

WIND BRINGS JOBS AND ECONOMIC DEVELOPMENT TO **ALL 50 STATES**

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Photo by Ed Collier/The Wind Portrait Project



Executive Summary

The American wind industry is a leading creator of jobs and economic development in areas that need it most, from rural America to Rust Belt manufacturing hubs. The wind industry has invested more than \$143 billion in the United States over the last decade, and is poised for further growth.

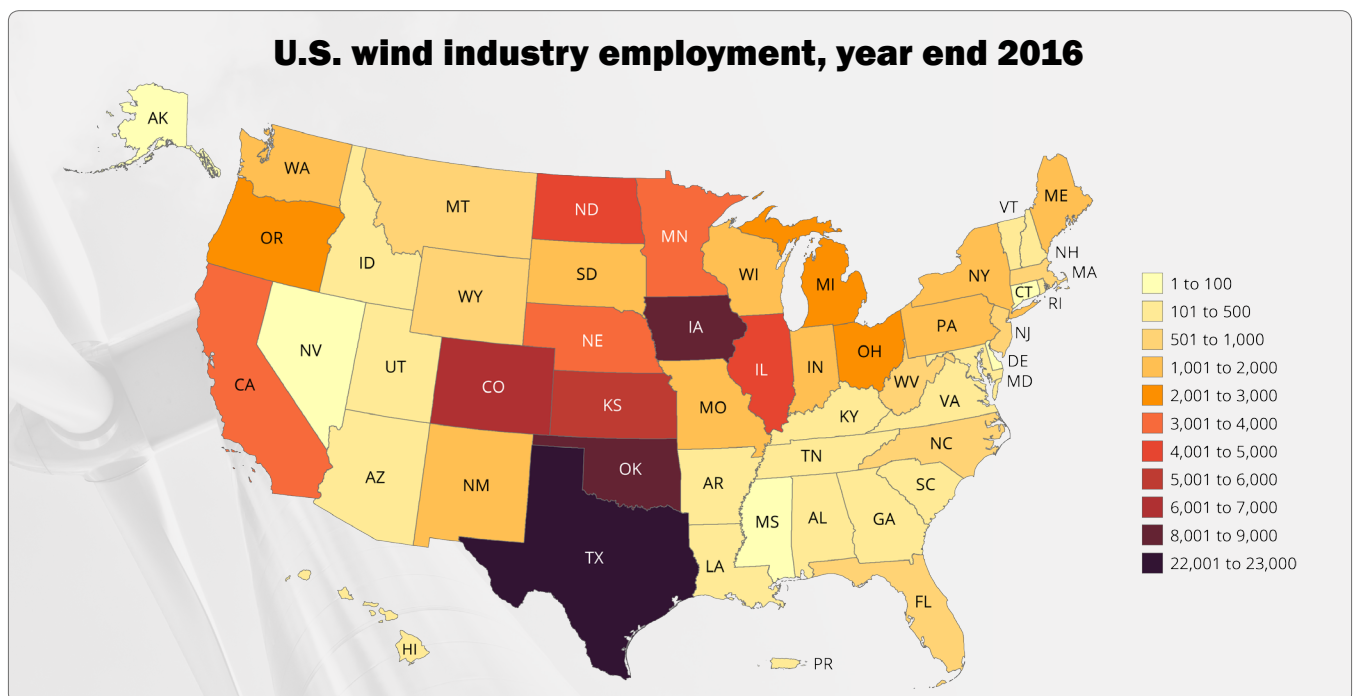
- In 2016, the U.S. wind industry broke the 100,000 job marker for the first time, reaching 102,500 industry jobs in all 50 states.
- Navigant Consulting expects wind-related employment to reach 248,000 jobs by 2020 when including economic activity induced by the wind industry.
- Jobs from the U.S. wind industry benefit all 50 states, ranging from construction to manufacturing to project operation.
- Over the last 10 years, the wind industry has invested \$143 billion in U.S. wind projects.
- Looking forward, the industry will drive \$85 billion in economic activity through 2020, according to Navigant Consulting.
- As the U.S. wind industry continues to grow, Navigant expects land lease payments to local landowners to grow from \$245 million annually in 2016 to over \$350 million by 2020, with nearly all of the payments flowing to Rural America.
- Navigant forecasts that new projects built over the next four years will provide a cumulative \$8 billion in property, income, and sales tax payments.

Introduction

This report highlights wind energy’s historical economic and employment benefits. Additionally, it briefly summarizes a companion report by Navigant Consulting, “Economic Development Impacts of Wind Projects,” which explains how the wind industry is poised to expand these benefits going forward. Navigant’s report concludes that wind-related employment will grow to reach 248,000 jobs - including 146,000 direct and indirect jobs - across all 50 states by 2020 under current state and federal policy.

	AWEA: 2016 Jobs	Navigant: 2020 Jobs
Direct & Indirect Wind Industry Jobs	102,500	146,000
Induced Jobs	NA	102,000
Total Jobs	102,500	248,000

In 2016, the U.S. wind industry exceeded 100,000 jobs for the first time, reaching 102,500 direct and indirect jobs in all 50 states.

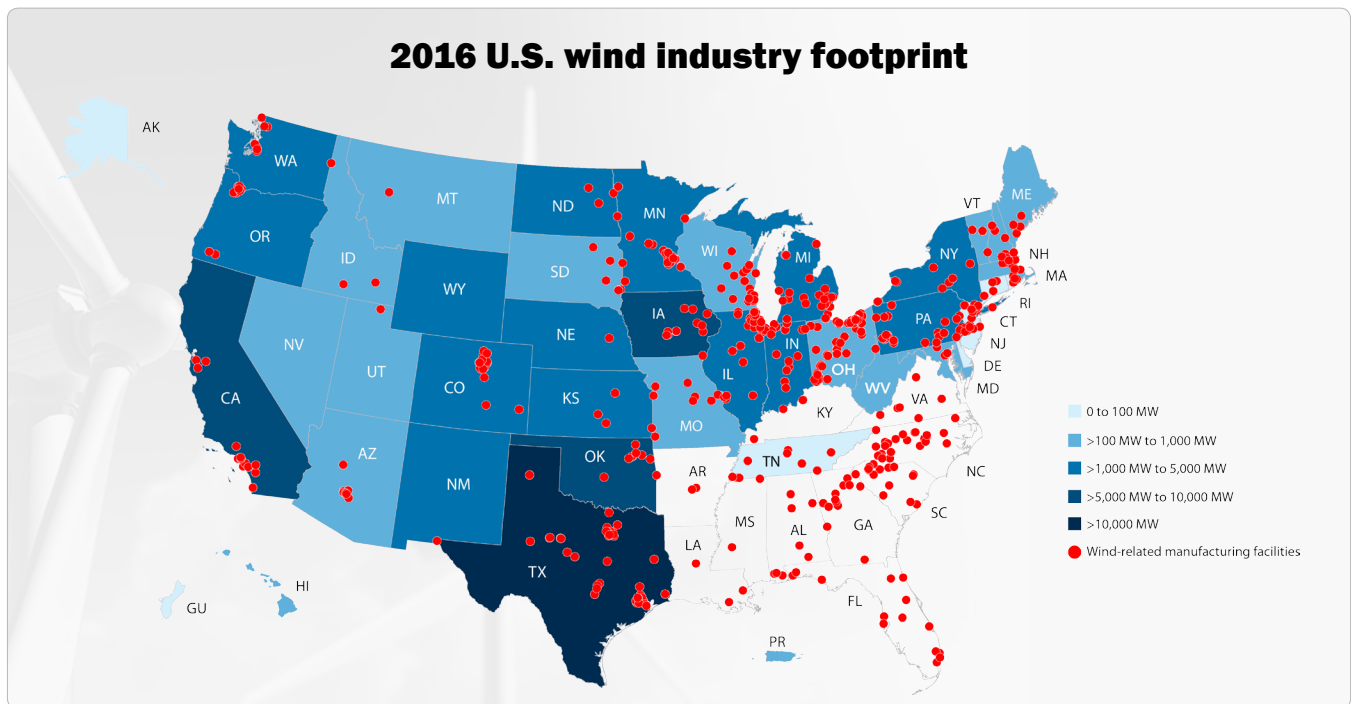


Source: AWEA

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The Department of Energy (DOE) recently concluded that more Americans work in wind energy than in either nuclear, coal, natural gas or hydroelectric power generation.¹ Additionally, DOE's report shows that the U.S. wind industry hires veterans at a 50% higher rate than the average industry in the country.

