities in 1976.

OCCUPATIONS IN THE TELEPHONE INDUSTRY

Just about everyone has a telephone. Many households have two or more, and large businesses and organizations have hundreds. Some people have telephones in their cars and on their boats. A few even have

portable telephones that they carry with them like briefcases. There also are thousands of public telephones on street corners and in airports, restaurants, and stores. Altogether, more than 155 million telephones were in use in the United States in 1976, and people made over 600 million local and long-distance calls every day.

To provide all this service, telephone companies employed approximately 920,000 persons in 1976. Most worked in telephone craft occupations, in clerical occupations, or as telephone operators.

The telephone industry offers steady, year-round employment in jobs requiring a variety of skills and training. Most require a high school education; some can be learned on the job. Many require particular skills that may take several years of experience, in addition to 9 months of training, to learn completely.

Telephone jobs are found in almost every community, but most telephone employees work in cities that have large concentrations of industrial and business establishments. The nerve center of every local telephone system is the central office that contains the switching equipment through which one telephone may be connected with any other telephone. When a call is made, the signals travel from the caller's telephone through wires and cables to the cable vault in the central office. Here thousands of pairs of wires, including a pair for the caller's telephone, fan out to a distributing frame where each pair is attached to switching equipment. As the number is dialed, electromechanical and electronic switching equipment make the connection automatically, and, in seconds, the caller hears the telephone ringing. Only in a few remaining switchboards and in unusual situations does an operator make the connection.

Because some customers make and receive more calls than a single telephone line can handle, a system somewhat similar to a miniature central office may be installed on the customer's premises. This system is the private branch exchange (PBX), usually found in office buildings, hotels, department stores, and other business firms.

Another type of service for businesses is called CENTREX, in which incoming calls can be dialed to any extension without an operator's assistance, and outgoing and interoffice calls can be dialed by the extension users. This equipment can be located either on telephone company premises or on the customer's premises. CENTREX has replaced PBX in popularity among business and industrial users that handle a very large volume of calls. However, PBX is still more popular with smaller users.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radio-telephones in automobiles, boats, airplanes, and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

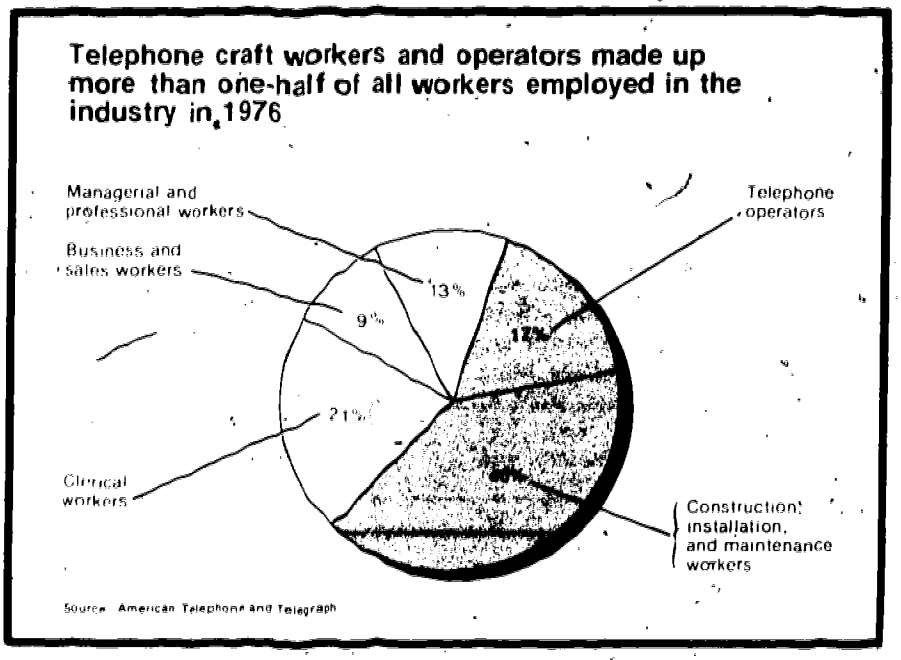
Besides providing telephones and switching equipment, telephone companies build and maintain most of the vast network of cables and radio-relay systems needed for communications services, including those that join the thousands of broadcasting stations around the country. These services are leased to networks and their affiliated stations. Telephone companies also lease data and private wire services to business and government offices.

The Bell System owns more than 4 out of 5 of the Nation's telephones. Independent telephone companies own the remainder. There are approximately 1,600 independent telephone companies in the United States. General Telephone and Electronics Corp., United Utilities, Inc., and Continental Telephone Corp., service about 2 out of every 3 telephones owned by independent companies.

Telephone Occupations

Although the telephone industry requires workers in many different occupations, telephone craft workers and operators make up more than one-half of all workers. (See accompanying chart.)

Telephone craft workers install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform. Construction workers place, splice, and maintain telephone wires and cables; installers and repairers place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and central office craft workers test,



maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and provide information. Detailed discussions of telephone craft occupations and telephone and PBX operators are presented elsewhere in the *Handbook*.

