

Lightweight Technology Workforce

Supply-Demand Quarterly Update



ABOUT THIS REPORT

Lightweight Innovations for Tomorrow (LIFT) is a public-private partnership that develops and deploys advanced lightweight materials manufacturing technologies and implements education and training programs to prepare the workforce. An educated and skilled workforce is critical to the future of manufacturing. Under the direction of Emily Stover DeRocco, LIFT's Education & Workforce Director, LIFT's State Teams, engaging manufacturers, educators, workforce and economic developers, and state and local officials, are designing and implementing a cohesive strategy to deliver the talent necessary to the long-term health of the U.S. defense and commercial industrial bases.

Lightweight materials are increasingly important to the competitiveness of transportation manufacturing sectors, including suppliers in the automotive, aircraft, heavy truck, ship, rail, and defense manufacturing industries. Lighter vehicles for the military, industry, and consumer alike, have better performance and use less fuel.

From welding to skilled metalwork, to logistics and mechanical and chemical engineering, to industrial design and manufacturing management, lightweighting-related jobs are found in nearly every manufacturing sector. This report provides an overview and examines the changing demand for workers in jobs that are related to lightweighting in Tennessee. This analysis is meant to further enhance the future development of lightweighting workforce education and training in the region.

Of particular note, throughout this analysis and report, we rely not just on national databases related to traditional occupations and job families. The pace of change in the manufacturing industry, largely resulting from technology infusion and forces of globalization, is reflected in rapid-fire change in the knowledge, skills and abilities the manufacturing workforce requires. To provide the best available analyses, this report integrates intelligence gathered from the real time, transactional labor market reflecting the realities of demand and supply, the changing nature of manufacturing employment, and the competencies that are needed in the 21st century manufacturing workforce.



EMPLOYER DEMAND AND EMPLOYMENT TRENDS

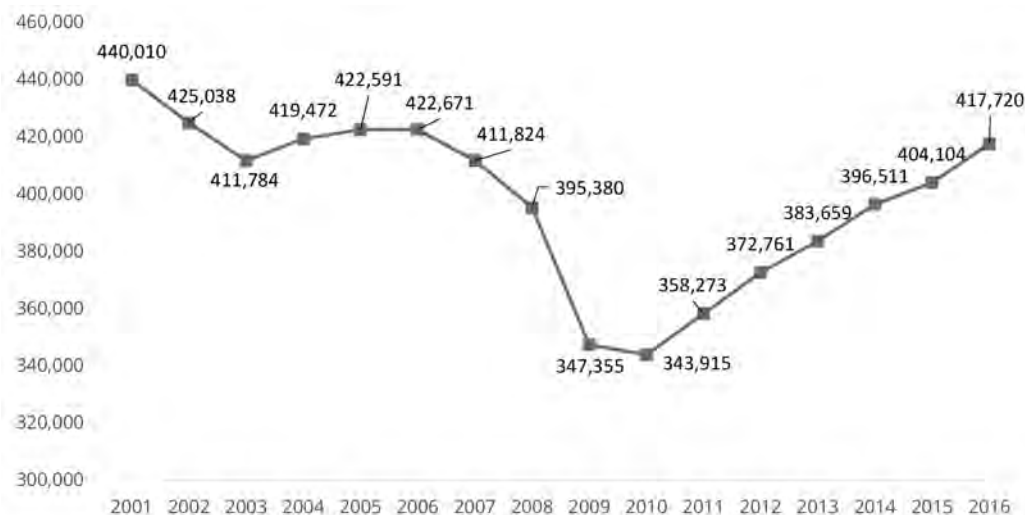
Online job ads for advanced manufacturing jobs related to lightweighting in Tennessee were up 8% to 10,868 in Q3 2016, compared to 10,107 in Q2 2016. This level of online job postings was 14% lower than the 12,640 postings in Q3 2015, a year ago. Meanwhile, 2016 marked the sixth consecutive year of employment growth for lightweighting-related jobs in Tennessee. In 2013, less than 344,000 workers were employed in lightweighting-related advanced manufacturing jobs, and in 2016, employment reached nearly 418,000, a 21% increase.