As shown below, the benefits of wind energy are widespread, with wind farms (blue coloring) or manufacturing facilities (red dots) in all 50 states. The Southeast, while not currently a major region for wind project development, is a true manufacturing hub, with more than 100 facilities supplying components and materials to the industry.



Source: AWEA

In addition to creating jobs across the country, the wind industry has invested \$143 billion in wind projects over the last ten years and provides hundreds of millions of dollars in annual landowner lease payments, and billions in annual property, sales, and income tax payments.

The vast majority of landowner lease payments go to rural farmers and ranchers, often providing critical additional income that allows a family to stay on their farm or ranch. Wind project owners paid \$245 million in landowner lease payments in 2016, and are expected to supply landowners with an additional \$1.2 billion over the next four years, according to Navigant Consulting. Similarly, the billions of dollars provided by

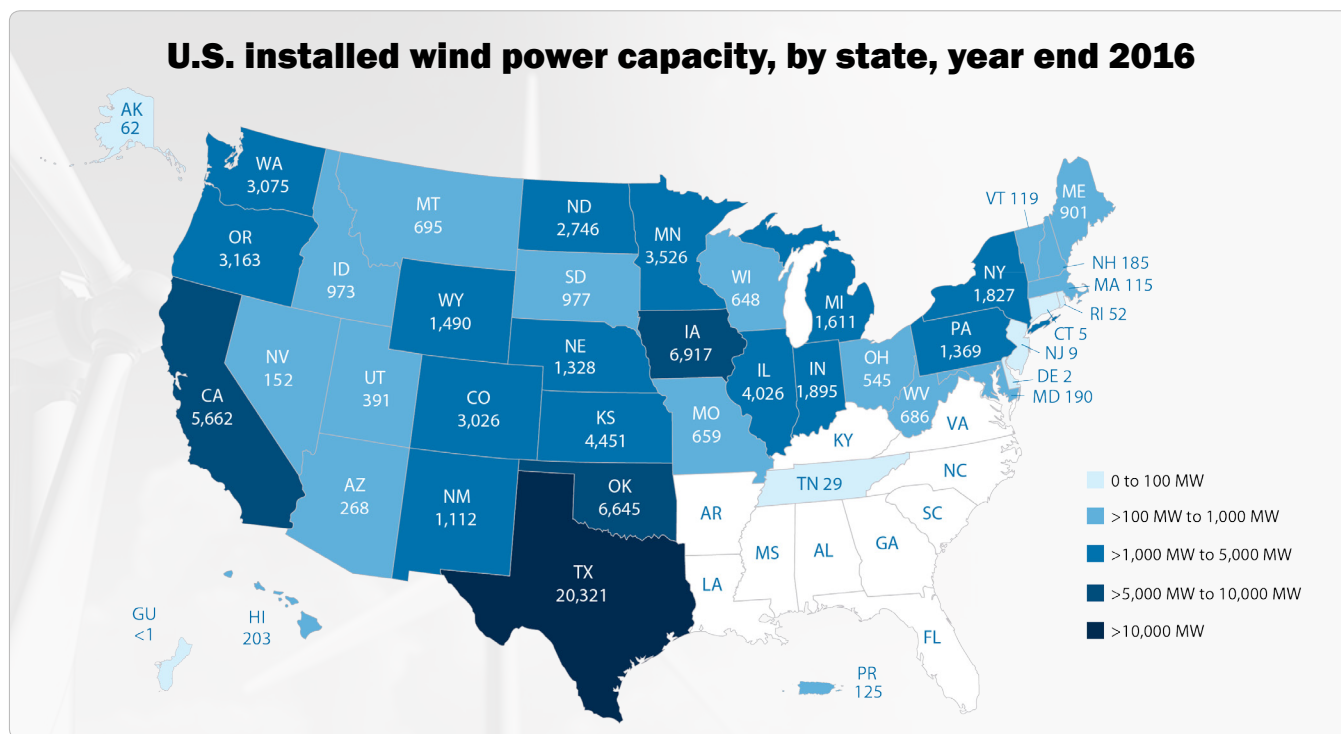
¹ https://www.energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf

wind projects in annual property, sales, and income tax payments directly benefit rural communities, helping to pay for new schools, emergency services, and other infrastructure. Navigant expects that new wind projects built over the next four years will provide a cumulative \$8 billion in tax revenues between 2017 and 2020.

The wind industry continues to expand its presence, with technological advances opening up sites for wind project investment that were not previously viable. For example, the first utility-scale wind project in North Carolina began operations in early 2017, expanding U.S. wind’s footprint to 41 states. Moreover applications to build wind projects are pending in nearly all of the states that currently lack wind projects. Customers in many of these states already directly benefit from wind energy, as their utilities are buying low-cost wind energy from other states.

Wind power growth

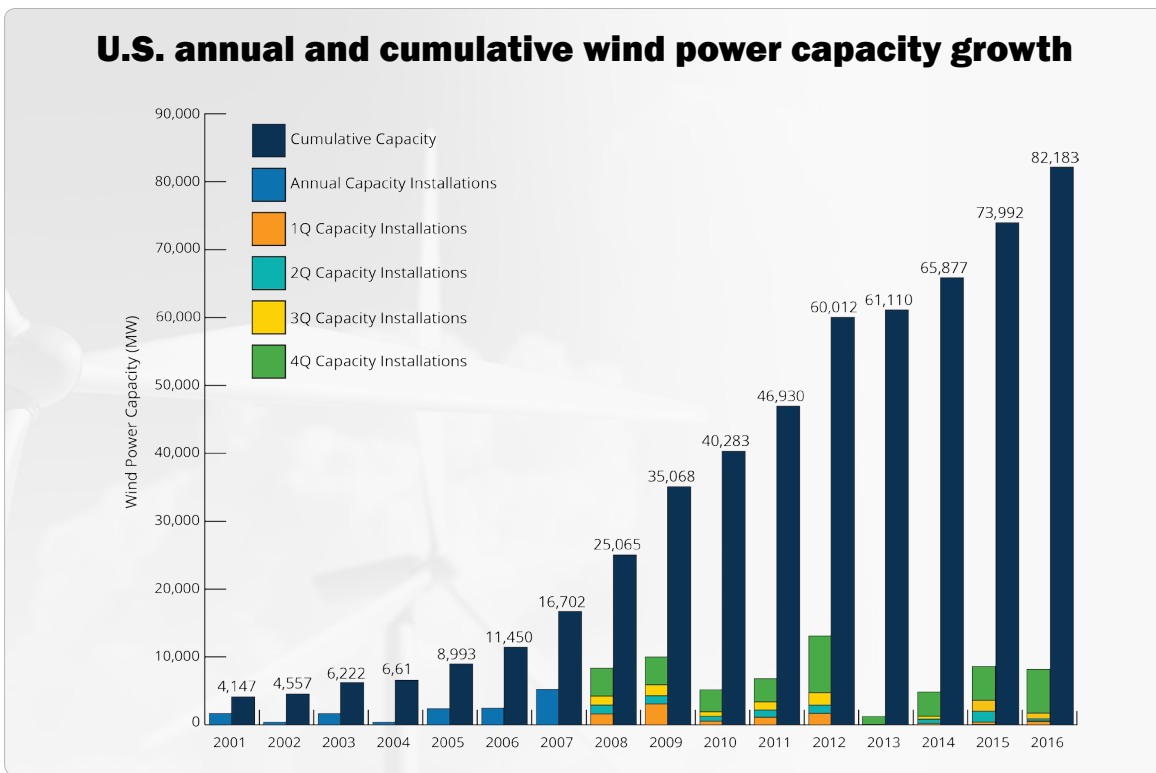
The U.S. wind industry directly benefits communities in every state. With an installed capacity of 82,183 MW at the end of 2016 – equal to more than 52,000 operating wind turbines in 40 states plus Guam and Puerto Rico – there is now enough capacity to power the equivalent of 24 million average U.S. homes every year.²



Source: AWEA U.S. Wind Industry Fourth Quarter 2016 Market Report

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The U.S. wind industry added 8,203 MW of wind capacity in 2016 alone, representing more than \$14 billion in new investment. The 6,478 MW installed during the fourth quarter reflects the second strongest quarter for installations on record. Further, America now has its first offshore wind farm. The 30 MW, five turbine Block Island wind project became operational off the coast of Rhode Island at the end of 2016.



