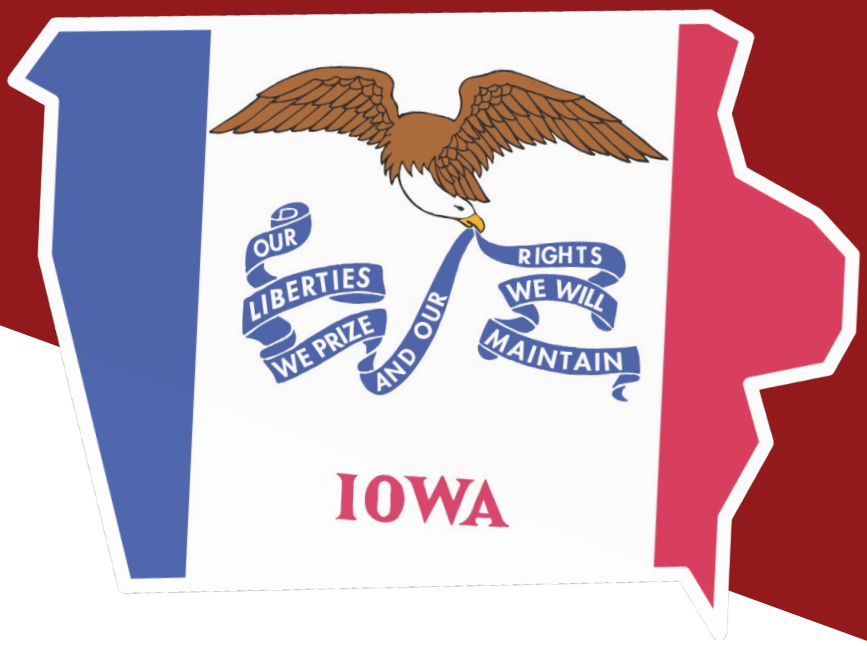
AEE INSTITUTE

IOWA ADVANCED ENERGY EMPLOYMENT SURVEY

Prepared by BW Research Partnership



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About the Advanced Energy Economy Institute

The Advanced Energy Economy Institute (AEEI) is a 501 (c)(3) charitable organization whose mission is to raise awareness of the public benefits and opportunities of advanced energy. AEEI provides critical data to drive the policy discussion on key issues through commissioned research and reports, data aggregation and analytic tools. AEEI also provides a forum where leaders can address energy challenges and opportunities facing the United States. AEEI is affiliated with Advanced Energy Economy (AEE), a 501(c)(6) business association, whose purpose is to advance and promote the common business interests of its members and the advanced energy industry as a whole.

About BW Research Partnership

BW Research Partnership (www.bwresearch.com) is a full-service research consulting firm with offices in California and Massachusetts. Recognized by the Congressional Research Office as developing the most accurate data to date, BW Research has conducted more clean energy labor market analyses than any other firm. Recent projects include: The Solar Foundation's National Solar Jobs Census, wind and solar labor market reports for the National Renewable Energy Laboratory (NREL), and clean energy studies for the Natural Resources Defense Council (NRDC), the Massachusetts Clean Energy Center, the Clean Energy Trust (Illinois), the State of Vermont, and many others.

Iowa Advanced Energy Employment Survey

Introduction and Key Findings

Iowa has a large number of firms and employees delivering energy efficiency services, is a leader in advanced fuels and wind power, and is poised for growth in job-creating installation of solar energy. These are among the key findings of the first comprehensive survey of the advanced energy industry in the Hawkeye State.

With 22,643 workers at 1,427 establishments, the advanced energy industry has become a significant part of Iowa's economy and can be expected to contribute to the state's overall economic health and growth going forward. Firms in the industry project employment growth of 6% over the next 12 months, pushing total advanced energy jobs in Iowa to nearly 24,000 by the summer of 2015.

Iowa has a long history of supporting advanced energy. In 1983, Iowa was the first state in the nation to implement a Renewable Energy Standard (RES). State leaders have maintained and expanded this policy and others over the last 30 years, including action this year to increase tax credits for biofuel production, triple solar energy tax credits, and more.

The results are clear. According to the American Wind Energy Association, Iowa is a national leader in wind power, with rankings that include:

- 1st in the percentage of electricity generated by wind (27%)
- 3rd in megawatts installed (5,177)
- 3rd in the number of utility-scale wind turbines (3,216)

In addition to its acknowledged leadership in wind energy, Iowa was rated 12th among the states in energy efficiency in the 2013 State Energy Efficiency Scorecard from the American Council for an Energy-Efficient Economy. Finally, Iowa is a world leader in the production of advanced biofuels.

Energy efficiency is the employment leader in Iowa's advanced energy industry. Nearly half (48%) of advanced energy employment in Iowa – 10,888 workers – is in delivery of energy efficiency products and services. Advanced fuels, which include ethanol, biodiesel, and cellulosic biofuels, account for 4,737 jobs in the state, or 21% of Iowa's advanced energy workforce. Wind power employs a total of 3,626 workers in Iowa, while solar energy supports 726 workers.

