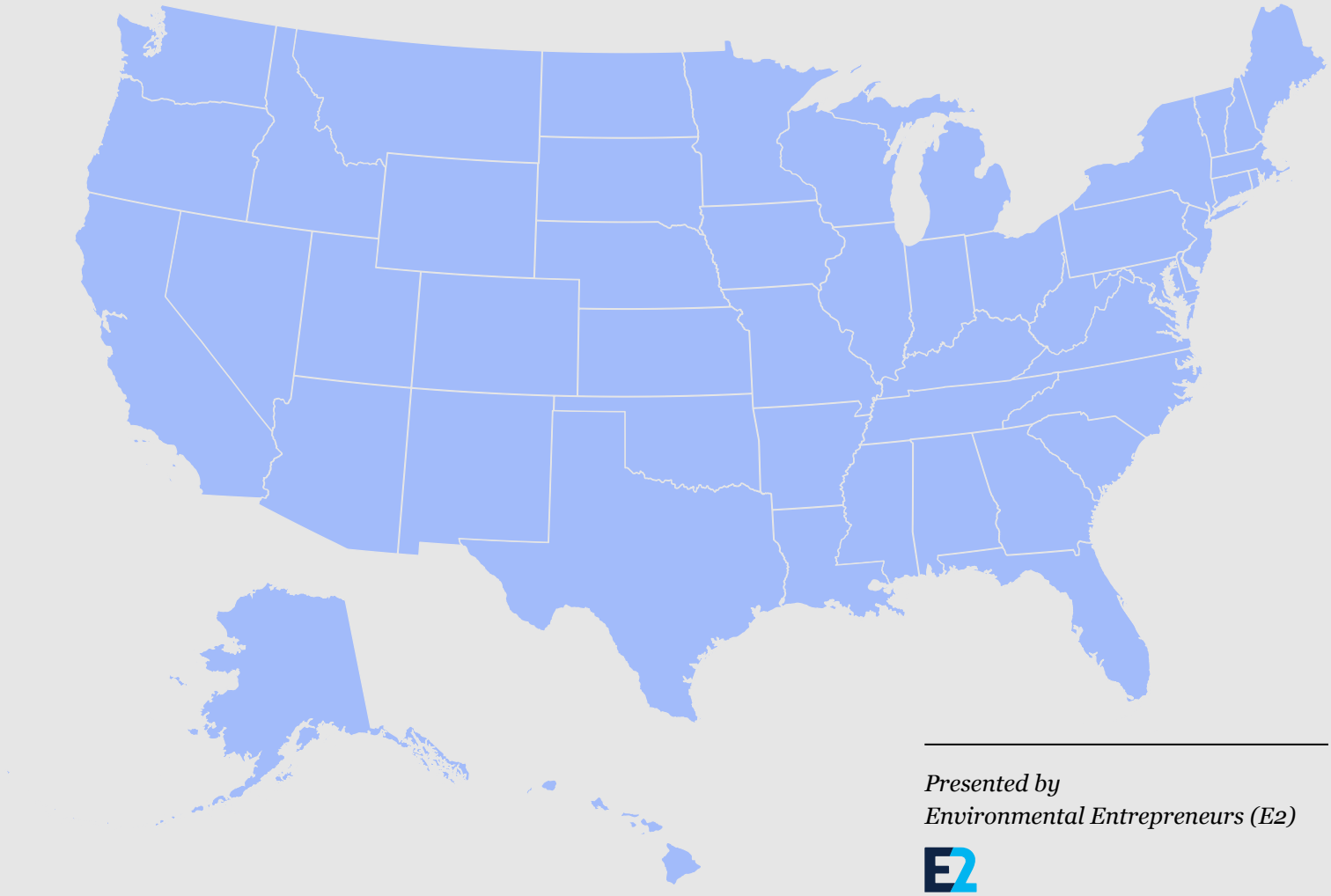
Clean Jobs America

A comprehensive analysis of clean energy jobs in America.



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About E2

Environmental Entrepreneurs (E2) is a national, nonpartisan group of business leaders, investors, and professionals from every sector of the economy who advocate for smart policies that are good for the economy and good for the environment. Our members have founded or funded more than 2,500 companies, created more than 600,000 jobs, and manage more than $100 billion in venture and private equity capital. For more information, see www.e2.org or follow us on Twitter at @e2org.