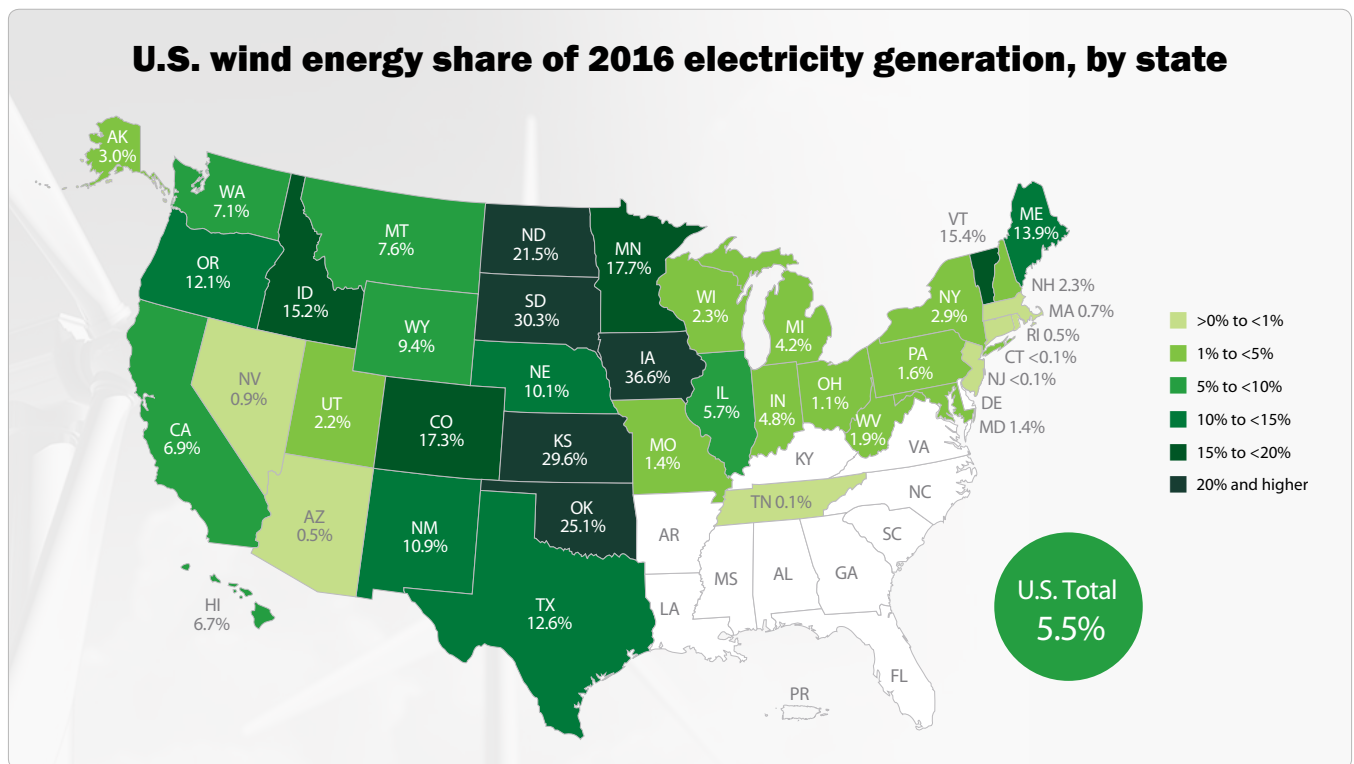
Source: AWEA U.S. Wind Industry Fourth Quarter 2016 Market Report

There are currently 18 states with more than 1,000 MW of installed capacity. Texas ranks first in the nation with 20,321 MW - nearly triple the installed capacity of any other state - followed by Iowa (6,917 MW) and Oklahoma (6,645 MW). These states highlight the rapid growth of the wind industry. It took only 8 years for U.S. wind power to more than triple in capacity, growing from 25,065 MW at the end of 2008 to 82,183 MW at the end of 2016.

² Assuming a 36% capacity factor and an average annual household electricity consumption of 10.82 MWh.

Delivering renewable energy

Thanks to strong growth in wind power capacity, wind is now a mainstream electricity source. Throughout 2016, wind power generated more than 5.5% of all electricity across the U.S., with many states experiencing even higher rates of wind generation. Iowa recently became the first state to generate more than 35% of its electricity from wind, reaching 36.6% in 2016. South Dakota joined Iowa at more than 30% wind energy, while Kansas, Oklahoma, and North Dakota all produced over 20% of their electricity from wind power. In 2016, 14 states generated over 10% of their electricity from wind.



Data Source: EIA | Chart Source: AWEA

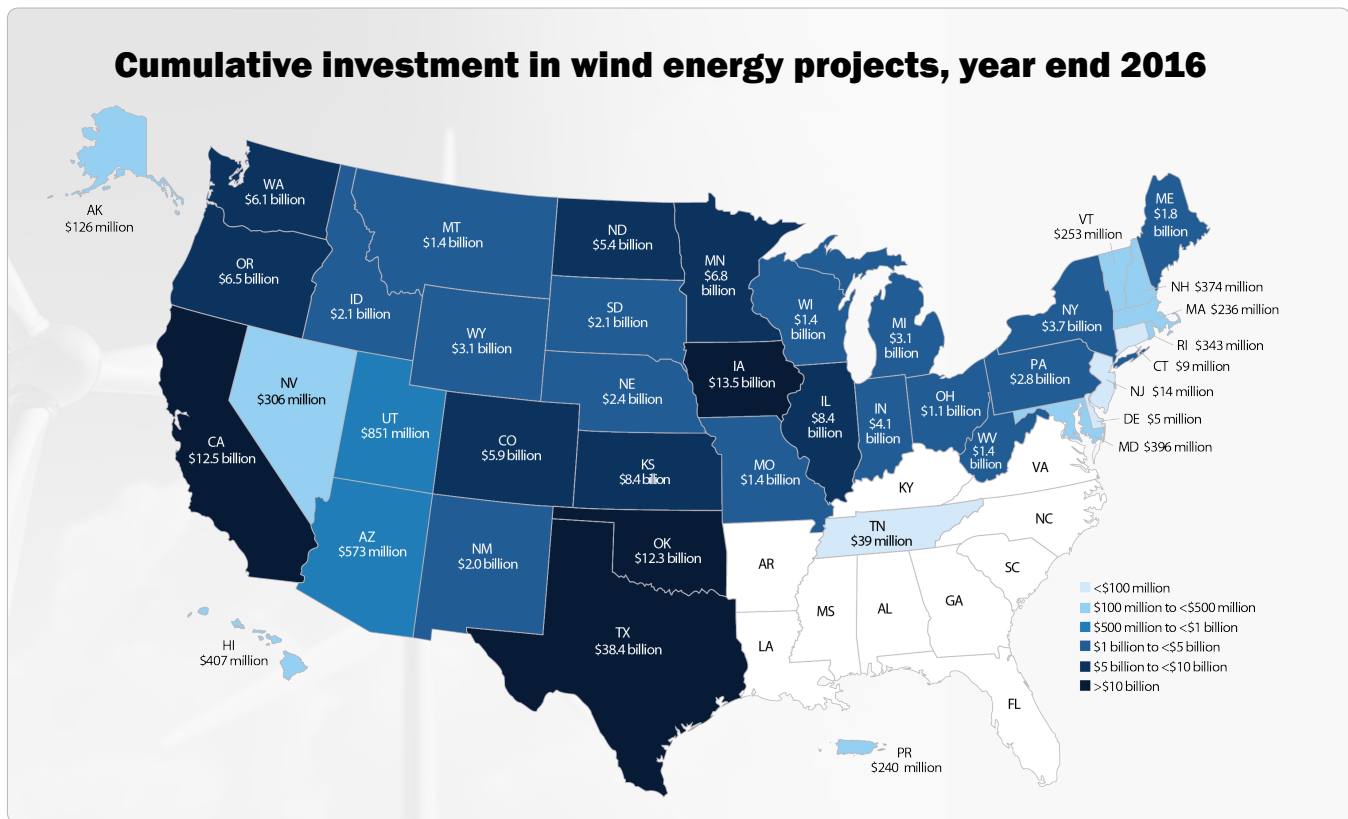
The U.S. continues to be a global leader in wind energy generation. In 2016, U.S. wind energy provided a record 226 million megawatt-hours (MWh) of electricity, breaking last year's record of 191 million MWh. Further, currently installed U.S. wind projects provide enough electricity to power the equivalent of over 24