Job postings over time Tennessee

Q1 2013 - Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



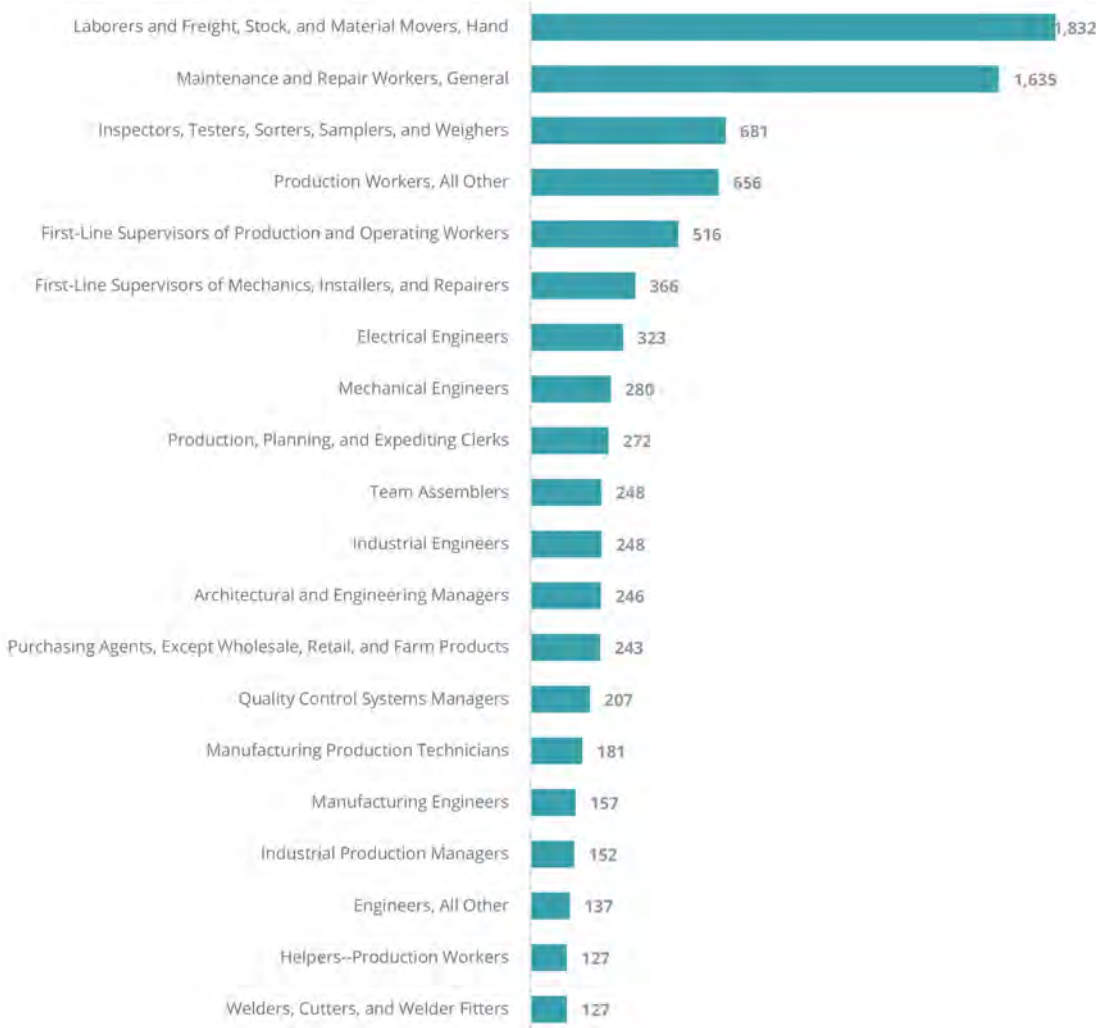
Employment over time Tennessee

Q1 2013 - Q3 2016

Data: EMSI, QWI
Analysis: Workforce Intelligence Network

TOP JOBS

The top in-demand occupation related to lightweight advanced manufacturing was laborers and freight, stock, and material movers, with 1,832 online job postings in Tennessee during Q3 2016. As in Q2 2016, close in second were maintenance and repair workers (1,635 postings).



Top posting jobs Tennessee Q3 2016

Data: Burning Glass
Technologies
Analysis: Workforce Intelligence
Network

8%
increase in
demand for
advanced
manufacturing
workers

10,868
Total online job
ads in Q3 2016

417,720
Number of
Tennessee workers
in advanced
manufacturing



INTRODUCTION TO SKILLED TRADES

Skilled trades workers are the builders and makers of America. They work directly with advanced materials, assemble complicated products, and are experts in welding and machinery. They ensure that designs and plans are carried out to every detail and specification. These workers do everything from welding, to setting and managing computer-numerically-controlled machines, to overseeing manufacturing floors. These skilled workers are essential to the manufacturing of lightweight materials.

The 71 individual occupations within this cluster can be split into three distinct occupation sub-groups; machinists, assembly & operations workers, and skilled materials workers.