More than one-fifth of all telephone industry employees are clerical workers. They include stenographers, typists, bookkeepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Clerical workers keep records of services, make up and send bills to customers, and prepare statistical and other reports.

About one-tenth of the industry's employees are professional workers. Many of these are scientific and technical personnel such as engineers and drafters. Engineers plan cable and microwave routes, central office and PBX equipment installations, new buildings, and the expansion of existing structures, and solve other engineering problems.

Some engineers also engage in research and development of new equipment, and persons with engineering backgrounds often advance to fill top managerial and administrative positons. Other professional and technical workers are accountants, personnel and labor relations workers, public relations specialists and publicity writers, computer systems analysts, computer programmers, and lawyers.

About 1 in every 12 of the industry's employees is a business and sales representative. These employees sell new communications services and directory advertising and handle requests for installing or discontinuing telephone service.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telphone industry are janitors, porters, and guards.

Employment Outlook

Telephone industry employment is expected to increase about as fast as the average for all industries through the mid-1980's. In addition to the jobs from employment growth, tens of thousands of openings will arise each year because of the need to replace experienced workers who retire, die, or leave their jobs for other reasons.

Employment will grow primarily because higher incomes and a larger and more mobile population will increase the use of telephone service. Greater demand for transmission of computer-processed data and other information via telephone company lines also will stimulate employment growth. Laborsaving innovations, however, will keep employment from growing as rapidly as telephone service.

Employment of telephone operators is expected to decline. As the number of telephone companies charging customers for directory assistance calls increases, more people will dial numbers directly and use telephone directories to locate needed numbers, thus reducing the need for operators. Also, improved switching equipment will allow more calls to be connected without an operator's assistance, and more advanced billing systems will automatically relay billing information to computerized files that are used in preparing customer's billing statements. Technological innovations will restrict employment growth in some skilled crafts. For example, mechanical improvements, such as pole-lifting equipment and earth-boring tools, have limited the employment of line installers by increasing their efficiency.

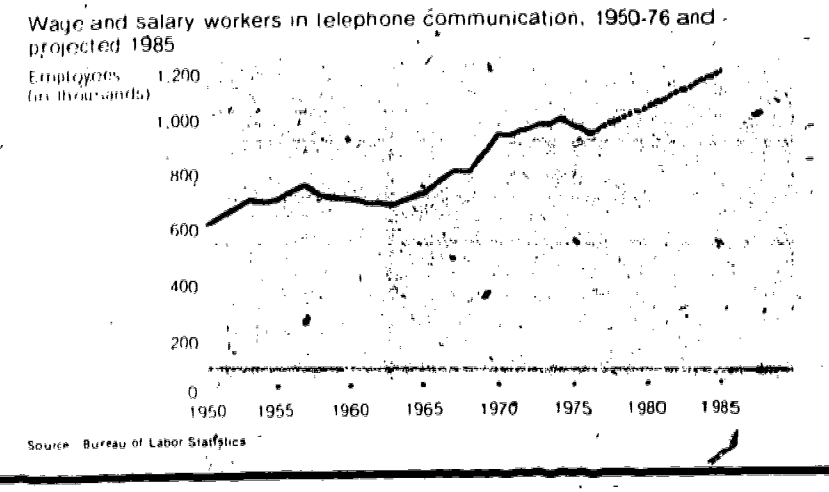
New technology, however, is expected to increase the demand for engineering and technical personnel, especially electrical and electronic engineers and technicians, computer programmers, and systems analysts. Employment in administrative and sales occupations will rise as telephone business increases.

Earnings and Working Conditions

In 1976, earnings for nonsupervisory telephone employees averaged $6.46 an hour. In comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

In late 1975, basic rates ranged from an average of $3.75 an hour for telephone operator trainees to

Although employment in the telephone industry will fluctuate due to economic cycles, moderate long-term growth is expected



$10.76 for professional and semiprofessional workers other than drafters.

A telephone employee usually starts at the minimum wage for the particular job. Advancement from the starting rate to the maximum rate generally takes 5 years, but operators and clerical employees of some companies may reach the maximum rate in 4 years.

More than two-thirds of the workers in the industry, mainly telephone operators and craft workers, are members of labor unions. The two principal unions representing workers in the telephone industry are the Communications Workers of America and the International Brotherhood of Electrical Workers, but many other employees are members of the 15 independent unions that form the Telecommunications International Union.

Union contracts govern wage rates, wage increases, and the amount of time required to advance from one step to the next for most telephone workers. The contracts also call for extra pay for work beyond the normal 8 hours a day, or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

Overtime work sometimes is required, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report for work during nonscheduled hours, workers are guaranteed a minimum period of pay at the basic hourly rate. Travel time between jobs is counted as worktime for craft workers under some contracts.

Paid vacations are granted according to length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 1 to 7 years; 3 weeks for 8 to 15 years; 4 weeks for 16 to 24 years; and 5 weeks for 25 years and over. Depending on locality, holidays range from 9 to 11 days a year. Most telephone workers are covered by paid sick leave plans and group insurance which usually provide sickness, accident, and death benefits and retirement and disability pensions.