million average American homes. As we look to the future, wind energy is on track to meet the Department of Energy’s Wind Vision target of 10% wind energy by 2020 and 20% by 2030.

Wind provides major economic benefits

Project investment

The U.S. wind industry continues to be an economic engine for the country. In 2016 alone, the 8,203 MW of wind power installed represent more than \$14 billion in new investment. This exceeds the annual revenue of the National Football League (NFL).³ Moreover, it is not a one-off event; over the last ten years, the U.S. has invested more than \$143 billion in wind energy projects.



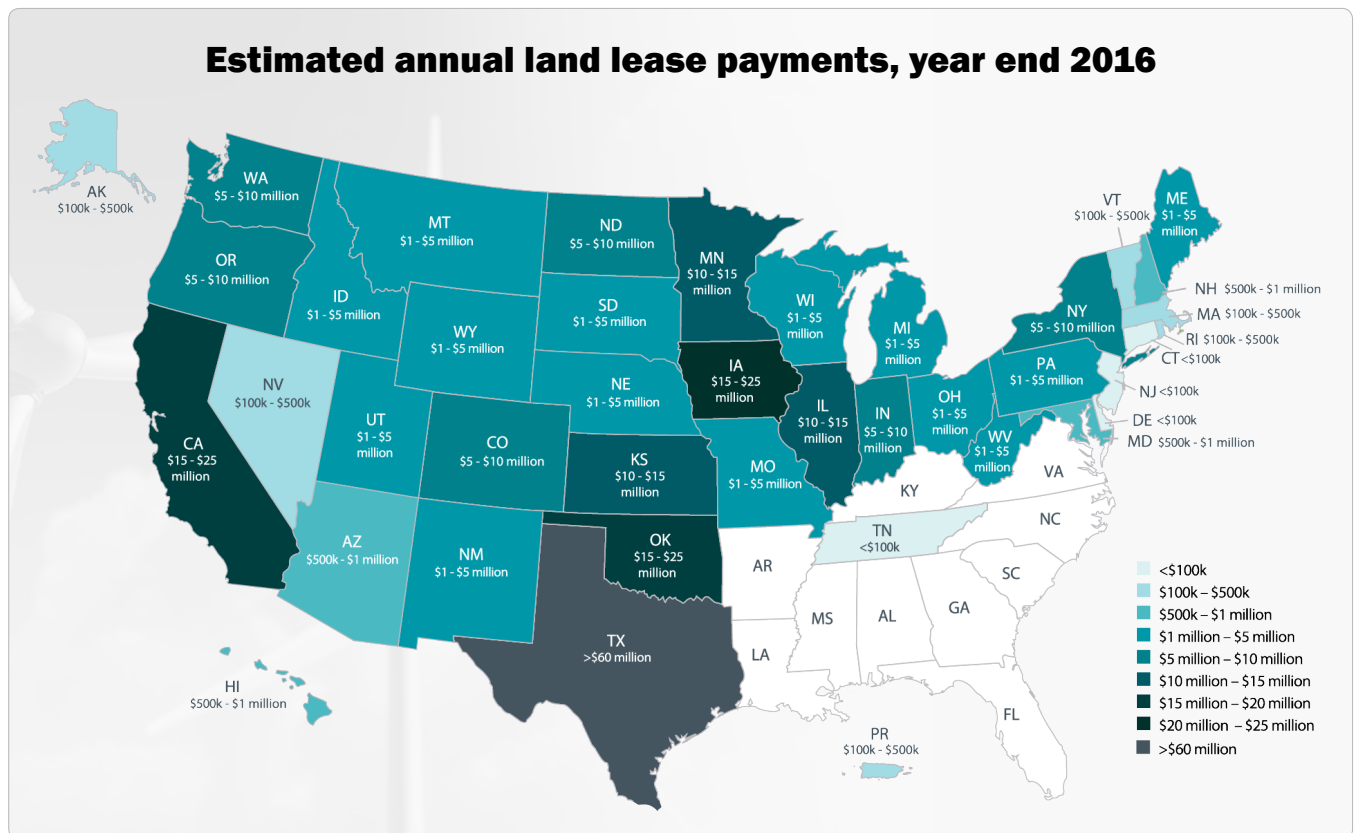
Source: AWEA

³ <http://www.forbes.com/sites/jasonbelzer/2016/02/29/thanks-to-roger-goodell-nfl-revenues-projected-tosurpass-13-billion-in-2016/#67ab8ac93278>

Land lease payments

The value of a wind project doesn't end at direct capital investment, but also flows to local communities through annual landowner lease payments, property tax payments, and other state and local tax payments. With 99% of all wind energy projects located on private land, wind energy projects deliver more than \$245 million annually in landowner payments to local farmers and ranchers. Since wind projects require minimal land, landowners retain the agricultural or ranching productivity of their land, making wind a 'cash crop' that provides supplemental income.

Landowners in seven states currently receive annual land lease payments in excess of \$10 million, led by Texas, Iowa, Oklahoma, California, Kansas, Illinois and Minnesota. Annual land lease payments exceed \$1 million in 27 states.



Source: AWEA

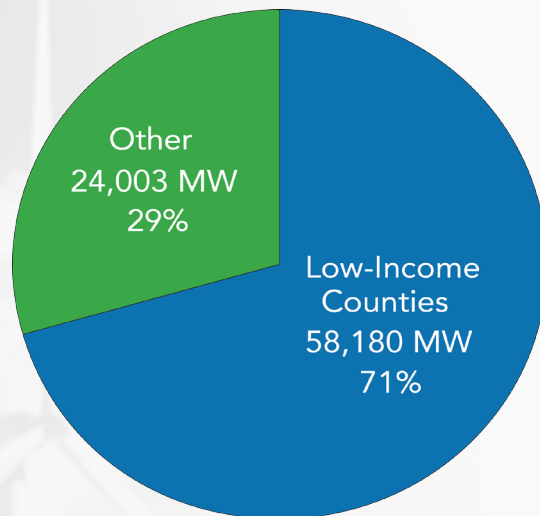
Tax payments

Wind projects are often the largest source of county tax revenue. In most states, wind projects pay property, sales, and income taxes. These tax contributions are often used towards community development in the form of schools, libraries, and hospitals. In many instances, local communities would lack sufficient funds to provide these valuable services without the contributions from wind projects.

Supporting rural communities

The U.S. wind industry invests heavily in rural communities, where more than 99% of operating wind capacity is located.⁴ Approximately 71% of this development is located in low-income counties, meaning that wind projects are delivering investment, taxes, land lease payments, and employment to communities that need it most.⁵ For example, approximately \$175 million of the \$245 million in annual land lease payments paid during 2016 went to landowners in low-income counties, providing much needed supplemental income.

