Welcome to the Webinar!


A presentation on regional and national energy & advanced manufacturing jobs and workforce data from the 2019 USEER Report

- All are on mute for the duration of the presentation
- Q&A time permitting; Questions submitted via chat function
- Slides will be posted on netl.doe.gov/rwfi on the Webinar Archive Section
- Subscribe to NETL RWFI E-Note (netl.rwfi@netl.doe.gov)

Disclaimer: The analysis presented and conclusions drawn herein represent solely those views of the author(s), and do not represent the views of the United States Department of Energy
About the Webinar

NETL Energy Jobs Data Webinar

We hope you will leave the webinar with knowledge about:

• Background on the National Energy Technology Laboratory (NETL) and the NETL Regional Workforce Initiative (NETL RWFI)

• Results from USEER, showing the current number of energy jobs and where they are in the workforce both regionally and nationally

• Future job and workforce growth trends in energy and advanced manufacturing, including employer hiring expectations for the next 12 months

• Hiring difficulty by energy technology and industrial classification

• High demand jobs and workforce skills gaps
I. Introductions and Background on the NETL RWFI  
Presenter: Anthony Armaly, Federal Coordinator, NETL RWFI

II. The U.S. Energy and Employment Report; A National Prospective — National Association of State Energy Officials; Energy Futures Initiative  
Presenter: David Foster; Distinguished Associate, Energy Futures Initiative

III. The U.S. Energy and Employment Report- A Regional Prospective — BW Research  
What is the workforce demand and hiring difficulty for the region?  
A discussion of regional trends in current and emerging energy and manufacturing technologies.  
Presenter: Phillip Jordan, VP and Principle Researcher, BW Research

A perspective on energy jobs data and what it means for states like Pennsylvania  
Presenter: Denise Brinley Executive Director at Pennsylvania Governor's Office of Energy
NETL Regional Workforce Initiative

A Focus on Energy and Advanced Manufacturing Regional Workforce Readiness and Development
NETL Regional Workforce Initiative Mission

A Platform For:

• Communication and collaboration with regional/national stakeholders and partners, DOE, and other federal agency partners

• Connecting public investment in energy and advanced manufacturing NETL R&D to national and regional economic development, education, and jobs

• Discussing energy and manufacturing regional and national workforce skills gaps generally and specifically related to NETL’s core R&D

How We Engage:

• Monthly E-Note Email Bulletin
• On-Campus Engagements
• Webinars and Webcasts
• NETL RWFI Website
• Participation and representation at regional and national energy and manufacturing workforce meetings and groups

Understand, Engage, and Facilitate discussions on the economic and workforce benefit of NETL Research to the Region
RWFI aligns to the Administration’s efforts to connect R&D investment to economic growth, job growth, and development of a skilled technical workforce.

- OMB Memorandum to Agency Heads on FY 2020 Administration Research Development Budget Priorities
- EO-Establishing the President’s Council for the American Worker
- EO-Establishing Apprenticeships in America
- EO-Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure
RWFI Outreach, Meetings, Webinars, and Workshops
Consistent, meaningful, outcome driven, engagement
• Continued outreach to regional stakeholders, such as the Appalachian Regional Commission (ARC)

• Planning for RWFI webinars on:
  • Briefing on Natural Gas Storage and Regional Energy Infrastructure
  • Energy 101 Series

• Potential on-campus events:
  • The future of work in the national and regional fossil energy sector
  • Energy and advanced manufacturing industry workforce roundtable
  • Innovation and Entrepreneurship in Energy and Advanced Manufacturing
Core Competencies & Technology Thrusts

Computational Science & Engineering
Materials Engineering & Manufacturing
Geological & Environmental Systems
Energy Conversion Engineering
Systems Engineering & Analysis
Program Execution & Integration

Carbon Storage
Carbon Capture
Sensors & Controls
Advanced Materials
Advanced Computing
Advanced Energy Systems
Water Management
Rare Earth Elements

Enhanced Resource Production
Environmentally Prudent Development
Methane Hydrates
Offshore
Natural Gas Infrastructure
Unconventional

Energy Efficiency & Renewable Energy (EERE)
Office of Electricity (OE)
Cybersecurity, Energy Security, and Emergency Response (CESER)

Support to Other DOE Offices
Vehicles
Solid State Lighting
Geothermal
Micrgrid
Energy Storage
Energy Security & Restoration
Cybersecurity

U.S. DEPARTMENT OF ENERGY
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A Joint Project of the National Association of State Energy Officials and the Energy Futures Initiative

May 30, 2019
NETL Webinar

David Foster, EFI, Distinguished Associate
Overview—2019 USEER

• The USEER is based on an annual supplemental employer survey, integrated with the BLS Quarterly Census on Employment and Wages.

• It studies employment in the following sectors:
  • Fuels
  • Electric Power Generation (EPG)
  • Transmission, Distribution, and Storage (TDS)
  • Energy Efficiency (EE)
  • Motor Vehicles

• Fuels, EPG, and TDS make up the Traditional Energy Sector.
The survey covers direct employment in 53 different energy, energy efficiency and motor vehicle technologies across 186 NAICS codes located in seven broad industrial classifications.

The survey determines:

- Employment numbers
- Employer hiring expectations for the next 12 months
- Hiring difficulty by technology and industrial classification
- High demand jobs and skills gaps
- Workforce demographics by race, ethnicity, gender, and veteran’s status
- Geographic location by state, county, congressional and legislative districts, and MSA of each technology and industrial classifications
1. Governor’s Introduction.
2. Spotlight on real world experience.
3. More state (9) participation.
4. Two new trade associations.
5. New chart and data formats provide both technology and industrial sector profiles
6. Additional crosscut profiles:
   1. How generation and fuels technologies interact and compare.
   2. Natural gas industry
   3. Nuclear industry
   4. Petroleum industry
   5. Energy storage
Key Takeaways—2019 USEER

- Traditional Energy and Energy Efficiency added 152,000 jobs in 2018, outperforming the economy for the 4th year in a row by 0.5 percentage point (2.3% to 1.8%).
  - Energy Efficiency again led the way with 76,000 new jobs, almost 275,000 new jobs in 3 years.
- Fuels production added 52,000 new jobs, 33,000 in oil and 17,000 in natural gas, while coal mining held firm.
- Coal generation dropped by 7,000 jobs.
- Solar jobs declined for the second year in a row by 8,000 jobs, but low emissions' natural gas, wind, CHP, and geothermal all grew.
- Energy storage now employs 81,000 with battery storage at 61,000, an 18% increase.
- Motor vehicles added 74,000 jobs, while alternative fuel vehicles bounced back, adding almost 34,000 jobs.
- Hiring difficulty rose sharply to almost 77%, an increase of 10%.
  - In key growth sectors such as EE construction jobs, over 50% of firms now say hiring was very difficult.
- Overall, surveyed employers predicted a 4.6% growth rate for 2019.

Spotlight: “We are in the middle of an historic transition of the energy sector.”