The telephone industry has one of the best safety records in American industry. The number of disabling injuries has been well below the average.

Sources of Additional Information

More details about employment opportunities are available from the telephone company in your community or local offices of the unions that represent telephone workers. If no local union is listed in the telephone directory, write to:

Telecommunications International Union, P.O. Box 5462, Hamden, Conn. 06518.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

TELEPHONE CRAFT OCCUPATIONS

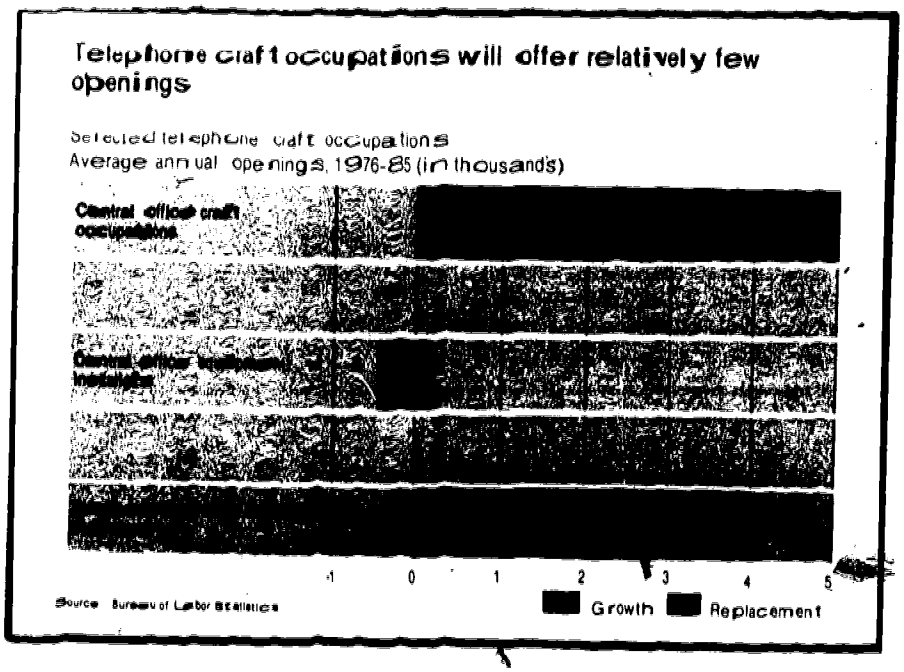
More than 1 out of every 3 employees in the telephone industry is a craft worker who installs, repairs, and maintains phones, cables, and related equipment. This chapter discusses the four groups of telephone craft occupations: Central office craft occupations, central office equipment installers, line installers and cable splicers, and telephone installers and repairers.

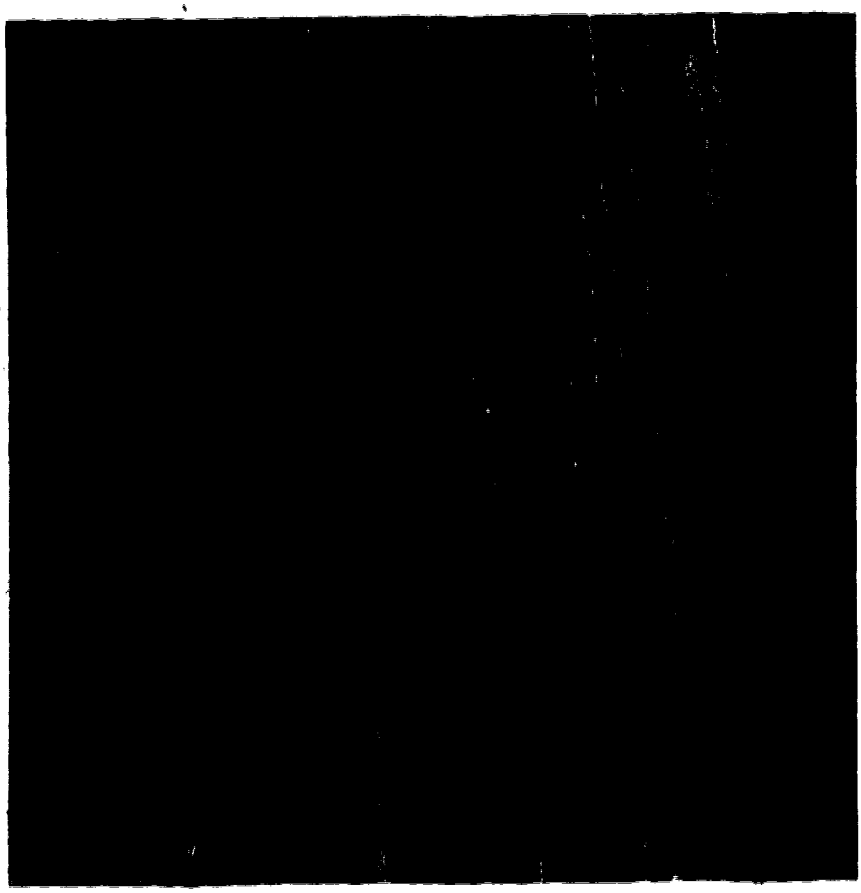
CENTRAL OFFICE CRAFT OCCUPATIONS

Nature of the Work

Telephone companies employed about 135,000 craft workers in 1976 to maintain and repair the complex equipment in their central offices. Most worked as frame wirers, central office repairers, and trouble locators. In small telephone companies, central office craft workers must perform a variety of jobs, but most specialize in one of these three areas.