U.S. installed wind power capacity in low-income counties, year end 2016



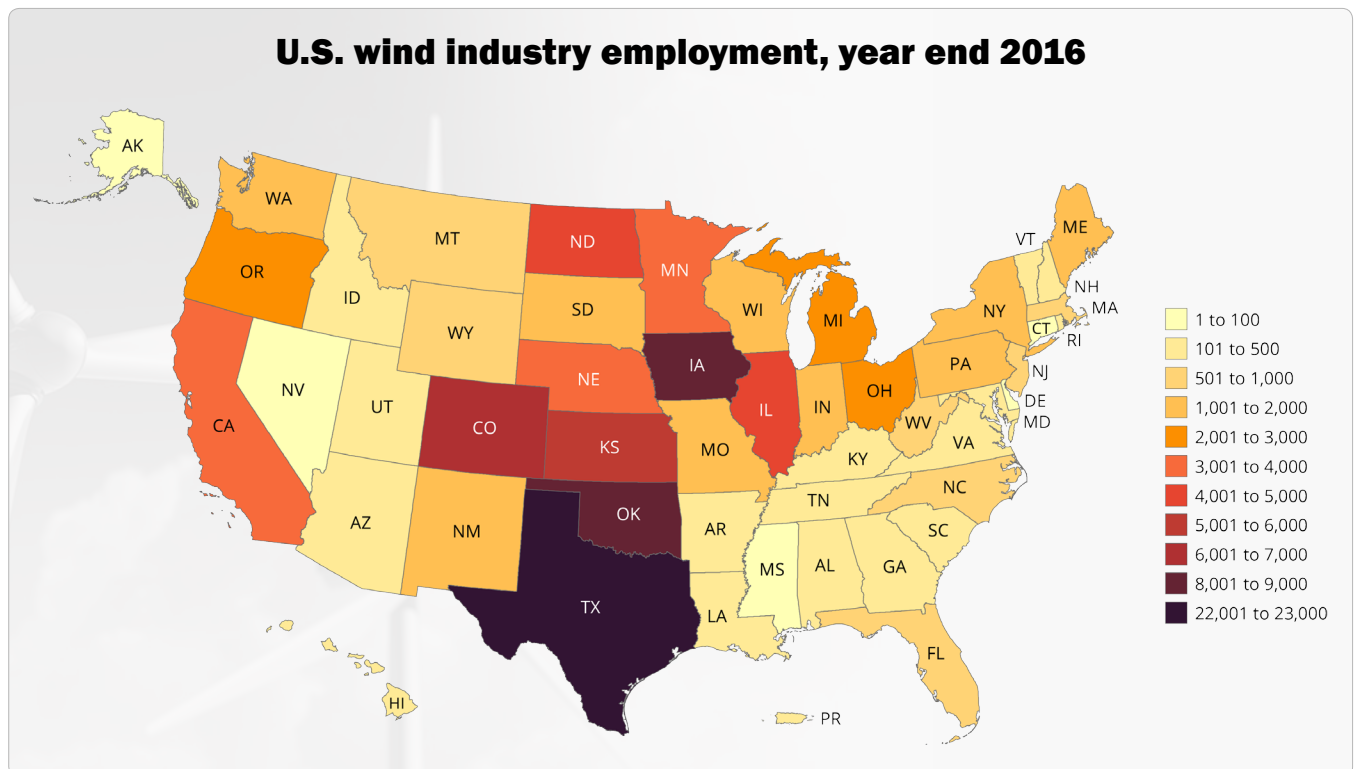
Source: AWEA

⁴ Rural areas are any geographic footprints that fall outside U.S. Census Bureau designated urban areas. <https://www.census.gov/geo/reference/ua/urban-rural-2010.html>

⁵ Low-income counties have median household incomes below the national median household income. <https://www.census.gov/did/www/saipe/data/statecounty/data/2013.html>

Wind is a major source of employment

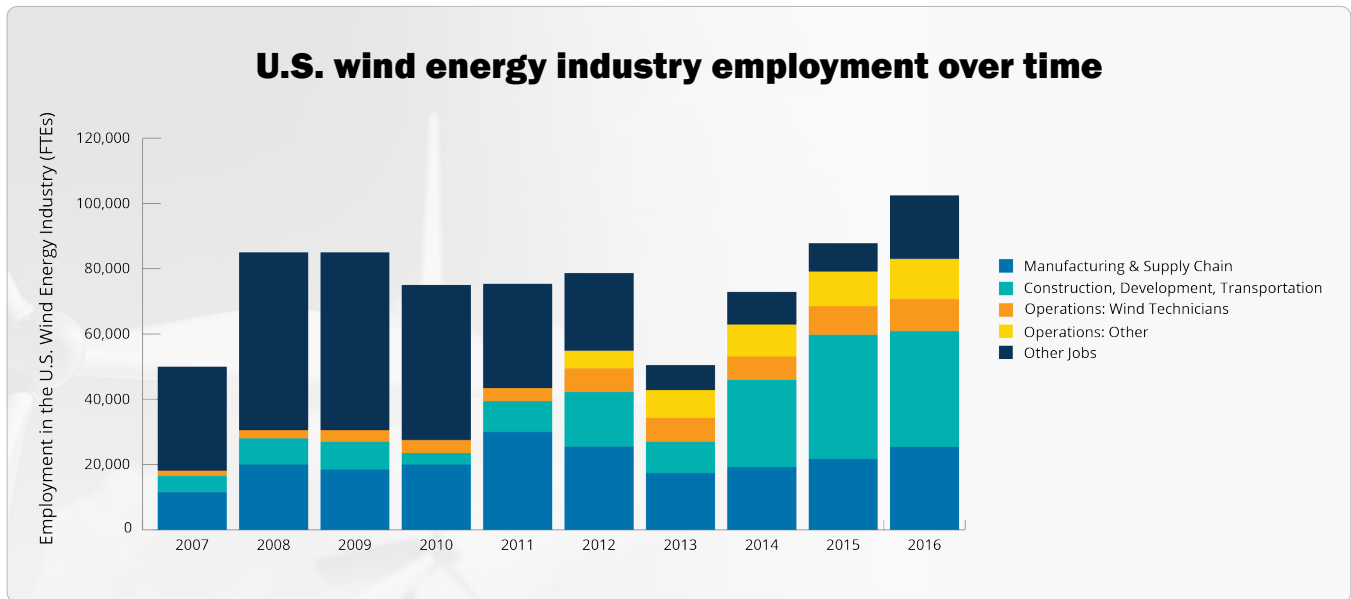
The U.S. wind industry is a growing employer across all 50 states, with the wind industry adding jobs faster than other industries. Over the past four years, wind jobs have grown over 25% annually. Today, the U.S. wind energy industry supports 102,500 full-time equivalent (FTE) jobs directly associated with wind energy project planning, siting, development, construction, manufacturing and supply chain, and operations.



Source: AWEA

The wind industry is a major provider of domestic manufacturing jobs. In particular, the size and scale of wind turbine components motivate manufacturers to establish local manufacturing facilities. As a result, more than 25,000 Americans are employed manufacturing many of the 8,000 components that comprise a modern wind turbine. Many of these workers were able to transfer their skill set to the wind industry after their previous manufacturing jobs ceased to exist.

The U.S. wind industry is also home to the fastest growing job in America. According to the Bureau of Labor Statistics, the occupation of wind turbine technician is growing faster than any other occupation in the country.⁶ As the industry continues to grow, wind technicians will be a sought after resource. Individual wind projects often operate for 25 years or more before being refurbished with newer wind turbine technology, ensuring employment for wind technicians for decades to come.



