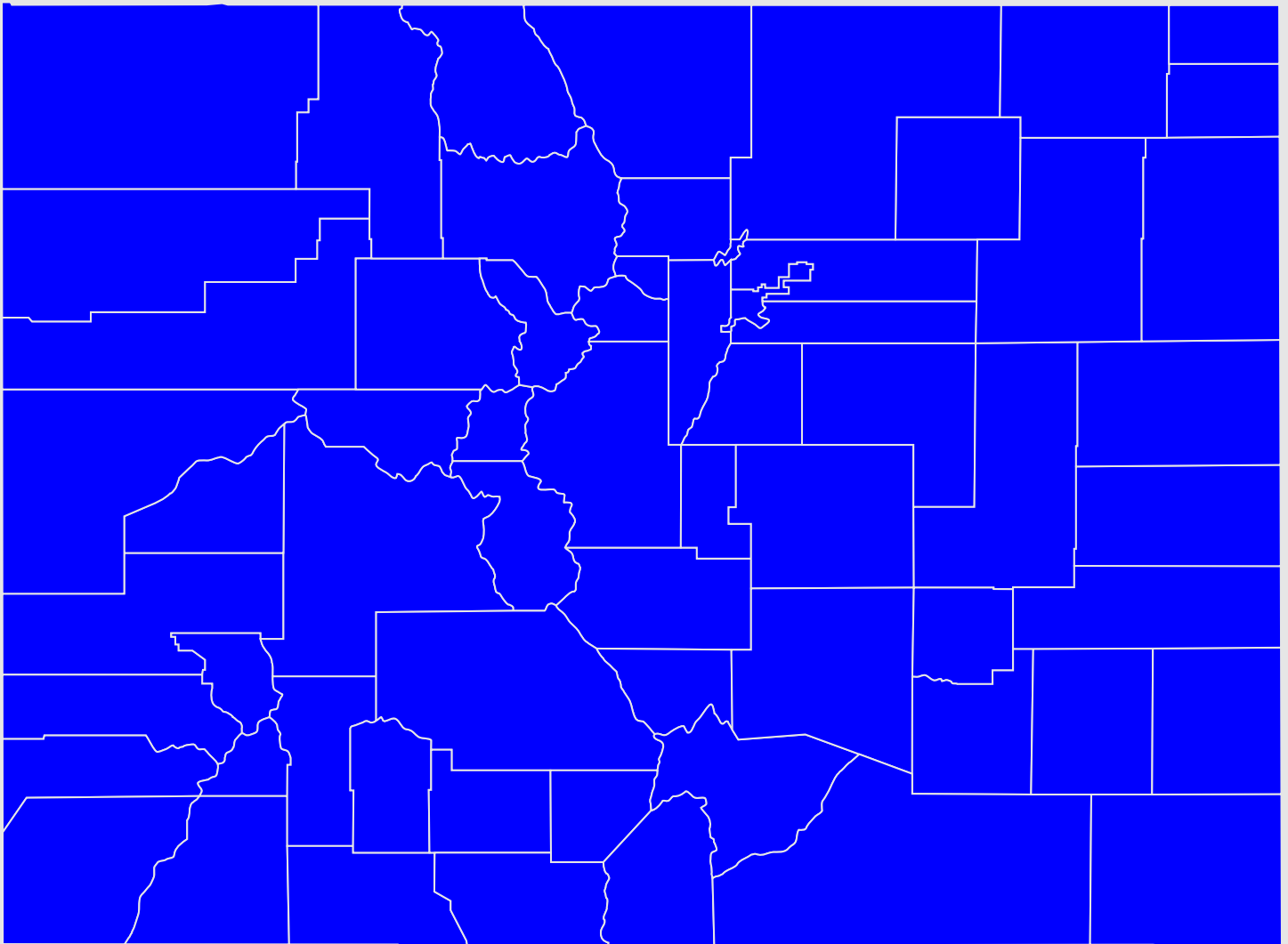


Clean Jobs Colorado



Presented by

Environmental Entrepreneurs (E2)

January 2017

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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](https://twitter.com/e2org).