Frame wirers (D.O.T. 822.884) connect and disconnect wires that run from telephone lines and cables to equipment in central offices. This equipment consists of a frame having many terminal lugs mounted on it, each of which is assigned a specific telephone number. It also contains one pair of wires for each customer's telephone that is connected to that central office. To connect a new telephone, the frame wirer solders the





Frame wirer makes connection for new telephone.

customer's pair of wires to a set of terminal lugs. To disconnect a telephone, a frame wirer melts off the solder and removes the wires from the terminal. Frame wirers occasionally change a customer's phone number. This is done by reconnecting the customer's pair of wires to a different set of terminal lugs.

Central office repairers (D.O.T. 822.281) maintain the switching equipment that automatically connects lines when customers dial numbers. Electromechanical switching systems contain moving parts that must be cleaned and oiled periodically. Also, electronic switching circuits must be checked occasionally for breakages.

When customers report trouble with their telephones, *trouble locators* (D.O.T. 822.381) work at special switchboards to find the source of the problem. To do this, they communicate with telephone installers and repairers as they attempt to make connections from a portable telephone through the customer's service line to the central office. The trouble shooter locates the problem by having the telephone repairer connect the portable phone at various places on the customer's line until a connection can be made through to the central office. If the problem is found to be at the central office, the trouble locator repeats this procedure with a central office repairer. In addition, trouble locators must also test new equipment when it is installed to make sure installations are made correctly. They also work with other employees, such as central office repairers and cable splicers, who help find the cause of trouble and make repairs.

Training, Other Qualifications, and Advancement

Telephone companies give classroom instruction and on-the-job training to new central office craft employees. In addition, telecommunications equipment manufacturers often train central office craft workers in the use, maintenance, and repair of equipment that they sell to telephone companies. Some vocational schools, particularly those in rural areas served by small independent telephone companies, also offer training to persons interested in becoming central office craft workers. A few people may learn these crafts through apprenticeship programs designed by State employment agencies in conjunction with local telephone companies. Often classrooms are supplied with equipment similar to that which the trainee will be using on the job.

Trainee jobs generally are filled by employees already with the company, such as telephone operators or line installers. Occasionally workers are hired from outside. Usually, trainees are assigned to the starting job of frame wirer, and take basic courses in telephone communications. They gain practical experience by observing and helping experienced frame wirers under the direction of supervisors. With additional training and experience, a frame wirer can advance to central office repairer or trouble locator. Usually it takes at least 5 years for an inexperienced worker to advance to the top pay rate in either of these two jobs.

Since electrical wires are usually color coded, persons who are considering careers in central office crafts should not be color blind. They also should be able to work closely with others, because teamwork often is essential in solving complex problems. A basic knowledge of electricity and electronics and telephone training in the Armed Forces are helpful.

Telephone companies give central office craft employees continued training throughout their careers to keep them abreast of the latest developments. As new types of equipment and tools and new maintenance methods are introduced, employees are sent to schools to learn about them.

Central office craft workers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment in central office craft occupations is expected to increase about as fast as the average for all occupations through the mid-1980's. Many new central offices will be built to meet the expected increase in demand for telephone services. Older, outdated central offices will be remodeled to include improved electronic switching systems (ESS). As population grows and becomes more mobile, a greater demand for telephone installations and removals will result in employment growth for frame wirers, trouble locators, and central office repairers. Additional employment growth for trouble locators and central office repairers will result from the use of increasingly complex equipment which requires more maintenance. Also, newer and more complex central office equipment will require more testing when installed, thus increasing the demand for trouble locators.

In addition to employment growth, many job openings will arise from the need to replace experienced workers who retire, die, or transfer to other occupations. Retirements and deaths alone may result in several thousand openings each year. Although most job openings are filled by the advancement of operators and other workers already employed by telephone companies, some trainee positions as frame wirers should be available for new employees. Most job openings will be in metropolitan areas.

Earnings and Working Conditions

In late 1976, average hourly rates were $7.24 for trouble locators and $6.95 for central office repairers. By comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

Earnings increase considerably with length of service. Under the terms of a major union contract in effect in late 1976, frame wirers started at $4.68 an hour and could work up to a maximum of $7.03 an hour after 4 years. Central office repairers and trouble locators could earn a maximum of $8.34 an hour after 5 years.

Employees in central offices work in clean and well-lighted surroundings. Since the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craft workers, therefore, have work schedules that include shift work and some weekends and holiday work for which they receive extra pay. Central office craft workers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

CENTRAL OFFICE EQUIPMENT INSTALLERS

(D.O.T. 822.381)

Nature of the Work

Central office equipment installers set up the complex switching and dialing equipment used in central offices of telephone companies. They may install equipment in new central offices, add equipment in an expanding office, or replace outdated equipment.

