National Wind Workforce Assessment: Current Workers to Industry

Brinn McDowell
Elena Smith
Jeremy Stefek
Acknowledgments

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1. Read the presentation like a report

2. Use the “Overview: Quick Click” slide to navigate through the presentation

Image created by John Frenzl, NREL
Overview: Quick Click

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- Key Takeaways

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- Employee Perception of Wind Industry

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- Industry Firm Challenges: General

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- Industry Segment
- Value Chain Segment
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Automation

- Implementation of Automation
- Agreement with Automation
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Introduction
The U.S. wind energy market, both land-based and offshore, is expected to grow significantly over the next few decades, increasing the need for employment in the industry.

Federal policy support for wind industry growth has been increasing.

- The White House has set targets of 80% renewable energy generation by 2030 and 100% carbon-free electricity by 2035 (White House 2021a).

- Wind energy could potentially make up 20% of the U.S. electricity mix by 2030 and 35% by 2050 (DOE-WETO 2017).

- The Biden administration has set a goal to have 30 GW of offshore wind be deployed by 2030 (White House 2021b).

- The Inflation Reduction Act and Infrastructure Investment Jobs Act have incentivized the creation and expansion of the domestic wind energy market, growing the demand for a locally available and properly trained workforce throughout the industry.
An available and properly trained workforce is needed for the success of the wind industry. However, past research has indicated that there is a disconnect between wind industry employers, the workforce, and educational institutions, which has been referred to as the wind workforce gap.

Wind workforce gap: Wind energy employers report having difficulty finding qualified candidates, while the potential wind energy workforce (e.g., students and recent graduates who are not yet working in the wind energy industry) report difficulty finding jobs, and educational institutions report having difficulty placing students in jobs (Stefek 2022).

Narrowing the gap could simultaneously (Keyser & Tegen 2019).

- Reduce recruitment costs for employers
- Help educational institutions fill classrooms
- Grow the domestic wind workforce by properly communicating wind industry careers to the potential workforce.
Defining the Wind Energy Workforce Gap (Stefek 2022) indicated that the top three reasons for the workforce gap include experience, education and training qualifications, and geographic locations of jobs. This report expands on these findings.

### Experience

Experience was noted as a challenge for more than one-quarter of all wind industry firms looking for entry- (27.6%) and non-entry-level (33%) job applicants.

### Education and Training

More than one-quarter of responding firms indicated that “there are enough applicants, but too many applicants do not have the training or education needed for the job” (29.7%).

### Geographic Location of Jobs

The third highest reason among wind firms searching for both entry- and non-entry-level applicants was that there are not enough applicants for available positions in areas where wind is being developed.

Members of the total workforce (68%) responded that gaining applicable work experience is somewhat of a challenge or a considerable challenge when trying to find work opportunities in the wind industry.

Current and potential workers identified getting hands-on training (62%) or technical training (61%) to develop skills and expertise as a challenge or obstacle when searching for relevant opportunities in the wind industry.

Finding employment opportunities where one lives or is willing to live was ranked the second highest challenge for the total and potential workforce (67%) and the top challenge for the current workforce (64%).
This report presentation is intended for use by employees looking to gain insight into the wind workforce gap from the industry side and actionable steps that can be taken to help narrow the workforce gap. More information can be found in complementary resources.

This presentation includes:

• Modeled scenario of Wind Workforce through 2050 based on Business-as-Usual
• Perceptions of the wind industry from the current workforce
• Scenarios on how the workforce gap is affected by changing perceptions
• Hiring challenges for wind industry firms
• Automation and the wind workforce
• Connective actions for industry and education/training programs.

The information presented in the report originates from the 2022 survey effort conducted in partnership between NREL and BW Research Partnership, and various outside resources. To learn more about the methodology behind data collection and workforce modeling, please refer to the National Wind Energy Workforce Assessment Methods Report: Surveys and System Dynamics Model (McDowell and Stefek 2023).
### Employer Survey (n=228)

**Involvement in Wind Energy Industry, 2022 (n=228)**

- Yes, only land-based wind: 43.4%
- Yes, only offshore wind: 49.6%
- Yes, both land-based and offshore wind: 7.0%

**Number of Employees at Wind Energy Firms, 2022 (n=142)**

- 1 to 9 employees: 61.8%
- 10 to 49 employees: 19.7%
- 50 or more employees: 18.4%

### Involvement in Wind Industry Segments, 2022 (n=228)

- Operations and Asset Management: 62.3%
- Development and Siting: 61.4%
- Construction: 59.6%
- Education, Training, and Advocacy: 56.1%
- Research and Development: 54.8%
- Finance, Legal, and Insurance: 44.3%
- Government and Regulations: 42.1%
- Manufacturing, Including Component Parts Manufacturing: 42.1%
- Transportation and Logistics: 39.5%
Who Took the Survey?