Iowa's advanced energy industry is largely a "deployment-based" industry, with nearly half of all firms (47%) engaged in installation of advanced energy products, and a significant percentage (22%) focused on sales and distribution. These numbers demonstrate that Iowans themselves are choosing advanced energy goods and services, a conclusion that is supported by the fact that fully 79% of advanced energy firms report that their customers are primarily in Iowa.

Detailed information about these findings, and other responses from the 2014 survey of Iowa's advanced energy firms, can be found in the pages that follow.

Industry Overview

Iowa is home to a strong advanced energy industry with 22,643 workers

The State of Iowa has a significant advanced energy industry, employing 22,643 workers at 1,427 business establishments in 2014. This is more than the employment reported for crop production (21,734), general freight trucking (19,590) and animal production (19,170) in 2014. Advanced energy employment represents approximately 1.3% of Iowa's total workforce.[1]

Midwest Renewable Biofuels is located in Prairie City. Photo credit: Midwest Renewable Biofuels, Inc.

These advanced energy employment figures do not include the nearly 30,000 farmers, support workers, and others involved in growing the corn and soy feedstock for advanced fuels like ethanol, biodiesel, and cellulosic biofuels.[2]

67% of Iowa's advanced energy workers devote at least half of their work time to advanced energy activities. 53% of the workers spend all of their time on advanced energy work, demonstrating that advanced energy is a full-time occupation for thousands of Iowans.[3]

There is no national ranking measuring the relative size of the advanced energy workforce in each state, so it's not possible to gauge exactly how Iowa compares nationally. We note, however, that the 1.3% of advanced energy workers in the total Iowa workforce is similar to Illinois (1.5%). Among states that have studied this industry, Vermont has the highest percentage of workers supported by advanced energy and related industries, at 4.3% of the total workforce, followed by California and Massachusetts at 2.4%.[4]

Employment declined slightly from 2013, driven by a drop in wind power jobs

The 2014 total is 837 less than the 23,480 advanced energy workers in Iowa in 2013, a drop of nearly 4% (Figure 1). The decline appears to be largely attributable to a drop in wind energy employment from a previous peak. For example, Iowa's 2014 wind power workforce total represents a decline of as much as 50% from a high achieved in 2011-2012, as reported in the American Wind Energy Association Annual Market Report, 2011, 2012 and AWEA State Fact Sheets. This decline occurred during a sharp downturn in the U.S. wind industry associated with the expiration, followed by renewal, of the federal production tax credit (PTC), which resulted in a 90% drop in wind industry revenue in 2013.[5] Even with the decline, Iowa has the second highest wind power employment in the nation.

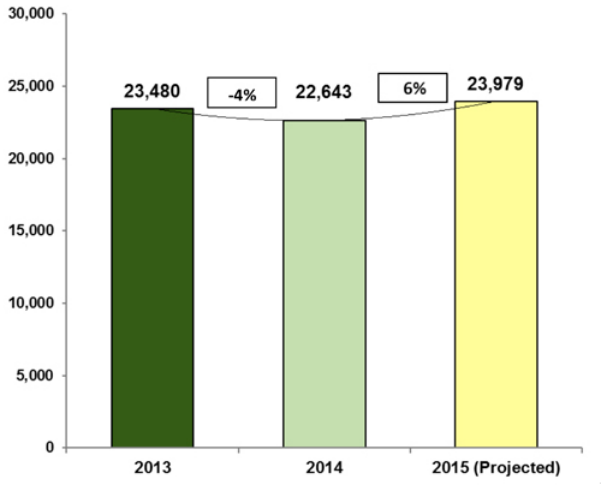

Figure 1: Advanced Energy Employment in Iowa, 2013-2015

Advanced energy firms project employment growth of 6% in 2015

When asked if they expected to employ more or fewer workers over the next 12 months, only 1% expected any reduction in staff size. The overwhelming majority (63%) said they would hold steady at their current level, and nearly a third (31%) said that they expected to hire more employees for advanced energy work in the coming year.

The projected 6% overall growth will drive the total advanced energy workforce to 23,979 by the summer of 2015. By comparison, overall employment growth in Iowa is expected to be in the neighborhood of 2%.[6]

While projected employment growth in advanced energy is expected to be healthier than Iowa's overall economy, current hiring is limited. Only 25% of advanced energy firms reported current openings "for workers to support the advanced energy portion of the business." 73% did not have current openings when surveyed.

Energy efficiency is by far the largest advanced energy segment in Iowa

Of the 1,427 advanced energy establishments in Iowa, 881 firms (62%) are primarily engaged in "building energy efficiency" work (Figure 2). The energy efficiency segment also has the largest number of workers, employing 10,888 workers, or almost half (48%) of all the industry's employees in the state (Figure 3).

