Electrical and Electronics Engineers

Summary

Quick Facts: Electrical and Electronics Engineers	
2021 Median Pay	$101,780 per year $48.93 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2020	313,200
Job Outlook, 2020-30	7% (As fast as average)
Employment Change, 2020-30	20,400

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 $100,420 in May 2021.

The median annual wage for electronics engineers, except computer was $104,820 in May 2021.

Job Outlook
Overall employment of electrical and electronics engineers is projected to grow 7 percent from 2020 to 2030, about as fast as the average for all occupations.

About 22,700 openings for electrical and electronics engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

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 Electrical and Electronics Engineers Do

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

- Electronics engineers analyze the requirements and costs of electrical systems.

- Work with project managers on production efforts to ensure that projects are completed satisfactorily, on time, and within budget

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.

Work Environment

Electrical engineers held about 188,000 jobs in 2020. The largest employers of electrical engineers were as follows:

- Engineering services 21%

- Electric power generation, transmission and distribution 10

- 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 125,200 jobs in 2020. The largest employers of electronics engineers, except computer were as follows:

- Telecommunications 18%

- Federal government, excluding postal service 14

- Semiconductor and other electronic component manufacturing 13

- Engineering services 7

- Navigational, measuring, electromedical, and control instruments manufacturing 6

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.

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, 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.

Electrical and electronics engineers typically need a bachelor's degree in electrical engineering, electronics engineering, 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.

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 information, see the profile on sales engineers.

Pay

The median annual wage for electrical engineers was $100,420 in May 2021. 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$62,360, and the highest 10 percent earned more than $162,930.

The median annual wage for electronics engineers, except computer was $104,820 in May 2021. The lowest 10 percent earned less than $73,630, and the highest 10 percent earned more than $166,890.

In May 2021, the median annual wages for electrical engineers in the top industries in which they worked were as follows:
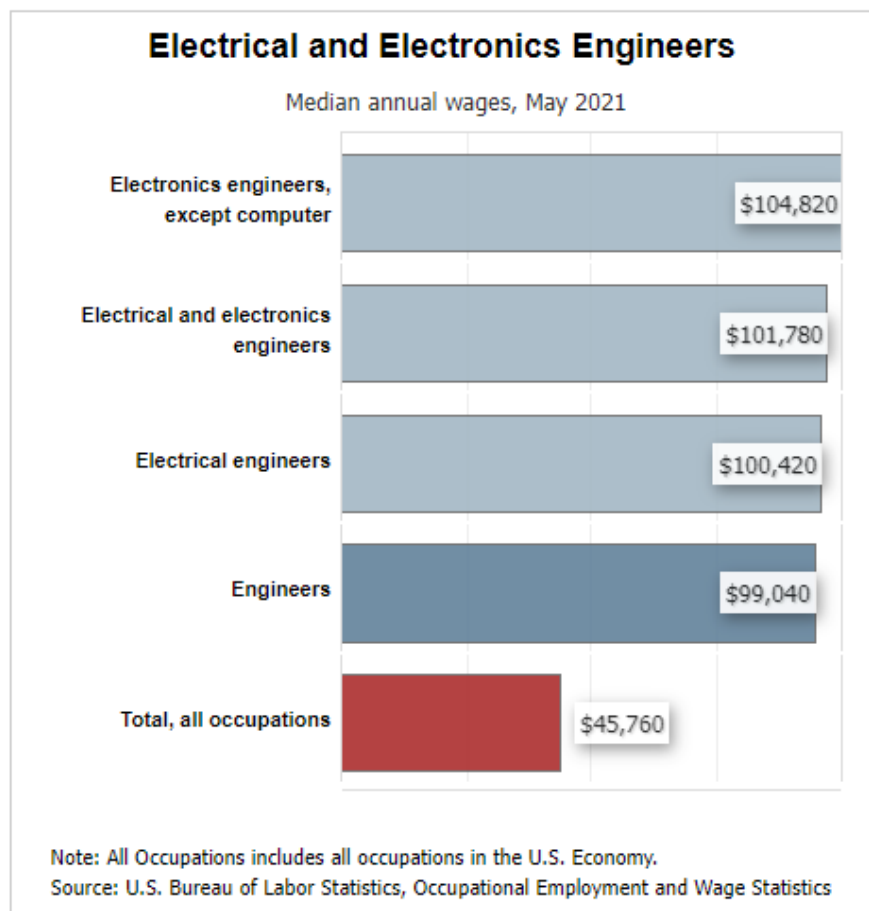
Research and development in the physical, engineering, and life sciences $125,080

- Semiconductor and other electronic component manufacturing 107,190

- Navigational, measuring, electromedical, and control instruments manufacturing 102,110

- Electric power generation, transmission and distribution 101,780

- Engineering services 99,330

In May 2021, 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 $128,560

- Semiconductor and other electronic component manufacturing 128,330

- Federal government, excluding postal service 117,730

- Engineering services 102,390

- Telecommunications 100,290

Most electrical and electronics engineers work full time.