Machinists

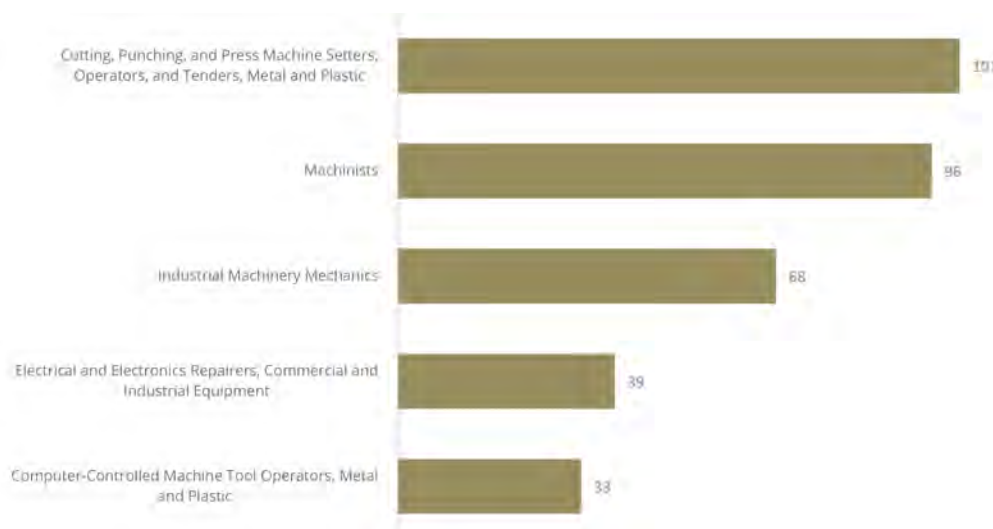
Machinists set up and operate a variety of machine tools to produce parts and instruments. Some work on traditional industrial machinery while others operate or develop programs for computer-controlled machinery.

Skilled Materials

Skilled Materials workers perform numerous roles from general maintenance to welding. All Skilled Materials workers must have intimate knowledge of lightweight metals and techniques in order to conduct proper repairs and/or assembly.

Assembly & Operation

Assembly & Operations workers assist other Skilled Trades workers during production. Some perform quality assurance inspections, assist with assembly, or perform supervisory duties on the factory floor.



Top posting jobs

Machinists

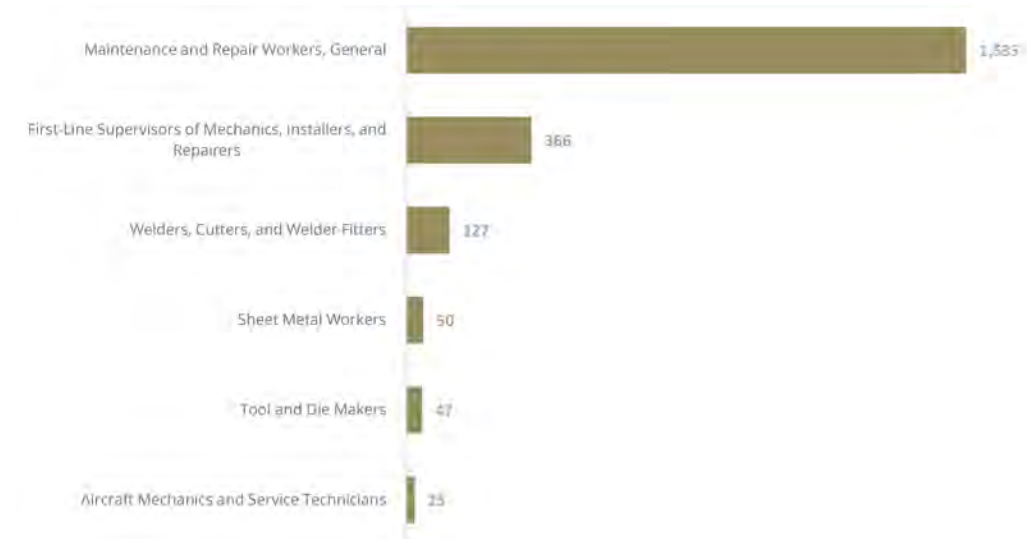
Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Cutting, punching and press machine setters, operators, and tenders were the most in-demand occupation in the Machinists sub-group during Q3 2016.

Tennessee employers posted 101 online job ads for these workers between July and September 2016. The next most in-demand occupations included machinists (96 postings) and industrial machinery mechanics (77 postings).

SKILLED TRADES



Top posting jobs

Skilled Materials Workers

Q3 2016

Data: Burning Glass Technologies

Analysis: Workforce Intelligence Network

Maintenance and repair workers were the most in-demand occupation in the Skilled Materials sub-group. The 1,635 online job ads for this occupation was more than four times the demand for the next most in-demand job in the sub-group, first-line supervisors of mechanics, installers, and repairers (366 postings).