About the Research and Analysis Partners

BW Research Partnership is a full-service, economic and workforce research consulting firm with offices in Carlsbad, California, and Wrentham, Massachusetts. It is the nation's leading provider of accurate, comprehensive clean energy research studies, including the National Solar Census, wind industry analyses for the National Renewable Energy Laboratory and the Natural Resources Defense Council, and state-level clean energy reports for Massachusetts, Illinois, Vermont, Iowa, and Florida, among others.

The Economic Advancement Research Institute (EARI) is a nonprofit research organization focused on economic mobility and regional competitiveness. EARI is primarily focused on studying the impact of policies and systems on economic growth and prosperity across all income levels. EARI has conducted numerous labor market analyses that address key economic sectors with high probability to provide opportunities to underrepresented and disadvantaged populations.

Introduction

Clean energy jobs flourish in Colorado: tens of thousands of workers in the state are driving the transition to a lower-carbon future.

They're installing solar panels, building and repairing wind turbines, and making buildings more efficient.

The current uncertainty surrounding energy policy with 2017's pending administration changeover needn't stall the momentum Colorado has achieved. Wind power, for example, has brought more than \$4.8 billion into Colorado's economy and supplies 16 percent of its electricity.¹ Xcel Energy's new Rush Creek wind project will provide 600 megawatts of the state's lowest-cost wind power. Solar, too, is growing, with more than 382 firms in the state and \$305 million in installations last year alone, with more on the way.² In eastern Colorado, 16 renewable energy facilities paid more than \$7 million in property tax and \$7.5 million in landowner lease payments, according to a report from regional interest group Progressive 15.³

Colorado's renewable energy growth takes place against the backdrop of an oil and gas boom-and-bust cycle in the state over the past decade. While recent fossil fuel price drops have caused that job market to stumble, clean energy is creating a more diverse workforce and higher-quality jobs.⁴ ⁵ As more businesses and homeowners seek efficient energy solutions that will save money and cut pollution, more Coloradans will find work in the state's bustling clean energy industry.

¹ <http://awea.files.cms-plus.com/FileDownloads/pdfs/Colorado.pdf>

² <http://www.seia.org/state-solar-policy/colorado>

³ <https://brianallmerradionetwork.wordpress.com/2016/10/17/10-17-16-progressive-15-colorados-eastern-plains-a-renewable-energy-economic-hub-according-to-new-report/>

⁴ <http://www.denverpost.com/2016/03/14/oil-gas-losses-dont-derail-51-month-employment-growth-streak/>

⁵ <http://www.dbipartners.vc/resource/clean-energy-employment-booming-creates-a-more-diverse-workforce-and-higher-quality-jobs/>

Overall Clean Energy Jobs

Quick Facts

Colorado’s clean energy industry is significant and growing, employing more than 62,000 workers in 2015.

62,071

clean energy workers in Colorado

From energy efficiency to renewables to clean fuels and other markets, the sector is helping drive the Centennial State’s thriving overall economy, which is among the top five U.S. states in real gross domestic product growth.⁶ Employers expect the clean energy sector to grow 2 percent over the next year, adding 1,474 more jobs.