In fact, Iowa is among the national leaders in energy efficiency. The state is #12 out of the 50 states and Washington, D.C., in the annual energy efficiency ranking from the American Council for an Energy Efficient Economy (ACEEE), and earned particularly high scores for the "significant budgets for energy efficiency programs" at utility companies in the state ($150 million annually), and for its "energy efficiency standard," which applies to both electricity and natural gas.[7]

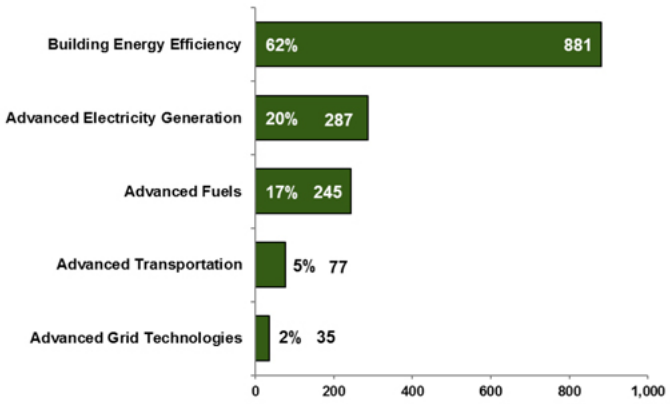

Figure 2: Establishments by Advanced Energy Segment

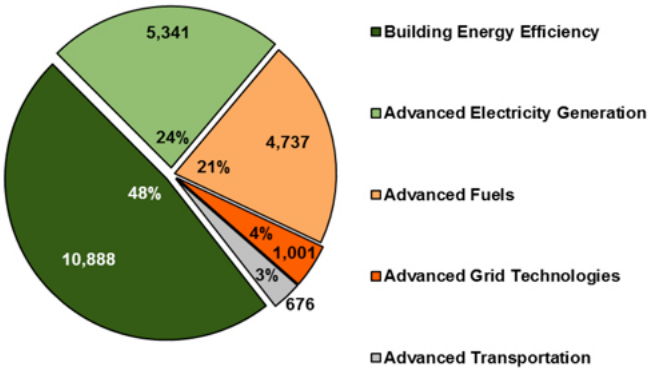

Figure 3: Employment by Advanced Energy Segment

Iowa is a national leader in energy efficiency.
Photo credit: Department of Energy

Iowa has also used building energy codes to drive energy efficiency results, and has supported code compliance with training and outreach programs and timely compliance studies. State government initiatives, including a major loan program through the Iowa Energy Bank, grant programs, support for energy efficiency focused research institutions, and "lead by example" investments in making state government buildings more energy efficient round out Iowa's commitment to energy efficiency.

This strong commitment has helped create an industry segment that is the largest component of the overall advanced energy industry in the state. While less visible than the rows of wind turbines, energy efficiency work employs thousands of Iowans and significantly drives advanced energy industry growth.

More than 4,700 workers are employed in Iowa's advanced fuels segment

Advanced fuels account for 245 (17%) of the advanced energy industry establishments in Iowa, and employ 4,737 advanced energy workers in the state – 21% of the total workforce. This is 1,111 more workers than in Iowa's substantial wind energy subsegment, and nearly as many as all "advanced electricity generation" workers (wind, solar, etc.) combined.

By most metrics, Iowa is the nation's leader in production of advanced fuels. The Iowa Renewable Fuels Association reports that Iowa has 42 ethanol refineries capable of producing more than 3.8 billion gallons annually, including 2 million gallons of cellulosic ethanol production. In addition, Iowa has 12 biodiesel facilities with the capacity to produce nearly 315 million gallons annually.

And more are coming, even at a time of uncertainty regarding the future of tax credits and federal incentives for ethanol. POET-DSM, a joint venture between ethanol giant POET LLC and Dutch enzyme manufacturer Royal DSM, opened a 25-million-gallon-per-year cellulosic biofuel plant in Emmetsburg in September.[8] When operating at full capacity, the facility is expected to process 770 tons of corn stover (leaves, stalks, and other residue) a day to produce 20 million gallons a year, before ramping up to its full capacity over time. The POET-DSM project will be followed by a DuPont facility in central Iowa with an expected capacity up to 30 million gallons per year.[9]

Federal policies related to advanced fuels are important to the segment's health and growth. Legislators and advanced fuel advocates closely track federal action on a wide range of issues, including the Renewable Fuel Standard, Petroleum Mandate, biodiesel blenders tax credit, Open Fuel Standard, cellulosic ethanol tax credit, and related programs within the Energy Title of the federal farm bill.

Turbine manufactured at Siemens facility in Ft. Madison. Photo credit: Duke Energy.

Wind energy dominates advanced electricity generation

287 advanced energy establishments in Iowa (20% of the total) are primarily involved in "advanced electricity generation," which includes wind, solar, nuclear, and other technologies. These firms employ 5,341 (24%) of the advanced energy workers in the state.

