



# OCCUPATIONAL OUTLOOK HANDBOOK

Occupational Outlook Handbook > Architecture and Engineering >

PRINTER-FRIENDLY

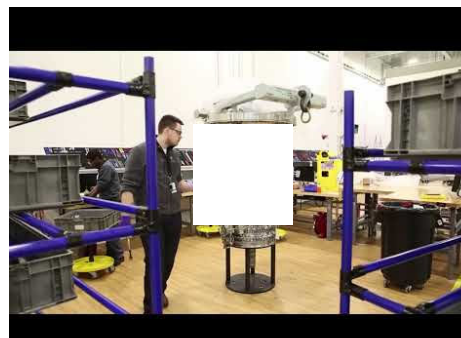
## Electrical and Electronics Engineers

- Summary**
- What They Do
- Work Environment
- How to Become One
- Pay
- Job Outlook
- State & Area Data
- Similar Occupations
- More Info

Summary

### Summary

Quick Facts: Electrical and Electronics Engineers	
<b>2019 Median Pay</b>	\$101,250 per year \$48.68 per hour
<b>Typical Entry-Level Education</b>	Bachelor's degree
<b>Work Experience in a Related Occupation</b>	None
<b>On-the-job Training</b>	None
<b>Number of Jobs, 2019</b>	328,100
<b>Job Outlook, 2019-29</b>	3% (As fast as average)
<b>Employment Change, 2019-29</b>	10,800



#### [What Electrical and Electronics Engineers Do](#)

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment.

#### [Work Environment](#)

Electrical and electronics engineers work in industries including research and development, engineering services, manufacturing, telecommunications, and the federal government. Electrical and electronics engineers generally work indoors in offices. However, they may have to visit sites to observe a problem or a piece of complex equipment.

#### [How to Become an Electrical or Electronics Engineer](#)

Electrical and electronics engineers must have a bachelor's degree. Employers also value practical experience, such as internships or participation in cooperative engineering programs.

#### [Pay](#)

The median annual wage for electrical engineers was \$98,530 in May 2019.

The median annual wage for electronics engineers, except computer was \$105,570 in May 2019.

#### [Job Outlook](#)

Overall employment of electrical and electronics engineers is projected to grow 3 percent from 2019 to 2029, about as fast as the average for all occupations. Employment growth is expected to be tempered by slow growth or decline in some industries, such as manufacturing and utilities.

#### [State & Area Data](#)

Explore resources for employment and wages by state and area for electrical and electronics engineers.

#### [Similar Occupations](#)

Compare the job duties, education, job growth, and pay of electrical and electronics engineers with similar occupations.

#### [More Information, Including Links to O\\*NET](#)

Learn more about electrical and electronics engineers by visiting additional resources, including O\*NET, a source on key characteristics of workers and occupations.

[What They Do ->](#)

What They Do

### What Electrical and Electronics Engineers Do

About this section

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment, such as electric motors, radar and navigation systems, communications systems, or power generation equipment. Electrical engineers also design the electrical systems of automobiles and aircraft.

Electronics engineers design and develop electronic equipment, including broadcast and communications systems, such as portable music players and Global Positioning System (GPS) devices. Many also work in areas closely related to computer hardware.

### Duties

Electrical engineers typically do the following:

- Design new ways to use electrical power to develop or improve products
- Perform detailed calculations to develop manufacturing, construction, and installation standards and specifications
- Direct the manufacture, installation, and testing of electrical equipment to ensure that products meet specifications and codes
- Investigate complaints from customers or the public, evaluate problems, and recommend solutions
- Work with project managers on production efforts to ensure that projects are completed satisfactorily, on time, and within budget



Electronics engineers analyze the requirements and costs of electrical systems.

