

Chemical Engineers: Creating New Technologies and Materials

Caleb Embree and Edward J. Lazaros

Ball State University

cmembree@bsu.edu; ejlazaros@bsu.edu

Introduction

This paper gives information about a lesser known career for career and technical education students. Chemical engineering is a career path that is of interest to students that are interested in aspects of technology and of science, notably chemistry. This paper details the duties of chemical engineer, their work environment, the steps to take to become a chemical engineer, and their pay and job outlook.

Duties of a Chemical Engineer

A chemical engineer uses the principles of chemistry and other related sciences to solve problems related to the use of chemicals, whether it be in food, production, fuel, drugs, or many other fields. The field of chemical engineering is a broad one that can describe a number of types of work. The chemical engineer can manufacture new chemicals, or create new applications for chemicals, or create new machinery to manufacture chemicals and byproducts (U.S. Department of Labor, 2014).

One of the main roles of chemical engineers is to develop, maintain, and improve chemical manufacturing processes. They can develop processes for many industries, working with chemicals to separate components of liquids and gasses, or to generate electricity using chemical processes, for example. This includes creating new technologies and machinery to implement the manufacturing of products. Their job also commonly involves developing safety procedures for the new chemicals and chemical processes that they work with. They test the equipment and processes and make sure that everything is up to optimal efficiency. Chemical engineers are often responsible for estimating the production costs and other aspects of the manufacturing processes for their management (U.S. Department of Labor, 2014).

Many chemical engineers pick a specialization and work in a setting according to their specialization. They could specialize in a specific process, such as oxidation reactions, which uses oxygen to react with other chemicals, or polymerization, which is the process of making plastics and resins. They can also specialize in a specific chemical field, such as nanomaterials, or very small substances, biological engineering, or in the development of specific types of products (U.S. Department of Labor, 2014).

Chemical engineers do not just have to produce new chemicals. They can work in many industries, such as producing electricity, making electronics, food, clothing, or even paper. They can also work in fields other than manufacturing, such as life sciences, biotechnology, or business. No matter what fields a chemical engineer works in, they

need to be aware of all aspects of the manufacturing process and how it influences the products, workers, and the environment (U.S. Department of Labor, 2014).

Work Environment of Chemical Engineers

Most chemical engineers work in office or laboratory settings, though they can work in industrial settings if they are overseeing the setup and workings of a manufacturing process. They usually work with other scientists and the technicians that create and operate the manufacturing equipment. Some chemical engineers have to travel around the world for their job. Most chemical engineers work full time (U.S. Department of Labor, 2014).

There are a number of industries that hire chemical engineers. The industry that hires the most chemical engineers is the architecture and engineering industry, followed by the chemical manufacturing industry. The industry that hires the next largest amount of chemical engineers is the scientific research and development industry. Next is the artificial synthetic fibers and filaments manufacturing industry, which also includes the resin and synthetic rubber industry. Finally, the petroleum and coal products manufacturing industry hires the next largest number of chemical engineers (U.S. Department of Labor, 2014).

How to Become a Chemical Engineer

The minimum education requirement to become a chemical engineer is a bachelor's degree. The degree should be in chemical engineering. A graduate degree, up to a PhD is needed for the chemical engineer to work in research, or to teach at a university. Having practical experience is key, so many programs at universities offer co-ops with local engineering firms to get students the experience while they are still learning. (U.S. Department of Labor, 2014). Engineering programs at a university are often accredited by ABET. ABET is an independent accreditation organization that makes sure that a university's degree program prepares students for life as a chemical engineer and that they have all of the needed skills to become chemical engineers, once they receive their degree (ABET, 2013).

Some people also believe that the education of chemical engineers needs to be geared towards the future, so they often take sustainable engineering courses. Instructors in these courses teach the chemical engineer how to make sustainable technology, and they teach how to design processes that are safe and sustainable on the environment. These skills will be important in the near future, and it is more beneficial to chemical engineers to have these skills when they get their degrees, rather than having to learn them on the job (Byrne, 2010, p. 28).