On a job, installers follow blueprints, diagrams, and floor plans in order to position the equipment properly and wire it correctly. They often use hoists to lift heavy items into place and use handtools, such as screwdrivers or soldering guns, to connect equipment once it is in place. Recently developed equipment sometimes comes in preassembled components and often requires only simple plug-in connections.

After the new equipment has been put in place, installers connect the outgoing and incoming telephone trunklines, often consulting diagrams to ensure that connections are made correctly. Once this is completed, installers then test the systems, using electrical testing equipment, such as electrical pulse repeaters and ohmmeters, to measure the strength and consistency of the current flow. If installers discover that the system is not functioning properly, they must check the equipment and all connections to determine the cause, and then correct it.

Places of Employment

About 20,000 installers were employed in 1976. Most worked for manufacturers of central office equipment. Others worked directly for telephone companies or for private contractors who specialize in large-scale installations.

Most central office equipment installers work in metropolitan areas, where large central offices are found. Hundreds of installers may be required to work on large jobs such as a long-distance toll center in a big city. Other installers are assigned areas that include several States, and therefore they must travel frequently to small towns within their area. Installing equipment in small communities often requires only 2 or 3 installers.

Training, Other Qualifications, and Advancement

Individuals considering careers as central office equipment installers should have good eyesight and, since electrical wires are generally color coded, should not be color blind. They should be able to work with others, for teamwork often is essential to solving a complex problem. Although manufacturers generally provide all the necessary training to perform this job, courses in blueprint reading and electronic theory are helpful to those interested in this career.

New employees attend classes the first few weeks to learn basic installation and then begin on-the-job training. Often trainees will be transported to the plant where the equipment is manufactured to receive their training.

Workers who have several years of experience may qualify as skilled installers. Training continues, however, even after they become skilled; additional courses are given from time to time to improve skills and to teach new techniques in installing

Installer wires a new distribution frame and switching equipment

telephone equipment. Also, technological innovations are constantly resulting in changes in equipment. When manufacturers develop new equipment, installers must be retrained to install it.

Installers who have managerial ability can advance to supervisory positions.

[illegible]

[illegible] equipment installer is expected [illegible] the [illegible] through the mid-1980's. However, a few hundred openings will arise each year to replace experienced installers who transfer to other work, retire, or die.

Thousands of new central offices will be constructed in the next decade. In addition, many older offices obsolete manual and dial switching equipment will be replaced with more efficient electronic switching systems (ESS). However, most new central office equipment will be manufactured in components that come partially assembled, thus greatly reducing the time needed for installation. The greater complexity of ESS's will require more testing of new equipment, but this will not offset the time savings resulting from the use of component parts.

Employment may fluctuate from year to year, however, because investment in central office equipment is subject to changes in business conditions and availability of funds. Thus, when business is prospering, installations and modifications of central offices may occur at an above average pace. When the business outlook is depressed, there is less likelihood that new central offices will be built or that existing offices will be enlarged or modernized.

Earnings and Working Conditions

[illegible] terms of a major [illegible] agreement effective late 1976, covering most central office equipment installers, starting rates for inexperienced installers ranged from $3.73 to $4.71 an hour. The contract provided for periodic increases, and employees could reach rates of $7.20 to $8.34 an hour after 5 years of experience. Travel and expense allowances also were provided.

The Communications Workers of America represents most central office equipment installers, including those with the Bell System. The International Brotherhood of Electrical Workers represents some installers employed by various telephone companies, by manufacturers supplying the independent segment of the telephone industry, and by large installation contractors.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

LINE INSTALLERS AND CABLE SPLICERS

Nature of the Work

The vast network of wires and cables that connect telephone central offices to each other and to customers' telephones and switchboards is constructed and maintained by line installers and cable splicers and their helpers. Telephone companies employed almost 55,000 of these workers in 1976, including about 33,000 cable splicers, 15,000 line installers, and 7,000 helpers, laborers, and other workers.

To construct new telephone lines, *line installers* (D.O.T. 822.381) place wires and cables that lead from the central office to customers' premises. They use power driven equipment to dig holes and set in telephone poles which support cables. Line installers climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, installers place cables in underground conduits. On construction jobs, installers work in crews of two persons or more. A supervisor directs the work of several crews.

When wires or cables break or a pole is knocked down, line installers often are called upon to make emergency repairs. These repairs are most common in parts of the country that have hurricanes, tornadoes, and heavy snowfalls. The line crew supervisor keeps in radio contact with the central office, which directs the crew to problem locations on the lines.

Some installers periodically inspect sections of lines in rural areas and make minor repairs.

After line installers place cables on poles or in underground conduits, *cable splicers* (D.O.T. 829.381) generally complete the line connections. Splicers work on poles, on aerial ladders and platforms, in manholes, or in basements of large buildings. They connect individual wires within the cable and rearrange wires when lines have to be changed. At each splice, they either wrap insulation around the wires and seal the joint with a lead sleeve or cover the splice with some other type of closure. Usually, they fill the cable sheathing with compressed air to keep out moisture.