Alicia Barton, President and CEO, NYSERDA

The New York State Energy Research and Development Authority's (NYSERDA) mission is to "advance innovative energy solutions in ways that improve New York's economy and environment." Providing significant choices and opportunities for New Yorkers to pursue their own clean energy choices is integral to this mission and advancing the clean energy economy.

For the last three years NYSERDA has funded the collection of clean energy jobs data to facilitate that mission. This New York data is an important component of the 2019 USEER.

Alicia Barton, President and CEO, NYSERDA, spoke about the importance of jobs data to her organization's business. "We are in the middle of an historic transition of the energy sector. Policy makers in our state rely on jobs data to correlate meaningful progress towards our clean energy goals with sustainable economic growth opportunities for the benefit of all New Yorkers."
In total, 6.7 million Americans work in Traditional Energy* industries and Energy Efficiency.

- An increase of 152K (including gas stations).

- Fuels production directly employs almost 1.13 million workers,
  - 52,000 new jobs in Fuels.

- Electric Power Generation employs 875,600.
  - EPG lost almost 8,300 jobs.

- 2.37 million Americans work in Transmission, Distribution, and Storage of all energy products.
  - 33,000 new jobs (excluding gas stations)

- 2.32 million work in Energy Efficiency.
  - A net increase of over 76,000.

- In addition, 2.54 million work in motor vehicles
  - A net increase of 74,000 in 2017.
  - 254,000 work with alternative fuels vehicles, an increase of almost 34,000, after a significant decline in 2017.

*Traditional Energy sectors include Fuels, Electric Power Generation and Transmission, Distribution and Storage.
Executive Summary—Fuels

TRENDS

• **2018 Job Gain.** In 2018, the Fuels sector grew by approximately 52,000 jobs, or nearly 5% for a total of 1,127,553 jobs.

• **Oil and Gas Recovery.** Oil and natural gas employers added the most new jobs, nearly 51,000, employing 603,000 and 271,000 respectively.

• **Coal Growth.** Coal jobs increased by 650 jobs, totaling about 74,800.

• **Biofuels.** Woody biomass added 1,800 jobs, while corn ethanol also increased.

• **2019 Expectations.** Fuels’ employers anticipate over 3% job growth in 2019, with most of the increase expected in oil and natural gas.
Executive Summary--Fuels

SNAPSHOT OF EMPLOYMENT

Figure 1.
Fuels Sector - Employment by Industry, 2017-2018

Figure 2.
Fuels Sector - Employment by Detailed Technology Application, 2017-2018

Spotlight: “We are at a critical inflection point in Pennsylvania.”

Denise Brinley, Executive Director, Governor’s Office of Energy, Pennsylvania

According to USECR data, Pennsylvania has added 6200 jobs in natural gas extraction and electric power generation in the last two years. Currently, almost 17,000 Pennsylvanians are employed in these two sectors.

As Denise Brinley, Executive Director of the Governor’s Office of Energy in Pennsylvania, observed, “We are at a critical inflection point in Pennsylvania because of the volume of natural gas, the network of pipelines being built, and the importance of climate change. Simultaneously, we have had 14 coal plants with 6,000 MWs of capacity close since 2010. Nuclear power plants produce approximately 50% of the state’s baseload electricity, and some are beginning to struggle financially, in part because of the low cost of natural gas. Every form of energy in our state is experiencing a transition.

“Natural gas has provided us with three primary waves of employment. The first was initiated in 2007 with natural gas drilling operations. The second is occurring now and is related to the construction of pipelines. We are now exploring the third, most sustainable future phase — how we can use our natural gas and liquids as a low-cost fuel and feedstock for manufacturers right here in Pennsylvania, which will help spur job creation. We currently export 80% of our natural gas and 100% of our ethane, and we would very much like to change that dynamic.”
Executive Summary—Electric Power Generation

TRENDS

• **2018 Job Growth.** In 2018, the Electric Power Generation sector declined by almost 1%, dropping 8,258 jobs for a total of 875,585.

• **Technology Shifts.** Advanced natural gas added the most new jobs, 4,500, while solar contracted, losing 8,000 jobs. Other technologies that grew included wind, combined heat and power, and geothermal while nuclear and coal also declined.

• **2019 Expectations.** Electric Power Generation employers anticipated 7.1% job growth in 2019, with most of the increase expected in renewable construction.
Executive Summary—EPG

SNAPSHOT OF EMPLOYMENT

Figure 28.
Electric Power Generation Sector – Employment by Industry, 2017-2018

Figure 29.
Electric Power Generation Sector – Employment by Detailed Technology Application, 2017-2018

Spotlight: “For a utility, a cyber-attack doesn’t just hurt us; it can turn out the lights for everybody.”

Jim Somborovich, Senior Director of Cyber Security, Xcel Energy

“The reliability of the electricity system underpins virtually every sector of the modern U.S. economy,” said the most recent Quadrennial Energy Review from the U.S. Department of Energy.

Xcel Energy serves parts of eight states, providing electricity to 3.6 million customers and natural gas service to 2 million customers. In response to questions on the changing utility workforce, Jim Somborovich, Senior Director of Cyber Security at Xcel, spoke of the rapid growth of cyber employment. “Two years ago, it was me and 25 others. At the end of this year, we will have tripled our cyber workforce.”

“Cyber skills are in high demand throughout the economy and we’ve had to grow in a negative unemployment environment for cyber. Some positions are harder than others to fill, so we have adopted several different strategies.

“We have gone after really junior people with the intent to train them ourselves. For these hires we’ve developed a 4-to-6 week training program and are preparing a skills assessment tool to help with their eligibility for promotions.”
Midwestern States and Generation Jobs

Electric Power Generation Jobs by Technology

Illinois
- Solar: 4879
- Wind: 3934
- Coal: 844
- Nuclear: 439
- Natural Gas: 748
- Oil & Other Fossil: 1879
- Hydro: 45
- Other: 4169

Iowa
- Solar: 704
- Wind: 4655
- Coal: 4564
- Nuclear: 2457
- Natural Gas: 8706
- Oil & Other Fossil: 1378
- Hydro: 45
- Other: 3714

Michigan
- Solar: 6172
- Wind: 3598
- Coal: 3241
- Nuclear: 1372
- Natural Gas: 8743
- Oil & Other Fossil: 3714
- Hydro: 700
- Other: 4602

Minnesota
- Solar: 948
- Wind: 662
- Coal: 1869
- Nuclear: 2223
- Natural Gas: 1575
- Oil & Other Fossil: 2538
- Hydro: 1869
- Other: 1194

Missouri
- Solar: 339
- Wind: 339
- Coal: 859
- Nuclear: 2538
- Natural Gas: 1194
- Oil & Other Fossil: 1590
- Hydro: 1869
- Other: 2819

Wisconsin
- Solar: 1061
- Wind: 662
- Coal: 1064
- Nuclear: 1052
- Natural Gas: 2420
- Oil & Other Fossil: 1590
- Hydro: 1869
- Other: 3007

Total
- Solar: 21,544
- Wind: 23,294
- Coal: 65,308
- Nuclear: 43,597
- Natural Gas: 175,734
- Oil & Other Fossil: 160,476
- Hydro: 175,734
- Other: 192,528
Executive Summary — Transmission, Distribution, and Storage

TRENDS

• **2018 TDS Employment:** Excluding retail employees in gas stations and fuel dealers, 1,365,887 workers were employed in Transmission, Distribution, and Storage, adding 33,000 new jobs. Gas stations and fuel dealers contracted by approximately 2,000 employees.