Introduction

Over the past decade, every state in America has benefitted from the boom in clean energy.

From the rise of solar in states stretching from the Carolinas to California, to the wind industry's rapid growth from west Texas to North Dakota, to the huge upswing in energy efficiency in our cities, towns and military bases, we've long known that clean energy was creating jobs and driving economic growth all across our nation.

But we never knew just how many Americans work in clean energy.

Until now.

Facts & Figures

2.5M

Americans work in clean energy

In a comprehensive analysis of clean energy and clean transportation jobs, Environmental Entrepreneurs (E2) has found that more than 2.5 million Americans now work in clean energy at businesses across all 50 states.

These are workers who install solar panels, manufacture electric vehicle parts, and retrofit our homes, schools and businesses to make them more energy efficient. They build wind turbine blades, invent battery technologies, and assemble the most energy-efficient kitchen appliances on the planet.

This first-of-its-kind analysis was completed for E2 in late 2015 by the research team at BW Research Partnership. It is based on data from the U.S. Bureau of Labor Statistics and the U.S Department of Energy and was done in conjunction with partners Clean Energy Trust, The Solar Foundation and Advanced Energy Economy. As part of the study, BW Research surveyed more than 20,000 businesses nationwide.

More than 2.5 million Americans go to work everyday in the clean energy industry.

414,000

people are employed by renewable energy technologies like wind and solar

Energy efficiency is by far the largest job-creator, with nearly 1.9 million Americans manufacturing efficient appliances, creating advanced materials and insulation, and manufacturing or installing efficient lighting products. This overall energy efficiency number also captures heating, ventilation and air conditioning (HVAC) workers who spend a significant portion of their time working on or with energy-efficient projects and products.

Nearly 414,000 people are currently employed in renewable energy generation in the United States. About 300,000 of them work at solar energy businesses. More than 77,000 people work in America's wind energy industry.

Continued strong investments in clean energy, triggered by international, federal and state policies proposed and finalized in 2015, point to continued expansion of the clean energy economy.

For instance, the federal Clean Power Plan, which sets the first-ever limits on carbon pollution from power plants, has sent a strong, clear market signal to the private sector to ramp up investments and expand hiring. Despite the recent stay by the U.S. Supreme Court, many states, utilities, and businesses continue to prepare for a future powered by clean energy. In addition to the Clean Power Plan, other 2015 clean energy developments expected to continue driving job growth include: an international climate agreement reached at the United Nations COP 21 climate summit in Paris; extension of key federal tax incentives for wind and solar electricity; the establishment of the U.S. "Mission Innovation" program to accelerate R&D investments in clean energy, and the related "Breakthrough Energy Coalition" clean energy investment fund announced by Microsoft founder Bill Gates, Amazon founder Jeff Bezos and other U.S. business leaders.

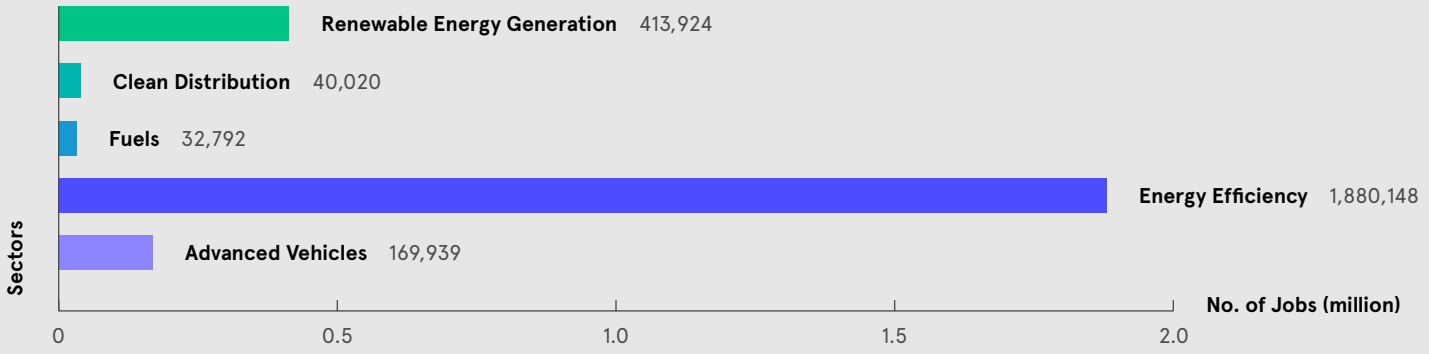
The Numbers

More than 2.5 million people work in clean energy across the United States. Energy efficiency is the largest sector, accounting for nearly three out of every four American clean energy jobs, or 1.9 million workers. Energy efficiency is followed by renewable energy generation, which employs nearly 414,000 people who work in booming industries like wind and solar. Advanced vehicles is another big employer with nearly 170,000 jobs, highlighting the automotive industry's shift toward low-carbon hybrid and electric vehicle technologies.