Splicers also install terminal boxes that connect customers' telephones to outside cables. An innovation in telephone connecting, these terminal boxes are often placed in the basements of apartment buildings or other buildings containing multiple telephone customers. When a telephone installer wishes to connect or disconnect a customer's telephone, it can be done quickly at the terminal box.

Splicers also maintain and repair cables. The preventive maintenance work that they do is extremely important, because a single defect in a cable may cause a serious interruption in service. Many trouble spots are located through air pressure or electric tests.

Telephone companies hire inexperienced workers to train for jobs as line installers or cable splicers.

Training, Qualifications, and Advancement

Telephone companies hire inexperienced workers to train for jobs as line installers or cable splicers. Knowledge of the basic principles of electricity and training in installing telephone systems with the Armed Forces are helpful. Physical examinations usually are given to prospective employees, since some line and cable work is strenuous, requiring workers to climb poles and lift heavy cables and equipment. The ability to distinguish colors is necessary because wires usually are coded by color.

Telephone companies have training programs for line installers and cable splicers that include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus [illegible] that is as similar to working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid falls and contact with power wires. After a short period of classroom training, some trainees are assigned to a crew to work with experienced line installers and cable splicers under the supervision of a line supervisor.

In addition to the training provided by the telephone companies, some manufacturers of cable installation equipment also train line installers and cable splicers in the use of equipment that the manufacturers sell to telephone companies. [illegible] phone company will send its line and cable workers to the manufacturer's training school. At other times manufacturers send their instructors to the job site.

Some small independent telephone companies, particularly those in rural areas, do not have adequate facilities to train their employees. Therefore, they may rely on local vocational and technical schools to provide classroom training to craft employees. A few apprenticeships also are available for line and cable workers. In these cases, employees receive classroom training in courses such as mathematics and electronic theory

sponsored by outside agencies, for example State employment agencies, while they receive on-the-job training. Apprenticeships generally last 4 years.

Line installers and cable splicers continue to receive training throughout their careers, to qualify for more difficult assignments and to keep up with technological changes. Due to the strenuous nature of the job, most line installers and cable splicers find it necessary to transfer to other occupations as they advance in age. Those having the necessary qualifications find many additional advancement opportunities in the telephone industry. For example, a line installer may be transferred to telephone installer and later to telephone repairer or other higher rated job.

Employment Outlook

Employment of cable splicers is expected to show little or no change through the mid-1980's. Technological developments such as the telephone splicing van which uses the truck engine to heat and ventilate manholes and drive power tools and equipment will improve the efficiency of splicers, thus limiting the need for additional workers. Nevertheless, many job openings will arise due to the need to replace experienced splicers who retire, die, or transfer to other occupations.

Little or no change is expected in the number of line installers because the increasing use of mechanical improvements such as plows that can dig a trench, lay cable, and cover it in a single operation have eliminated much of the heavier physical work of the line crews and have caused reductions in crew size. Also, satellites are expected to carry an increasing volume of telephone traffic, thus slightly reducing the emphasis on cable installation. On the other hand, as urban and suburban areas expand outward, some employment opportunities for line installers and cable splicers may be created by the desire to place unsightly cables underground in localities where cables presently are hung from poles. In addition, some job openings will occur as experienced line installers retire, die, or transfer to other occupations.

Due to the many miles of cable which must be installed and maintained in rural areas, job openings for line installers and cable splicers may be easier to find in small cities than in metropolitan areas.

Earnings and Working Conditions

In late 1975, wage rates of cable splicers averaged $6.86 an hour, line installers averaged $6.49, and cable splicers' helpers, $5.46. By comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

Pay rates for cable splicers and line installers depend to a considerable extent upon length of service and geographic location. For example, under the terms of a major union contract in effect in late 1976, new workers in line construction jobs in the highest pay scale cities began at $4.71 an hour and could reach a maximum of $8.34 after 5 years of service. The maximum hourly rate for cable splicers also was $8.34. Line installers and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Line installers and cable splicers work outdoors. They must do considerable climbing, and often work in stooped and cramped positions. Safety standards, developed over the years by telephone companies with the cooperation of labor unions, have greatly reduced the hazards of these occupations. When severe weather damages telephone lines, line installers and cable splicers may be called upon to work long and irregular hours to restore service.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

TELEPHONE AND PBX INSTALLERS AND REPAIRERS

Nature of the Work

About 1 in every 3 telephone craftworkers is a telephone installer or repairer. About 110,000 were employed in 1976. They install and service telephones and switchboard systems such as PBX and CENTREX on customers' property and make repairs on the equipment when trouble develops. These workers generally travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When customers move or request new types of service, they relocate telephones or make changes on existing equipment. For example, they may install a switchboard in an office, or change a two-party line to a single-party line in a residence. Installers also may fill a customer's request to add an extension in another room, or to replace an old telephone with a new model. Most installers and repairers specialize in one or two of the jobs described below, however; installers and repairers employed at small telephone companies may perform all of these jobs.