Source: AWEA

A growing source of domestic manufacturing

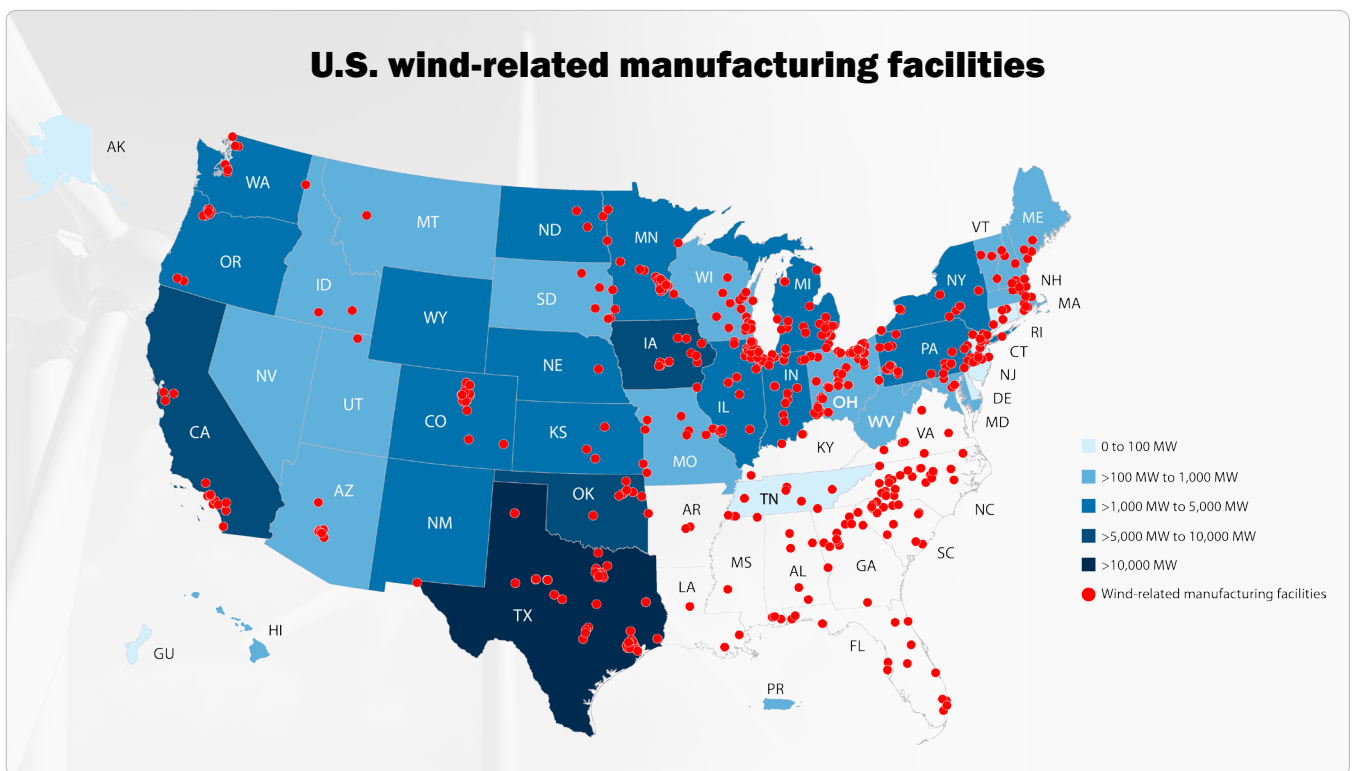
Today the U.S. has over 500 wind-related manufacturing facilities across 43 states. American factories make everything from major wind turbine components such as nacelles, blades, towers, and gearboxes, to internal components like bearings, slip rings, fasteners, and power converters. These factories supported more than 25,000 manufacturing employees in 2016.

The U.S. wind industry supply chain includes eight utility-scale blade facilities, ten tower facilities, and four turbine nacelle assembly facilities. Major manufacturing facilities have the capability to produce approximately

⁶ <https://www.bls.gov/ooh/fastest-growing.htm>

10,200 MW of turbine nacelles, 10,000 individual blades, and 3,100 towers annually. In 2016, 95 percent of the wind capacity installed in the U.S. used a turbine manufacturer with at least one U.S. manufacturing facility. According to LBNL, the share of domestic manufacturing content for nacelle assembly exceeds 85 percent, while towers are between 80 to 85 percent. Blades and hubs also have strong domestic content, estimated between 50 to 70 percent.

Ohio boasts the highest number of wind-related factories with over 60 plants, followed by Texas (40), Illinois (35), North Carolina (27), and Michigan, Pennsylvania, and Wisconsin (26 each). Although much of the Southeast currently lacks wind farms, it is a wind manufacturing hub, with more than 100 wind component factories.

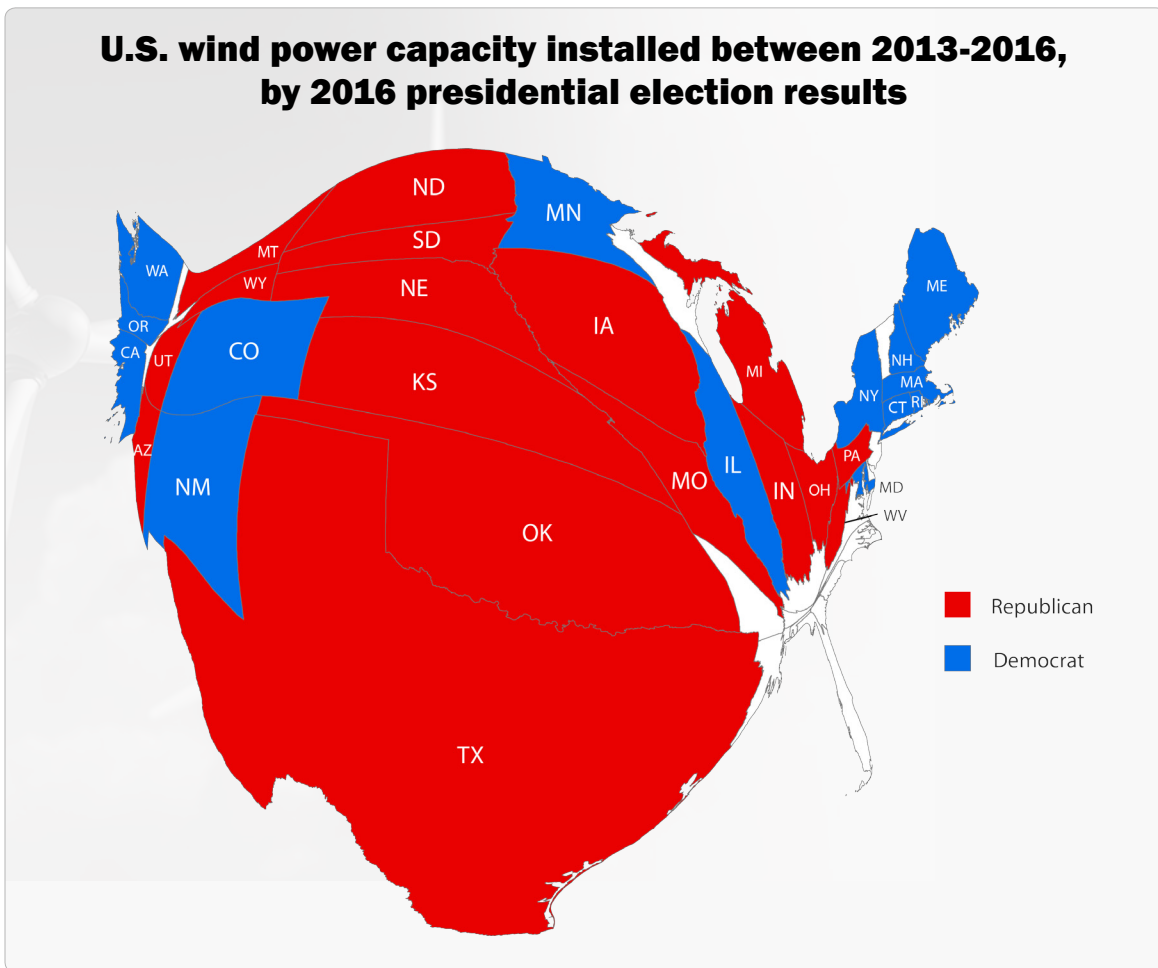


Source: AWEA

Stable policy has enabled wind turbine component manufacturers to make new U.S. investments. At least five companies expanded existing manufacturing facilities to meet growing orders and three companies opened new facilities, including GRI Renewable Industries' new tower facility in Amarillo, Texas. As the scale of wind turbine components continues to increase, additional opportunities will exist for domestic manufacturing.