Sector Breakdown

	Industry	No. of Jobs
Renewable Energy Generation	Solar	299,953
	Wind	77,088
	Geothermal	7,645
	Biofuel	18,804
	Low-Impact Hydro	8,608
	Other	1,826
	Renewables Total	**413,924**
Clean Distribution	Storage	27,140
	Smart Grid	12,880
	Clean Distribution Total	**40,020**
Fuels	Other Ethanol/Non-Woody Biomass	14,761
	Woody Biomass	18,031
	Fuels Total	**32,792**
Energy Efficiency	Energy Star Appliances	162,083
	Energy-Efficient Lighting	328,288
	Traditional HVAC	630,587
	High AFUE	185,545
	REHC	135,102
	Advanced Materials/Insulation	292,667
	Other	145,876
	Energy Efficiency Total	**1,880,148**
Advanced Vehicles	Hybrid	53,030
	Electric	55,401
	Natural Gas Vehicle	51,885
	Hydrogen Vehicle	2,822
	Fuel Cell Vehicle	6,801
	Advanced Vehicles Total	**169,939**
All Sectors Total		**2,536,823**

Sector Comparison



The Sectors

The clean energy sectors providing the most jobs are energy efficiency, renewable energy generation, and advanced vehicles. Energy efficiency and advanced vehicles jobs both represent evolutions within traditional industries, while renewable energy is growing with the adoption of next-generation technologies.

Energy Efficiency

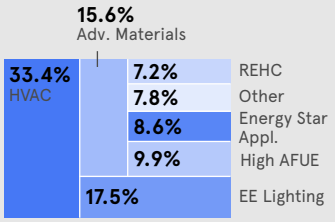
Nearly 1.9 million Americans are employed in jobs related to energy efficiency. With nearly three in four clean energy workers working in energy efficiency, it's by far the largest sector of the clean energy economy.

Energy efficiency is primarily comprised of workers who manufacture or install Energy Star appliances, energy-efficient lighting, efficient HVAC equipment, and advanced materials like lightweight materials and insulation.

By consuming less energy, energy efficiency increases economic output. Between 2007 and 2015, energy productivity in the U.S. (i.e., the GDP-to-energy-consumed ratio) increased by 13 percent. Put another way, U.S. primary energy consumption fell 2.4 percent while the economy grew 10 percent, according to Bloomberg New Energy Finance. Much of this can be attributed to energy efficiency—largely spurred by federal appliance standards, as well as state efficiency requirements that are helping states including Colorado, North Carolina, California, and others use less energy while growing their economies.

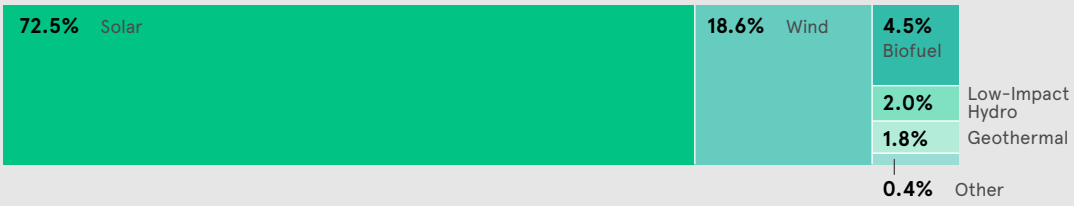
Facts & Figures

1.9M energy efficiency jobs



Consuming less energy increases economic output and creates jobs

Renewable Energy



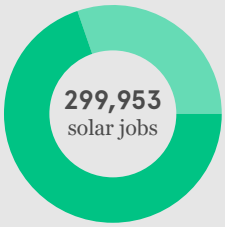
In 2015, there were 299,953 jobs in solar energy generation, making up nearly three quarters of all jobs in renewable energy generation. Of these, about 209,000 workers spend most of their time working on solar-related activities, according to The Solar Foundation/BW Research Partnership, while 90,000 work in solar part-time.[1]

According to The Solar Foundation, which with BW Research publishes an annual industry census, the U.S. solar industry in 2015 grew at a 20 percent growth rate for the third consecutive year. The industry has added more than 115,000 jobs since 2010—a job creation rate that's 12 times what the rest of the economy experienced during that time frame.