A deeper examination, however, clearly shows that wind power is the number one subsegment in the Hawkeye State by a wide margin (Figure 4). 3,626 workers in Iowa's advanced electricity generation workforce (68%) are employed in wind power, with solar power's 726 workers (14%) a distant second, followed by 625 in nuclear power (12%). The nuclear employment of 625 represents the permanent employment total for Iowa's single nuclear plant (Duane Arnold Energy Center), which is unchanged from last year.

Iowa's 3,626 wind energy workers rank it second in the nation in wind power employment in the nation, according to the American Wind Energy Association (AWEA).

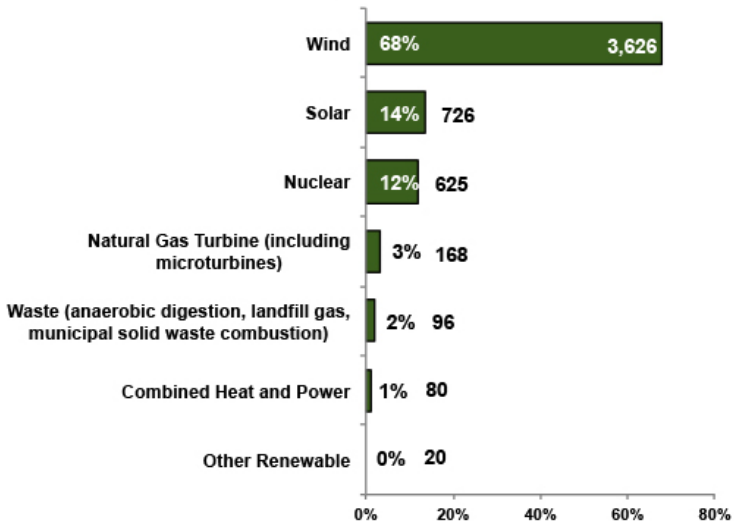

Figure 4: Employment by Advanced Electricity Generation Subsegments

It's easy to see why Iowa has a sizable wind power workforce. The state is a national wind energy powerhouse, as these AWEA statistics demonstrate. Iowa is:

- 1st in the nation in the percentage of electricity generated by wind (27%)
- 3rd in megawatts installed (5,177)
- 3rd in the number of utility-scale wind turbines (3,216)

Two new projects are scheduled to nearly double Iowa's wind capacity in the next three years, one of which is the largest onshore wind farm proposal yet.[10]

The growth of the wind power segment has contributed to Iowa's overall economic development. For example, both Google and Facebook have decided to locate data centers in Iowa partly because of the available wind energy, with Google signing five long-term Power Purchase Agreements (PPAs) for renewable energy.[11]

Iowans overwhelmingly support the growth of the wind energy segment. Fully 85% of people in the state view wind energy more favorably than any other energy source, providing political support for pro-wind policies.[12]

Iowa's solar energy subsegment is poised for growth

While the state's wind energy firms are clearly the dominant players in the advanced electricity generation segment, Iowa's solar power companies employ 726 advanced energy workers.

Public support for solar is high. The success of the state's 2012 solar energy tax credit resulted in such high demand that the 2013 cap of $1.5 million in total credits was raised to $4.5 million in 2014. Demand is strong for the 2014 credits.[13]

Iowa has barely begun to tap the potential for solar deployment. The state ranks among the top third of U.S. states (#16) in the technical potential for solar PV energy production, according to the National Renewable Energy Laboratory (NREL), placing it ahead of states with greater reputations for sunshine like Florida, Georgia, Utah, North Carolina, and South Carolina.[14]

Installation, sales and distribution are the largest advanced energy activities

Iowa's advanced energy industry involves business activity throughout all parts of an extensive supply chain, including: installation, sales and distribution, engineering and research, manufacturing and assembly, "finance, legal and professional services," and other goods and services. An analysis of the primary supply chain activities of establishments in the industry provides an additional way to view advanced energy work in Iowa, and understand where the jobs and business opportunities are (Figure 5).

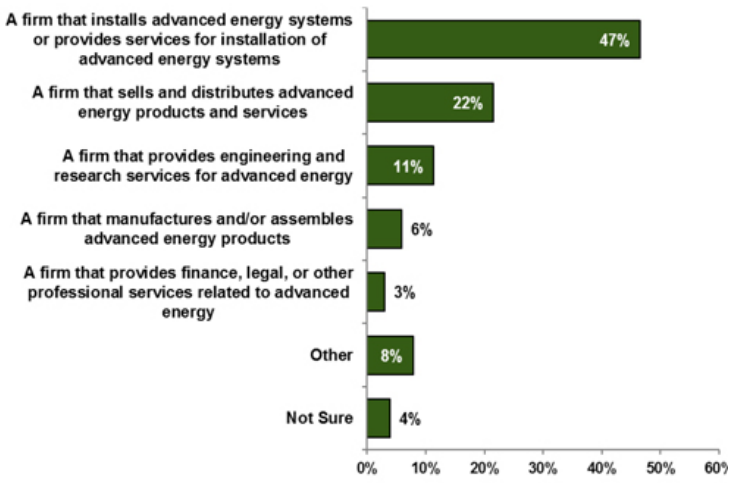

Figure 5: Advanced Energy Firms by Primary Activity

Almost half (47%) of Iowa's advanced energy firms are primarily involved in the business of installing and maintaining advanced energy systems. The next highest number (22%) is focused on sales and distribution. As we will see, many of these sales are to in-state customers.