There are a few skills that are necessary for the chemical engineer to have. They need to have analytical skills so that they analyze data and explore problems. Chemical engineers need to be creative so that they have inspiration to design new chemicals, materials, and machinery. Chemical engineers need to have ingenuity so that they can apply the concepts of chemistry and engineering in new ways to create new products. A

chemical engineer must have good interpersonal skills so that they can communicate with the people that put their solutions into production. Math skills are needed for the analysis of solutions and for designing machinery. Problem solving skills are integral for a chemical engineer because they must be able to look at a problem and analyze and come up with ways of solving it (U.S. Department of Labor, 2014).

While licensure is not necessarily needed for chemical engineers, it is encouraged for advancement. To become a licensed professional engineer, a chemical engineer has to go through the following steps. First, they need a degree in chemical engineering from an ABET accredited school. Then, they need to get a passing score on the fundamentals of engineering exam. Finally, after they have gained sufficient work experience, they need a passing score on their professional engineering exam (U.S. Department of Labor, 2014).

Pay of Chemical Engineers

The median pay of chemical engineers in 2012 was \$95,350. This means that the lowest 10 percent of chemical engineers earned less than \$58,830 and the highest 10 percent earned more than \$154,840. The pay for chemical engineers also varies according to their education levels. The chemical engineers that reported a bachelor's degree as their highest education level had a media salary of \$67,800. Some chemical engineers also receive benefits such as stock options or profit sharing rewards from their company (U.S. Department of Labor, 2014). The pay of chemical engineers continues to climb because of how competitive the industry is (Jenkins, 2014, p. 17).

The pay for chemical engineers varies according to what industry they are working in. A chemical engineer working in the petroleum and coal manufacturing industry makes a median salary of \$105,840, while one working in basic chemical manufacturing has a median salary of \$99,510. A chemical engineer that works in the scientific research and development industry has a median salary of \$97,800. A chemical engineer working in the resin, synthetic rubber, and synthetic fiber manufacturing industry has a median salary of \$94,810, while one working in the architecture and engineering industry has a median salary of \$93,390 (U.S. Department of Labor, 2014).

Job Outlook for Chemical Engineers

The employment of chemical engineers is expected to increase by 4% from 2012 to 2022. This equates to 1,500 new jobs being created. The demand for chemical engineers is largely based on the demand for the products of the industries they work for. This means that employment growth can be assured if chemical engineers can continue to innovate and improve to make sure that their industries stay on the forefront of new technology (U.S. Department of Labor, 2014). Growth is already increasing because there is increasing demand in multiple areas, and because there are more complex projects going on around the globe (Jenkins, 2014, p. 17).

Many chemical engineers work in industries that supply to the manufacturing industry. This means that as demand for their products in the manufacturing industry changes so does the demand for chemical engineers. However, many chemical engineers are joining

new and developing fields such as nanotechnology and biotechnology, which will help sustain the demand for chemical engineers (U.S. Department of Labor, 2014).

Conclusion

Chemical engineers are one of the most important parts of the manufacturing processes. They create the technologies that allows the manufactures to produce their products. They develop new materials and drugs, and new technology for chemical processes (U.S. Department of Labor, 2014). Even though chemical engineers are so critical to the manufacturing process, they are relatively unmown. This can be changed if more students learn about the career path of chemical engineering.

References

- ABET. 2013. *Accreditation*. Retrieved from: <http://www.abet.org/accreditation/>
- Byrne, E. 2010. Educating the chemical engineer of the future. *TCE: The Chemical Engineer*, 833, 27-29.
- U.S. Department of Labor, Bureau of Labor Statistics. 2014. *Occupational Outlook Handbook*. Retrieved from: <http://www.bls.gov/ooh/>
- Jenkins, S. 2014. CPI workforce: Filling the gaps. *Chemical Engineering*, 121(11), 17-21.