In 2015, for the first time ever, more solar capacity was brought on-line than natural gas. Solar supplied 29 percent of all new electric generating capacity in 2015.

The solar industry's dramatic growth last year came even amid the clouds cast over the industry by the expected expiration of the federal Investment Tax Credit (ITC). But in December 2015 as part of a larger tax package, Congress passed a multi-year extension for the ITC and the major tax credit for wind, the Production Tax Credit (PTC).

Facts & Figures: Solar Jobs



30% Part-time

70% Full-time

209,000 people work in solar full-time or close to full-time, according to The Solar Foundation and BW Research Partnership

20%

job growth rate for the third consecutive year

↑115,000

solar jobs added since 2010

1 *http://www.thesolarfoundation.org/national/*

The ITC was extended at its current level of 30 percent of project costs through 2019. After that, it will be phased down to 26 percent in 2020 and 22 percent in 2021, and will then drop to 10 percent for commercial projects and zero percent for residential projects. Importantly, solar projects are allowed to qualify when they begin construction, meaning that this extension will be driving commercial-scale projects through 2023.

The extended ITC will make more projects feasible, and we can expect continued job growth in solar in the coming years. Analysis from the Solar Energy Industries Association (SEIA) finds that the extension of the tax credit will help bring 72 additional GW of solar online in the next 5 years (for reference, there are currently about 25 GW of total installed solar capacity in the U.S.). As a result of this nearly tripling of capacity, more than 220,000 new solar jobs will be created, SEIA predicts.[2]

Wind is another major renewable energy employer, with more than 77,000 jobs nationwide. Like solar, wind is expected to see strong growth in the coming years thanks to extension of the PTC. About 75 GW of wind energy are currently installed across the country.

220,000

new solar jobs predicted in coming years due to ITC extension alone

77,000

Americans work in the wind energy industry

Advanced Vehicles

Advanced vehicles — including hybrid, electric, fuel cell, and natural gas-powered vehicles — are another growing portion of the clean energy economy, with a correspondingly large number of clean energy workers: the sector employed nearly 170,000 people in 2015.

Electric vehicle and energy storage company Tesla Motors has been a big driver of job growth in this sector, announcing thousands of jobs in its car and battery production facilities in California and Nevada in 2014 and 2015. The California-based company has grown 14-fold since 2010, and continues to add jobs at a rapid clip.

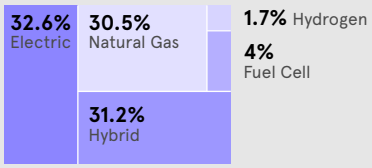
Automakers Nissan and Chevrolet are also manufacturing more electric and hybrid vehicles — and employing more Americans — at factories and assembly plants in states like Michigan and Tennessee.

One of the main reasons for growth in U.S. advanced vehicle jobs is the 54.5-mpg fuel standard finalized in 2012. This standard — as well as new fuel-efficiency standards for trucks — is growing clean vehicle industries that help automakers meet the standards.

Facts & Figures

170,000

advanced vehicle jobs



The 54.5 mpg fuel efficiency standard has led to a job boom in advanced vehicles

2 *http://www.seia.org/research-resources/impacts-solar-investment-tax-credit-extension*

Georgia biz leaders, farmers, conservative pols have solar on their minds

By Peter Voskamp

Birdsong Peanuts recently invested in this 1 MW solar array at its shelling and drying facility in Colquitt, Georgia. (Hannah Solar Photo)

PETER MARTE founded Atlanta-based Hannah Solar in 2007. Within two years, he had five employees.

Meanwhile, the solar power industry barely registered on Georgia's business landscape. In the entire state, only 500 kilowatts of solar capacity was installed.

"The market did not exist," Marte said.

But over the next six years, Hannah Solar became of one the fastest-growing renewable energy companies in the nation.

The company now has 77 employees, and in 2014 it was the 13th-fastest growing company in the metro Atlanta area. In 2014, the White House recognized Marte and nine other solar entrepreneurs as "Champions of Change." In August 2015, Hannah Solar was named the 18th-largest commercial solar contractor in the nation.