Student and Recent Graduate Survey (n=346)

Type of School Attended, 2022 (n=226)

- College or community college: 1.3%
- University: 27.9%
- Trade school: 69.5%
- Other: 1.3%

Last Educational Level Completed, 2022 (n=346)

- Less than high school: 1.2%
- High school diploma or GED: 20.2%
- Some college: 42.2%
- Post high school certificate or associate degree (A.A. or A.S.): 8.7%
- Four-year bachelor’s degree (B.A. or B.S): 21.1%
- Graduate school (M.S., MBA, M.A., Ph.D., M.D., J.D...): 6.6%

Degree Students and Recent Graduates were/are Working Toward, 2022 (n=226)

- Finance, accounting, and/or business: 18.1%
- Computer engineering: 15.5%
- Applied and/or field science related to wind energy: 13.3%
- Mechanical engineering: 12.4%
- Electrical engineering: 9.7%
- Civil engineering: 8.0%
- Basic and skilled trades (such as electrician, plumber, or machinist): 6.2%
- Other engineering: 4.4%
- Wind technician or wind turbine technician: 4.0%
- Aerospace engineering: 1.3%
- Other: 7.1%
Who Took the Survey?

Current Worker Survey (n=29)

Primary Sector of Work in the Wind Industry (n=29)

- Land-based wind: 34.5%
- Both land-based & distributed: 17.2%
- Offshore wind: 13.8%
- Distributed wind: 13.8%
- Both land-based & offshore: 10.3%
- All three, land-based, offshore & distributed: 6.9%
- Both offshore & distributed: 3.4%

Most Recent Employment Level in the Wind Industry (n=29)

- Intern or apprenticeship: 3.4%
- Entry-level position: 48.3%
- Mid-level position: 37.9%
- Senior or other high-level position: 10.3%

Area of Study (n=29)

- Don’t know/Refused: 3.4%
- Engineering: 6.9%
- Applied and/or Field Science related to Wind Energy: 10.3%
- Basic & Skilled trades (such as electrician, plumber, or machinist): 13.8%
- Finance, Accounting and/or Business: 17.2%
- Wind technician or Wind turbine technician: 48.3%
### Who Took the Survey?

#### Educator Survey (n=27)

**Type of Program in the School Employed (n=14, n =12)**

- **College or community college**
- **University**
  - Bachelors program (35.7%)
  - Masters program (28.6%)
- **Associates program (91.7%)**
- **Certificate program (8.30%)**
- **Doctorate (28.6%)**
- **Certificate program (7.1%)**

**Type of School Currently Employed (n=27)**

- College or community college: 44.4%
- University: 51.9%
- Trade school: 3.7%

**Program Involvement With the Wind Industry (n=27)**

- Wind industry specific program: 40.7%
- Renewable energy program with specific courses on the wind industry: 37.0%
- Renewable energy program with no specific courses on the wind industry: 11.1%
- Energy related program that does not focus on the wind industry: 7.4%
- A non-energy related program that offers some courses on the wind industry: 3.7%
Key Takeaways
According to model projections under a business-as-usual (BAU) scenario, if the wind energy industry is to progress in line with NREL 2022 Standards Scenario Mid-case with nascent technology and current policy—one potential path for expansion—a larger supply of qualified and adequately trained workers will be needed to support overall workforce demand.

<table>
<thead>
<tr>
<th>Year</th>
<th>Workforce Supply</th>
<th>Workforce Demand</th>
<th>Workforce Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>134,364 FTE Supply</td>
<td>258,459 FTE Demand</td>
<td>124,095 FTE Deficit</td>
</tr>
</tbody>
</table>

In coming years, the demand for wind energy jobs will increase, outpacing the growth of available labor. Under current assumptions, the wind industry supply is expected to increase steadily through 2050; however, it is not predicted to be at the rate that is needed to meet 2030 or 2050 wind workforce demand. The workforce supply estimations are informed by current wind industry perceptions and baseline data collected through the 2022 survey effort, and results vary depending on the qualitative inputs.