These numbers demonstrate that Iowans are not just talking about advanced energy, but are actively buying and deploying advanced energy solutions right now. In fact, Iowa's advanced energy industry could reasonably be characterized as primarily a "deployment-focused" industry, with most workers retrofitting buildings, erecting wind turbines, putting up solar panels, and distributing fuels.

The high number of firms focused on installation is also a corollary to the dominant position that energy efficiency holds in Iowa's advanced energy economy. As a segment, energy efficiency is geared toward installation of existing technologies, goods and services.

Engineering, research, manufacturing, and assembly make up 17% of Iowa's advanced energy industry

Engineering and/or research firms account for 11% of all advanced energy firms in Iowa, and manufacturing/assembly companies make up 6% of the total. The 17% total compares well with the 18% in neighboring Missouri, but less favorably with the 35% of workers in these categories in Illinois.

Although the shares are smaller, they are significant, and the manufacturing and assembly portion of advanced energy appears to have particular potential for growth. The wind energy industry, for example, has a history of locating part of its manufacturing and assembly supply chain near areas with large-scale turbine deployment, and there are already at least 14 wind-related manufacturing and assembly facilities in Iowa, according to the American Wind Energy Association.

Advanced energy employment is overwhelmingly at small businesses

The overwhelmingly majority (75%) of advanced energy workers in Iowa are employed by firms that have fewer than 25 employees, and more than half (56%) work at companies with fewer than 10 (Figure 6).

The high number of small businesses involved in advanced energy in Iowa is consistent with other states that have significant clean energy industries. It is also consistent with the large presence of the energy efficiency segment in the state, and with the bulk of business activity in installation and sales/distribution.

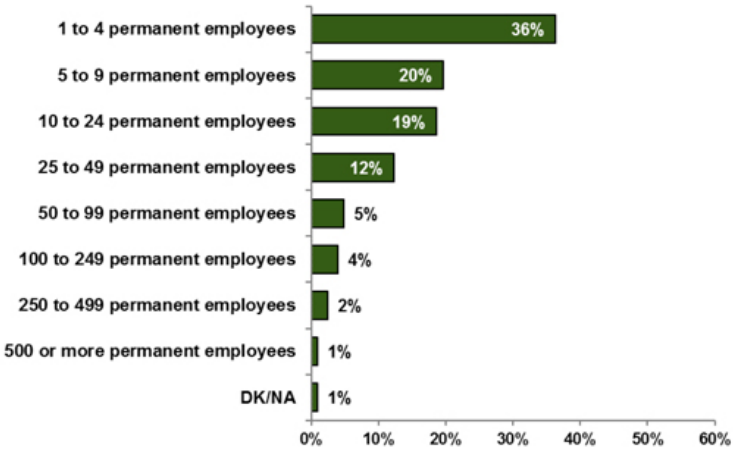

Figure 6: Firms by Number of Permanent Employees

Advanced energy work provides supporting revenue for many Iowa firms

For some firms in Iowa (14%), advanced energy work is all that they do. For most, however, the market for advanced energy goods and services provides a significant revenue stream that complements other business activities. Advanced energy dollars support workers throughout the state whose firms may also engage in things like lighting, electrical work, HVAC, construction, engineering, and more.

Figure 7 shows the distribution of Iowa firms engaging in advanced energy markets to varying degrees.

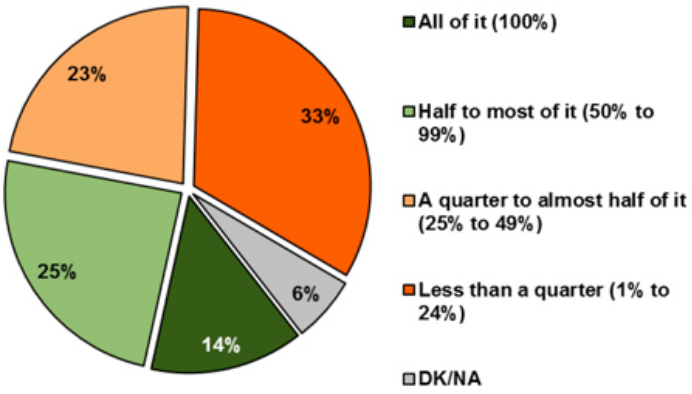

Figure 7: Percentage of Firm's Work Related to Advanced Energy

Photo credit: Kurt Stepnitz, Michigan State University Office of Biobased Technologies.

Iowa's advanced energy industry is embedded in the state and Midwest

The advanced energy industry in Iowa largely draws revenue from Iowa customers, but is also connected to vendors and suppliers in the surrounding states.