Since its beginnings, Hannah has installed 75 megawatts of solar capacity, and is set to install another 20 megawatts, primarily in Georgia, North Carolina and Mississippi.

And Georgia has become one of the fastest-growing solar states in the nation, overseen by an all-Republican Public Service Commission.

Georgia farmers, lawmakers eye solar opportunities

Six years ago, nearly 60 percent of the electricity provided by Georgia Power, the state's primary energy supplier, came from coal. That number is now closer to 30 percent. While much of the decline is due to the low price and ubiquity of natural gas, there has also been a shift toward renewables.

Also in 2009, Georgia Power was statutorily obliged to purchase only a half-megawatt of renewable energy. The company is now committed to purchasing 1,000 megawatts — one gigawatt — of renewably sourced energy over the next three years. At approximately $2 a watt, that's a $2 billion investment. This is due in large part to the decrease in cost for renewable sources.

Marte credits state and federal policies for the role they have played in getting the industry up on its feet. They "spawned an industry," he said.

When Hannah started, solar installation cost approximately $10 a watt. Now, it's between $1.75 and $3.50 per watt depending on the type of project — commercial, residential, or farm.

The 30-percent federal tax credit for solar remains a big part of the equation. While the industry is now "a wobbly toddler," Marte said that the tax incentives will be needed for a few more years in order for the industry to "walk on its own."

Marte points out that all forms of energy production in the U.S. enjoy some form of government incentive.

A marked drop in the cost of solar panels has been a welcome but only recent phenomenon, Marte explained, and having the tax credits in place help companies take advantage of that drop in costs.

In Georgia, peanut and cotton farmers have discovered and taken advantage of the tax credits — $300,000 on a $1 million investment — that come with installing renewable energy capacity.

Two years ago, Hannah Solar installed a 1-megawatt solar array for Birdsong Peanut Co. in Colquitt, Georgia. Not only does Birdsong get the tax credit to offset income from its larger enterprise, but it will sell 100 percent of the electricity to Georgia Power for the next two decades.

Marte said he knows of two 1,000-acre farms in Georgia that are planning to install 100-megawatt and 130-megawatt solar farms respectively.

Military solar projects

Hannah is also expanding its reach, installing solar arrays at military facilities through its sister company, Hannah Solar Government Services. There are three projects underway in Puerto Rico — at the San Juan VA hospital, Fort Allen and Fort Buchanan. Another project is set for Pearl Harbor in Hawaii.

One project Marte is particularly excited about is the new stadium for the Atlanta Falcons football team, which will be the first LEED Platinum-certified stadium in the country, and will include more than a megawatt of on-site solar.

Marte applauds the federal Clean Power Plan, saying it is "long overdue" and "very important to our industry."

When it comes to generating the energy we need to go about our daily lives, Marte said burning fossil fuels like coal and natural gas don't stack up when compared to solar.

"There are better ways to do it," he said.

The Policies

When it comes to clean energy, policies matter. Long-term extensions of the Investment Tax Credit for solar and the Production Tax Credit for wind at the end of 2015 are both expected to lead to a flurry of economic activity and job growth in those two renewable energy sectors. Additionally, the Paris climate agreement has been called the "mother of all market signals," while the federal Clean Power Plan remains our nation's biggest breakthrough yet on climate change. Despite a decision by the U.S. Supreme Court in February 2016 to stay the Clean Power Plan, the policy remains on strong legal footing and it is expected to be a major driver of clean energy job growth nationwide as utilities, businesses, and states continue to prepare for its implementation. At the state level, stronger renewable portfolio standards and energy efficiency standards are further fueling clean energy job growth.

Production Tax Credit

Along with the ITC for solar, the PTC, a 2.3-cents-per-kWh credit for wind generation, was renewed by Congress in the waning days of 2015. For years, the wind energy industry has been caught in a boom-and-bust cycle dictated by passages and lapses of the PTC; the renewal of the PTC through January 2020, however, gives the industry the long-term certainty it needs to invest in new projects, expand capacity, and create jobs across the supply chain. According to a report from the Natural Resources Defense Council, nearly 1,100 workers are needed over the lifetime of a typical 250-megawatt wind energy project.