• **2019 Expectations:** TDS employers predict 3.2% job growth in 2019, led by professional and business services employers who anticipate 5.5% growth, followed by wholesale trade, distribution, and transport and other services at 5.4% and 4.9% respectively.

• **Key Industry Sectors:** The construction sector employed 35% of all TDS workers, while the utility industry employed another 31%

*TD&S includes both electricity and fuels.*
Executive Summary—TDS

Spotlight: “Public agencies have the opportunity to create a pathway forward that is embedded with equity and opportunity.”

Madeline Janis, Executive Director, Jobs to Move America

“A moment of transition can be fear-inducing, or it can be a moment of opportunity,” states Madeline Janis, co-founder and executive director of Jobs to Move America. “The clean energy transition is creating fear among existing workers in the fossil fuel sector, a fear which can be alleviated by implementing a much more specific framework around good jobs and equity.”

Jobs to Move America is a national non-profit organization dedicated to harnessing government procurement to realize equity, to promote environmental sustainability; to further open, democratic government; and to achieve an inclusive, diverse workforce that lifts people into middle-class jobs.

A key leverage point in achieving this mission, notes Janis, is in public purchasing and spending. Jobs to Move America’s U.S. Employment Plan offers a multi-point, “all-in” strategy to ensure a just and equitable transition. Recommended strategies include: providing training and technology access for transitioning workers; selecting equipment manufacturers that prioritize local communities and equity in their operations and hiring practices; and deploying new technologies in the communities most affected by environmental and economic injustice.
Overall, the natural gas industry employs 625,369, growing by 6.2% in 2018.

The sectors that added the most jobs were:
- Mining and extraction—16,816
- Construction—8,373
- Utilities—7,754

Natural gas industry wages
- Average entry level = $18.20
- Average median level = $26.03
- Average highest level = $39.92
Overall, the petroleum industry employs 799,531, growing by 5.3% in 2018.

The sectors that added the most jobs were:
- Mining and extraction—25,471
- Construction—6,725
- Professional services—3,963

Petroleum industry wages
- Average entry level = $17.75
- Average median level = $25.99
- Average highest level = $39.59
Overall, the coal industry employs 197,418, declining by 3% in 2018.

The sectors were impacted unevenly with:

- Fuels adding 650 jobs
- Electric power generation losing 6,641 jobs
- Professional services adding 1,851 jobs

Coal industry wages

- Average entry level = $17.53
- Average median level = $26.25
- Average highest level = $40.53
Crosscut by Major Technology

How Jobs in Industries Are Distributed Across Different Technologies

![Bar chart showing the distribution of jobs across different technologies and industries for fuels, generation, TDS, and storage.]
Crosscut Analysis by Industry Sector

How Jobs Are Distributed across Industrial Sectors

- **Natural Gas**: 52,382 Mining & Extraction, 67,243 Coal, 51,098 Petroleum, 176,167 Nuclear, 113,339 Solar, 51,098 Wind
- **Coal**: 162,928 Mining & Extraction, 43,327 Utilities, 8,639 Construction, 45,795 Manufacturing, 55,905 Wholesale, 11,273 Professional, 28 Other
- **Petroleum**: 170,945 Mining & Extraction, 155,267 Coal, 91,057 Petroleum, 71,127 Nuclear, 479 Solar, 11,273 Wind
- **Nuclear**: 46,809 Mining & Extraction, 330 Coal, 4,913 Petroleum, 14,374 Nuclear, 0 Solar, 4,913 Wind
- **Solar**: 48,142 Mining & Extraction, 26,759 Coal, 46,539 Petroleum, 177,320 Nuclear, 0 Solar, 26,759 Wind
- **Wind**: 27,058 Mining & Extraction, 11,783 Coal, 26,490 Petroleum, 36,706 Nuclear, 11,783 Solar, 6,231 Wind
TRENDS

• **2018 Job Growth.** In 2018, the Energy Efficiency sector continued to produce the most new jobs of any energy sector — over 76,000 — with 2,324,866 jobs in total. Demand growth for efficient technology and building upgrades has driven expansion across many traditional industries including construction trades which added almost 21,000 jobs and professional services which added 35,000 employees.

• **2019 Expectations.** Energy Efficiency employers report a projected growth rate for employment in 2018 of almost 8%. Construction employers, in particular, report expected Energy Efficiency job growth of 8.8% by the end of 2019.

• **Key Occupations:** The majority, nearly 56%, of Energy Efficiency employees worked at construction firms in 2018, installing or servicing Energy Efficiency goods or performing Energy Efficiency related services. Approximately one in five workers in the Energy Efficiency sector worked in professional and business services.

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1 Building control equipment includes electrical equipment to automate, manage, or otherwise control mechanical and electrical building components such as lighting, ventilation, and power systems equipment.
Executive Summary—Energy Efficiency

Table 44. Energy Efficiency Sector – Employment by Detailed Technology
Application and Industry, Q2 2018

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<td>ENERGY STAR Appliances</td>
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<td>Traditional HVAC goods, control systems, and services</td>
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<td>Reduced water consumption products and appliances</td>
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<tr>
<td>AL</td>
<td>7,726</td>
</tr>
<tr>
<td>MA</td>
<td>7,521</td>
</tr>
</tbody>
</table>
**Demographics of EE Workforce**

**Table 49. Energy Efficiency Sector – Demographics, Q4 2018**

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Employees</th>
<th>Percent of Sector</th>
<th>National Workforce Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1,767,865</td>
<td>76%</td>
<td>53%</td>
</tr>
<tr>
<td>Female</td>
<td>557,000</td>
<td>24%</td>
<td>47%</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>365,427</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>1,959,438</td>
<td>84%</td>
<td>83%</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>32,553</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Asian</td>
<td>120,540</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>175,914</td>
<td>8%</td>
<td>12%</td>
</tr>
<tr>
<td>Native Hawaiian or other Pacific Islander</td>
<td>26,716</td>
<td>1%</td>
<td>&gt;1%</td>
</tr>
<tr>
<td>White</td>
<td>1,811,682</td>
<td>78%</td>
<td>78%</td>
</tr>
<tr>
<td>Two or more races</td>
<td>157,460</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Veterans</td>
<td>235,384</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>55 and over</td>
<td>327,072</td>
<td>14%</td>
<td>23%</td>
</tr>
<tr>
<td>Union</td>
<td>251,785</td>
<td>11%</td>
<td>11%</td>
</tr>
</tbody>
</table>

