INTRODUCTION

The US Department of Energy (US DOE) Clean Energy Manufacturing Initiative has identified advanced composites as a key cross-cutting technology with high potential to enable increased energy efficiency in transportation and energy production while creating new economic opportunity for US manufacturers. The Institute for Advanced Composites Manufacturing Innovation (IACMI) closely aligns and leverages existing facilities and capabilities to create focused technology areas to support the specific advanced composites needs in targeted vehicles, wind energy and compressed gas storage applications.

IACMI is part of the National Network of Manufacturing Institutes (NNMI). The US DOE awarded IACMI a $70 million grant to further research, innovation, and technology transfer in the field of advanced composites. IACMI has 122 partners and $259 million in total funding.

Composites are advanced materials that are positively disrupting the way manufacturers do business. From vehicles to wind turbines, compressed gas storage to resins, composite materials are an innovation that touch nearly every industry. The workforce related to composites is equally diverse. Workers ranging from engineers to mechanics, chemists to skilled tradesmen, will need to be upskilled as new materials innovations come to market.

One of IACMI’s goals is to identify the workforce that is likely to be directly affected by new composites technologies and develop the talent pipeline before new materials come to market.

By creating relationships with education and workforce partners and increasing the workforce capacity now, world-class composites talent will be ready to work when new composites technologies are full integrated into industry.
EXECUTIVE SUMMARY

A talented workforce is critical to the future of the U.S. economy, especially a workforce trained in composite materials. As the economy adapts and composites are integrated into energy generation, manufacturing, construction, and other industrial processes, a workforce prepared to utilize and work with new materials and technologies will make or break the success of these industries.

In order to help identify the composite-related workforce and pinpoint opportunities for investments in talent programs, the IACMI team engaged the Workforce Intelligence Network (WIN) for workforce data analysis. The WIN research team is experienced in workforce analysis, talent investments, and comprehensive workforce planning. The process of analyzing the composites-related workforce included the following steps:

1. Define the occupations most related to IACMI’s research and then group those occupations into clusters and again into sub-groups for simpler and clearer analysis.

2. Analyze the workforce in these occupations within the IACMI region to understand the talent landscape: who the workers are, what jobs they have, demographic information, and current employer needs.

3. Create a comprehensive supply and demand report honing in occupation level information for the six-state IAMCI region.

This report marks the third and final step in the initial workforce analysis project for IACMI. The information within this report identifies composite-related occupations, analyzes the current workforce in these occupations, and provides context for workforce planning in light of employer needs and worker supply. Data analyzed in the report includes traditional labor market information such as:

- Employment
- Workforce demographics
- Current wages
- Required educational attainment of workers
- Completions: degrees and certificates awarded in related fields

In addition to traditional labor market data this report includes data on online job postings. This is meant to be a proxy for employer demand to show what current companies need in terms of talent. By coupling the current employer demand with data on completions (degrees and certificates awarded), it is clear to see where more talent investments need to be made to ensure that employers have the workers they need right now. The more traditional data highlighting the age of workers helps to identify where future talent gaps may appear. All of these analyses are necessary to better understand how IACMI and its partners can invest in workforce programming to aid employers in getting the talent they need now to move composite technologies forward and the talent they will need in the future to ensure continued success.
While many occupations were hit hard by the recession, few have recovered as strongly as those in composites. Between the 2010 trough and this past year, 2014, employment in composites-related fields grew 11.5% from 2,060,688 to 2,296,670, adding 235,982 jobs in the IACMI region* states.

Employers are growing jobs rapidly in advanced composites fields and demand for workers has been on the rise. In 2014, employers in the IACMI region posted 273,316 available jobs in composites-related occupations. In 2010, there were 141,009 job postings. Employer demand has nearly doubled since 2010.

Of the 12,760,129 workers in the nation in occupations related to composites, 18% are located in the IACMI region. The advanced composites-related workforce in the IACMI region has a competitive edge. With a location quotient of 1.4, the region has a 40% higher concentration of composites-related workers than the rest of the country on average.