An extremely high proportion (79%) of advanced energy firms report that their customers are primarily in Iowa (Figure 8). This figure corresponds with the percentages for energy efficiency work, and for installation activity of all kinds. But even allowing for these correlations, the number is striking, indicating just how much advanced energy firms in Iowa serve Iowa businesses and consumers.

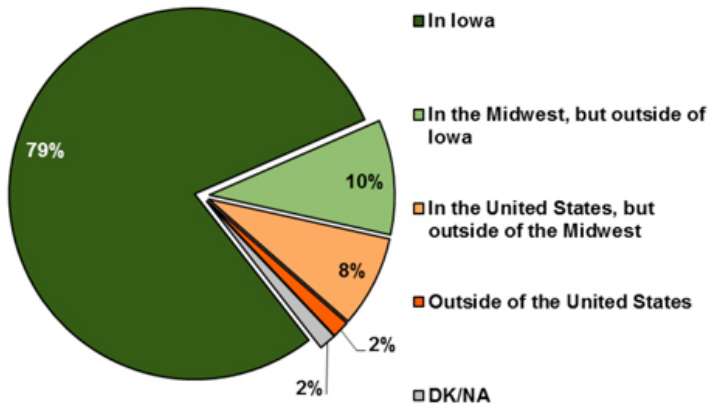

Figure 8: Location of Customers

Of the remaining 21% in the industry's customer base, half of it (10%) was in the Midwest region, demonstrating that the Iowa industry has a very small customer footprint outside of the Midwest (8%), and an even smaller international presence (2%).

The industry's supplier and vendor base was less limited to Iowa (54%), but is still primarily regional in nature, with another 27% in surrounding Midwestern states (27%), bringing the regional total to 81% (Figure 9).

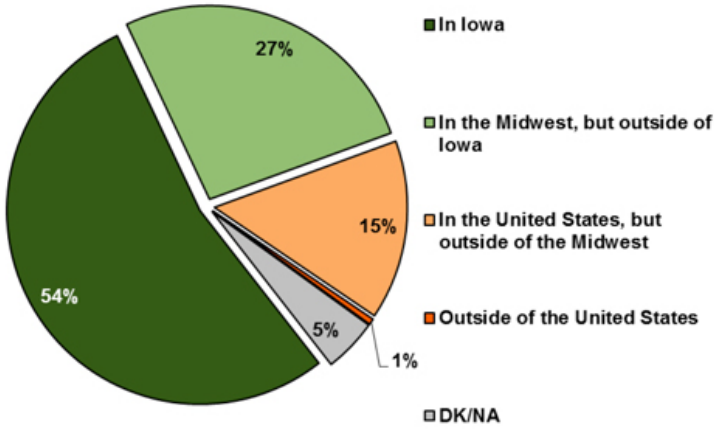

Figure 9: Supplier and Vendor Location

These statistics indicate that Iowa's advanced energy industry is firmly rooted in the state, with some presence in the surrounding Midwest region. Iowans are clearly in the market for advanced energy solutions, and are interested customers for goods and services provided by local companies. With such a strong existing customer base, it's likely that the in-state market for advanced energy still has great potential. At the same time, Iowa companies have barely begun to tap regional, national and international markets that might be available to them. Finally, the high plurality of out-of-state vendors and suppliers suggests that advanced energy firms might support competitive in-state suppliers for items currently being purchased out-of-state. These are all opportunities for additional advanced energy growth in Iowa.

On the downside, Iowa's advanced energy firms are now heavily dependent on Iowa customers to support employment and company growth. The state's advanced energy industry is vulnerable to downturn in the Iowa economy, as well as changes in Iowa's supportive policies, with potential impacts in slower business and job growth.

Advanced energy firms believe that incentives are important to customers

In Iowa, as in other states, the growth of the advanced energy industry can be accelerated by effective public policies and utility programs. To understand which policies and incentives are considered most helpful by advanced energy business owners, our survey offered an open-ended question to probe which offerings had the greatest impact on business growth.

A majority of advanced energy firms (52%) believe that rebates, tax credits, and incentives from government and utility companies – all programs that reduce the customer's cash outlay – have the greatest impact on consumers (Figure 10). Much smaller percentages cited government codes, standards, and other policies. This is consistent with the overall deployment-and-installation focus of Iowa's advanced energy industry, with utility rebates, tax credits, and financing programs important factors in final cost to customers. Clearly, companies in the Iowa industry see the value of continued support for business, government and family consumers to make the financial decision to invest in advanced energy solutions.