Top posting jobs

Assembly & Operations

Q3 2016

Data: Burning Glass Technologies

Analysis: Workforce Intelligence Network

Inspectors, testers, sorters, samplers, and weighers led the Assembly & Operations sub-group with 681 online ads while production workers had 656 postings during Q3 2016. The high demand for both of these occupations indicates strong employment growth potential in Assembly & Operations.

SKILLED TRADES

IN-DEMAND TECHNICAL SKILLS

The Skilled Trades group requires a wide array of high-level technical skills. While more traditional skills remain necessary, such as repair, inspection and the ability to weld and use hand tools, more skills requiring post-secondary education and training have become prevalent in Skilled Trades job postings. Skills like supervisory skills and teaching are in high-demand.

- | | |
|---|--|
| <ul style="list-style-type: none">• Repair, Inspection• Scheduling• Packaging• Supervisory Skills, Budgeting• Machinery | <ul style="list-style-type: none">• Plumbing, HVAC• Hand Tools• Welding• Product Development• Microsoft Office |
|---|--|

IN-DEMAND EMPLOYABILITY SKILLS

While Skilled Trades workers now need advanced technical skills, they also need to maintain more traditional employability skills critical to succeeding in the workplace. Employers hiring Skilled Trades workers often desire employability skills like communication, the ability to perform physical labor, problem solving, and basic computer skills. These types of skills are crucial for Skilled Trades workers so that they can collaborate effectively. Employability skills are especially needed in high-demand supervisor roles.

- | | |
|--|--|
| <ul style="list-style-type: none">• Communication Skills• Ability to Perform Physical Labor• Troubleshooting, Problem Solving• Preventative Maintenance• Detail-Oriented | <ul style="list-style-type: none">• Computer Skills• Writing• Organizational Skills• Quality Assurance and Control• Research |
|--|--|

SKILLED TRADES

IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

Advertised experience in online job postings for Skilled Trades workers in Tennessee reveals that an overwhelming majority of openings require less than five years of experience. The high number of job postings indicating little to no experience required indicates that entry-level jobs are available for qualified workers. Further, many employers expect candidates to have at least some post-secondary training, as evidenced by the nearly 2,500 postings in Q3 2016 requiring this level of educational attainment. If potential candidates can learn valuable in-demand technical skills like welding, programming, or mathematics, they can begin to fill the low-level experience openings that have high demand amongst employers in Tennessee. Job postings requiring five or more years of experience most likely represent supervisor or management positions.

Experience in-demand Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



Education & training in-demand Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



WAGES

Advertised wages Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

The average advertised salary in online job postings during Q3 2016 for Skilled Trades workers in Tennessee was \$39,156, 22% higher than median earnings of all workers in the state (\$32,000). The average advertised salary was also 8% higher than the median income of current Tennessee Skilled Trades workers (\$36,171). A majority of postings advertising salary offered less than \$35,000. Increased demand for these workers should drive wages up. Furthermore, the ability to gain training and education in less than two years paired with the higher wage levels make Skilled Trades occupations an exciting option for Tennessee workers.



0-5 years
Experience most
in-demand by
Tennessee
employers

\$39,156
average
advertised salary

**Associate's
degree or less
is required**



INTRODUCTION TO ADMINISTRATION

Purchasing materials, ensuring worker safety around machines and with materials, and coordinating and analyzing material and goods movement are essential administration jobs related to lightweighting. Without workers focused on worker safety, production would slow down and more workers would be injured. Procurement professionals require an extensive understanding of the materials that they purchase. Logistics workers range from materials movers to logistics analysts. While these jobs are focused on administration, all of the workers in this occupation category must have detailed knowledge of materials, goods movement, and worker safety to help ensure smooth and seamless production.

There are 17 individual occupations within this cluster, which can be split into three distinct occupation sub-groups: procurement & purchasing, human safety, and logistics workers.