Electronics engineers typically do the following:

- Design electronic components, software, products, or systems for commercial, industrial, medical, military, or scientific applications
- Analyze customer needs and determine the requirements, capacity, and cost for developing an electrical system plan
- Develop maintenance and testing procedures for electronic components and equipment
- Evaluate systems and recommend design modifications or equipment repair
- Inspect electronic equipment, instruments, and systems to make sure they meet safety standards and applicable regulations
- Plan and develop applications and modifications for electronic properties used in parts and systems in order to improve technical performance

Electronics engineers who work for the federal government research, develop, and evaluate electronic devices used in a variety of areas, such as aviation, computing, transportation, and manufacturing. They work on federal electronic devices and systems, including satellites, flight systems, radar and sonar systems, and communications systems.

The work of electrical engineers and electronics engineers is often similar. Both use engineering and design software and equipment to do engineering tasks. Both types of engineers also must work with other engineers to discuss existing products and possibilities for engineering projects.

Engineers whose work is related exclusively to computer hardware are considered [computer hardware engineers](#).

[<- Summary](#)

Work Environment

[Work Environment ->](#)

## Work Environment

About this section

Electrical engineers held about 193,100 jobs in 2019. The largest employers of electrical engineers were as follows:

Engineering services	20%
Electric power generation, transmission and distribution	9
Navigational, measuring, electromedical, and control instruments manufacturing	7
Research and development in the physical, engineering, and life sciences	5
Semiconductor and other electronic component manufacturing	4

Electronics engineers, except computer held about 134,900 jobs in 2019. The largest employers of electronics engineers, except computer were as follows:

Telecommunications	17%
Semiconductor and other electronic component manufacturing	14
Federal government, excluding postal service	13
Engineering services	7
Navigational, measuring, electromedical, and control instruments manufacturing	5

Electrical and electronics engineers generally work indoors in offices. However, they may visit sites to observe a problem or a piece of complex equipment.

### Work Schedules

Most electrical and electronics engineers work full time.

[<- What They Do](#)

How to Become One

[How to Become One ->](#)

## How to Become an Electrical or Electronics Engineer

About this section



Electrical and electronic engineers work in various industries, including engineering services, research and development, and manufacturing.

Electrical and electronics engineers must have a bachelor's degree. Employers also value practical experience, such as internships or participation in cooperative engineering programs, in which students earn academic credit for structured work experience.

## Education

High school students interested in studying electrical or electronics engineering benefit from taking courses in physics and math, including algebra, trigonometry, and calculus. Courses in drafting are also helpful, because electrical and electronics engineers often are required to prepare technical drawings.

In order to enter the occupation, prospective electrical and electronics engineers need a bachelor's degree in electrical engineering, electronics engineering, electrical engineering technology, or a related engineering field. Programs include classroom, laboratory, and field studies. Courses include digital systems design, differential equations, and electrical circuit theory. Programs in electrical engineering, electronics engineering, or electrical engineering technology should be accredited by [ABET](#) .

Some colleges and universities offer cooperative programs in which students gain practical experience while completing their education. Cooperative programs combine classroom study with practical work. Internships provide similar experience and are growing in number.

At some universities, students can enroll in a 5-year program that leads to both a bachelor's degree and a master's degree. A graduate degree allows an engineer to work as an instructor at some universities, or in research and development.

## Important Qualities

**Concentration.** Electrical and electronics engineers design and develop complex electrical systems and electronic components and products. They must keep track of multiple design elements and technical characteristics when performing these tasks.

**Initiative.** Electrical and electronics engineers must apply their knowledge to new tasks in every project they undertake. In addition, they must engage in continuing education to keep up with changes in technology.

**Interpersonal skills.** Electrical and electronics engineers must work with others during the manufacturing process to ensure that their plans are implemented correctly. This collaboration includes monitoring technicians and devising remedies to problems as they arise.

**Math skills.** Electrical and electronics engineers must use the principles of calculus and other advanced math in order to analyze, design, and troubleshoot equipment.

**Speaking skills.** Electrical and electronics engineers work closely with other engineers and technicians. They must be able to explain their designs and reasoning clearly and to relay instructions during product development and production. They also may need to explain complex issues to customers who have little or no technical expertise.