Telephone installers (D.O.T. 822.381) install and remove telephones in homes and business places. They connect telephones to outside service wires and sometimes must climb poles to make these connections. Occasionally, especially in apartment buildings, the service wires or terminals are in the basement of the building in which the installation or removal is being done. Telephone installers are sometimes called station installers.

PBX installers (D.O.T. 822.381) perform the same duties as telephone installers, but they specialize in more complex telephone system installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for mobile radiotelephones, data processing equipment, and telephone switchboard systems for radio and television broadcasts that involve receiving phone calls from the audience.

Telephone repairers (D.O.T. 822.281), with the assistance of trouble locators in the central office, locate trouble on customers' equipment. A repairer finds the source of the problem by connecting a portable telephone to the customer's telephone cord and then dialing the trou-

ble locator in the central office. If the proper connection is made, the problem is in the customer's telephone. If a connection cannot be completed, the problem is in the service line between the phone and the central office, and the repairer repeats this procedure at various points along the service line until the problem is located. The repairer then makes the necessary repairs to restore service.

PBX repairers (D.O.T. 822.281), with the assistance of trouble locators, locate trouble on customers' PBX, CENTREX, or other complex telephone systems and make the necessary repairs. They also maintain associated equipment such as batteries, relays, and power plants. Some PBX repairers maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and data processing equipment.

Training, Other Qualifications and Advancement

Telephone companies give new service workers classroom instruction in subjects such as mathematics and electrical and electronic theory. Trainees supplement their classroom instruction with on the job training. Often additional training is conducted in classroom set ups that simulate actual working conditions. For example, telephone installer trainees are instructed in classrooms equipped with telephone poles, lines and cables, terminal boxes, and other equipment. They practice installing telephones and connecting wires just as they would on the job. After a few weeks in the classroom, trainees are assigned to the field for on the job training by experienced workers often supervisors.

Many small independent telephone companies, especially those located in rural areas, do not have the facilities, such as simulated classrooms, necessary to train their employees. Therefore, vocational and technical schools may provide training for installers and repairers employed by telephone companies in the area. A few installers and repairers may enter apprenticeship programs conducted jointly by State employment agencies and telephone companies. In these programs apprentices receive on-the-job training at the company where they are employed. At the same time, they receive classroom instruction from the State agencies. Generally apprenticeships last 4 years.

Because telephone wires usually are color-coded, applicants must have good eyesight—no color blindness. Physical examinations are sometimes required since the work may involve strenuous activity such as climbing poles. In addition, applicants may have to pass a test designed to determine the applicant's aptitude for the job. Often trainees are chosen from current telephone company employees, such as operators or line installers.

Telephone service workers continue to receive training throughout their careers to qualify for more responsible assignments and to keep up with technical changes. Those who have managerial ability can advance to supervisory jobs.

Employment Outlook

Employment of telephone installers and repairers is expected to increase about as fast as the average for all occupations through the mid-1980's. Most job openings will result

Employment of telephone installers will increase most rapidly in areas where the population is growing rapidly.

from employment growth, but many openings will arise from the need to replace workers who retire, die, or transfer to other occupations. These openings usually are filled by workers from other telephone jobs, such as operators, service representatives, line installers, or cable splicers, but some should be available to new employees.

Employment will increase due to the growing demand for telephones and PBX and CENTREX systems. Employment of installers will increase most rapidly in areas where the population is growing rapidly, thus creating a large demand for telephone installations. Also, areas that have a large influx or outflow of people, such as those with military bases or colleges nearby, will have a relatively large demand for telephone installations and removals.

On the other hand, technological improvements may limit the demand for installers and repairers. For example, terminal boxes allow a number of installations to be connected at one central location and make it unnecessary for installers to climb telephone poles.

Earnings and Working Conditions

In late 1978, the average hourly earnings for PBX repairers was $6.61, and the average for telephone and PBX installers was $6.15. In comparison, nonsupervisory workers in all private industries except farming had average earnings of $4.87 an hour.

Earnings increase considerably with length of service. Under the terms of a major union contract in effect in late 1976, in one of the higher pay scale cities telephone installers and repairers earned a starting rate of $4.49 an hour with periodic pay increases up to a maximum of $7.63 an hour after 5 years of service. Installers and repairers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Telephone installers and repairers work indoors and outdoors in all kinds of weather. They may work extra hours when breakdowns occur in lines or equipment.

(See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.)

TELEPHONE OPERATORS

Nature of the Work

Although millions of telephone numbers are dialed directly each day, there are times when making a call requires the assistance of a telephone operator. Often an operator is needed because a caller wants to reverse long-distance charges, locate a telephone number in another city, or know the cost of a call. Operators also may be needed to contact the police or fire department in an emergency or arrange a conference call for business executives.

Providing these service are two groups of telephone operators. The operators who work in telephone company central offices probably are the most familiar. But many business and large organizations receive so many calls that they also employ operators to run their private branch exchange (PBX) switchboards. Sometimes operators place calls by inserting and removing plugs that make switchboard connections and by listening and speaking into their headsets. However, many switchboards, especially those in telephone company central offices, are now operated by pushbuttons or dials.