Wind is a bipartisan energy source

The majority of wind power installed in 2016 was built in states that voted for President Trump in the 2016 presidential election - nearly 88% of the 8,203 MW installed. These thirteen states accounted for 7,126 MW of wind power capacity built during the year, continuing the concentration of wind power in Republican-leaning states.



Source: AWEA | States sized to reflect amount of wind energy capacity installed 2013-2016.

Wind energy has a presence in all 50 states and a majority of Congressional districts. The U.S. wind industry is present in 70% of all U.S. Congressional districts, including 75% of Republican-held districts and 64% of Democrat-held districts.

Navigant shows wind poised for continued growth

Thanks to stable policy, the U.S. wind industry is primed for continued growth. A new report from Navigant Consulting investigates the economic and employment impacts from wind projects that are forecast to be built over the next four years. Navigant forecasts the U.S. wind industry to deploy roughly 35,300 MW of new wind power capacity through 2020, ushering in over \$85 billion in economic activity by 2020. Additionally, wind-related employment will grow to reach 248,000 jobs - including 146,000 direct and indirect jobs - in all 50 states by 2020.

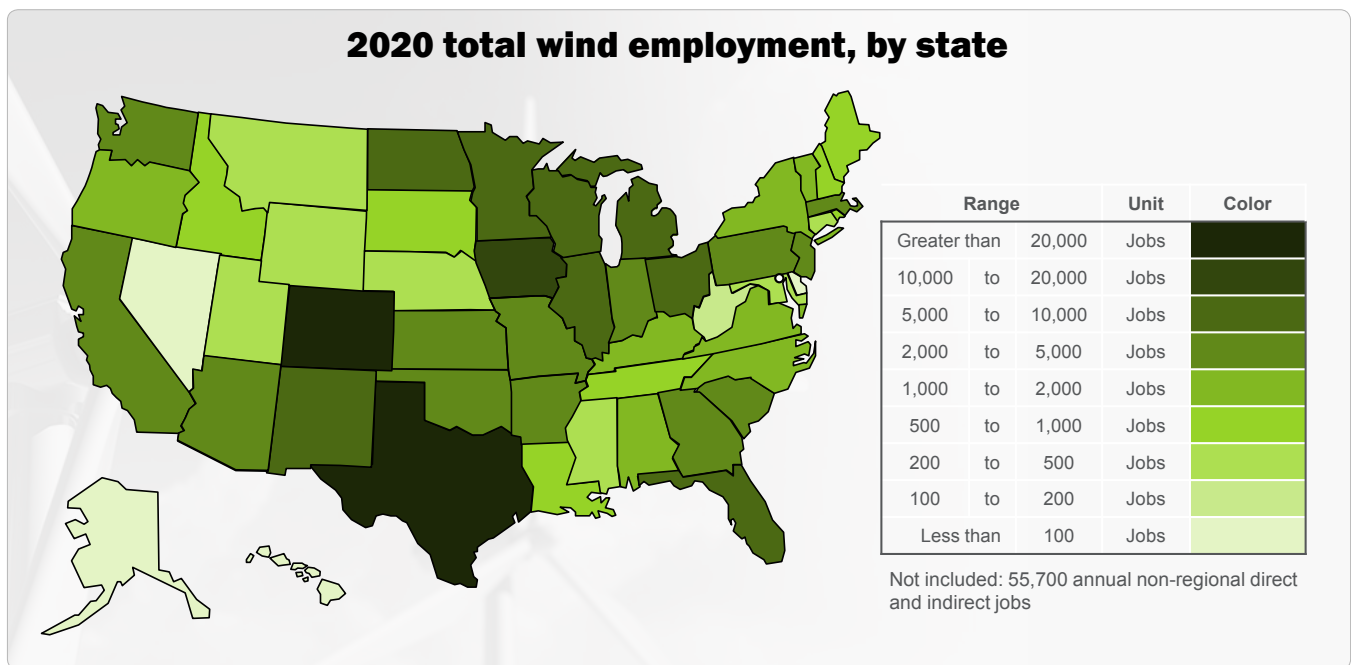
Using a combination of bottom-up forecasting, industry interviews, and electric sector modeling, Navigant forecasts new wind project additions from 2017-2020 and quantifies the jobs and economic benefits associated with those additions. The report finds the multi-year extension of the PTC will enable the development of around 35,300 MW of new wind power capacity by 2020.

Total Impacts on the U.S. Wind Market, 2017-2020	
New wind installed (GW)	35
Total wind economic impact	\$85 billion
Private Landowner Lease Payments	\$1.2 billion
Property, Sales, & Income Tax Revenues	\$8 billion

Navigant Consulting, 2017

Wind jobs to soar over 200,000

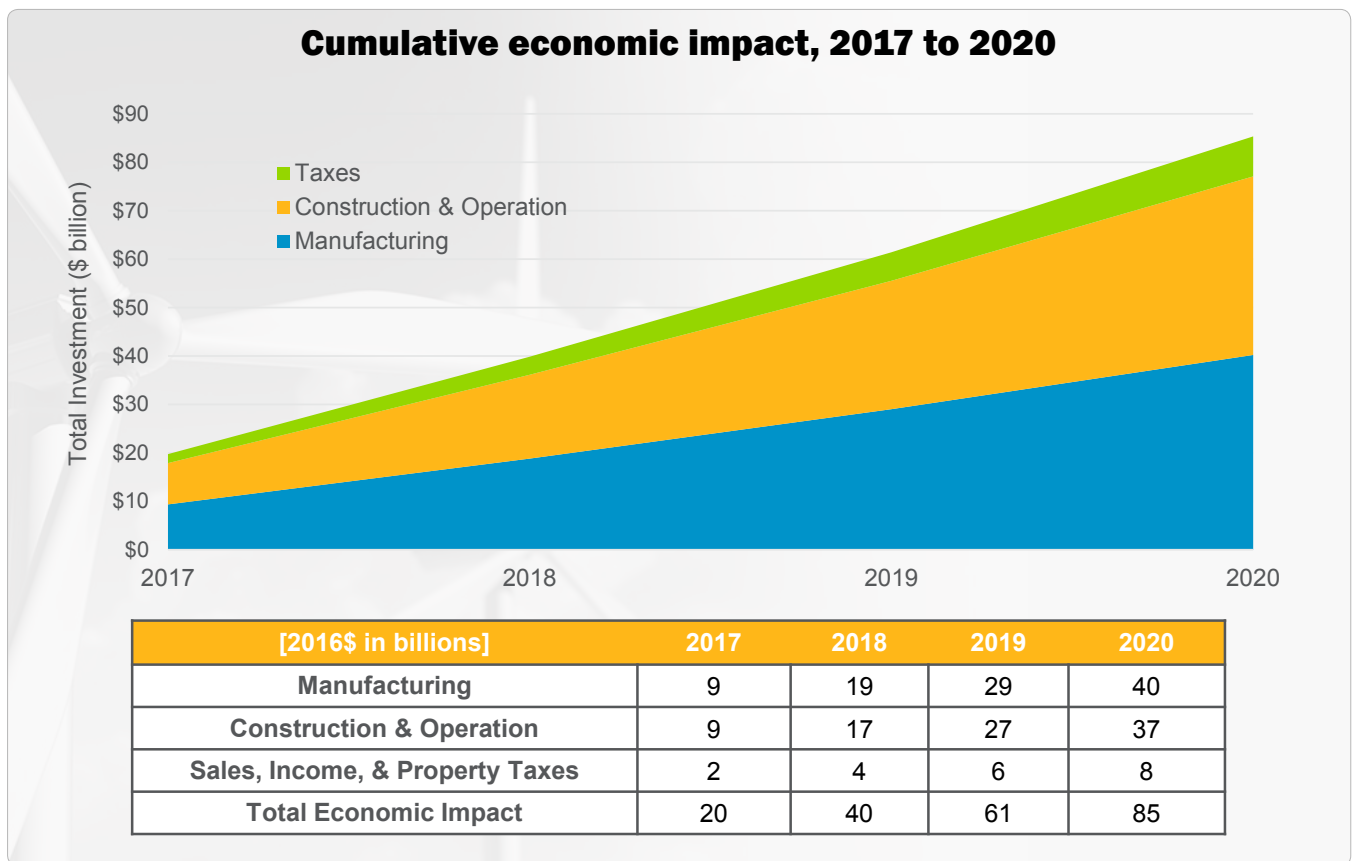
Strong wind project construction activity, growth in wind component manufacturing, and demand for more wind turbine technicians and project operators will create tens of thousands of new wind jobs. When including induced impacts, total wind related employment will reach 248,000 jobs in 2020. By 2020, Navigant expects 33,000 Americans to be working in wind-related manufacturing facilities, 114,000 Americans to be building, operating, and maintaining wind turbines, and an additional 102,000 jobs in other sectors induced by the wind industry’s economic activity.