Logistics

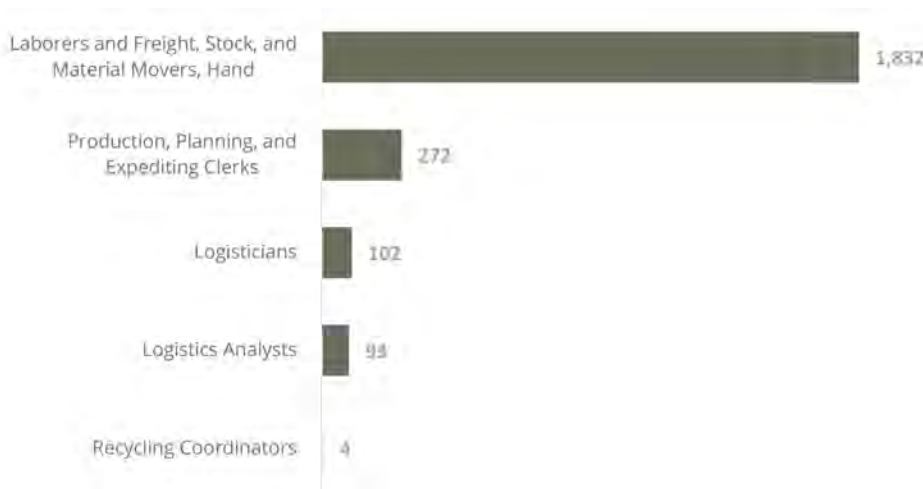
Logistics workers ensure transportation optimization of materials within organizations, from designing efficient supply chain processes to engaging in the actual transport of material and freight.

Procurement & Purchasing

Procurement & Purchasing workers ensure that all of the machinery, equipment, tools, and supplies necessary for metal manufacturers are ready and available for production.

Human Safety

Human Safety workers plan, implement, coordinate, review, and inspect safety programs and protocols to ensure a safe workplace environment.



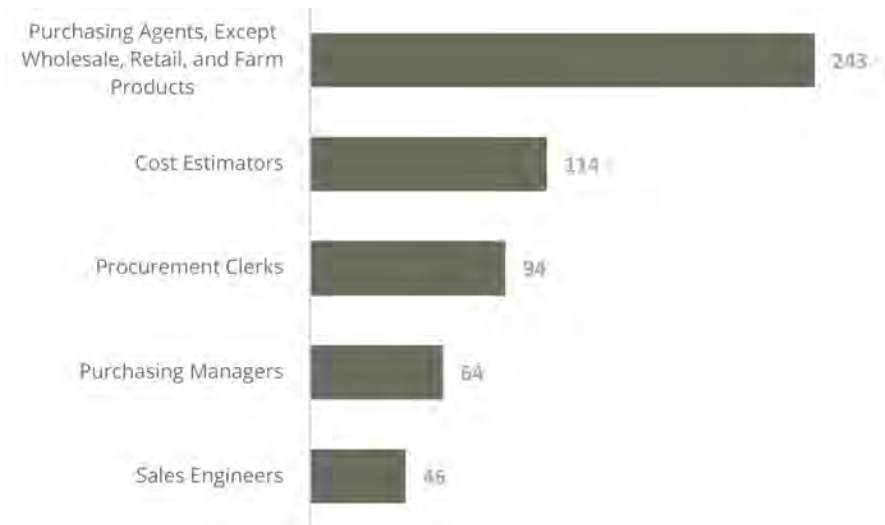
Top posting jobs

Logistics Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

The most in-demand Logistics occupation in Tennessee in Q3 2016 was laborers and freight, stock, and material movers. Other top Logistics jobs included production, planning, and expediting clerks (272 postings), and logisticians (102 postings).

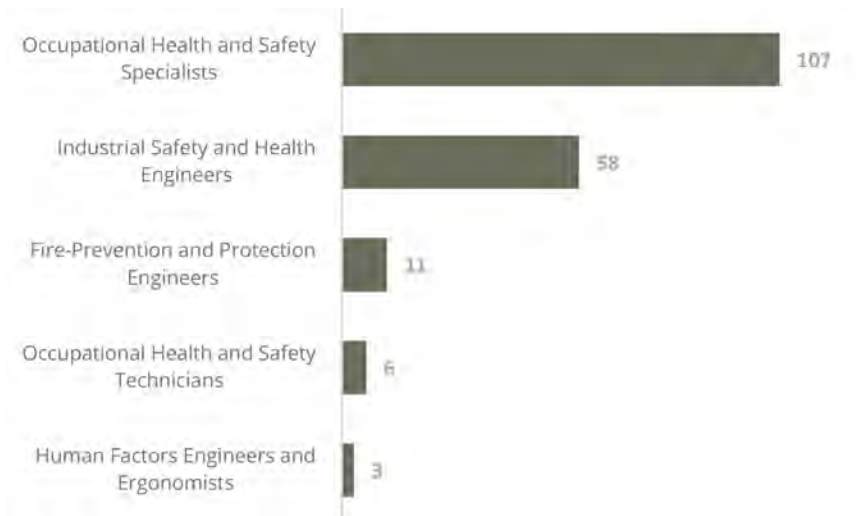
ADMINISTRATION



Top posting jobs *Procurement & Purchasing* Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Purchasing agents led the sub-group with nearly 250 online ads during Q3 2016. Cost estimators, purchasing managers, and procurement clerks were also in demand in Tennessee during Q3 as seen in Q2 2016.