In 2014, 128,723 new certificates and degrees were awarded in fields related to composites by higher education institutions in the IACMI region. During the same year, employers posted 273,316 jobs in related fields. Job postings outpace new worker supply 2:1, meaning that there are two job postings for every new graduate in composites-related fields. Not only are the 538,017 workers expected to retire in the coming decade vacating jobs that employers must fill, but the current supply of new talent is not meeting current employer needs. Without increased emphasis on the composites-related workforce, employers will struggle to find the talent they require for successful operations.

FINDINGS

353,493 new jobs since 2010

Growing employer demand

Employers are growing jobs rapidly in advanced composites fields and demand for workers has been on the rise. In 2014, employers in the IACMI region posted 273,316 available jobs in composites-related occupations. In 2010, there were 141,009 job postings. Employer demand has nearly doubled since 2010.

Competitive edge

Of the 12,760,129 workers in the nation in occupations related to composites, 18% are located in the IACMI region. The advanced composites-related workforce in the IACMI region has a competitive edge. With a location quotient of 1.4, the region has a 40% higher concentration of composites-related workers than the rest of the country on average.

An aging workforce

Composites-related workers are aging. In the IACMI region, 22.9% of these workers are over the age of 55 and set to retire in the next decade. This means that 538,017 workers will need to be replaced in the next ten years. Currently, there are more workers over 45 than under, meaning the pipeline is not strong. More emphasis on composites and materials training, education, and workforce development is necessary to ensure that employers can replace the workers they’ll lose in the coming years.

Talent pipeline development

In 2014, 128,723 new certificates and degrees were awarded in fields related to composites by higher education institutions in the IACMI region. During the same year, employers posted 273,316 jobs in related fields. Job postings outpace new worker supply 2:1, meaning that there are two job postings for every new graduate in composites-related fields. Not only are the 538,017 workers expected to retire in the coming decade vacating jobs that employers must fill, but the current supply of new talent is not meeting current employer needs. Without increased emphasis on the composites-related workforce, employers will struggle to find the talent they require for successful operations.

* The IACMI region is defined as Michigan, Colorado, Ohio, Indiana, Tennessee, and Kentucky
The IACMI region encompasses work in six states. Michigan, Colorado, Ohio, Indiana, Tennessee, and Kentucky. Each state brings unique industry expertise to the table.

In Michigan, vehicle manufacturing is a legacy industry that will continue to move forward with integration of composite materials. In Colorado, wind turbines are helping the nation re-think energy creation and composites are making new innovations for wind energy possible. Ohio's compressed gas storage capabilities are made more efficient because of composite technologies. Indiana brings unmatched design, modeling, and simulation abilities to the team to ensure that composite materials have industrial applications. Tennessee's focus on creating composite materials and processes is the flagship as the state's researchers create new materials for industry.

This six state team provides everything from R&D to industrial application of composites and everything in between.

PARTNERS

Oak Ridge National Laboratory
University of Tennessee
University of Kentucky
National Renewable Energy Laboratory

Michigan State University
Purdue University
University of Dayton Research Institute
OVERVIEW: EMPLOYMENT

With nearly 2.3 million employed in composites-related occupations, the six-state IACMI region contains 18% of the nation’s composites jobs, with a national employment location quotient of 1.4. This means that the IACMI region has a concentration of composites-related jobs 40% higher than the U.S. average. Advanced composites are becoming an important area for employment growth; the 2.3 million workers in composites-related occupations represent 11.5% of all employment in the six-state region.

Like nearly every occupation group, composites-related jobs were lost during the recession. Since 2010, however, employment has recovered from its lowest point of 2,060,688 to 2,296,670 in 2014—an 11.5% increase.

Employment in the region is strong. Not only is the concentration 40% higher than the rest of the country, but 18% of the nation's composite-related workforce resides in the six-state IACMI region.
Composites workers are largely white and male. 86.6% of workers are white, making minorities a vastly underrepresented group. Women are also underrepresented in composites-related professions, comprising only 16.0% of the workforce.

Composites-related workers are aging. 23% in the IACMI region are over the age of 55 and set to retire in the next decade. This means that 538,017 workers will need to be replaced in the next ten years. Currently, there are more workers over 45 than under, meaning the pipeline of future workers is not strong. More emphasis on composites and materials training, education, and workforce development is necessary to ensure that employers can replace the workers they will lose in the coming years.