Note: Information about the assumptions and data used is in the Methodology report. These projections are highly dependent on the assumption of the model and data gathered through the 2022 survey effort and should be used as a high-level estimate of scale and trend as opposed to a point projection.
Key Takeaways

Closing the gap between the workforce that is needed to meet deployment goals and the supply that is possible in the wind workforce under current assumptions will require:

- Increasing the Supply of the Workforce
- Adequately Training the Workforce Applying to Job Openings
- Decreasing the Demand of Full-Time Employees Needed.

This presentation will address mitigating the workforce gap by assessing perceptions that current wind employees have of the wind industry, and hiring challenges that wind industry firms face.
Reported perceptions of the wind industry from the current workforce:

- **Current wind industry workers** and **workers who transitioned into the wind industry** both reported being **very satisfied with their jobs**.
- The main reasons people transitioned into the wind industry were for a **better salary** and **more work life balance**.
- Student respondents also view a job in the wind energy industry as having **more positive attributes than comparable industries**.
- **Strengths** for wind are seen in **job stability** and the opportunity to do work that fits with people’s environmental priorities.
- Perceived **weaknesses** for the wind industry included **job location, and to a lesser extent, starting entry-level wages**.
- Many of the reported top hiring challenges faced by current wind employees are also faced by students.
- To attract more qualified applicants into the wind industry and help to close the workforce gap, historical challenges in hiring and perception, such as **providing opportunities for students to get hands-on training**, need to be addressed.

Reported hiring challenges for wind industry firms:

- Overall, wind industry firms reported that the **largest challenge** for hiring **entry-level employees** is a **lack of experience**, whereas the **largest challenge** for **non-entry-level employees** is the **lack of applicants** to open job postings.
- **Small firms (1–9 employees)** and **offshore wind firms** need people with more **experience**. Conversely, **medium and large firms (10–50+ employees)** and **land-based wind firms** need more **applicants**.
- Development and siting had the **highest reported difficulty** hiring **non-entry-level employees**, and **manufacturing** had the **highest reported difficulty** hiring **entry-level employees**.
- Some of the greatest hiring difficulties have been reported by wind industry members for **skilled trades** occupations. **Building connections between the wind industry and organized labor unions** could offer a large opportunity for growth in the wind workforce.
- **Offshore wind firms** had the **greatest reported challenge with hiring** compared to companies that work in land-based wind, or both land-based and offshore wind.
Key Takeaways

Automation:

• **More than two-thirds** of the overall respondents reported that they had implemented automation, with the **original intentions of implementation** being quality control, safety of workers, and to reduce operational costs within the firm.

• Firms involved in both land-based and offshore wind reported that automation technologies made their firm **more productive and that they expected to continue investing in these technologies**.

• Similarly, these firms also reported that automation technologies have allowed their firm to **better manage the lack of available workers** (54.8%) and **reduced the need to hire new workers** (61.9%).

• The top three occupations believed to be impacted from automation within wind energy firms are **operations and maintenance, accounting and administrative, and manufacturing and assembly**.
Perceptions of the Wind Industry: Current Workforce
The majority of current wind industry workers reported being very satisfied with their job in the wind industry (53%). Respondents were most satisfied with their opportunity to learn and be challenged (73.7%), the location of their work (73.7%), and their wages and pay (68.5%).
Similarly, workers who transitioned from another industry also had a positive perception of their job in the wind industry. Those who recently transitioned into the wind industry reported being very satisfied (77%), or somewhat satisfied (23%) with their decision.

Top reasons for transitioning into wind:

1) Higher salary (46.2%)
2) Better work life balance (46.2%)
3) Wanted to work in a different location (38.5%).

Job stability is also a major concern for current workers and acts as a lever for the perception of the wind industry. Overall, 83.3% of current workers felt stable in their work.
Of the current employees who reported transitioning into the wind industry, energy generation was the most common industry to transfer from (40%).