- **Key Takeaways, the EE Workforce is**
  - 3 to 1 male;
  - Racially diverse, however, A-A’s are less represented;
  - Veterans are more represented;
  - Older workers less represented;
  - Almost twice the private sector unionization rate of 6.4% at 11%.
## Wage Variation across Energy and Energy Efficiency Industry Sectors

<table>
<thead>
<tr>
<th></th>
<th>Construction</th>
<th>Professional Services</th>
<th>Manufacturing</th>
<th>Utilities</th>
<th>Mining and Extraction</th>
<th>Wholesale Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of EE’s</td>
<td>1,867,000</td>
<td>956,000</td>
<td>762,000</td>
<td>603,000</td>
<td>528,000</td>
<td>440,000</td>
</tr>
<tr>
<td>Entry level</td>
<td>$14.77</td>
<td>$22.10</td>
<td>$16.75</td>
<td>$25.06</td>
<td>$16.68</td>
<td>$21.83</td>
</tr>
<tr>
<td>Median level</td>
<td>$21.82</td>
<td>$33.44</td>
<td>$26.63</td>
<td>$36.61</td>
<td>$26.56</td>
<td>$33.35</td>
</tr>
<tr>
<td>Highest level</td>
<td>$34.60</td>
<td>$52.62</td>
<td>$44.38</td>
<td>$55.43</td>
<td>$40.87</td>
<td>$51.64</td>
</tr>
</tbody>
</table>

### Key Findings:
- Wage correlation is closest to industry sector as opposed to energy technology.
- Utilities, at all levels, provide the highest median wage.
- Over 50% of energy and energy efficiency sectors have median entry level wages below $17/hr.
- Largest percentage increase from entry level to median are in mining and manufacturing at 59%.
Energy Efficiency Jobs Generally Pay a Premium, but Location and Unions Count.

<table>
<thead>
<tr>
<th>Description</th>
<th>U.S. Median BLS Hourly Earnings</th>
<th>U.S. Median EE Hourly Earnings</th>
<th>Wage Premium or Discount</th>
<th>Minnesota EE</th>
<th>MN Wage Premium or Discount</th>
<th>North Carolina EE</th>
<th>NC Wage Premium or Discount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boilermakers</td>
<td>$29.93</td>
<td>$30.83</td>
<td>$0.90</td>
<td>$48.64</td>
<td>$18.71</td>
<td>$25.24</td>
<td>$(4.69)</td>
</tr>
<tr>
<td>Brickmasons and Blockmasons</td>
<td>$23.93</td>
<td>$24.65</td>
<td>$0.72</td>
<td>$38.89</td>
<td>$14.96</td>
<td>$20.18</td>
<td>$(3.75)</td>
</tr>
<tr>
<td>Carpenters</td>
<td>$21.71</td>
<td>$22.36</td>
<td>$0.65</td>
<td>$35.28</td>
<td>$13.57</td>
<td>$18.31</td>
<td>$(3.40)</td>
</tr>
<tr>
<td>Construction Laborers</td>
<td>$16.60</td>
<td>$17.10</td>
<td>$0.50</td>
<td>$26.98</td>
<td>$10.38</td>
<td>$14.00</td>
<td>$(2.60)</td>
</tr>
<tr>
<td>Operating Engineers and Others</td>
<td>$22.61</td>
<td>$23.29</td>
<td>$0.68</td>
<td>$36.74</td>
<td>$14.13</td>
<td>$19.06</td>
<td>$(3.55)</td>
</tr>
<tr>
<td>Electricians</td>
<td>$26.01</td>
<td>$26.79</td>
<td>$0.78</td>
<td>$42.27</td>
<td>$16.26</td>
<td>$21.93</td>
<td>$(4.08)</td>
</tr>
<tr>
<td>Insulation Workers, Floor, Ceiling, and Wall</td>
<td>$17.81</td>
<td>$18.34</td>
<td>$0.53</td>
<td>$28.94</td>
<td>$11.13</td>
<td>$15.02</td>
<td>$(2.79)</td>
</tr>
<tr>
<td>Insulation Workers, Mechanical</td>
<td>$21.90</td>
<td>$22.56</td>
<td>$0.66</td>
<td>$35.59</td>
<td>$13.69</td>
<td>$18.47</td>
<td>$(3.43)</td>
</tr>
<tr>
<td>Plumbers and Pipefitters</td>
<td>$25.28</td>
<td>$26.04</td>
<td>$0.76</td>
<td>$41.08</td>
<td>$15.80</td>
<td>$21.32</td>
<td>$(3.96)</td>
</tr>
<tr>
<td>Roofers</td>
<td>$18.74</td>
<td>$19.30</td>
<td>$0.56</td>
<td>$30.46</td>
<td>$11.72</td>
<td>$15.80</td>
<td>$(2.94)</td>
</tr>
<tr>
<td>Sheet Metal Workers</td>
<td>$23.07</td>
<td>$23.76</td>
<td>$0.69</td>
<td>$37.49</td>
<td>$14.42</td>
<td>$19.45</td>
<td>$(3.62)</td>
</tr>
<tr>
<td>Structural Iron and Steel Workers</td>
<td>$25.30</td>
<td>$26.06</td>
<td>$0.76</td>
<td>$41.12</td>
<td>$15.82</td>
<td>$21.33</td>
<td>$(3.97)</td>
</tr>
</tbody>
</table>
Executive Summary — Motor Vehicles

TRENDS

• **2017 Job Growth.** The U.S. Motor Vehicles sector employed 2,536,382 Americans in 2018, increasing by 74,000 employees over 2017. This is exclusive of dealerships and retailers, which employed nearly two million additional workers.

• **Alternative fuels vehicles.** Alternative fuels’ vehicles employed 253,599 workers in 2018, an increase of nearly 34,000 in 2018, after a significant decline in 2017.

• **Fuel economy.** 43% of employees — over 486,000 — in the auto parts sector work with products that contribute to fuel economy.

• **2019 Expectations.** Motor Vehicles’ employers anticipate 2.2% growth in 2019.
Spotlight: “Southwest Michigan is experiencing an extreme shortage of workers.”

Melinda Ellsworth, VP of Investor Relations and Corporate Communications, Kaiser Aluminum

Kaiser Aluminum is a leading producer of highly engineered aluminum products for aerospace, general engineering, and automotive applications. Aluminum is inherently sustainable, indefinitely recyclable and one of the most effective materials to achieve fuel efficiency standards.

In 2010, Kaiser opened a state-of-the-art rod and bar extrusion facility in Kalamazoo, Michigan, in the heart of its market with access to a good talent pool and educational resources. The business has continued to grow with the growth in automotive extrusion applications as vehicle lightweighting for fuel efficiency drove greater conversion of components from steel to aluminum. The facility produces aluminum extrusions for anti-lock braking systems, control arm assemblies and drive-train applications.

The 2015 USEER reported that 78% of motor vehicles’ manufacturers found it was difficult to hire new employees. “Southwest Michigan is experiencing an extreme shortage of workers due to a historically low 3.4% unemployment rate,” said Melinda Ellsworth, VP of Investor Relations and Corporate Communications. “We are competing to attract talent with other manufacturers who are also hiring — many well-known and highly regarded employers. Although the shortage of workers poses a challenge, it has been especially challenging with the shortage of skilled trades workers.”