**Writing skills.** Electrical and electronics engineers develop technical publications related to equipment they develop, including maintenance manuals, operation manuals, parts lists, product proposals, and design methods documents.

## Licenses, Certifications, and Registrations

Licensure is not required for entry-level positions as electrical and electronics engineers. A Professional Engineering (PE) license, which allows for higher levels of leadership and independence, can be acquired later in one's career. Licensed engineers are called professional engineers (PEs). A PE can oversee the work of other engineers, sign off on projects, and provide services directly to the public. State licensure generally requires

- A degree from an ABET-accredited engineering program
- A passing score on the Fundamentals of Engineering (FE) exam
- Relevant work experience, typically at least 4 years
- A passing score on the Professional Engineering (PE) exam

The initial FE exam can be taken after earning a bachelor's degree. Engineers who pass this exam commonly are called engineers in training (EITs) or engineer interns (EIs). After meeting work experience requirements, EITs and EIs can take the second exam, called the Principles and Practice of Engineering (PE).

Each state issues its own licenses. Most states recognize licensure from other states, as long as the licensing state's requirements meet or exceed their own licensure requirements. Several states require continuing education for engineers to keep their licenses.

## Other Experience

During high school, students can attend engineering summer camps to see what these and other engineers do. Attending these camps can help students plan their coursework for the remainder of their time in high school. The [Engineering Education Service Center](#) has a directory of engineering summer camps.

## Advancement

Electrical and electronic engineers may advance to supervisory positions in which they lead a team of engineers and technicians. Some may move to management positions, working as engineering or program managers. Preparation for managerial positions usually requires working under the guidance of a more experienced engineer. For more information, see the profile on [architectural and engineering managers](#).

For sales work, an engineering background enables engineers to discuss a product's technical aspects and assist in product planning and use. For more



Becoming an electrical or electronics engineer involves the study of math and engineering.

information, see the profile on [sales engineers](#).

[<- Work Environment](#)

[Pay ->](#)

Pay

## Pay

About this section

The median annual wage for electrical engineers was \$98,530 in May 2019. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than \$63,020, and the highest 10 percent earned more than \$155,880.

The median annual wage for electronics engineers, except computer was \$105,570 in May 2019. The lowest 10 percent earned less than \$66,620, and the highest 10 percent earned more than \$164,210.

In May 2019, the median annual wages for electrical engineers in the top industries in which they worked were as follows:

Research and development in the physical, engineering, and life sciences	\$113,050
Semiconductor and other electronic component manufacturing	104,170
Navigational, measuring, electromedical, and control instruments manufacturing	103,400
Electric power generation, transmission and distribution	99,610
Engineering services	96,540

In May 2019, the median annual wages for electronics engineers, except computer in the top industries in which they worked were as follows:

Navigational, measuring, electromedical, and control instruments manufacturing	\$114,260
Federal government, excluding postal service	112,870
Semiconductor and other electronic component manufacturing	106,240
Engineering services	101,580
Telecommunications	98,600

Most electrical and electronics engineers work full time.

[<- How to Become One](#)

[Job Outlook ->](#)