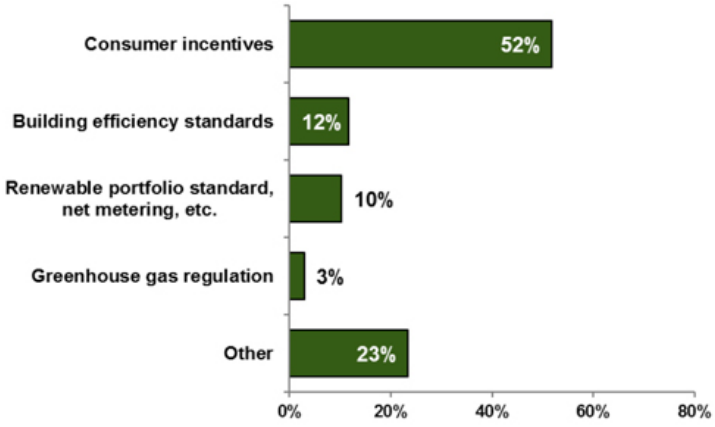

Figure 10: Policies Accelerating Advanced Energy Growth

Advantages and Disadvantages of Doing Business in Iowa

Why are 1,427 advanced energy businesses located in Iowa? Are there particular advantages and disadvantages to doing business in the Hawkeye State? Could actions be taken to emphasis the advantages, and help companies minimize the disadvantages? These are questions for economic development leaders to consider as they assess ways to accelerate the growth of the advanced energy industry in Iowa.

With this in mind, we asked business owners an open-ended question about the single most important advantage and disadvantage to locating in Iowa. The responses provide additional insight into the Iowa business climate for advanced energy.

As in other state surveys, the largest share of Iowa advanced energy business owners (29%) report that a major advantage to operating in the state is that they live here, they started their business here, and they expect to stay here as a member of the community (Figure 11). This is in keeping with the fact that the overwhelming majority of advanced energy firms are small business enterprises, launched to serve local and state markets.

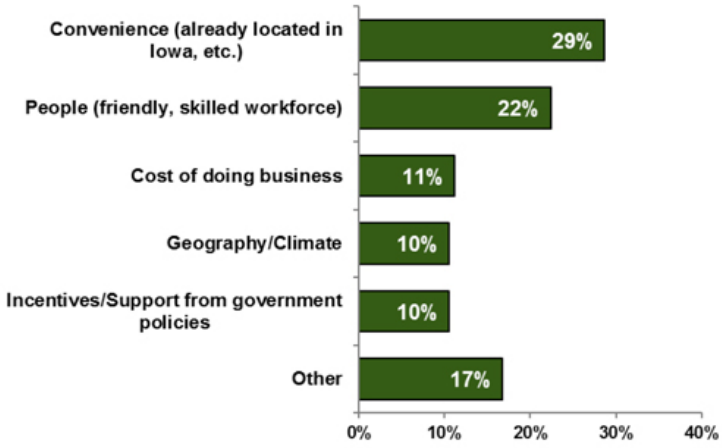

Figure 11: Advantages of Being in Iowa

Beyond this, the next biggest advantage to operating in the Hawkeye State was "the people" (22%). Iowa was cited by business owners as having friendly, well-educated people who provide a skilled and productive workforce.

It was notable that "incentive/support from government policies" was selected by only 10% of respondents as the single biggest Iowa advantage. This answer may reflect the fact that only 14% of advanced energy companies receive all of their business from advanced energy. The majority has revenue streams from additional business activities as well.

A minority of 10% said that "geography/climate" was the single biggest advantage to an Iowa location (although, as we will see, a larger share called geography, as in weather, the biggest disadvantage to being in Iowa).

Four items were suggested as the biggest disadvantage to Iowa as a business location, but "poor weather" was easily on top, with one quarter of respondents identifying it as a problem (Figure 12). Among the perceived disadvantages that policymakers and entrepreneurs could actually address, three were bunched closely together and deserve examination. These were "high cost of doing business," "distance from suppliers," and "poor government incentives/high regulation."

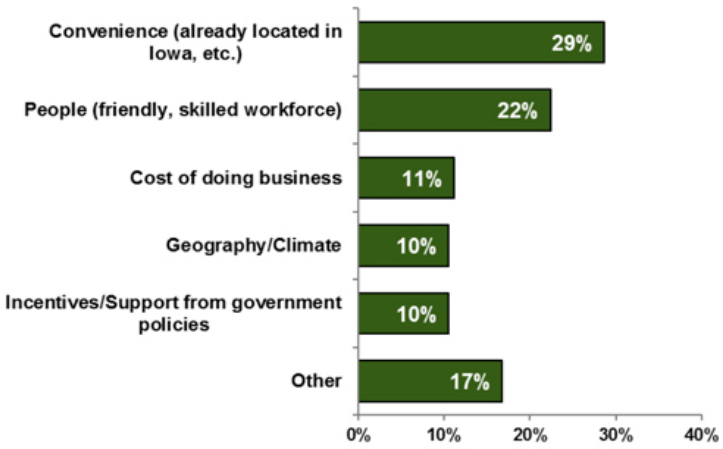

Figure 12: Disadvantages of Being in Iowa

Conclusion

The State of Iowa has a strong advanced energy economy, and it is poised for further growth. While there was a small drop in total employment (4%) in 2014 compared to 2013, companies expect to recover any losses and move back into positive growth over the next 12 months.