Several initiatives to entice applicants include employee referral programs. Other programs include sign-on bonuses for maintenance technicians; partnerships with community colleges/other organizations; expanding the recruiting efforts outside the local areas, offering in certain situations, full relocation; pursuing candidates outside the traditional manufacturing experience pool and continuing to focus on training and development employees.
Executive Summary—Hiring Difficulties

• 76.9% of all surveyed employers reported difficulty hiring qualified workers over the last 12 months; 29% noted it was very difficult. (In 2017, these numbers were 70% and 26%)

• Technologies and Occupations with the highest hiring difficulties:
  • Energy Efficiency construction jobs, 52% very difficult, 84% somewhat difficult.
  • Professional and business services EE jobs, 82% very or somewhat difficult.
  • Battery storage employers, 92% very or somewhat difficult.

• Highest Demand Occupations in EE Construction:
  • Technician or mechanical support (42%)
  • Electricians (41%)
  • Installation (27%)
Executive Summary—Projected Hiring Rates

• Employer projected hiring rates for 2019:
  • Energy Efficiency — 7.8% growth or 185,000 jobs (74,000 in 2018)
  • Electric Power Generation — 7.1% growth or 62,000 jobs (-8,000 in 2018)
  • Transmission, Wholesale Distribution and Storage — 3.2% growth or 44,000 jobs (33,000 in 2018)
  • Fuels — 3% growth or 34,000 jobs projected for 2019 (52,000 job increase in 2018).
  • Motor Vehicles — 2.2% growth or 56,000 jobs (74,000 in 2018)
• 76.9% of all surveyed employers reported difficulty hiring qualified workers over the last 12 months; 29% noted it was very difficult (In 2017, these numbers were 70% and 26%).
Executive Summary—Workforce Demographics

- Many of these sectors are now racially more diverse than the workforce as a whole (22%).
  - 10–19% Latino or Hispanic compared to 17% overall.
  - 5–9% Black or African-American compared to 12% overall.
  - 7–10% 2 or more races compared to 2% overall.
  - EPG is the most diverse sector with 31% of the workforce people of color.
- Women make up from 23–32% of these sectors compared to 47% of the overall workforce.
  - Electric Power Generation employs the highest percentage of women.
- Veterans comprise about 9–11% of employees, compared to 6% nationally.
- Unionization rates are generally higher than the national rate of 6.5% in the private sector, ranging from 3–16%.
2018 USEER

Thank you!

Questions?

For more information, contact:

• David Foster at dafoster@energyfuturesinitiative.org
• Sandy Fazeli at sfazeli@naseo.org

A Regional Look (PA, OH, WV, KY)

May 30, 2019
NETL Webinar

Philip Jordan VP and Principle Researcher
BW Research Partnership
The region added more than 18,600 energy jobs (2.3% growth) between 2017 and 2018.
2017-2018 Employment Growth: Fuels

### Detailed Technology

- **Coal**
  - 2018: 30,814
  - 2017: 32,040
- **Oil & Other Petroleum**
  - 2018: 40,951
  - 2017: 34,922
- **Natural Gas**
  - 2018: 26,844
  - 2017: 31,159
- **Corn Ethanol**
  - 2018: 5,177
  - 2017: 5,139
- **Other Ethanol / Non-woody Biomass**
  - 2018: 1,971
  - 2017: 2,013
- **Woody Biomass**
  - 2018: 2,040
  - 2017: 1,920
- **Other Fuels**
  - 2018: 15,265
  - 2017: 15,986

### Industry

- **Agriculture and Forestry**
  - 2018: 4,276
  - 2017: 4,520
- **Mining & Extraction**
  - 2018: 59,692
  - 2017: 56,862
- **Construction**
  - 2018: 437
  - 2017: 438
- **Manufacturing**
  - 2018: 31,509
  - 2017: 33,096
- **Trade**
  - 2018: 15,603
  - 2017: 16,262
- **Professional Services**
  - 2018: 11,104
  - 2017: 11,545
- **Other Services**
  - 2018: 440
  - 2017: 457
2017-2018 Employment Growth: TDS

### Detailed Technology

- **Micro Grid & Other**
  - 2018: 28,883
  - 2017: 28,460

- **Smart Grid**
  - 2018: 1,287
  - 2017: 1,230

- **Storage**
  - 2018: 4,378
  - 2017: 5,404

- **Traditional Transmission and Distribution**
  - 2018: 82,582
  - 2017: 78,290

### Industry

- **Utilities**
  - 2018: 41,597
  - 2017: 36,093

- **Construction**
  - 2018: 33,776
  - 2017: 35,058

- **Manufacturing**
  - 2018: 6,003
  - 2017: 6,196

- **Trade & Transport**
  - 2018: 29,700
  - 2017: 29,800

- **Professional & Business Services**
  - 2018: 5,398
  - 2017: 5,543

- **Other Services**
  - 2018: 656
  - 2017: 694
### 2017-2018 Employment Growth: EE

#### Detailed Technology

- **Energy Star & Efficient Lighting**
  - 2017: 19,156
  - 2018: 19,461

- **Traditional HVAC**
  - 2017: 38,762
  - 2018: 39,052

- **High Efficiency & Renewable Heating & Cooling**
  - 2017: 40,324
  - 2018: 42,010

- **Advanced Materials and Insulation**
  - 2017: 35,610
  - 2018: 38,126

- **Other**
  - 2017: 19,461
  - 2018: 38,126

#### Industry

- **Construction**
  - 2017: 96,719
  - 2018: 100,466

- **Manufacturing**
  - 2017: 40,095
  - 2018: 41,626

- **Trade**
  - 2017: 15,869
  - 2018: 16,497

- **Professional & Business Services**
  - 2017: 20,129
  - 2018: 20,924

- **Other Services**
  - 2017: 3,232
  - 2018: 3,357
2017-2018 Employment Growth: MV

Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing</td>
<td>54,104</td>
<td>83,126</td>
</tr>
<tr>
<td>Professional Services</td>
<td>4,835</td>
<td>8,711</td>
</tr>
<tr>
<td>Trade &amp; Transport</td>
<td>54,104</td>
<td>84,487</td>
</tr>
<tr>
<td>Other Services</td>
<td>83,126</td>
<td>194,506</td>
</tr>
</tbody>
</table>
2019 USEER Supplemental Wage Survey

- 76 Total Occupations
- Measures Regional Differences
- Type of Employment (Permanent, Temporary, Full-Time, Part-Time)
- Entry-level, Average, and Highest Wages by Occupation
- Benefits Offered by Occupation (Health Insurance and Retirement)
- Identifies Feeder Occupations
- Identifies Advancement Occupations
Thank you!

Questions?