Electrical and Electronics Engineers

Median annual wages, May 2021

Occupation	Wage
Electronics engineers, except computer	$104,820
Electrical and electronics engineers	$101,780
Electrical engineers	$100,420
Engineers	$99,040
Total, all occupations	$45,760

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Occupational Employment and Wage Statistics

Job Outlook

Overall employment of electrical and electronics engineers is projected to grow 7 percent from 2020 to 2030, about as fast as the average for all occupations.
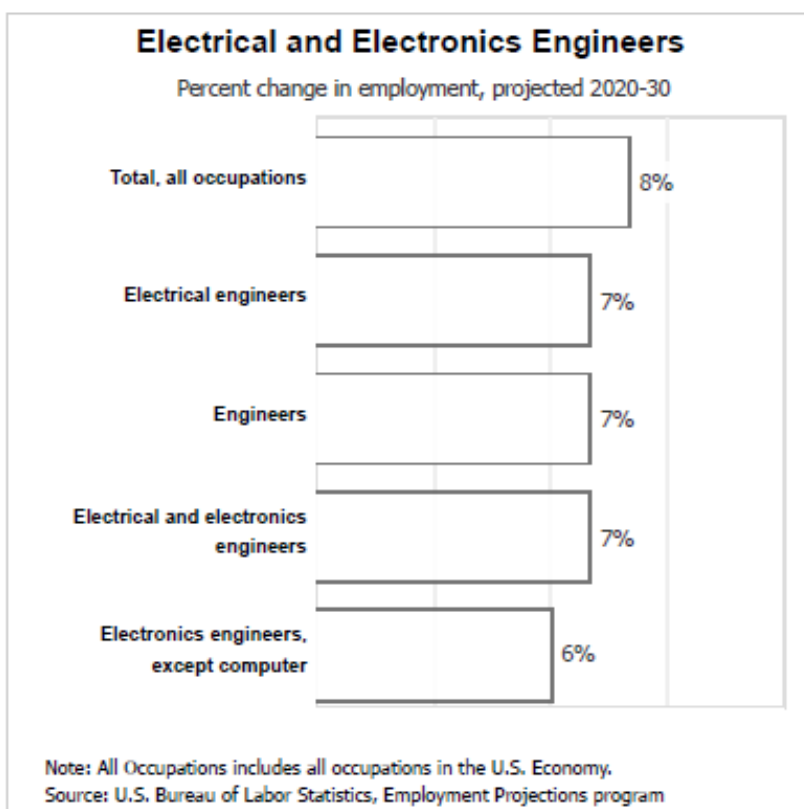
About 22,700 openings for electrical and electronics engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

Employment

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.

Electrical and Electronics Engineers

Percent change in employment, projected 2020-30

Occupation	Percent change
Total, all occupations	8%
Electrical engineers	7%
Engineers	7%
Electrical and electronics engineers	7%
Electronics engineers, except computer	6%

Note: All Occupations includes all occupations in the U.S. Economy.
Source: U.S. Bureau of Labor Statistics, Employment Projections program

Employment projections data for electrical and electronics engineers, 2020-30

Electrical and electronics engineers

SOC Code:

17-2070

Employment, 2020:

313,200

Projected Employment, 2030:

333,600

Change, 2020-30 (Percent):

7

Change, 2020-30 (Numeric):

20,400

Employment By Industry:

Get data

Electrical engineers

SOC Code:

17-2071

Employment, 2020:

188,000

Projected Employment, 2030:

200,700

Change, 2020-30 (Percent):

7

Change, 2020-30 (Numeric):

12,700

Employment By Industry:

Get data

Electronics engineers, except computer

SOC Code:

17-2072

Employment, 2020:

125,200

Projected Employment, 2030:

132,900

Change, 2020-30 (Percent):

6

Change, 2020-30 (Numeric):

7,700

Employment By Industry:

Get data

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

State & Area Data

Occupational Employment and Wage Statistics (OEWS)

The Occupational Employment and Wage Statistics

(OEWS) 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 OEWS data maps for employment and wages by state and area.

- Electrical engineers

- Electronics engineers, except computer

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

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.

Similar Occupations

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

Aerospace Engineers

Job Duties:

Aerospace engineers design primarily aircraft, spacecraft, satellites, and missiles.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$122,270

Architectural and Engineering Managers

Job Duties:

Architectural and engineering managers plan, direct, and coordinate activities in architectural and engineering companies.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$152,350

Bioengineers and Biomedical Engineers

Job Duties:

Bioengineers and biomedical engineers combine engineering principles with sciences to design and create equipment, devices, computer systems, and software.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$97,410

Computer Hardware Engineers

Job Duties:

Computer hardware engineers research, design, develop, and test computer systems and components.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$128,170

Electrical and Electronic Engineering Technologists and Technicians

Job Duties:

Electrical and electronic engineering technologists and technicians help engineers design and develop equipment that is powered by electricity or electric current.

Entry-Level Education:

Associate's degree

2021 Median Pay:

$63,640

Electrical and Electronics Installers and Repairers

Job Duties:

Electrical and electronics installers and repairers install or repair a variety of electrical equipment.

Entry-Level Education:

See How to Become One

2021 Median Pay:

$61,760

Electricians

Job Duties:

Electricians install, maintain, and repair electrical power, communications, lighting, and control systems.

Entry-Level Education:

High school diploma or equivalent

2021 Median Pay:

$60,040

Electro-mechanical and Mechatronics Technologists and Technicians

Job Duties:

Electro-mechanical and mechatronics technologists and technicians operate, test, and maintain electromechanical or robotic equipment.

Entry-Level Education:

Associate's degree

2021 Median Pay:

$60,360

Network and Computer Systems Administrators

Job Duties:

Network and computer systems administrators are responsible for the day-to-day operation of computer networks.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$80,600

Sales Engineers

Job Duties:

Sales engineers sell complex scientific and technological products or services to businesses.

Entry-Level Education:

Bachelor's degree

2021 Median Pay:

$103,710

Contacts for More Information

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