While advanced fuels, wind power, and solar energy receive the lion's share of attention in the media, and generally drive the overall image of the advanced energy industry in the state, the results of this study serve as reminder that energy efficiency is the largest segment of the advanced energy industry, supporting the most businesses and employing the most workers. In Iowa, more advanced energy workers – 10,888 – are employed in energy efficiency than in advanced fuels, wind energy, and solar power combined. Support for energy efficiency should continue to be a strong priority, fueling job creation.

Finally, it is clear that advanced energy firms believe that continued government policies and investments are critical to the growth of the industry and to reaping the benefits, economic and environmental, of advanced energy technologies and services. Federal and state government officials, and utility company executives, are encouraged to continue Iowa's strong history of investment in programs and policies that make it easier for businesses and households to choose advanced energy.

Appendix: Methodology

In June of 2014, BW Research Partnership conducted a survey of advanced energy businesses in Iowa. To be included in the survey, participants were required to answer a number of screener questions to ensure that their organization: a) conducts activities directly related to the advanced energy industry; and b) employs workers in Iowa who spend at least some portion of their time conducting advanced energy-related activities.

For the purposes of this report, an advanced energy firm is defined as being directly involved with researching, developing, producing, manufacturing, distributing, selling, or implementing components, goods or services related to alternative fuels and vehicles; energy efficiency; renewable, nuclear, and natural gas electricity generation; smart grid; and other related technologies. This can include supporting services such as consulting, finance, tax, and legal services related to advanced energy. It does not include farm workers involved in growing feedstock (corn, soy, etc.) for advanced fuels.

Advanced energy employees are defined as full-time and part-time permanent employees who support the advanced energy portion of the business, including administrative staff and excluding interns and other temporary workers.

In order to accurately capture data from the industry, surveys were administered by telephone to a list of known employers as well as to a representative sample of companies from the NAICS industries identified by the Bureau of Labor Statistics and BW Research Partnership as being potentially related to the renewable energy, energy efficiency, advanced fuel and advanced transportation segments. This NAICS listing is similar to those used in surveys conducted in Massachusetts, Vermont, Missouri, and Illinois, with a few minor modifications to reflect the uniqueness of each state's economy. The Iowa analysis also includes employment in nuclear energy and some portions of natural gas generation and transit that are excluded in other state studies that employ a similar methodology.

The research team attempted over 4,500 telephone calls to employers. The survey effort, with an overall combined margin of error for employment questions of approximately +/-4.16% at the 95% confidence interval, yielded 535 survey responses with an average of 12.4 minutes in length per completion.

Surveys were administered by BW Research Partnership to a list of businesses that were identified by AEE, various state agencies, and other publicly available sources (the "known universe"). Telephone surveys were administered to the known universe and to a random sampling of businesses identified by NAICS code by IHR Research Group.

Endnotes

1. Economic Modeling Specialists, Inc. (EMSI) Class of Worker, Q1, 2014. Note that EMSI data may include a wider set of workers than official "covered employment" estimates from the Bureau of Labor Statistics and Iowa Department of Labor, including self-employed/sole proprietors, among others. Given the inclusion of self-employed workers in the survey sample, EMSI is the most appropriate comparison set.

2. Contribution of the Renewable Fuels Industry to the Economy of Iowa, ABF Economics (John M. Urbanchuk), for the Iowa Renewable Fuels Association, January2014. http://www.iowarfa.org/ documents/2014IowaEconomicImpact.Final.pdf

3. As a point of regional comparison, 2014 studies using similar methodology have found 96,825 "clean energy" workers in Illinois.

4. Clean Energy Trust, *Clean Jobs Illinois*, http://www.cleanjobsillinois.com; Massachusetts Clean Energy Center, *Clean Energy Industry Report 2014*, http://www.masscec.com/content/2014-clean-energy-industry-report; Vermont Clean Energy Development Fund, *Vermont Clean Energy 2014 Industry Report*, http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.pdf; Advanced Energy Economy Institute, *California Advanced Energy Survey*, http://info.aee.net/ca-jobs-report-14

5. Advanced Energy Now 2014 Market Report, Navigant Research for Advanced Energy Economy. http://info.aee.net/advanced-energy-now-2014-market-report

6. EMSI Class of Worker, 2014.2

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8. "Cellulosic ethanol plant opens to big celebration," David Swartz, *Estherville News*, September 5, 2014. http://esthervilledailynews.com/page/content.detail/id/520060/Cellulosic-ethanol-plant-opens-to-big-celebration.html?nav=5003

9. "Cellulosic plant prepares to open its doors," Amanda Peterka, E&E News, August 13, 2014

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12. Iowa Wind Energy Association, www.iowawindenergy.org/whywind.php

13. "Iowa View: From Wind to Solar, Clean Power is Good for Iowa," Joe Bolkcom and Mike Breitbach, *Des Moines Register*, April 4, 2014. http://www.desmoinesregister.com/story/opinion/columnists/iowa-view/2014/04/04/wind-solar-clean-power-good-iowa/7290333/

14. National Renewable Energy Laboratory, "U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis" July 2012: http://www.nrel.gov/docs/fy12osti/51946.pdf

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