For more information, contact:
Philip Jordan — pjordan@bwresearch.com
Diverse Resources Driving Energy Independence

Denise Brinley
Executive Director
Governor's Office of Energy
PENNSYLVANIA ENERGY PRODUCTION
PENNSYLVANIA: PIONEERS IN ENERGY
PENNSYLVANIA’S ELECTRICITY GENERATION: DECEMBER 2018

- Natural Gas-Fired: 2.02%
- Coal-Fired: 2.69%
- Nuclear: 33.34%
- Hydroelectric: 39.47%
- Non-Hydroelectric Renewables: 22.48%

- Coal is decreasing
- Natural gas is increasing
- Nuclear is flat
- Solar is flat

Pennsylvania is a net energy exporter

24% exported in 2018

Source: EIA Total End Use Energy Consumption Estimates for Pennsylvania
PENNSYLVANIA AND THE SURPRISE OF NATURAL GAS
Pennsylvania Natural Gas Drilling & Production: 2008–2018

11,000+ unconventional wells
 PIPELINE DEVELOPMENT — $10 BILLION

Line N West Side Expansion (East Coast Markets)

Mariner East I & II (Marcus Hook)

Atlantic Sunrise (East Coast Markets)

Sunbury (East Coast Markets)

Northeast Energy Direct (New England Markets)

Constitution (New England Markets)

Leidy Southeast (East Coast Markets)

PennEast (East Coast Markets)

Note: Map is generated from ArcGIS Online and the lines are approximations and generalizations.
TRANSITIONING FROM COAL TO NATURAL GAS

Power Plant Retirements 2000–2015

Source: Decommissioning U.S. Power Plants — Decisions, Costs, and Key Issues, Resources for the Future, October 2017

Natural gas represents approximately 97 percent of new interconnection requests in Pennsylvania.

Percent MW Capacity by Fuel Type

- Natural Gas, 96.5%
- Nuclear, 0.6%
- Wind, 1.4%
- Solar, 1.3%
- Storage, 0.1%
- Wood, 0.1%
- Methane, 0.0%
- Diesel, 0.0%
COMBINED CYCLE NATURAL GAS POWER PLANTS

Panda Power Funds Commissions Nation’s First Marcellus Shale Gas Power Plant — 829 MW

- First new generating station sited on Marcellus Shale gas formation will power up to 1M homes
- Supports long-term market for PA natural gas royalty owners
PENNSYLVANIA’S NATURAL GAS CONSUMPTION: 1997–2015

Beginning in 2010, production dramatically outpaces consumption.

Source: EIA Natural Gas Summary Data for Pennsylvania
NATURAL GAS LIQUIDS (NGLS)
ABUNDANT NATURAL GAS LIQUIDS
PA's IHS Markit Report estimates enough ethane remaining in the Marcellus to support **three** additional world-scale ethane crackers.

There is enough ethane in the Utica to support **one** additional ethane cracker.
Pennsylvania is uniquely positioned as an emerging petrochemical hub with an already-established, strong plastics industry, a combination not found in any other region of the U.S.

- 7th largest in plastics manufacturing in U.S.
- 2nd largest in plastics manufacturing in Appalachian region
- Expected to produce 40% of U.S. natural gas and NGL by 2030
- Globally cost-competitive ethane and propane
- Among top industries for FDI into PA
SHELL PENNSYLVANIA CHEMICALS

An Ethane Cracker Plant in Southwestern Pennsylvania
In 2016, Royal Dutch Shell announced it was building a $6B chemical plant in western Pennsylvania.

This game-changing plant will create thousands of jobs in Pennsylvania while expanding and creating market opportunities for downstream manufacturing and job creation.
WHY DID SHELL CHOOSE PA?

4 Critical Factors:

• Abundant inexpensive ethane
• Proximity to 70% of North American polyethylene customers
• Incentives
• Intensive state, regional, and local collaboration
HOW WILL IT IMPACT PA’S ECONOMY?

- 6,000 construction jobs
- 600 full-time permanent jobs
- Supplies robust, low-cost polyethylene feedstock for downstream market
According to Shell, future jobs at the plant will fall into three main categories:

• Maintenance
• Operations
• Management
In the interim before the plant reaches full operation, programs like these will help prepare our workers for the unique requirements of the new plant.
THE FUTURE: DISTRIBUTED ENERGY & RENEWABLES
Rethinking the Energy System

Centralized vs. Distributed Power?

Microgrids?
LOCAL USE — MEHOOPANY, PA

- Proctor & Gamble’s largest manufacturing facility in the world
- CHP an effort to save money and reduce CO₂ emissions
- 64 MW of electricity
- Gross savings of $16.5 million per year
- Reduced CO₂ emissions of 850 tons per year
• P.H. Glatfelter completed $63 million in renovations to convert from coal to natural gas

• Global leader in manufacturing of specialty papers

• State assistance played role in conversion ($8 million)
RENEWABLES
Pennsylvania’s Solar Future Plan

Promoting 10% in-state generation of solar by 2030

Anticipated 60,000 construction jobs (Installation, O&M)

Manufacturing of panels and electrical parts occurs elsewhere
THANK YOU!
Thank you for your participation


A presentation on regional and national energy & advanced manufacturing jobs and workforce data from the 2019 USEER Report

Thursday, May 30th, 2019 1-2 PM ET

Slides will be posted on netl.doe.gov/rwfi on the Webinar Archive Section

Subscribe to NETL RWFI E-Note (netl.rwfi@netl.doe.gov)

Disclaimer: The analysis presented and conclusions drawn herein represent solely those views of the author(s), and do not represent the views of the United States Department of Energy
• Methodology
• Additions to the 2019 USEER
How Is the USEER Survey Administered?

- A national supplemental survey that tracks existing BLS QCEW data
  - QCEW is compiled from unemployment records collected at the state level and then aggregated into 1,057 industry sectors using the North American Industrial Classification System (NAICS)
- The survey is administered to a representative sample of 30,000 employers by phone and internet. Results are integrated with QCEW data.
- Analyzes four sectors
  1. Electric Power Generation and Fuels Production
  2. Electric Power and Fuels Transmission, Distribution, and Storage
  3. Energy Efficiency
  4. Motor Vehicles
## Electric Power Generation: National

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>QCEW-BLS</th>
<th>2017 USEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil fuels</td>
<td>92,817</td>
<td>187,117</td>
</tr>
<tr>
<td>Nuclear</td>
<td>44,753</td>
<td>68,176</td>
</tr>
<tr>
<td>Wind</td>
<td>6,050</td>
<td>101,738</td>
</tr>
<tr>
<td>Solar</td>
<td>2,708</td>
<td>260,077</td>
</tr>
<tr>
<td>CHP</td>
<td>1,649</td>
<td>18,034</td>
</tr>
<tr>
<td>Hydro</td>
<td>17,501</td>
<td>65,554</td>
</tr>
<tr>
<td>Geothermal</td>
<td>1,117</td>
<td>5,768</td>
</tr>
<tr>
<td>Biomass</td>
<td>1,693</td>
<td>26,014</td>
</tr>
</tbody>
</table>

## Electric Power Generation: New York

<table>
<thead>
<tr>
<th>Fuel Source</th>
<th>QCEW-BLS</th>
<th>2017 USEER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fossil fuels</td>
<td>2,080</td>
<td>5,030</td>
</tr>
<tr>
<td>Nuclear</td>
<td>2,991</td>
<td>n/a</td>
</tr>
<tr>
<td>Wind</td>
<td>97</td>
<td>2,855</td>
</tr>
<tr>
<td>Solar</td>
<td>61</td>
<td>12,411</td>
</tr>
<tr>
<td>CHP</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Hydro</td>
<td>1,045</td>
<td>5,859</td>
</tr>
<tr>
<td>Geothermal</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Biomass</td>
<td>n/a</td>
<td>3,325</td>
</tr>
</tbody>
</table>
What Is the USEER?