Job Outlook

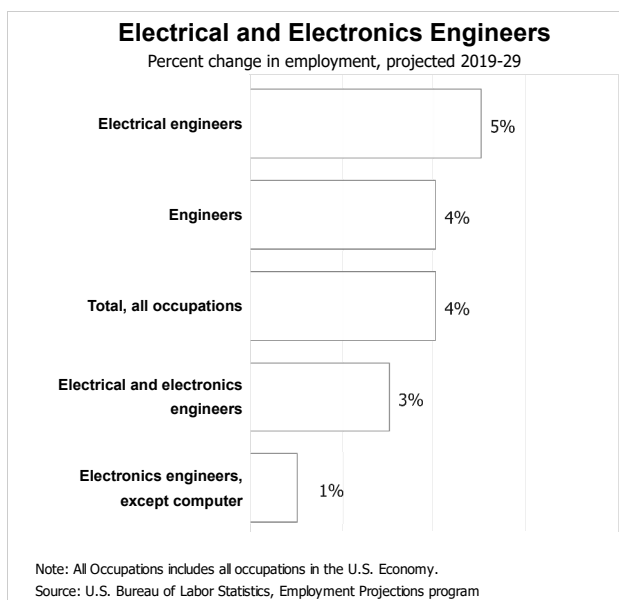
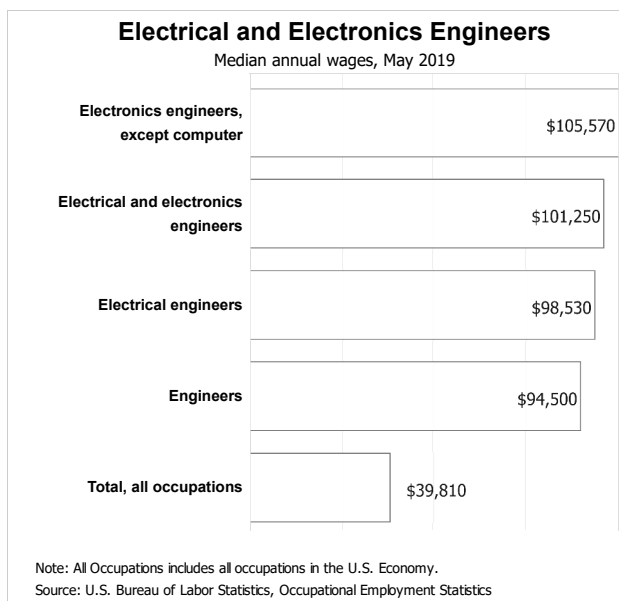
## Job Outlook

About this section

Overall employment of electrical and electronics engineers is projected to grow 3 percent from 2019 to 2029, about as fast as the average for all occupations. Employment growth is expected to be tempered by slow growth or decline in some industries, such as manufacturing and utilities.

Job growth for electrical and electronics engineers is projected to occur largely in professional, scientific, and technical services firms, as more companies are expected to tap the expertise of engineers for projects involving electronic devices and systems. These engineers also will be needed to develop sophisticated consumer electronics.

The rapid pace of technological innovation will create some demand for electrical and electronics engineers in research and development, an area in which engineering expertise will be needed to design distribution systems related to new technologies. These engineers will play key roles in new developments with solar arrays, semiconductors, and communications technologies.



### Employment projections data for electrical and electronics engineers, 2019-29

Occupational Title	SOC Code	Employment, 2019	Projected Employment, 2029	Change, 2019-29		Employment by Industry
				Percent	Numeric	

Occupational Title	SOC Code	Employment, 2019	Projected Employment, 2029	Change, 2019-29		Employment by Industry
				Percent	Numeric	
<b>Electrical and electronics engineers</b>	17-2070	328,100	338,900	3	10,800	<a href="#">Get data</a>
<b>Electrical engineers</b>	17-2071	193,100	202,100	5	9,000	<a href="#">Get data</a>
<b>Electronics engineers, except computer</b>	17-2072	134,900	136,800	1	1,900	<a href="#">Get data</a>

SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program

[<- Pay](#)

[State & Area Data ->](#)

State & Area Data

## State & Area Data

[About this section](#)

### Occupational Employment Statistics (OES)

The [Occupational Employment Statistics](#) (OES) program produces employment and wage estimates annually for over 800 occupations. These estimates are available for the nation as a whole, for individual states, and for metropolitan and nonmetropolitan areas. The link(s) below go to OES data maps for employment and wages by state and area.

- [Electrical engineers](#)
- [Electronics engineers, except computer](#)

### Projections Central

Occupational employment projections are developed for all states by Labor Market Information (LMI) or individual state Employment Projections offices. All state projections data are available at [www.projectionscentral.com](http://www.projectionscentral.com). Information on this site allows projected employment growth for an occupation to be compared among states or to be compared within one state. In addition, states may produce projections for areas; there are links to each state's websites where these data may be retrieved.