**WORKFORCE DEMOGRAPHICS**

Composites workers are largely white and male. 86.6% of workers are white, making minorities a vastly underrepresented group. Women are also underrepresented in composites-related professions, comprising only 16.0% of the workforce.

Composites-related workers are aging. 23% in the IACMI region are over the age of 55 and set to retire in the next decade. This means that 538,017 workers will need to be replaced in the next ten years. Currently, there are more workers over 45 than under, meaning the pipeline of future workers is not strong. More emphasis on composites and materials training, education, and workforce development is necessary to ensure that employers can replace the workers they will lose in the coming years.

**WORKFORCE DEMOGRAPHICS**

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**Composites-related Worker Race/Ethnicity (IACMI Region 2015)**

- Hispanic or Latino: 0.6%
- White: 7.4%
- Black or African American: 4.0%
- American Indian or Alaska Native: 1.8%
- Asian: 0.6%
- Native Hawaiian or Other Pacific Islander: 1.8%
- Two or More Races: 1.8%

- **86.6%**

**Composites-related Worker Age Demographics (IACMI Region 2015)**

- Under 24: 6%
- 25-34: 18%
- 35-44: 24%
- 45-54: 29%
- 55+: 23%

- **538,017**

**Composites-related Worker Gender (IACMI Region 2015)**

- **Females**: 16.0%
- **Males**: 84.6%

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**14.1%**

14.1% of the composites workforce is non-white. The minority population is a great source for future talent.

**23%**

23% share of the workforce set to retire in the next decade.

**16%**

16.0% of the composites-related workforce is female, making women a potential source for talent growth.
Not all postings represent an open job. While some postings are up due to employee turnover and churn, others are postings because of job growth. Whatever the reason, employers post jobs because they need to find talent to keep production moving. Postings for jobs related to composites are on a strong growth trend.

In 2014, employers in the IACMI region posted 273,316 jobs in composites-related occupations. In 2010, there were 141,009 job postings. Employer demand has more than doubled, growing in an almost linear pattern since 2010.

Data: EMSI, BLS
Analysis: Workforce Intelligence Network

100% Employer demand for workers doubled between 2010 and 2014

273k In 2014, employers in the IACMI region posted 273,316 jobs in composites-related fields.
Composites related jobs range from those in research and development, science labs, to manufacturing floors and distribution centers. During 2014 the top posting jobs related to IACMI's composites innovation work included:

- A combined 57,000 postings for engineers
- Over 35,000 postings for maintenance workers
- 18,000 postings for technical and scientific product sales representatives
- Nearly 15,000 postings for manufacturing supervisors

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network
SUPPLY AND DEMAND: BY OCCUPATION

Employer demand, as defined by online job postings, has grown consistently since data became available in 2010. Current metrics show that employers in the IACMI region posted 273,316 available jobs in composites-related occupations during 2014. In a span of just five years (2010-2014) postings have nearly doubled. Coupling the current employer demand with data on completions (degrees and certificates awarded), it is clear to see where more talent investments need to be made to ensure that employers have the workers they need right now.

### Composites-related Supply/Demand Top Job Postings* and Related Grads
(2013 Graduates and 2014 Job Postings)

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Related Postings 2014</th>
<th>Related 2013 Grads*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance and Repair Workers, General</td>
<td>36,705</td>
<td>203</td>
</tr>
<tr>
<td>Sales Representatives, Wholesale and Manufacturing,</td>
<td>18,470</td>
<td>754</td>
</tr>
<tr>
<td>Technical and Scientific Products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineers</td>
<td>15,953</td>
<td>5,138</td>
</tr>
<tr>
<td>Electrical Engineers</td>
<td>13,164</td>
<td>3,510</td>
</tr>
<tr>
<td>Industrial Engineers</td>
<td>11,592</td>
<td>1,570</td>
</tr>
<tr>
<td>Civil Engineers</td>
<td>10,392</td>
<td>2,495</td>
</tr>
<tr>
<td>Inspectors, Testers, Sorters, Samplers, and Weighers</td>
<td>9,033</td>
<td>175</td>
</tr>
<tr>
<td>Computer-Controlled Machine Tool Operators, Metal</td>
<td>8,834</td>
<td>730</td>
</tr>
<tr>
<td>and Plastic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First-Line Supervisors of Mechanics, Installers,</td>
<td>8,525</td>
<td>2,241</td>
</tr>
<tr>
<td>and Repairers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Notes: “Grads” includes certificates and degrees related to IACMI occupations. Graduates are not mutually exclusive, a degree program can prepare an individual for more than one career. Therefore, each comparison of jobs to graduates cannot be aggregated.