Facts & Figures

1,100

workers needed over the lifetime of a typical wind farm

Paris Climate Agreement

In December 2015, leaders from nearly 200 nations gathered in Paris for the United Nations COP 21 climate summit and to negotiate the most ambitious global agreement in history to fight climate change.

The deal requires countries to peak their emissions as soon as possible, and to continue reducing emissions throughout the century. The agreement will also unlock trillions of dollars in investment in clean energy resources like wind and solar by sending to the private sector what's been labeled "the mother of all market signals."

During the negotiations, in a tremendous groundswell of action, cities, organizations, businesses, and major investors made commitments of their own to fight climate change and build a clean energy future. One of the most notable was from the "Breakthrough Energy Coalition" group of business leaders led by Bill Gates. Together, business and technology titans pledged to invest more than $2 billion in private capital in clean energy research-and-development.

The Paris agreement designates new private-sector funding sources for clean energy research, incentivizes massive new renewable energy initiatives by nations, states and cities, and builds unprecedented momentum for action on climate change.

Facts & Figures

$2B+

pledged by business leaders to invest in clean energy R&D at Paris climate summit

Clean Jobs Midwest: 569,000 jobs. With stronger policies, more on the way?

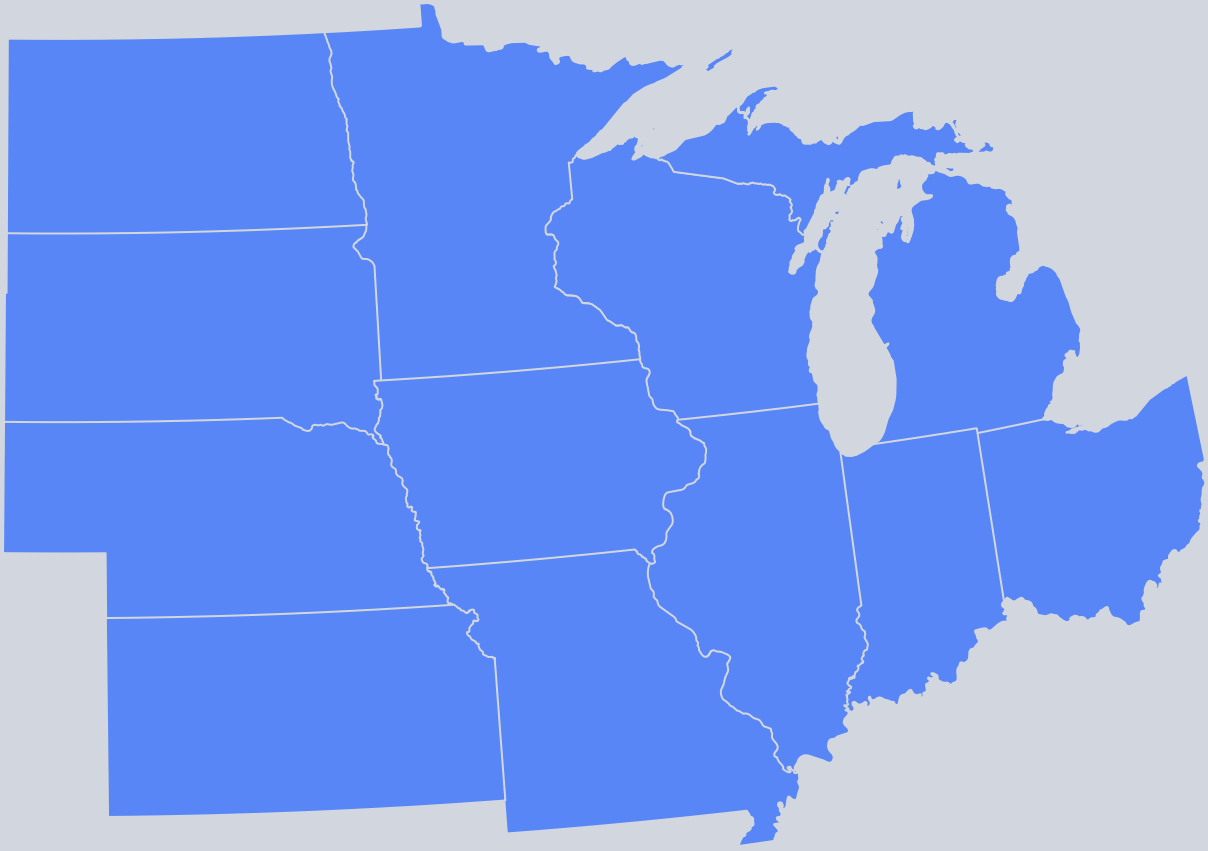
MIRRORING Clean Jobs America's methodology, E2, Clean Energy Trust and other partners released Clean Jobs Midwest in March 2016. This regionally focused survey of clean energy employment—available at www.CleanJobsMidwest.com and searchable by county, congressional and state legislative district—shows that nearly 569,000 people in 12 Midwestern states work in clean energy.