Of the employees who transferred out of the wind industry, electric power generation was the most common industry to be transferring into (23%).
At least one in seven currently employed student respondents works in a job that includes some work in the wind industry. One-fifth of working students or recent graduates were conducting work in the distributed wind energy industry (20.7%) and/or land-based wind energy industry (20.3%). Another 15.2% of survey respondents indicated that their job involved some work in the offshore wind energy industry. Overall, the largest proportion of respondents were working in a renewable energy industry other than wind energy (30.0%), followed by an energy industry other than renewable energy, such as fossil fuels and nuclear energy (28.3%).
Additionally, students looking to start a career in the wind industry reported that their perceptions of wind industry employment attributes are generally average or above average when compared to other industries.

45% of respondents perceived that employment in the wind industry was better than average for providing the opportunity to do work that fits with their environmental priorities.

16.5% of respondents perceived that employment in the wind industry was worse than average for providing the opportunity to work in locations where they want to live.

81% of students or recent graduates who work in wind reported they felt they had stability in their job.
Despite the overall positive perception of the industry by current workers and the potential workforce, there are still hiring and perception challenges that need to be overcome if the workforce gap is to be mitigated.

Educators reported that 89.19% of students had jobs 6 months after graduation. 47.95% of students with jobs after 6 months had them within the wind industry. 37.5% of students and recent graduate respondents have not considered working in the wind energy industry. 24.4% have actively searched for work opportunities, and 33.8% have considered but not actively searched for wind industry employment.

Top Three Reasons for Lack of Consideration of Employment in Wind Energy

1) Interest in other industries (71.2%)
2) Lack of exposure to the wind industry in coursework (60.0%)
3) Unsure what jobs make up the wind industry (54.2%).
Many of the reported top hiring challenges faced by current wind employees are also faced by students. To attract more qualified applicants into the wind industry and help to close the workforce gap, historical challenges in hiring and perception need to be addressed.

Top Three Reasons Reported For Hiring Difficulty by Students

1) Getting technical training, developing technical skills and expertise
2) Getting the free time needed to focus on my career goals
3) Finding employment opportunities near where I live or am willing to live.

Top Three Reasons Reported For Hiring Difficulty by Current Wind Employees

1) Getting hands-on training that develops wind energy specific skills
2) Finding employment opportunities near where I live or am willing to live
3) Getting relevant work and/or industry experience.

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Not a challenge</th>
<th>It depends</th>
<th>Don’t know/ Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting technical training, developing technical skills and expertise</td>
<td>69.2%</td>
<td>16.9%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Getting the free time needed to focus on my career goals</td>
<td>64.6%</td>
<td>27.7%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Finding employment opportunities near where I live or am willing to live</td>
<td>64.6%</td>
<td>24.6%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Getting relevant work and/or industry experience</td>
<td>60.0%</td>
<td>32.3%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Getting assistance from career services</td>
<td>58.5%</td>
<td>29.2%</td>
<td>12.3%</td>
</tr>
<tr>
<td>Getting the academic degree and/or certification needed</td>
<td>55.4%</td>
<td>30.8%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Developing resumes and related materials that demonstrate qualifications</td>
<td>53.8%</td>
<td>26.2%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Getting comfortable and confident communicating with employers and those hiring</td>
<td>50.8%</td>
<td>35.4%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Getting hands-on training that develops wind energy specific skills</td>
<td>44.6%</td>
<td>40.0%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Getting assistance from career services</td>
<td>14.3%</td>
<td>42.9%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Getting hands-on training that develops wind energy specific skills</td>
<td>25.0%</td>
<td>46.4%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Getting comfortable and confident communicating with employers and those hiring</td>
<td>21.4%</td>
<td>28.6%</td>
<td>35.7%</td>
</tr>
<tr>
<td>Finding employment opportunities that are near where I live or am willing to live</td>
<td>25.0%</td>
<td>42.9%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Getting the academic degree and/or certification needed</td>
<td>28.6%</td>
<td>32.1%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Getting relevant work and/or industry experience</td>
<td>32.1%</td>
<td>32.1%</td>
<td>25.0%</td>
</tr>
</tbody>
</table>

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Considerable Challenge Somewhat of a Challenge Not a Challenge It Depends Don’t know/ Refused
One way to help mitigate hiring challenges in the wind industry is by utilizing educational institutions for job recruitment opportunities offered through education. Creating connections between educational and training institutions and the wind industry can help build a sustainable pipeline for a utilized labor force.