Data: Burning Glass Technologies, EMSI
Analysis: Workforce Intelligence Network

The top postings jobs for composites-related workers are dominated by jobs for Mechanics workers (maintenance and repair), Supply Chain workers (sales representatives for technical and scientific projects), and Engineers (mechanical, electrical, industrial, and civil). Comparing these online postings side-by-side with recent graduates shows a clear mismatch in the degrees awarded to students in the IACMI region and the jobs employers have available.

On the other hand, some occupation areas have an oversupply of new graduates compared to current demand. For example, many manager positions have more than five times the graduates as postings. This is partially due to an emphasis on business degrees in recent years and also partially due to the fact that some degrees prepare workers for many occupations and the data shown does not de-duplicate graduates.
Another level to supply-demand analysis adds in current employment. This adds another layer to the worker supply picture because any current worker is technically part of the available pool for employers. Any worker can change jobs according to this assumption. Adding employment also adds context. For some occupations, the postings versus completions picture is rather bleak, but if employment is very high and postings are a small share of employment then it is possible that the disconnect between supply and demand is not as critical a problem.

Right now, the largest gaps exist for the top postings occupations where postings are a large share of current employment. Employers in the region likely have a substantial amount of turnover or are in great need of adding workers to their ranks. Either way, demand is far outpacing the supply of new talent (completions) and is a large share of the current workforce.

Training at higher education institutions within the IACMI region is not aligning with employer demand. The strongest gap exists for supply chain and engineering talent where a degree in the related field is necessary for employment.

**Composites-related Supply/Demand**

**Top Job Postings* Related Grads and Employment**

(2013 Graduates and 2014 Job Postings & Employment)

- Maintenance and Repair Workers, General: 206,764
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products: 60,222
- Mechanical Engineers: 65,992
- Electrical Engineers: 23,564
- Industrial Engineers: 55,995
- Civil Engineers: 32,735
- Inspectors, Testers, Sorters, Samplers, and Weighers: 97,030
- Computer-Controlled Machine Tool Operators, Metal and Plastic: 37,477
- First-Line Supervisors of Mechanics, Installers, and Repairers: 65,310
- Purchasing Agents, Except Wholesale, Retail, and Farm Products: 44,692
- Manufacturing Engineers: 23,977
- Architectural and Engineering Managers: 30,039
- Commercial and Industrial Designers: 8,916
- Bus and Truck Mechanics and Diesel Engine Specialists: 43,084
- Quality Control Systems Managers: 39,367
- Industrial Truck and Tractor Operators: 97,359
- Chemical Engineers: 4,656
- Assemblers and Fabricators, All Other: 71,267
- Industrial Production Managers: 39,367

*Notes: “Grads” includes certificates and degrees related to IACMI occupations. Graduates are not mutually exclusive, a degree program can prepare an individual for more than one career. Therefore, each comparison of jobs to graduates can not be aggregated.

Data: Burning Glass Technologies, EMSI, BLS
Analysis: Workforce Intelligence Network
Advanced composites-related employment is concentrated in the Production & Construction and Industrial Application clusters. The Machinists sub-group is the largest overall with 495,663 employees in the six-state IACMI region. High employment in the Machinists, Skilled Trades, and Production Management sub-groups ensures that the Production & Construction cluster has the most composites-related workers in the region. The 1.2 million Production & Construction workers are important as new composite materials are introduced to the marketplace.

High employment in the Industrial Application cluster sub-groups means that there are nearly 900,000 Mechanics, Supply Chain workers and Civil & Occupational Safety Engineers with skills potentially adaptable for increasing the use and longevity of composite materials in the market. Occupations in the Research and Product Development cluster account for just 10.2% of composite-related jobs currently in the workforce. The Electrical & Mechanical Engineers sub-group, however, accounts for over half the jobs in the cluster with nearly 130,000 workers in the IACMI region and aid in designing new technologies using composite materials.