The report notes clean energy jobs are growing in every Midwestern state—in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. In the next 12 months, the Midwest's clean energy employers project a growth rate of about 4.4 percent, adding another 25,000 jobs to the payroll.

Three out of four clean energy workers in the Midwest work in energy efficiency, the region's largest clean energy industry. About 13 percent of the jobs are in renewable energy industries like wind and solar, while a similar amount are employed in the advanced transportation industry, highlighting a shift within traditional automotive industries toward more alternative and advanced vehicles.

The report includes profiles of Midwest clean energy workers. A sampling of those profiles is included in this section.

Policy actions—such as enacting and/or strengthening state-level renewable portfolio standards and energy efficiency standards, as well as implementing the federal Clean Power Plan with an emphasis on renewables and efficiency—could result in even more clean energy jobs in the Midwest, the report notes.



Worker Profiles

Jennifer Pytleski
Lighting Design Specialist — Werner Electric, Minnesota

Jennifer Pytleski is saving business owners money on their energy bills and making employees more productive... and all it takes is the right lighting.

Jennifer graduated with a degree in interior design. It wasn't until she started filling out circuit loads and realized how much electrical wattage she was using in her designs that she even thought about energy efficiency. She got certified by the National Council on Qualifications for the Lighting Professions (NCQLP) and joined Minnesota-based Werner Electric. Now she works with architects on retrofits and new construction projects, analyzing floorplans and making recommendations on what fixtures and light levels will result in the most efficient and productive commercial spaces.

According to Jennifer, half of her clients are looking to reduce their energy and maintenance costs and half are just looking to upgrade their current lighting. The good news is they can do both. "It's not just investing in the environment," said Jennifer of installing more efficient lighting. "It's an investment back into your pocketbook."

Jennifer Pytleski

Patrick Kemp

Patrick Kemp
Project Engineer — Microgrid Energy, Missouri

Patrick Kemp joined St. Louis-based solar company Microgrid Energy shortly after graduating from college in 2012.

Microgrid Energy completes solar projects ranging from small, 25-killowatt installations to multi-megawatt roof and ground mount projects. Patrick's job is to determine the best way to design and construct the project to meet a client's needs.

As project engineer, Patrick oversees pre-construction design and engineering from a project's conception to construction takeoff. He also designs commercial and utility scale solar projects—from small, battery-based microgrids to multi-megawatt installations.

Patrick, who has always had an interest in how solar and wind can contribute to our energy future, has found his professional match at a company that operates with a focus on people, planet and prosperity.

"There is a general misperception that the cost of energy upgrades is prohibitive and the technology has huge room for improvement," said Patrick of the solar industry. "What we have seen, however, is that the cost is competitive and the technology is proven."

Clean Power Plan

The federal Clean Power Plan has been driving investments and job growth in clean energy since it was announced by the Environmental Protection Agency in the summer 2015. This growth is expected to continue in states that choose to implement the plan with an emphasis on renewables and energy efficiency in coming years. The Clean Power Plan sets the first-ever carbon pollution limits on domestic power plants across the U.S., and it will help reduce power-sector carbon emissions 32 percent from 2005 levels by 2030, in part by increasing renewable energy and energy efficiency. The Clean Power Plan is sending a strong, clear market signal to the private sector to increase job-creating investments in renewables and energy efficiency.

The Clean Power Plan is not just our nation's most significant policy on climate change, it also is expected to be a major economic catalyst.

While states were making progress on their own plans to address carbon emissions, the U.S. Supreme Court in February 2016 decided to stay the Clean Power Plan, temporarily halting its implementation. Lower courts have ruled in favor of the Clean Power Plan on three previous occasions, and many states, utilities, and businesses are continuing to make preparations and investments due to their expectation that the Clean Power Plan will go forward.