• The U.S. Energy and Employment Report (USEER) is produced annually from a supplemental survey of employers with energy sector employment.
  • Based on the Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW).
  • Developed at DOE in 2015 with review and approval of BLS and the Energy Information Administration.
  • Issued twice by DOE, in 2016 and 2017, with data collected in the Q4 of the preceding year.

• In Q3, 2017, DOE acknowledged it would not conduct the USEER survey or issue the 2018 USEER.

• In October, 2017, NASEO, and EFI announced an effort to raise private funding, hire BW Research (who held the DOE contract), conduct the Q4 2017 survey and produce the 2018 USEER.
• The survey instrument in the 2018 USEER and underlying methodology is identical to that used in the primary data collected on behalf of the United States Department of Energy (OMB Control No. 1910-5179) for the 2017 U.S. Energy and Employment Report and secondary data from the United States Department of Labor’s Quarterly Census of Employment and Wages for Q2 of 2017.

• Data collection was performed in Q4 2017 to provide accurate year-over-year job comparisons with the 2016 and 2017 USEERs.
The USEER addresses three gaps in current BLS QCEW energy employment data:

1. Business activities essential to the operation of traditional energy companies, but classified in other industry sectors.
   - Full-time contractor maintenance workers at nuclear plants classified as construction workers.
   - Outside contractors who have displaced utility in-house construction crews.

2. Renewable energy jobs such as wind, solar, geothermal, etc.;
   - Residential PV installers, classified as construction electricians or roofers.
   - Wind development professionals working for non-utility firms.

3. Energy efficiency jobs;
   - No differentiation between employees producing or installing high efficiency, Energy Star, and non-Energy Star products.
## USEER Technologies

<table>
<thead>
<tr>
<th>Electric Power Gen.</th>
<th>Fuels Production</th>
<th>Trans, Dist., Storage</th>
<th>Energy Efficiency</th>
<th>Motor Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Photovoltaics</td>
<td>Coal</td>
<td>Traditional T&amp;D</td>
<td>Energy Star Appliances</td>
<td>Gasoline and Diesel</td>
</tr>
<tr>
<td>Wind</td>
<td>Petroleum</td>
<td>Pumped Hydro</td>
<td>Efficient Lighting</td>
<td>Hybrid Electric</td>
</tr>
<tr>
<td>Geothermal</td>
<td>Natural Gas</td>
<td>Battery Storage</td>
<td>Traditional HVAC</td>
<td>Plug-in Hybrid</td>
</tr>
<tr>
<td>Bioenergy/Biomass</td>
<td>Other Fossil Fuels</td>
<td>Other Storage</td>
<td>Energy Star HVAC</td>
<td>All Electric</td>
</tr>
<tr>
<td>Low Impact Hydro</td>
<td>Corn Ethanol</td>
<td>Smart Grid</td>
<td>Renewable HVAC</td>
<td>Natural Gas</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>Woody Biomass</td>
<td>Other Modernizing</td>
<td>Recycled Build. Mat.</td>
<td>Fuel Cell</td>
</tr>
<tr>
<td>Advanced Gas</td>
<td>Other Biofuels</td>
<td></td>
<td>Reduced H20</td>
<td></td>
</tr>
<tr>
<td>Nuclear</td>
<td>Nuclear Fuels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petroleum/Oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Agriculture — NAICS 11
• Mining, Oil and Gas Extraction — 21
• Utilities — NAICS 22
• Construction — NAICS 23
• Manufacturing — NAICS 31-33
• Wholesale Trade — NAICS 42
• Professional and Technical Services — NAICS 54
What the USEER Is Not

• NOT a substitute for the existing BLS QCEW.
  • The USEER is an additional lens through which to understand energy-related employment numbers, hiring forecasts, hiring difficulty, skills needs, and demographics, etc.

• NOT a measurement of indirect job impacts.
  • The USEER counts and surveys only direct jobs in the identified firms.

• NOT a total jobs impact study of an industry.
  • The USEER does not estimate the “induced jobs” created by the energy industry in other parts of the economy.

• NOT an economic impact analysis of the energy industry.
  • The USEER does not use input-output modelling systems such as Implan or REMI to measure the overall economic impact of an industry based on spending or revenue data nor is it a policy forecasting tool such as NEMS.
Executive Summary — Manufacturing

• Of the 12.8 million manufacturing jobs in the U.S., over 762,000, about 6% are directly involved in the production of fuels, generating equipment, and energy efficiency products.
  • 356,000 jobs are in Electric Power Generation and Fuels
  • 321,000 jobs are in Energy Efficiency.
  • 85,000 jobs are in Transmission, Wholesale Distribution, and Storage

• Another 1.01 million jobs are in Motor Vehicle manufacturing.
  • 57,000 of these jobs are in manufacturing alternative fuels vehicles.
  • 636,000 manufacturing jobs are in component parts. 43% of all component parts jobs support fuel efficiency technologies.
Executive Summary—Professional Services

• **Of the 30.1 million professional services jobs in the U.S., 956,000, about 3%** are directly engaged in traditional energy or energy efficiency firms.
  • **166,000 jobs** are in Fuels.
  • **176,000 jobs** are in EPG
  • **130,000 jobs** are in TDS
  • **484,000 jobs** are in EE.

• **2019** projected growth rate is 6.4% or 31,000 new jobs
• Job growth rates in all 5 sectors increased in 2018 to 3.5%, (2.3% in energy and energy efficiency) exceeding the national average of 1.8%.

• Fuels
  • Considerable growth in oil and gas extraction.

• Electric Power Generation
  • Overall jobs declined slightly, just under -1%
  • Declines were largest in solar (8,000), coal (7,000), and nuclear (1,700)
  • Natural gas grew the most (5,200)

• Energy Efficiency
  • Growth rate increased from 3% in 2017 to 3.4% in 2018, but hiring difficulty also rose.
  • Intensity held steady with 79% of firms spending the majority of their time on EE
  • Employer hiring difficulty over 80% for ¾ of firms; In EE construction firms 52% report “very difficult”, up 3% percentage points.
  • Need concentrated effort to identify in-demand job skills, geographic locations, and relevant training programs.