For many occupations, job postings largely mirror current employment. Not in terms of volume but instead in terms of share. There are, however, many occupations with a disconnect between postings and employment. For the occupations where the overall share of postings outweights that of employment, there is likely more employer need relative to other occupations. In occupations where the employment share vastly outweighs the demand, employers are not likely to be in as dire need of workers as the other occupations.
OVERVIEW: OCCUPATIONAL CLUSTERS

The 133 occupations likely to be affected by innovations in composite materials are easily analyzed in cluster groups. Three clusters emerge along the technology transfer pathway for IACMI-related occupations: Research & Product Development, Production & Construction, and Industrial Application.

While some overlap exists, each occupation fits within an important part of the supply-chain of bringing composites to market. Within the three clusters are 12 sub-groups. These sub-groups organize the occupations by function allowing for more fluid workforce analysis.

Research & Product Development
* Manufacturing Process Research/Modeling & Simulation
* Chemical & Materials Scientists & Engineers
* Product Safety
* Designers & Drafters
* Computer, Electrical, Mechanical Engineers

Production & Construction
* Machinists
* Skilled Trades
* Production Management
* Engineering Technicians & Technologists

Industrial Application
* Mechanics
* Civil and Occupational Safety Engineers
* Supply Chain
Essential Research and Product Development jobs related to composite materials include researching, designing, and testing innovative opportunities to use composites in manufacturing and industrial technologies. Not only do the workers in these occupations envision the products of the future but they also ensure that products are functional, safe, reliable, and durable. Workers in the Research and Product Development cluster will pioneer advanced uses of polymer composites to reduce production costs and energy emissions while simultaneously improving performance and recyclability.

Employment in the Research & Product Development cluster has been growing steadily since 2009. The Computer, Electrical, and Mechanical Engineers sub-group makes up the bulk of this cluster with 129,018 workers in the IACMI region.
RESEARCH & PRODUCT DEVELOPMENT OVERVIEW

Average wages in this cluster are very high and commensurate with the educational attainment needed to enter this workforce. The two highest paid occupation sub-groups (Chemical & Materials Scientists & Engineers and Computer, Electrical, & Mechanical Engineers) both have wages near $35/hr. This translates to roughly $73,000 annually. Most of the jobs in these two sub-groups also require a Bachelor's degree for an entry-level position.

Wages for the other three sub-groups in the Research and Product Development cluster are also competitive with median hourly wages between $24 and $26. This translates to about $50,000 annually. Occupations in Product Safety typically require a Bachelor's degree whereas Designers & Drafters and Manufacturing Process Research/Modeling & Simulation jobs require Associate's degrees.

<table>
<thead>
<tr>
<th>Occupation Sub-Group</th>
<th>Typical Entry-Level Hourly Wage</th>
<th>Median Hourly Wage</th>
<th>Median Annual Salary</th>
<th>Typical Education for Entry-Level</th>
<th>Work Experience Required</th>
<th>Typical Training in Addition to Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Process Research/Modelling &amp; Simulation</td>
<td>$14.79</td>
<td>$24.19</td>
<td>$50,315</td>
<td>Associate's degree</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
<tr>
<td>Chemical &amp; Materials Scientists &amp; Engineers</td>
<td>$21.81</td>
<td>$37.53</td>
<td>$78,072</td>
<td>Bachelor's degree</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Product Safety</td>
<td>$15.72</td>
<td>$24.03</td>
<td>$49,974</td>
<td>Bachelor's degree</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
<tr>
<td>Designers &amp; Drafters</td>
<td>$17.10</td>
<td>$25.67</td>
<td>$53,385</td>
<td>Associate's degree</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Computer, Electrical, Mechanical Engineers</td>
<td>$26.31</td>
<td>$40.29</td>
<td>$83,808</td>
<td>Bachelor's degree</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Between 2010 and 2011, postings nearly doubled for occupations in the Research and Product Development cluster; online ads increased from 32,962 in 2010 to 60,332 in 2011. Since then, postings have remained relatively stable. Most recently, postings increased from 58,634 in 2013 to 60,214 in 2014, a modest 2.7% increase.
This section highlights the 2014 top posting jobs in each sub-group within the Research & Product Development occupation cluster. For each sub-group, the top five jobs are shown. If fewer than five are shown, then fewer than five occupations had job postings in 2014.