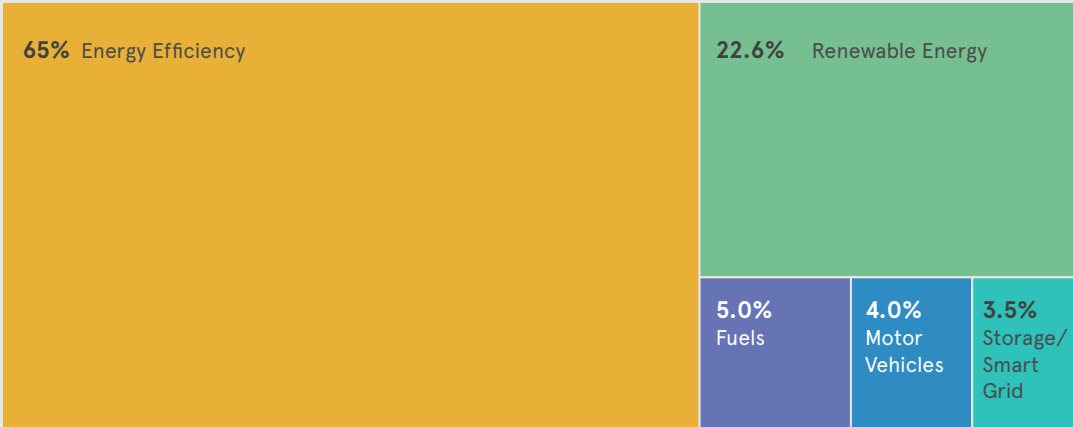
2%

anticipated growth in clean energy jobs

The majority of Colorado’s clean energy jobs come from a diverse field of energy efficiency firms. Of 2,483 businesses in clean energy, nearly two-thirds offer energy efficiency services, accounting for 40,335 jobs.

Renewable energy is the second-largest category, representing 22.6 percent of clean energy businesses, followed by fuels including non-woody biomass (5 percent), motor vehicles including electric vehicles, or EV’s, (4 percent) and energy storage and the smart grid (3.5 percent).

Colorado firms that work with clean energy tech overwhelmingly rely on it as an income stream. Seventy-two percent say they generate most or all of their revenue from advanced energy activity. Most clean energy companies in Colorado are small: Nearly 88 percent of the firms employ less than 50 staff, 6 percent have 50–100 employees, and 6 percent have over 100 employees.



65%

of clean energy jobs are in energy efficiency

Fig. 1: Clean energy jobs breakdown by sector

6 http://www.bea.gov/newsreleases/regional/gdp_state/qgsp_newsrelease.htm

Clean Energy Jobs by County

Like most industries in the state, the largest share of clean energy positions is centered in Denver and surrounding densely populated counties—Denver, Arapahoe and Jefferson. Still, nearly every county, congressional district, and state legislative district is home to a clean energy workforce.

After the Denver metro area (46,244 jobs), Boulder and Fort Collins-Loveland have the most clean energy workers (2,757 and 2,365 respectively). Greeley and Colorado Springs each have more than 1,500 workers, with Grand Junction (1,105) and Pueblo (579) rounding out the metro locations.

Beyond cities, the state’s more rural counties employ a total of 5,937 in clean energy. Other counties with more than 2,000 energy jobs include Adams (4,899), Arapahoe (11,270), Boulder (2,756), Denver (15,443), Douglas (3,384), Jefferson (9,826), and Larimer (2,365).

County	Employment	County	Employment	County	Employment	County	Employment
Adams	4,899	Douglas	3,384	Lake	32	Prowers	113
Alamosa	113	Eagle	499	Larimer	2,365	Pueblo	579
Arapahoe	11,270	El Paso	1,484	Las Animas	113	Rio Blanco	113
Archuleta	150	Elbert	255	Lincoln	59	Rio Grande	54
Baca	16	Fremont	113	Logan	177	Routt	263
Boulder	2,756	Garfield	467	Mesa	1,094	Saguache	32
Broomfield	708	Gilpin	57	Mineral	5	San Juan	16
Chaffee	177	Grand	172	Moffat	118	San Miguel	86
Cheyenne	11	Gunnison	123	Montezuma	177	Sedgwick	16
Clear Creek	99	Hinsdale	16	Montrose	311	Summit	284
Conejos	16	Huerfano	21	Morgan	177	Teller	53
Costilla	21	Jackson	32	Otero	70	Washington	43
Custer	48	Jefferson	9,826	Ouray	59	Weld	1,544
Delta	166	Kiowa	38	Park	311	Yuma	91
Denver	15,433	Kit Carson	91	Phillips	38		
Dolores	38	La Plata	783	Pitkin	397		