In 2022, just under three in five (59%) employers reported that they did not work with U.S.-based educational institutions. Creating stronger networks with U.S.-based educational institutions for job candidates and increasing students’ overall awareness and perception of wind careers could be an opportunity for wind industry firms looking to hire candidates with adequate training.

Utilization of U.S.-Based Educational Institutions by Wind Employers, 2020, 2022
Graph courtesy of BW Research Partnership

Utilization of Educational Institutions by Wind Energy Firms, 2022 (n=187)
Graph courtesy of BW Research Partnership
Additionally, current wind industry employees reported that volunteer jobs, skills learned at past internships/apprenticeships, and participation in student organizations helped prepare them the most for their careers in wind. Wind industry firms could help to prepare the workforce pipeline through greater involvement in these avenues.

Top three reported valuable experience gaining opportunities:

1) Volunteer jobs (66.6%)
2) Skills learned at past internships/apprenticeship jobs (61.1%)
3) Participation in student organizations (61.1%).

Note: These numbers are the sum of current employee respondents who reported “Somewhat agree” + “Strongly agree.”

75% of current or recent wind employees surveyed participated in an internship or apprenticeship before entering the wind industry.
To better understand how the perception of the wind industry affects application rates into wind occupations, key levers discovered through the survey effort were implemented into the workforce estimation model. Some of the key levers that affect the perception people have of the wind industry, and therefore the application rates into wind occupations, were labor wages, job stability, and job location.

We define perception as “a way of regarding, understanding, or interpreting something” (Oxford Languages). It was found that increasing the positive perception that job seekers have of these key levers helps to increase the percent of applicants trying to apply into the wind industry.

A scenario was run to evaluate how positively or negatively changing the perception that people trying to enter the wind workforce have affects the percent of people submitting wind job applications. The effects of these changes on the workforce supply and workforce gap can be found on Slide 24.
Assuming that demand of the wind workforce stays constant to BAU estimations, increasing the number of applicants to wind industry jobs, and therefore the number of industry employees, can help to mitigate the gap between demand of workers needed to meet deployment projections and supply of workers available in the wind industry. According to the model, the percent the workforce gap closes will be correlated to how much the positive perception of the wind industry increases or decreases. Potential ranges are displayed below but are highly dependent on taking actions to make student perceptions of labor wages, location of jobs, and job stability more positive. Due to the general positive perception and attractiveness of the wind industry as indicated in the survey effort, decreasing the perception of the wind industry causes a greater decrease from BAU than increasing the perception.

**Workforce Demand Estimation: Perception Scenario**

Demand stays consistent at 258,459 FTE

**Workforce Gap Estimation: Perception Scenario**

Maximum perception 2030: deficit of 119,759 Jobs  
2030: Decrease of 3.49% from BAU  
2050: Decrease of 13.6% from BAU

Minimum perception 2030: deficit of 136,038 Jobs  
2030: Increase of 9.62% from BAU  
2050: Increase of 31.7% from BAU

**Workforce Supply Estimation: Perception Scenario**

Maximum perception 2030: 138,700 Jobs  
2030: Increase of 3.23% from BAU  
2050: Increase of 9.06% from BAU

Minimum perception 2030: 122,422 Jobs  
2030: Decrease of 8.89% from BAU  
2050: Decrease of 21.1% from BAU
Hiring Challenges: Wind Industry Firms
Overall, difficulty for finding and hiring employees that are qualified for entry-level and non-entry-level positions at wind energy firms remains high. Employers surveyed in 2022 reported greater hiring difficulty for entry- and non-entry-level employees than in 2020.

Reported Reasons for Hiring Difficulties

Entry-Level vs. Non-Entry-Level

The top reason reported for hiring difficulty of entry-level workers is a lack of experience needed for the job.

The top reason reported for hiring difficulty of non-entry-level workers is a lack of applicants for the position.

Reasons for Hiring Difficulty of Entry- (n=256) and Non-Entry-Level Employees (n=218)

Note: These numbers are the sum of employer respondents who reported “some difficulty” + “great difficulty.”
Employer respondents who reported their firm size to be between 10 and 49 employees indicated slightly higher levels of difficulty finding and hiring entry-level and non-entry-level employees when compared to smaller (1 to 9 employees) and larger firms (50+ employees).