**RESEARCH, MODELING, & SIMULATION**

Employers posted 1,081 online ads for Manufacturing Process Research/Modeling & Simulation occupations in 2014. Chemical technicians claimed the top spot, accounting for nearly one out of every two postings in this sub-group. In second were physicists with 363 postings in 2014.

**Top Manufacturing Process Research/Modeling & Simulation Job Postings**

(IACMI Region 2014)

- Chemical Technicians: 534
- Physicists: 363
- Model Makers, Metal and Plastic: 162
- Patternmakers, Metal and Plastic: 22

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

**DESIGNERS & DRAFTERS**

In 2014 there were 9,760 postings by employers for Designer & Drafter occupations in the six-state IACMI region. With 5,219 online ads in 2014, commercial and industrial designers dominated postings for this sub-group (53%). Other top posting occupations included mechanical drafters (2,593 postings) and all other drafters (1,269 postings).

**Top Designers & Drafters Job Postings**

(IACMI Region 2014)

- Commercial and Industrial Designers: 5,219
- Mechanical Drafters: 2,593
- Drafters, All Other: 1,269
- Electrical Drafters: 423
- Electronic Drafters: 166

*Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network*
CHEMICAL & MATERIALS SCIENTISTS & ENGINEERS

Employers posted 17,446 online ads for Chemical & Materials Scientists & Engineers in 2014. Manufacturing engineers claimed the top spot with 6,035 online postings, accounting for about one out of every three ads in this sub-group. Other top posting occupations included chemical engineers (4,536 ads), chemists (2,741 ads), and materials engineers (1,805 ads).

PRODUCT SAFETY

Employers posted 2,067 online ads for Product Safety occupations in 2014. Industrial safety and health engineers dominated this sub-group with nearly 70% of total postings (1,446). Hazardous materials removal workers was second in the product safety sub-group with 579 postings.

COMPUTER, ELECTRICAL, MECHANICAL ENGINEERS

With 32,974 postings by employers in 2014, Computer, Electrical, and Mechanical Engineering jobs are in the highest demand of any sub-group within the Research & Product Development cluster. This sub-group is dominated by two occupations; mechanical engineers had 15,953 online ads last year while electrical engineers had 13,164. Together, these two occupations represent 88% of all postings within this sub-group for 2014.
Workers in the Production and Construction cluster operate directly with advanced composite materials to assemble the products of tomorrow. These workers ensure that the designs and plans are carried out to every detail and specification. They do everything from managing computer-controlled machines, to assembling and inspecting products before being released to market, to overseeing manufacturing and production floors. Production and Construction workers are crucial to creating safe, reliable products using polymer composites.

Employment has been increasing for three of the four Production & Construction sub-groups since 2009 but have yet to surpass pre-recession levels. Employment for Engineering Technicians & Technologists has been relatively flat since 2005. The Machinists sub-group has the highest number employed not only for this cluster but also for all the occupational sub-groups related to composite materials with 495,663 workers in 2014. With high employment also in Skilled Trades and Production Management, the Production & Construction cluster has 1.2 million workers in the six-state IACMI region.
PRODUCTION & CONSTRUCTION OVERVIEW

Average wages in this cluster are commensurate with the educational attainment needed to enter this workforce. The highest paid occupation sub-group (Production Management) has wages near $30/hr. This translates to about $63,000 annually. Most of the jobs in this sub-group require a Bachelor's degree and five or more years of experience for an entry-level position. The next highest paid occupation sub-group (Engineering Technicians & Technologists) has wages near $24/hr or about $50,000 annually.

The Machinists and Skilled Trades sub-groups have wages over $16/hr or about $35,000 annually. Most of these occupations require post-secondary training along with on-the-job training in order to earn median wages.