Top posting jobs *Human Safety* Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Occupational health and safety specialists and industrial safety and health engineers dominated postings for this sub-group with 107 and 58 ads, respectively, during Q3 2016.

ADMINISTRATION

IN-DEMAND TECHNICAL SKILLS

Occupations within the Administration group require a unique combination of hands-on technical skills, similar to the Skilled Trades, in conjunction with business and management prowess. For example, online job postings in Tennessee showed that Administration workers need to understand manufacturing-related subjects such as machinery and inspection while also having customer service and procurement skills. Common skill listings like scheduling and contract management communicate employer demand for Administration workers in high-wage management occupations.

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|--|--|
| <ul style="list-style-type: none">• Forklift Operation, Machinery• Microsoft Excel, Microsoft Office• Scheduling• Project and Contract Management• Purchasing, Procurement, Budgeting• Inspection, Repair | <ul style="list-style-type: none">• Customer Service• Scanners• Labeling, Sorting, Packaging• Inventory Management and Control• Logistics, Supply Chain Management |
|--|--|

IN-DEMAND EMPLOYABILITY SKILLS

Similar to the Skilled Trades group, Tennessee employers seek administration workers with traditional employability skills such as the ability to communicate, perform physical labor, organize, and solve problems. The inclusion of mathematics as a common baseline skill in postings reflects the technical nature of Administration occupations and the higher levels of education required for most openings. Due to the numerous business-oriented duties of Administration workers, computer and writing skills are necessary for success.

- | | |
|---|--|
| <ul style="list-style-type: none">• Communication Skills, Team Work-Collaboration• Ability to Perform Physical Labor• Organizational Skills, Detail-Oriented• Computer Skills• Writing, English | <ul style="list-style-type: none">• Planning, Problem Solving, Project Management• Problem Solving• Mathematics• Building Effective Relationships• Work Area Maintenance |
|---|--|

ADMINISTRATION

IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

Of the online postings that advertised experience required, a majority stated that little to no experience was required for job openings for Administration workers. A substantial amount of postings also required three to five years (365 postings), possibly indicating that employers would like sales analysts with previous experience or enough experience for management positions. Of the online postings that advertised minimum education requirements, a large majority required some post-secondary training. Another substantial share of ads required a bachelor's degree, most likely for high-wage sales, logistics, and management positions.

Experience in-demand

Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



Education & training in-demand

Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



WAGES

Advertised wages

Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

A substantial majority of postings advertising wages for Administration occupations offer less than \$35,000 per year (70%). The average salary advertised (\$37,254) was about 9% higher than median incomes of currently employed Administration workers in Tennessee (\$34,216) and 16% higher than the median income for all workers in the state over the age of 25 (\$32,000). The overwhelming majority of advertised salaries being less than \$35,000 could indicate that employers' greatest needs are at the entry-level.



0-2 years
Experience most
in-demand by
Indiana employers

\$37,254
average
advertised salary

**High school
diploma or
vocational training
are required**



INTRODUCTION TO ENGINEERING & DESIGN

Engineers and industrial designers create the blueprints for all things manufacturing. These workers not only envision the products of the future but they also ensure that the products are functional, safe, reliable, and durable.

There are 52 individual occupations within this group which can be split into four distinct occupation sub-groups; Electrical & Mechanical Engineering, Chemical Engineering & Metallurgy, Industrial Designers & Drafters, and Process Engineering & Testing.

Process & Testing

Process & Testing workers design processes and test manufacturing machinery to ensure that production of lightweight metal materials meet both internal and external safety and quality requirements.

Electrical & Mechanical

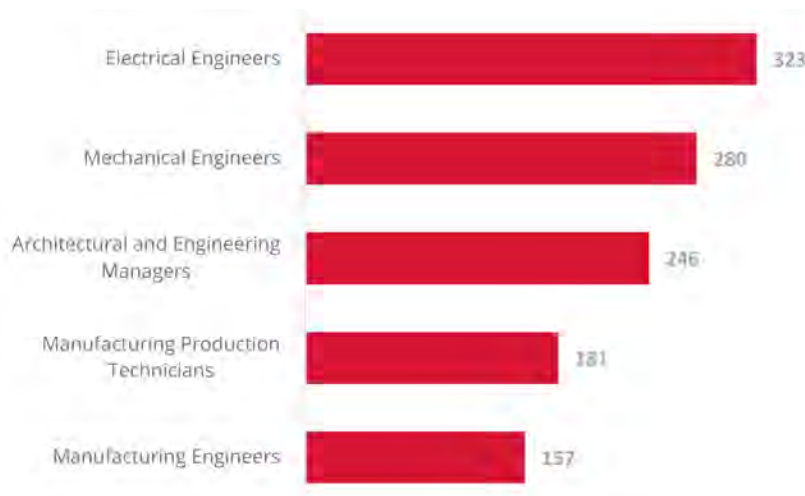
Electrical & Mechanical Engineers perform duties related to the research, design, development, and testing of mechanical functioning, electrical, and manufacturing equipment, components, or systems for commercial, industrial, military, or scientific use.