Reported Difficulty for Finding and Hiring Qualified Applicants by Firm Size (n=220)

<table>
<thead>
<tr>
<th>Size of Firm</th>
<th>No Difficulty</th>
<th>Some Difficulty</th>
<th>Great Difficulty</th>
<th>Don’t Know/Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entry Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 9 employees</td>
<td>23.8%</td>
<td>31.0%</td>
<td>19.0%</td>
<td>26.2%</td>
</tr>
<tr>
<td>(n=42)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10 to 49 employees</td>
<td>24.4%</td>
<td>53.7%</td>
<td>17.1%</td>
<td>4.9%</td>
</tr>
<tr>
<td>(n=41)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 or more employees</td>
<td>28.5%</td>
<td>46.7%</td>
<td>22.6%</td>
<td>2.2%</td>
</tr>
<tr>
<td>(n=137)</td>
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<tr>
<td><strong>Nonentry Level</strong></td>
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<tr>
<td>1 to 9 employees</td>
<td>16.7%</td>
<td>26.2%</td>
<td>31.0%</td>
<td>26.2%</td>
</tr>
<tr>
<td>(n=42)</td>
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<td></td>
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<tr>
<td>10 to 49 employees</td>
<td>14.6%</td>
<td>36.6%</td>
<td>46.3%</td>
<td>2.4%</td>
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<tr>
<td>(n=41)</td>
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<tr>
<td>50 or more employees</td>
<td>24.1%</td>
<td>44.5%</td>
<td>29.9%</td>
<td>1.5%</td>
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<tr>
<td>(n=137)</td>
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</tbody>
</table>

- Firms that reported having 10 to 49 employees (70.8%) and firms that reported having 50 or more employees (69.3%) had similar levels of difficulty when hiring qualified entry-level candidates.

- Firms that reported having 10 to 49 employees (82.9%) reported more difficulty when finding qualified non-entry-level candidates than firms with 1 to 9 employees (57.2%) and firms with 50 or more employees (74.4%).

- There was a higher percentage of uncertainty around hiring difficulty for firms who reported having 1 to 9 employees.

Note: These numbers are the sum of employer respondents who reported “some difficulty” + “great difficulty.”
Furthermore, employer respondents who only participate in the offshore wind industry reported the greatest amount of hiring difficulty. The difficulty faced by the U.S. offshore wind industry could be due to a lack of awareness of a new, emerging industry.

### Reported Difficulty for Finding and Hiring Qualified Applicants by Wind Industry Sectors

<table>
<thead>
<tr>
<th>Wind Sector</th>
<th>No Difficulty</th>
<th>Some Difficulty</th>
<th>Great Difficulty</th>
<th>Don’t Know/Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entry Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land-Based Wind</td>
<td>29.0%</td>
<td>47.7%</td>
<td>15.0%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Offshore Wind</td>
<td>6.7%</td>
<td>40.0%</td>
<td>46.7%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Both</td>
<td>27.6%</td>
<td>42.9%</td>
<td>23.5%</td>
<td>6.1%</td>
</tr>
<tr>
<td><strong>Nonentry Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land-Based Wind</td>
<td>17.8%</td>
<td>37.4%</td>
<td>34.6%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Offshore Wind</td>
<td>13.3%</td>
<td>46.7%</td>
<td>40.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Both</td>
<td>25.5%</td>
<td>40.8%</td>
<td>30.6%</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

Employer respondents who only work in offshore wind reported the greatest amount of difficulty when finding and hiring qualified entry-level (86.7%) and non-entry-level (86.7%) applicants compared to land-based only wind companies and companies that work in both land-based and offshore wind.

Note: These numbers are the sum of employer respondents who reported “some difficulty” + “great difficulty.”
Additionally, manufacturing had the highest reported hiring difficulty for entry-level employees (67.4%), and development and siting had the highest reported hiring difficulty for non-entry-level employees (75.4%).