Fig. 2: Clean energy jobs for each county

Clean Energy Jobs by Congressional District

Congressional District	Employment
1	24,998
2	8,204
3	5,566
4	14,012
5	1,686
6	3,581
7	4,024

Fig. 3: Clean energy jobs by congressional district

Clean Energy Jobs by Legislative District

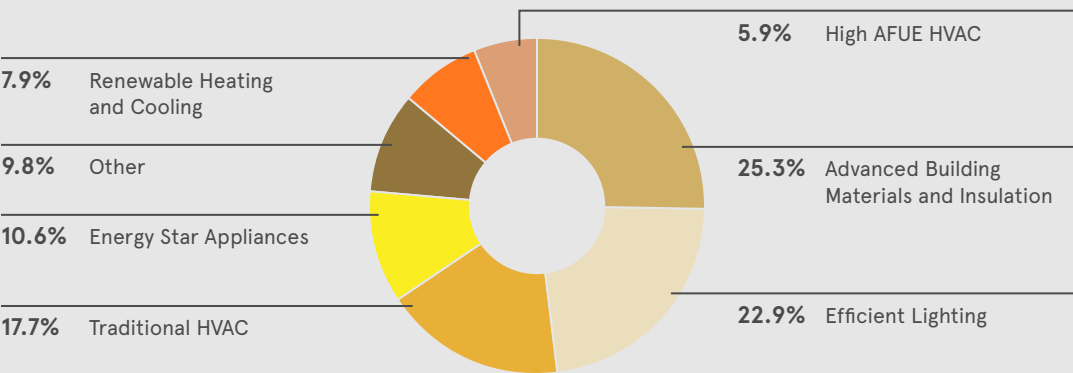
<i>Upper House District</i>	<i>Employment</i>	<i>Lower House District</i>	<i>Employment</i>	<i>Lower House District</i>	<i>Employment</i>
1	2,455	1	3,474	29	343
2	715	2	4,088	30	3,774
3	505	3	6,776	31	272
4	5,031	4	1,515	32	257
5	1,455	5	6,990	33	629
6	1,494	6	2,516	34	86
7	1,120	7	829	36	643
8	1,455	9	843	38	643
9	649	10	1,911	39	3,231
10	179	11	585	46	357
11	343	12	677	47	325
12	20	13	1,873	48	1,565
13	494	14	274	49	1,733
14	917	15	196	50	43
15	1,175	16	380	54	1,197
16	7,858	17	425	56	179
17	1,653	18	70	57	569
18	714	19	173	58	655
19	3,175	20	8	59	1,050
20	1,769	21	3	60	325
21	4,538	22	929	61	671
23	362	23	3,002	62	260
24	275	24	1,801	63	206
25	1,261	25	572	64	547
26	3,219	26	1,040	65	374
27	2,697	27	1,187		
28	261				
29	290				
30	797				
31	4,524				
32	2,842				
33	841				
34	6,307				
35	681				

Fig. 4: Clean energy jobs by Upper House district

Fig. 5: Clean energy jobs by Lower House district

Energy Efficiency Jobs

Quick Facts



1/4
of all Colorado energy efficiency jobs are in advanced building materials and insulation

Fig. 6: Energy efficiency subtechnologies

While energy efficiency is the bedrock of Colorado’s clean tech economy, a closer look reveals the services in this space are quite diverse. Companies are improving building insulation, providing smarter lighting and appliances, and supplying improved heating and cooling systems.

Of seven efficiency technology groupings, four of them—Advanced Building Materials and Insulation (10,191 jobs), Efficient Lighting (9,231), Traditional HVAC (7,140), and Energy Star Appliances (4,269)—each contain at least 10 percent of all energy efficiency jobs and together account for three-fourths of all energy efficiency workers. The remaining industries employ an additional 9,500 workers.