Chemical & Metallurgy

Chemical & Metallurgy workers perform duties related to the research, design, development, and testing of chemicals and metal materials. These workers often lead the charge in finding cutting-edge uses of lightweight metal materials.

Designers & Drafters

Designers & Drafters collaborate with other workers within the Engineer group to prepare detailed diagrams and designs of machinery, devices, and manufactured products. They combine their artistic talents and knowledge of lightweight metal capabilities to create both functional and appealing product designs.



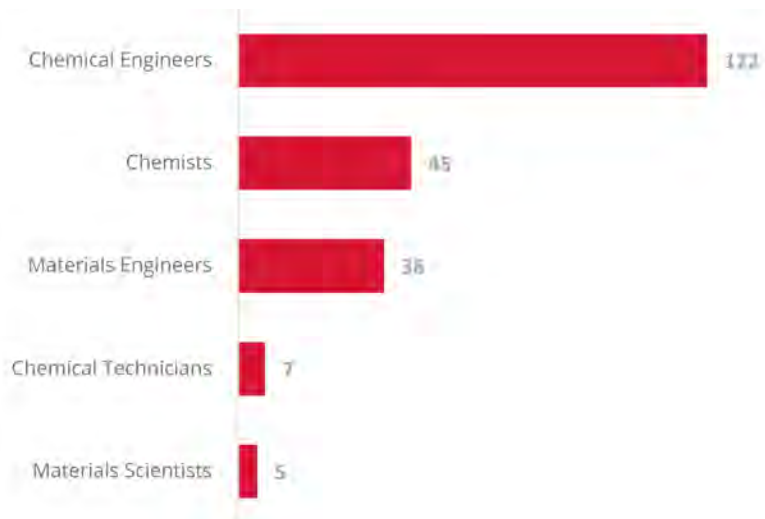
Top posting jobs

Electrical & Mechanical Q3 2016

*Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network*

This sub-group represents the largest in the Engineering & Design group in terms of employer demand. Mechanical engineers had the highest demand with 323 online ads during Q3 2016. The top five occupations in this group also made the overall top jobs list (see page 4).

ENGINEERING & DESIGN

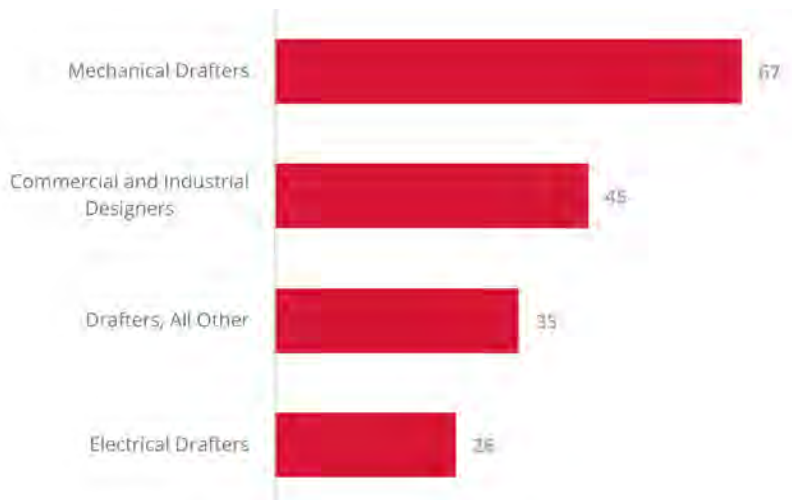


Top posting jobs

Chemical & Metallurgy Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Chemical engineers dominated this sub-group with over 120 online ads during Q3 2016. Chemists were also in demand with 45 postings during this time period.