Navigant Consulting, 2017

Wind a major source of economic development

In addition to creating jobs, the 35,300 MW of expected wind additions through 2020 will have a significant impact on the economy, supporting up to \$24 billion in annual economic activity. Over the next four years, wind will produce \$85 billion in economic activity through investments in new wind projects, manufacturing, construction and operations expenditures, and tax payments.

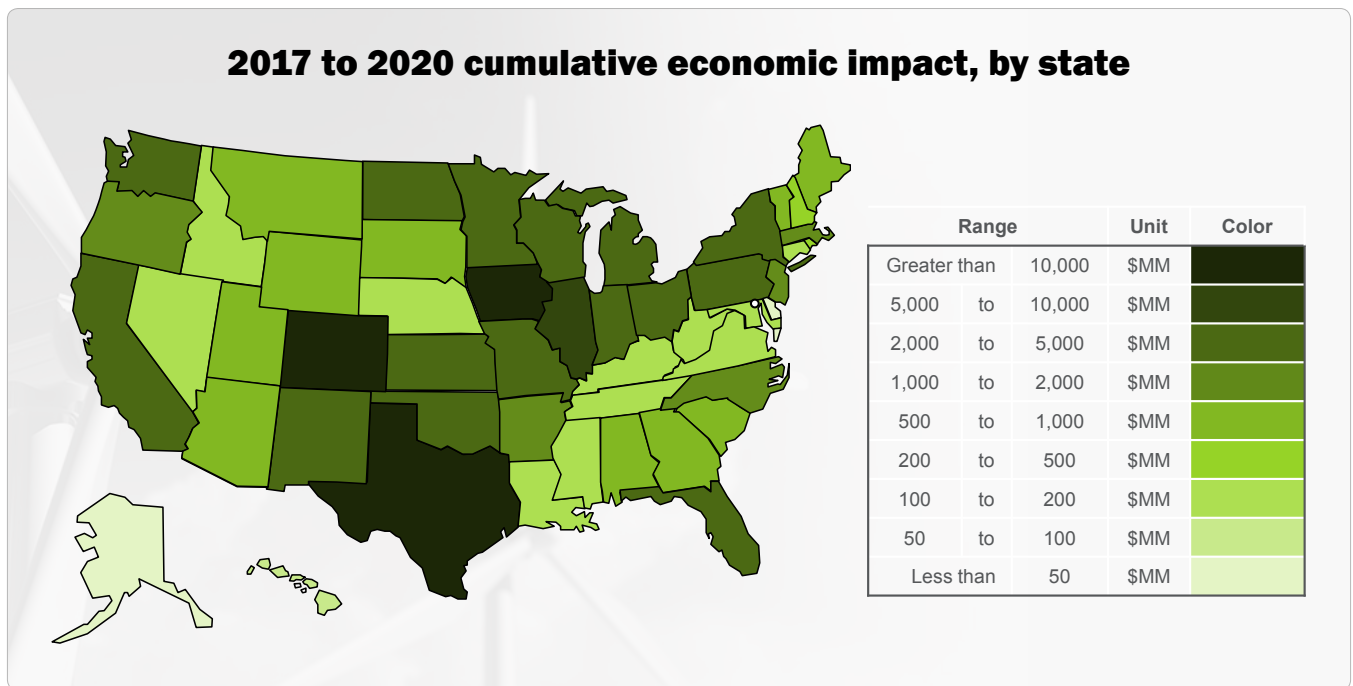


Navigant Consulting, 2017

Much of this economic investment flows to rural areas and manufacturing hubs that need it most, as shown on the following page. Much of the Interior region of the country will benefit substantially from the economic activity that wind projects deliver to their communities. Leading wind industry states such as Texas, Iowa,

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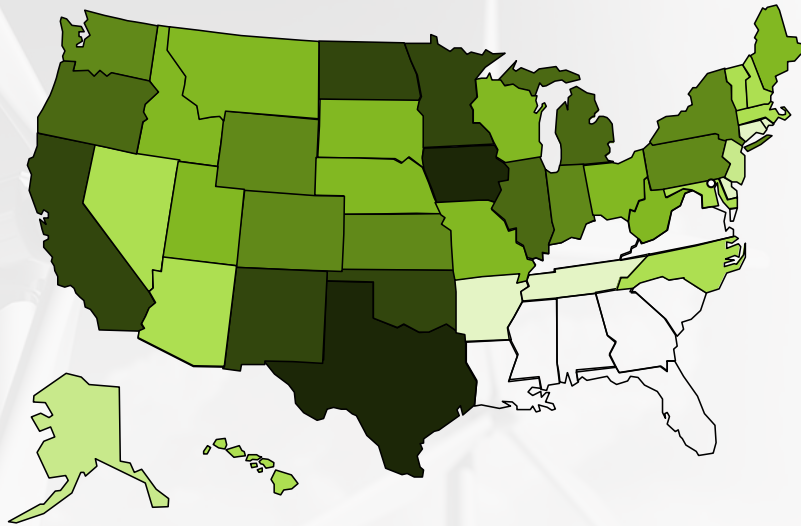
Oklahoma, Kansas, and Colorado will continue to see large investment, but Rust Belt states and upper Midwestern states will also benefit from major economic activity. In fact, economic activity from the wind industry will be spread across all 50 states.



Navigant Consulting, 2017

In addition to investments in manufacturing, construction, and operation, wind projects provide substantial funding to states and local communities through sales, income, and property taxes. These localized revenues provide new resources to fix roads, buy ambulances, or improve schools. New wind projects built over the next four years will provide \$8 billion in annual tax revenues between 2017 to 2020.

2020 income, sales, and property taxes, by state



Range	Unit	Color
Greater than 200	\$MM	Dark Green
100 to 200	\$MM	Dark Green
50 to 100	\$MM	Dark Green
20 to 50	\$MM	Dark Green
10 to 20	\$MM	Dark Green
5 to 10	\$MM	Dark Green
2 to 5	\$MM	Dark Green
1 to 2	\$MM	Dark Green
Less than 1	\$MM	Light Green
None		White

Navigant Consulting, 2017

Conclusion

The U.S. wind industry has been a major economic development engine across the country, particularly in rural and Rust Belt areas that need it most. The industry invested more than \$143 billion in the last ten years and today employs over 100,000 factory workers, construction workers, and technicians with well-paying jobs close to home. Thanks to stable policy, the wind industry will continue to expand these economic benefits. As Navigant Consulting concludes, the industry will deliver \$85 billion to the U.S. economy and employ over 248,000 Americans by 2020. Wind is working for America.