### Reported Difficulty for Finding and Hiring Qualified Applicants by Value Chain Segment

#### Entry Level

<table>
<thead>
<tr>
<th>Segment</th>
<th>No Difficulty</th>
<th>Some Difficulty</th>
<th>Great Difficulty</th>
<th>Don’t Know/Refused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations and Asset Management</td>
<td>30.1%</td>
<td>43.4%</td>
<td>20.6%</td>
<td>5.9%</td>
</tr>
<tr>
<td>Finance, Legal, and Insurance</td>
<td>33.0%</td>
<td>46.4%</td>
<td>16.5%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Transportation and Logistics</td>
<td>37.5%</td>
<td>42.0%</td>
<td>19.3%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Development and Siting</td>
<td>33.0%</td>
<td>42.0%</td>
<td>22.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>33.1%</td>
<td>42.3%</td>
<td>21.5%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Government and Regulations</td>
<td>31.9%</td>
<td>45.1%</td>
<td>17.6%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Education, Training, and Hiring</td>
<td>31.7%</td>
<td>40.7%</td>
<td>19.5%</td>
<td>8.1%</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>32.8%</td>
<td>41.0%</td>
<td>18.0%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>30.4%</td>
<td><strong>43.5%</strong></td>
<td><strong>23.9%</strong></td>
<td>2.2%</td>
</tr>
</tbody>
</table>

#### Nonentr-Level

<table>
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<tr>
<th>Segment</th>
<th>No Difficulty</th>
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<th>Great Difficulty</th>
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<td>Transportation and Logistics</td>
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<td>25.0%</td>
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</tr>
<tr>
<td>Development and Siting</td>
<td>21%</td>
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</tr>
</tbody>
</table>

Note: The numbers above are the sum of employer respondents who reported “some difficulty” + “great difficulty.”
• Construction saw the greatest decrease in reported hiring difficulty for entry-level employees between 2020 and 2022.

• Development and siting saw the greatest increase in hiring difficulty for non-entry-level employees between 2020 and 2022.
Some of the greatest hiring difficulties have been reported by wind industry members for skilled trades occupations. With 24.7% of wind industry firms reporting representing workers from organized labor unions, building connections between industry and organized labor unions could offer a large opportunity for growth in the wind workforce.
More than two-thirds (68.1%) of the respondents reported that they had implemented automation. Automation was defined in this survey effort as incorporating processes that use software, hardware, or other technologies used to automate tasks, improve quality control, and reduce work hours in tasks. When asked why they implemented automation technologies, the most prevalent reasons were for quality control, safety of workers, and to reduce operational costs within the firm. Additionally, 50% of respondents indicated that automation technology usage is expected to increase in the next three years.
Firms involved in land-based and offshore wind (71.4%) reported that automation technologies made their firm more productive and expected to continue investing in these technologies. While only 14.5% of respondents reported that the reason they implemented automation was because there are not enough applicants for positions needed to keep up with demand, wind industry employers reported automation technologies have allowed their firms to better manage the lack of available workers (61.9%) and reduced the need to hire new workers (54.8%).

Agreement with Statements About Automation Technologies at Wind Energy Firms by Wind Industry Segment (n=182)

Graph courtesy of BW Research Partnership

Top four occupational categories believed to be impacted from automation within wind energy firms:

1) Operations and maintenance (63.3%)
2) Accounting and administrative (59.9%)
3) Manufacturing and assembly (51.1%)
4) Research and development (50.7%).
While automation was a limiting factor in the SD model, it is integrated into the model as an assumption related to the speed of deployment for wind energy. While more research is needed on its effect on the wind supply chain, it has been a factor in the development of the SD model and projected outcomes related to workforce demands.

For the U.S., it is estimated that one robot unit lowers the demand for workers by 3.3 (Acemoglu & Restrepo 2020). From the survey effort, it was reported that automation is expected to grow significantly across industries.

Wind energy firms are following other industries in the U.S. for the implementation of automation, with 68.1% of firms having implemented automation in some form in recent years, for reasons such as quality control, safety of workers, and reduction of operational costs.

With the overall expected growth of automation reducing worker demand across the nation, current survey efforts report that automation has already made firms more productive, with a continued need to invest more in such technologies.
Potential actions for industry and education/training programs to better connect with qualified students

More information can be found in the Connective Actions for Educator & Wind Industry presentation.
**Actionable Steps to Address the Workforce Gap**

Lack of Experience

- Collaborate with Educational Institutions to Build Awareness of Wind Industry Opportunities.
- Establish Effective Internship and Apprenticeship Programs and Pipelines.

Lack of Applicants

- Connect with Students Through Outreach and Programs such as CWC.
- Reduce Barriers to Entrance for Historically Underrepresented Populations.

More information can be found in the *Connective Actions for Educator & Wind Industry* presentation.


Thank You

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