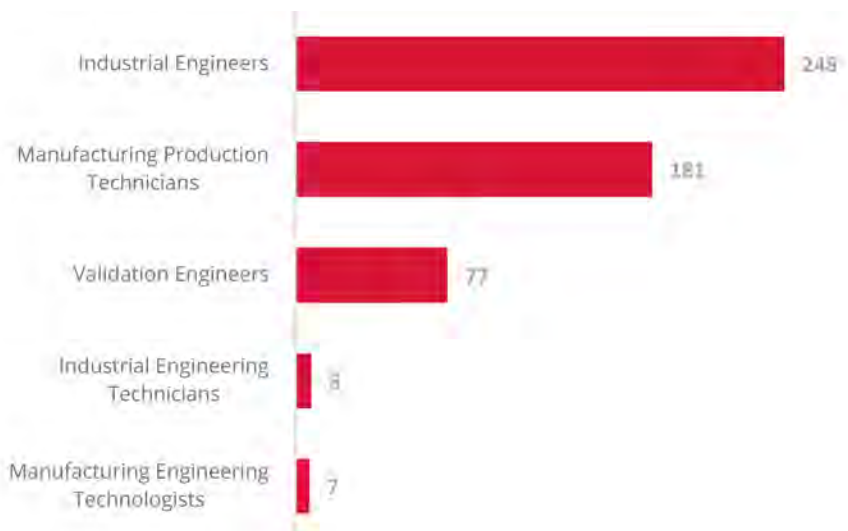


Top posting jobs

Designers & Drafters Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Mechanical drafters led the Designers & Drafters sub-group with over 50 online postings during Q3 2016. Commercial and industrial designers (45 postings) and drafters (35 postings) also had relatively high demand.



Top posting jobs

Process & Testing Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Industrial engineers led this sub-group with nearly 250 online job postings during Q3 2016. Manufacturing production technicians (181 postings) and validation engineers (77 postings) were also in high demand.

ENGINEERING & DESIGN

IN-DEMAND TECHNICAL SKILLS

STEM-related skills dominate the technical proficiency list for the Engineering & Design group such as PLC programming, CAD, and knowledge of mechanical and electrical engineering. Business and management-related skills such as budgeting and industry experience were also prevalent in postings, reflecting the demand for experienced workers for supervisory roles in Tennessee.

- | | |
|---|--|
| <ul style="list-style-type: none">• Project Management, Budgeting, Scheduling• Microsoft Office, Microsoft Excel• Repair, Inspection• AutoCAD/Computer Aided Drafting/ Design (CAD)• Mechanical Engineering | <ul style="list-style-type: none">• Electrical Engineering• Programmable Logic Controller (PLC) Programming• Manufacturing Process, Lean Manufacturing, Manufacturing Engineer• Industrial Engineering Industry Expertise• Technical Support |
|---|--|

IN-DEMAND EMPLOYABILITY SKILLS

While Engineers and Designers require critical technical skills learned through rigorous, advanced education, employers also require these workers to have foundational skills necessary to function efficiently on a team such as communication, teamwork, and planning. They must also have important project-oriented skills like planning, attention to detail, and problem solving. Overall, the top employability and technical skills reflect that Tennessee employers seek well-rounded candidates for Engineering & Design openings.

- | | |
|--|---|
| <ul style="list-style-type: none">• Communication Skills, Team Work/ Collaboration• Problem Solving, Troubleshooting• Writing• Planning, Organizational Skills, Detail-Oriented• Quality Assurance and Control | <ul style="list-style-type: none">• Ability to Perform Physical Labor• Research• Preventive Maintenance• Leadership• Creativity |
|--|---|

ENGINEERING & DESIGN

IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

The most advertised experience range for Engineers & Designers in Tennessee during Q3 2016 was three to five years with over 700 online ads. The low experience range, zero to two years, also captured a high proportion with 403 postings. This indicates that employers prefer Engineering & Design workers with previous experience but opportunities do exist at the entry-level. Employers seeking to hire workers in this group overwhelmingly want candidates with a bachelor's degree. In particular, of the 1,611 postings for Engineers & Designers in Tennessee during Q3 2016 that advertised an education requirement, 85% required a bachelor's degree.

Experience in-demand Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



Education & training in-demand Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network



WAGES

Advertised wages Q3 2016

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

The higher levels of experience and education requirement in online job postings for Engineers & Designers has translated into higher, more competitive wage advertisements by employers in Tennessee. Over 50% of Q3 postings that included wage information advertised annual salaries above \$50,000. The average advertised annual salary in postings was \$67,204, about seven percent less than the median annual salary of currently employed Engineers and Designers in Tennessee (\$72,384).



3-5 years
Experience most
in-demand by
Indiana employers

\$69,569
average
advertised salary

**Bachelor's
Degree most
often required**



For more information about LIFT and additional workforce data visit www.lift.technology