### Production and Construction Cluster, Wages and Education

<table>
<thead>
<tr>
<th>Occupation Sub-Group</th>
<th>Typical Entry-Level Hourly Wage</th>
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<th>Work Experience Required</th>
<th>Typical Training in Addition to Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machinists</td>
<td>$11.05</td>
<td>$16.73</td>
<td>$34,790</td>
<td>Postsecondary non-degree award</td>
<td>None</td>
<td>Long-term on-the-job training</td>
</tr>
<tr>
<td>Skilled Trades</td>
<td>$10.86</td>
<td>$16.76</td>
<td>$34,870</td>
<td>Postsecondary non-degree award</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
<tr>
<td>Production Management</td>
<td>$19.48</td>
<td>$30.15</td>
<td>$62,702</td>
<td>Bachelor's degree</td>
<td>5 years or more</td>
<td>Moderate-term on-the-job training</td>
</tr>
<tr>
<td>Engineering Technicians &amp; Technologists</td>
<td>$15.37</td>
<td>$24.02</td>
<td>$49,957</td>
<td>Associate's degree</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
</tbody>
</table>

Data: EMSI, BLS
Analysis: Workforce Intelligence Network

### Production & Construction-related Job Postings (IACMI Region)

Postings for occupations in the Production & Construction cluster have increased four of the last five years and in a near-linear fashion. Most recently, postings increased from 67,760 in 2013 to 75,543 in 2014, an 11.5% increase. 2014 also marks the highest number of postings in the five-year stretch.

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

75,500 job postings
This section highlights the 2014 top posting jobs in each sub-group within the Production and Construction occupation cluster. For each sub-group, the top five jobs are shown. If fewer than five are shown, then fewer than five occupations had job postings in 2014.

**MACHINISTS**

Employers posted 22,330 online job ads for Machinists jobs last year in the six-state IACMI region. Computer-controlled machine operators accounted for nearly 40% of all postings in this sub-group (8,834 online ads). Other top occupations include machinists (2,603 postings) and cutting, punching and press machine operators (2,174 postings).

**ENGINEERING TECHNICIANS & TECHNOLOGISTS**

Employers posted 5,186 online ads for Engineering Technicians & Technologists in 2014. Manufacturing production technicians was the most in-demand occupation in this sub-group with 1,735 postings last year. Other top posting occupations included mechanical engineering technicians (1,000 online ads) and engineering technicians, except drafters (961 postings).
SKILLED TRADES

With 33,235 postings by employers in 2014, Production Management jobs are in the highest demand of any sub-group within the Production & Construction cluster. The top posting occupation, first-line supervisors of production workers dominated with 14,549 online ads in 2014 (43%). The top five occupations in this sub-group account for 95% of 2014 postings.

Top Skilled Trades Job Postings
(IACMI Region 2014)

Inspectors, Testers, Sorters, Samplers, and Weighers
9,033
Assemblers and Fabricators, All Other 4,374
Metal Workers and Plastic Workers, All Other 1,258
Tool and Die Makers 1,228
Electrical and Electronic Equipment Assemblers 711

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network

Top Production Management Job Postings
(IACMI Region 2014)

First-Line Supervisors of Production and Operating Workers 14,549
Architectural and Engineering Managers 5,453
Quality Control Systems Managers 4,742
Industrial Production Managers 4,262
First-Line Supervisors of Construction Trades and Extraction Workers 2,527

Data: Burning Glass Technologies
Analysis: Workforce Intelligence Network
Workers in the Industrial Application cluster provide necessary oversight and distribution of products created using advanced composite materials. This cluster includes workers who help repair composite-related products, or use composites to construct more safe and efficient industrial and civil systems, or aid in the distribution of products once they have entered the market. The Industrial Application cluster is an essential segment of the composite material lifecycle as use of composites becomes more prevalent in day-to-day products and engineering.

Employment in the Industrial Application occupational cluster has been increasing since 2009 and is about level with pre-recession levels. As of 2014, there were 876,946 workers in the six-state IACMI region for this cluster. The Mechanics subgroup has the most number of people employed for the Industrial Application cluster with 423,161 workers. Overall, the Industrial Application cluster accounts for 38% of all jobs related to composite materials in the IACMI region.
INDUSTRIAL APPLICATION OVERVIEW

Average wages in this cluster are commensurate with the educational attainment needed to enter this workforce. The highest paid occupation subgroup (Civil and Occupational Safety Engineers) has wages near $34/hr which equates to about $70,053 annually. Most of the jobs in this subgroup require a Bachelor's degree for an entry level position.

Supply Chain occupations have median wages above $25/hr or $53,000 annually. Most of these jobs require a Bachelor's degree for an entry level position. Occupations in the Mechanics subgroup typically earn over $20/hr or $43,000 annually. These jobs require post-secondary certificates along with longer on-the-job training.