### CareerOneStop

CareerOneStop includes hundreds of [occupational profiles](#) with data available by state and metro area. There are links in the left-hand side menu to compare occupational employment by state and occupational wages by local area or metro area. There is also a [salary info tool](#) to search for wages by zip code.

[<- Job Outlook](#)








[Similar Occupations ->](#)




Similar Occupations

## Similar Occupations

[About this section](#)

This table shows a list of occupations with job duties that are similar to those of electrical and electronics engineers.

	OCCUPATION	JOB DUTIES	ENTRY-LEVEL EDUCATION	2019 MEDIAN PAY
	<a href="#">Aerospace Engineers</a>	Aerospace engineers design primarily aircraft, spacecraft, satellites, and missiles.	Bachelor's degree	\$116,500
	<a href="#">Architectural and Engineering Managers</a>	Architectural and engineering managers plan, direct, and coordinate activities in architectural and engineering companies.	Bachelor's degree	\$144,830
	<a href="#">Bioengineers and Biomedical Engineers</a>	Bioengineers and biomedical engineers combine engineering principles with sciences to design and create equipment, devices, computer systems, and software.	Bachelor's degree	\$91,410
	<a href="#">Computer Hardware Engineers</a>	Computer hardware engineers research, design, develop, and test computer systems and components.	Bachelor's degree	\$117,220
	<a href="#">Electrical and Electronics Engineering Technicians</a>	Electrical and electronics engineering technicians help engineers design and develop electrical and electronic equipment.	Associate's degree	\$65,260
	<a href="#">Electrical and Electronics Installers and Repairers</a>	Electrical and electronics installers and repairers install or repair a variety of electrical equipment.	<a href="#">See How to Become One</a>	\$59,080
	<a href="#">Electricians</a>	Electricians install, maintain, and repair electrical power, communications, lighting, and control systems.	High school diploma or equivalent	\$56,180

	OCCUPATION	JOB DUTIES	ENTRY-LEVEL EDUCATION	2019 MEDIAN PAY
	<a href="#">Electro-mechanical Technicians</a>	Electro-mechanical technicians operate, test, and maintain unmanned, automated, robotic, or electromechanical equipment.	Associate's degree	\$58,350
	<a href="#">Network and Computer Systems Administrators</a>	Network and computer systems administrators are responsible for the day-to-day operation of computer networks.	Bachelor's degree	\$83,510
	<a href="#">Sales Engineers</a>	Sales engineers sell complex scientific and technological products or services to businesses.	Bachelor's degree	\$103,900

[← State & Area Data](#)

[More Info →](#)

More Info

## Contacts for More Information

About this section

For more information about general engineering education and career resources, visit

[American Society for Engineering Education](#)

[Technology Student Association](#)

For more information about licensure as an electrical or electronics engineer, visit

[National Council of Examiners for Engineering and Surveying](#)

[National Society of Professional Engineers](#)

[International Society of Automation](#)

For more information about accredited engineering programs, visit

[ABET](#)

For more information about engineering summer camps, visit

[Engineering Education Service Center](#)

### O\*NET

[Electrical Engineers](#)

[Electronics Engineers, Except Computer](#)

[Radio Frequency Identification Device Specialists](#)

[← Similar Occupations](#)

#### SUGGESTED CITATION:

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Electrical and Electronics Engineers, at <https://www.bls.gov/ooh/architecture-and-engineering/electrical-and-electronics-engineers.htm> (visited March 02, 2021).

**Last Modified Date:** Monday, September 21, 2020

U.S. BUREAU OF LABOR STATISTICS Office of Occupational Statistics and Employment Projections PSB Suite 2135 2 Massachusetts Avenue NE  
Washington, DC 20212-0001

Telephone:1-202-691-5700\_ [www.bls.gov/ooh](http://www.bls.gov/ooh) [Contact OOH](#)