Telephone company operators may be assigned either to handle long-distance calls or to give directory assistance. Long-distance operators obtain the information needed to complete the call, make the necessary connections, and record the details for billing. *Directory assistance operators* (D.O.T. 235.862) look up and provide telephone numbers. Service assistants train and help new operators to complete difficult calls.

PBX operators (D.O.T. 235.862) run switchboards for business offices and other establishments. They connect interoffice or house calls, answer and relay outside calls, assist company employees in making outgoing calls, supply information to callers, and record charges. In many small establishments, PBX operators work at switchboards that serve only a limited number of telephones. These operators may do other office work such as typing or sorting mail and many also act as receptionists or information clerks. (The work of receptionists is described elsewhere in the *Handbook*.)

During peak calling periods, the pace at the switchboard may be very hectic.

Places of Employment

About 340,000 telephone operators were employed in 1976. More than one-half worked as PBX operators in manufacturing plants, hospitals, department stores, or businesses. The remainder worked in telephone companies. About one-fourth of all operators work only part time.

Both telephone company and PBX operators are concentrated in heavily populated areas. Nearly one fifth work in the New York, Chicago, and Los Angeles metropolitan areas.

Training, Other Qualifications, and Advancement

Persons planning to become telephone operators should like to serve the public, be pleasant and courteous, and not mind sitting at a switchboard for long periods. A clear and pleasing voice and good hearing also are important. Many telephone companies and business firms require applicants, including operators, to pass physical examinations. High school courses in speech, office practices, and business math provide a helpful background for persons interested in this occupation.

New operators are taught on the job how to use the equipment and keep records of calls. Once they have learned the procedure, they put through practice calls. Instruction and practice usually last from 1 to 3 weeks. Operators then are assigned to regular operator jobs and receive further instruction from supervisors.

PBX operators who handle routine calls may have a somewhat shorter training period than telephone company operators. In large businesses an instructor from the local telephone company may train new employees.

Experienced telephone company operators may be promoted to supervisory jobs or transfer to clerical occupations such as secretary or bookkeeper. They also may have the opportunity to advance to jobs as telephone craft workers such as telephone installers and repairers. PBX operators in large firms may advance to more responsible clerical positions; however, in many small business, opportunities for advancement usually are very limited.

Employment Outlook

Employment of telephone and PBX operators as a group is expected to decline slightly through the mid-1980's. Nevertheless, thousands of full-time and part-time workers will be hired each year to replace experienced operators who die, retire, or stop working for other reasons. Many other openings will result from the need to replace operators who advance to other occupations.

Employment of telephone company operators is expected to decline more than employment of PBX operators. As more telephone companies start charging customers for directory assistance and information calls, more people will dial numbers directly and use telephone directories to locate unknown numbers, thus reducing the need for operators. Also, technological improvements will limit the employment of operators. For example, more telephone companies are installing electronic switching systems in their central offices, thus reducing the need for manual switching of calls. In addition, traffic service position systems are being added, which automatically feed data about each telephone connection such as the length and cost of the call, into a computer that processes the billing statements. Formerly this information was tabulated by an operator and then transferred to the statement.

Even though new small businesses will require PBX services, employment growth of PBX operators will be limited as many large businesses convert to Central Exchange (CENTREX). With CENTREX, incoming and outgoing calls can be dialed directly without an operator's assistance.

Earnings and Working Conditions

Telephone company operators averaged $3.79 an hour in late 1975, experienced operators $4.90, service assistants $5.92, and supervisors or chief operators, $8.63. Contracts between unions and telephone companies generally provide for periodic pay increases and extra pay for work on evenings, Sundays, and holidays.

Most telephone company and PBX operators work between 35 and 40 hours a week. Often, their scheduled hours are the same as those of other office clerical workers. In telephone companies, however, and in hotels, hospitals, and other places where telephone service is needed on a 24-hour basis, operators work on shifts and on holidays and weekends. Some operators work split shifts—that is, they are on duty during the peak calling periods in the late morning, and early evening, and have time off between these two periods.

Operators usually work in well-lighted and pleasant surroundings. The job of a telephone operator does not require any physical exertion; however, during the peak calling periods in the late morning and late afternoon, the pace at the switchboard may be very hectic. Often operators are unable to leave their seats during these periods.

Insurance, pension programs, holidays, vacations, and other fringe benefits are much the same as those for other types of clerical employees. For specific information about fringe benefits for telephone company operators, see the statement on the telephone industry elsewhere in the *Handbook*.

Many operators employed by telephone companies are members of the Communications Workers of America, the International Brotherhood of Electrical Workers, and the Telecommunications International Union.

Sources of Additional Information

For more details about employment opportunities, contact the telephone company in your community or local offices of the unions that represent telephone workers. For general information on telephone operator jobs, write to:

Telecommunications International Union, P.O. Box 5462, Hamden, Conn. 06518

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005

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