• Energy Infrastructure
  • 65,000 new jobs predicted in Transmission, Wholesale Distribution, and Storage in 2019
  • 16,000 net new jobs in 2017
  • 33,000 new jobs in 2018
  • Energy security, resilience, and efficiency are key opportunities.

• Motor Vehicles — industry at all time high in 2016 w/ 17.9M vehicles sold, 17.5M in 2017, 17.1 in 2018
  • Alternative fuel vehicles rose by 34,000 jobs
  • 43% or over 486,000 component parts jobs contribute to fuel efficiency.
### Industry Hiring Expectations in Energy Efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>Construction</th>
<th>Professional Services</th>
<th>Manufacturing</th>
<th>Wholesale Trade</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>11%</td>
<td>8.30%</td>
<td>6.70%</td>
<td>4.90%</td>
<td>0%</td>
</tr>
<tr>
<td>2018</td>
<td>10.60%</td>
<td>8.50%</td>
<td>3.40%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>2019</td>
<td>8.80%</td>
<td>5.80%</td>
<td>6.40%</td>
<td>8.90%</td>
<td>7.70%</td>
</tr>
</tbody>
</table>
Anticipated Employer Growth Has Been Challenged by Hiring Difficulty in Construction

<table>
<thead>
<tr>
<th>Year</th>
<th>Projected Growth</th>
<th>Actual Growth</th>
<th>Hiring Difficulty in Construction</th>
<th>U.S. Unemployment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>0%</td>
<td>12.00%</td>
<td>82%</td>
<td>-20%</td>
</tr>
<tr>
<td>2017</td>
<td>11%</td>
<td>-7.20%</td>
<td>83%</td>
<td>0%</td>
</tr>
<tr>
<td>2018</td>
<td>11%</td>
<td>1.60%</td>
<td>84%</td>
<td>20%</td>
</tr>
<tr>
<td>2019</td>
<td>8.80%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In 2018, all surveyed employers reported an increase in hiring difficulty of 7 percentage points from 70% to 77%.

<table>
<thead>
<tr>
<th>Technology</th>
<th>2017 Projected Hiring</th>
<th>2018 Actual Hiring</th>
<th>2018 Hiring Difficulty</th>
<th>2019 Projected Hiring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficiency (overall)</td>
<td>9.0%</td>
<td>3.4</td>
<td>81%</td>
<td>7.8</td>
</tr>
<tr>
<td>Energy Efficiency Construction</td>
<td>10.6%</td>
<td>1.6%</td>
<td>84% (52%)</td>
<td>8.8%</td>
</tr>
<tr>
<td>Energy Efficiency Professional</td>
<td>3.4%</td>
<td>7.7%</td>
<td>82% (21%)</td>
<td>6.4%</td>
</tr>
<tr>
<td>Energy Efficiency Manufacturing</td>
<td>9.9%</td>
<td>1.9%</td>
<td>72%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Wind Construction</td>
<td>3.7% (overall)</td>
<td>3.5% (overall)</td>
<td>86% (28%)</td>
<td>6.2%</td>
</tr>
<tr>
<td>Solar Construction</td>
<td>5.0% (overall)</td>
<td>(.032)% (overall)</td>
<td>85%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Battery Storage</td>
<td>NA</td>
<td>18.1%</td>
<td>92% (23%)</td>
<td>4.4%</td>
</tr>
<tr>
<td>Grid Modernization</td>
<td>3.3%</td>
<td>80% (17%)</td>
<td>1.9–2.3%</td>
<td></td>
</tr>
<tr>
<td>TDS Construction</td>
<td>5.4%</td>
<td>4.8%</td>
<td>79% (34%)</td>
<td>4.0%</td>
</tr>
<tr>
<td>TDS Utilities</td>
<td>(.6)%</td>
<td>1.7%</td>
<td>56% (12%)</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Meeting Demand for Energy Efficiency Jobs

Hiring Difficulty in Energy Efficiency vs. Actual and Projected Growth Rates

<table>
<thead>
<tr>
<th>State</th>
<th>2018 Projected</th>
<th>2018 Actual</th>
<th>2018 Hiring Difficulty</th>
<th>2019 Projected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illinois</td>
<td>2.90%</td>
<td>8.30%</td>
<td>94.80%</td>
<td></td>
</tr>
<tr>
<td>Iowa</td>
<td>4.50%</td>
<td>8.00%</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>Michigan</td>
<td>1.20%</td>
<td>8.20%</td>
<td>90.00%</td>
<td></td>
</tr>
<tr>
<td>Minnesota</td>
<td>3.00%</td>
<td>7.90%</td>
<td>88.30%</td>
<td></td>
</tr>
<tr>
<td>Missouri</td>
<td>4.20%</td>
<td>6.70%</td>
<td>77.00%</td>
<td></td>
</tr>
<tr>
<td>Wisconsin</td>
<td>1.40%</td>
<td>8.10%</td>
<td>93.80%</td>
<td></td>
</tr>
<tr>
<td>National Average</td>
<td>3.40%</td>
<td>7.80%</td>
<td>70.00%</td>
<td></td>
</tr>
</tbody>
</table>
• **800,000 Americans are employed, in whole or part, in low carbon emissions** generation and fuels, virtually unchanged from 2017.

• **In generation,** these include:
  • Solar — 242,000 spending a majority of their time, with another 93,000 spending less than 50%, declines of 3.2% and 4.3%.
  • Wind — 111,000, increase of 3.7%
  • Nuclear — 72,000 (generation and fuels), decrease of 2.7%
  • CHP — 29,000, increase of 7.4%
  • Biomass — 13,000, increase of 8.3%
  • Geothermal — 8,500, increase of 7.6%
  • Hydro — 66,400 (12,000 low impact), a decline of 1%
  • Low emissions natural gas — 69,200, an increase of 7.0%

• **In fuels,** these include:
  • Corn Ethanol — 35,000, an increase of 1.4%
  • Woody Biomass/Cellulosic Biofuels — 33,100, an increase of 5.4%
  • Other Ethanol and Non-woody Biomass, incl. Biodiesel — 20,100, stable
  • Other Biofuels — 18,400, stable
Executive Summary—Construction Industry

• Of the 7.1 million construction jobs in the U.S., over 1.867 million, about 26% are directly supported by traditional energy or energy efficiency firms.
  • 1.295 million jobs are in Energy Efficiency.
  • 481,000 jobs are in Transmission, Wholesale Distribution, and Storage
  • 307,000 jobs are in Electric Power Generation and Fuels

• Construction firms in EE report the highest hiring difficulty in the entire survey with 52% indicating it is “very difficult” to hire new employees with 84% reporting some level of difficulty.
• Goal: to create a job quality index for jobs in the energy and energy efficiency sectors during a period of rapid technological change.

• Problem: jobs in different energy technologies rarely require completely unique skills and often build upon existing skill sets, but may require specialized training and qualifications.

• Index components:
  • Wages
  • Benefits
  • Safety performance
  • Career advancement and certification opportunities and premiums
  • Diversity
  • Entry level access
  • Geographic distribution
  • Stability