While the Clean Power Plan is temporarily paused, a growing number of governors — realizing the job and economic growth potential of clean energy — have already pledged to move forward with the state Clean Power Plan planning process. These governors recognize the economic benefits of providing regulatory certainty and sending strong market signals to give businesses the certainty they need to make new investments and expand operations. It makes sense for states to continue to develop their compliance plans — and for utilities to take advantage of the recently extended renewable tax credits by investing in wind and solar — so they are ready to move quickly when the stay is lifted. Indeed, continued implementation of the federal Clean Power Plan is one of the most important steps state policymakers can take, right now, to ensure the clean energy industry achieves its job-creating potential.

Facts & Figures

↓ 32%

reduction in power-sector carbon emissions from 2005 levels by year 2030, as a result of the Clean Power Plan

Conclusion

More than 2.5 million Americans work in the clean energy sector. They install solar panels on military housing units and in farmers' fallow fields. They make our homes and schools more energy efficient. They are building a clean, renewable energy future for all Americans.

Thanks to the Clean Power Plan, global carbon-reduction commitments in Paris, and the renewed tax credits for wind and solar, the U.S. clean energy economy is well-positioned for growth. We expect continued strong clean energy expansion through 2016 and beyond.

While recent policy gains are crucial factors in driving the industry forward, there is much more work to be done. Designing strong Clean Power Plan state implementation plans that prioritize renewables and efficiency as core compliance strategies is one of the biggest ways to ensure clean energy meets its job growth potential in the years ahead. States can also continue to enact and/or strengthen renewable portfolio standards and energy efficiency standards, or ensure utilities maximize energy in their resource plans.

Doing so grows clean energy businesses and creates more good, high-paying jobs for workers across our nation.

About BW Research Energy Employment Index

The BW Research Energy Employment Index (the "Index") methodology relies on the most recently available data from the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW, Quarter 2), together with a detailed survey of business establishments across the United States. Taken together, the data provide the most comprehensive calculation of energy-related employment available. The methodology has been used for local, state, and federal energy related data collection and analysis for nearly a decade, including The Solar Foundation's *National Solar Jobs Census* series, clean energy reports for state agencies in the Commonwealth of Massachusetts, State of Vermont, and State of Rhode Island, and numerous non-profit agencies across the U.S.

The Index survey uses a stratified sampling plan that is representative by industry code (NAICS or ANAICS), establishment size, and geography. These data are then analyzed and applied to existing public data published by the Bureau of Labor Statistics, effectively constraining the potential universe of energy establishments and employment. BW Research Partnership believes that the methodology used for the Index could be adopted as a supplemental series to the QCEW with only minor revision.

The Index survey was administered by telephone (more than 300,000 outbound calls) and by web, with more than 50,000 emails sent to participants throughout the U.S. The phone survey was conducted by I/H/R Research Group and Castelton Polling Institute. The web instrument was programmed internally and each respondent was required to use a unique ID in order to prevent duplication.

The sample was split into two categories, referred to as the known and unknown universes. The known universe includes establishments that have previously identified as energy-related, either in prior research or some other manner, such as membership in an industry association or participation in government programs.

These establishments were surveyed census style, and their associated establishment and employment totals were removed from the unknown universe for both sampling and for resulting employment calculations and estimates.

The unknown universe includes hundreds of thousands of businesses in potentially energy-related NAICS codes, acrossagriculture, mining, utilities, construction,manufacturing, wholesale trade, professional services, and repair and maintenance. Each of these segments and their total reported establishments (within the Bureau of Labor Statistics QCEW) were carefully analyzed by state to develop representative clusters for sampling. In total, approximately 20,000 business establishments participated in the survey effort, with more than 8,500 providing full responses to the survey. These responses were used to develop incidence rates among industries (by state) as well as to apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies.

For several industries, particularly transportation of goods, the Index utilized the methodology developed by the Department of Energy and the National Renewable Energy Laboratory for the Quadrennial Energy Review (QER). This methodology applies commodity flow data at the state level to employment within each transportation segment, including rail, air, truck, and water transport.

Of important note, the Index expressly excludes any employment in retail trade NAICS codes. This excludes gasoline stations, fuel dealers, appliance and hardware stores and other retail establishments.

All data in the index rely on the Bureau of Labor Statistics Quarterly Census of Employment and Wages data for the second quarter of 2015. The survey was administered between September 15, 2015 and November 24, 2015 and averaged 14 minutes in length.