<table>
<thead>
<tr>
<th>Occupation Sub-Group</th>
<th>Typical Entry-Level Hourly Wage</th>
<th>Median Hourly Wage</th>
<th>Median Annual Salary</th>
<th>Typical Education for Entry-Level</th>
<th>Work Experience Required</th>
<th>Typical Training in Addition to Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanics</td>
<td>$12.86</td>
<td>$20.70</td>
<td>$43,050</td>
<td>Postsecondary non-degree award</td>
<td>None</td>
<td>Long-term on-the-job training</td>
</tr>
<tr>
<td>Civil and Occupational Safety Engineers</td>
<td>$22.10</td>
<td>$33.68</td>
<td>$70,053</td>
<td>Bachelor's degree</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
<tr>
<td>Supply Chain</td>
<td>$15.29</td>
<td>$25.64</td>
<td>$53,322</td>
<td>Bachelor's degree</td>
<td>None</td>
<td>Moderate-term on-the-job training</td>
</tr>
</tbody>
</table>

Postings for Industrial Application occupations have nearly doubled in the last five years, increasing from 62,285 in 2010 to 128,532 in 2014. Most recently, online ads increased by 11.2% from 2013’s 115,573 postings. In 2014, the Industrial Application cluster had the most postings of the three clusters by 40,000 online ads.
This section highlights the 2014 top posting jobs in each sub-group within the Industrial Application occupation cluster. For each sub-group, the top five jobs are shown. If fewer than five are shown, then fewer than five occupations had job postings in 2014.

**MECHANICS**

Employers posted 55,145 online ads for Mechanics jobs in 2014 within the six-state IACMI region. Maintenance and repair workers dominated the postings for this sub-group with 36,705 ads in 2014 (67% of all postings). Other top posting occupations included first-line supervisors of mechanics (8,525 ads) and bus and truck mechanics (4,885 ads).

### Top Mechanics Job Postings
(IACMI Region 2014)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Postings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance and Repair Workers, General</td>
<td>36,705</td>
</tr>
<tr>
<td>First-Line Supervisors of Mechanics, Installers, and Repairers</td>
<td>8,525</td>
</tr>
<tr>
<td>Bus and Truck Mechanics and Diesel Engine Specialists</td>
<td>4,885</td>
</tr>
<tr>
<td>Electrical Power-Line Installers and Repairers</td>
<td>2,017</td>
</tr>
<tr>
<td>Electrical and Electronics Repairers, Commercial and Industrial Equipment</td>
<td>1,142</td>
</tr>
</tbody>
</table>

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

Employers posted 50,268 online ads for Supply Chain occupations in 2014 within the six-state IACMI region. Wholesale and manufacturing sales representatives for technical and scientific products dominated postings in this cluster with 18,468 online ads in 2014 (37% of postings in this cluster). The next most in-demand occupation, purchasing agents, had 7,767 online ads in 2014.

**CIVIL AND OCCUPATIONAL SAFETY ENGINEERS**

Employers posted 29,358 online ads for Civil and Occupational Safety occupations in 2014 within the six-state IACMI region. Industrial and civil engineers dominated postings with 11,592 and 10,392 online ads, respectively. Together, these two occupations accounted for three out of every four online ads in this subgroup in 2014. Industrial and civil engineers were also two of the ten most in-demand composites-related occupations.
The Institute for Advanced Composites Manufacturing Innovation, IACMI, is committed to delivering a public-private partnership to increase domestic production capacity, grow manufacturing and create jobs across the US composite industry.

Our collaboration of industry, research institutions and state partners is committed to accelerating development and adoption of cutting-edge manufacturing technologies for low-cost, energy-efficient manufacturing of advanced polymer composites for vehicles, wind turbines, and compressed gas storage.

IACMI’s research, development, and demonstration programs will be driven by major industry participation with a focus on reducing technical risk and developing a robust supply chain to support a growing advanced composites industry. Encouragement and development of small- and medium-enterprise industry participants and long term sustainability are key objectives of the Institute.

IACMI is the fifth Institute in the National Network of Manufacturing Innovation, supported by the US Department of Energy’s Advanced Manufacturing Office.