In Fort Collins, Pos-En carves out a market in microgrids

AT UNIVERSITIES, COMMERCIAL BUILDINGS, MILITARY BASES, AND OTHER PLACES AROUND THE WORLD, microgrids are becoming ever more common as a way to cut costs and boost reliability. Fort Collins-based Pos-En—the name is a short version of positive energies—is an example of the growing business in this new landscape.

Founded in 2011, Pos-En currently has 11 employees and expects to double that number by the end of next year. Founder Dan Gregory saw an opportunity to synthesize different emerging technologies into stronger, smarter energy systems while he was chairing the industry advisory board of the FREEDM Systems Center, a research group at North Carolina State University dedicated to modernizing the grid.

Now the company is building microgrids for both private enterprise and government. For the city of Boulder, Pos-En plans to add solar power, battery storage and other upgrades to critical sites such as emergency shelters. In Barranquilla, Colombia, it's modernizing the Ernesto Cortissoz Airport to bring down energy costs and increase reliability.

A number of factors have converged to make the time right for Pos-En's microgrid work, says Bob Lachenmayer, chief operating officer. In a 24-7 world, "the need for resiliency is increasing because the cost of downtime is increasing," he says, while at the same time, "the cost of generation on-site is just plummeting."

While the company doesn't promote one type of energy solution, Lachenmayer says, prices for solar power have reached the point where it outperforms the grid and is often "a much better alternative" than fossil fuel. That, combined with smart appliances, efficient heating and cooling systems, and advances in direct current and storage systems, makes it possible to build much more cost-efficient, reliable energy solutions.

Business models are also changing, Lachenmayer says, thanks to programs such as the Department of Energy's Property-Assessed Clean Energy (PACE), which he calls a "game-changer." PACE allows commercial property owners to finance efficiency improvements that might otherwise be ignored because they would benefit the tenant more than the owner. By making such improvements more appealing and affordable, programs like PACE open up the market for companies like Pos-En.



Ben Gregory, 26, works in business development at Pos-En. He's one of a growing number of millennials working in the clean energy industry in Colorado. (Photo courtesy of Pos-En)

The fact that Pos-En is technology-agnostic "actually attracts a lot of people" as employees, Lachenmayer says, because there's an opportunity to "create a custom approach client by client." He looks for systems engineers, project managers and other people who are not afraid to think outside the box. His main hiring challenge, he says, is finding people who can take a whole-system approach and can "live in the possibilities."

The sense of possibility is what led Gregory's son Ben, 26, to join the company three years ago. After starting as a coordinator, he's now in business development. "A big part of the clean energy field is breaking through the classic story of why we need a lot of fossil fuel generation," Gregory says. Reassessing that mix, with the attendant benefits for health and the climate, he says, has "made me passionate about what I'm doing."

Lachenmayer expects the company's business will eventually be evenly split between domestic and international clients. "Colorado is a great place to do business for what we're doing," he says, with its diverse energy industry and aggressive adoption of PACE. "Honestly, our biggest challenge is around staying focused and not getting distracted by all the different possibilities."

Renewable Energy Jobs

Colorado increased its solar power generation nearly tenfold between 2009 and 2014,⁷ and wind power now supplies about 16 percent of the state’s electricity,⁸ up from 1.5 percent in 2005.⁹ Accordingly, the booming renewable energy sector supplies more than a fifth of clean energy work, some 14,000 jobs. Most of those are in solar (6,939) and wind (6,456). The jobs include solar panel installers and wind turbine operators and mechanics. Solar and wind support jobs at more than 220 cleantech businesses in eastern Colorado alone.¹⁰

Biomass, low-impact hydroelectric and geothermal firms round out the remaining four percent of renewable energy employment, or roughly 600 jobs in total.

Quick Facts

14,000
renewable energy jobs in
Colorado

16%
of state's electricity supplied
by wind power

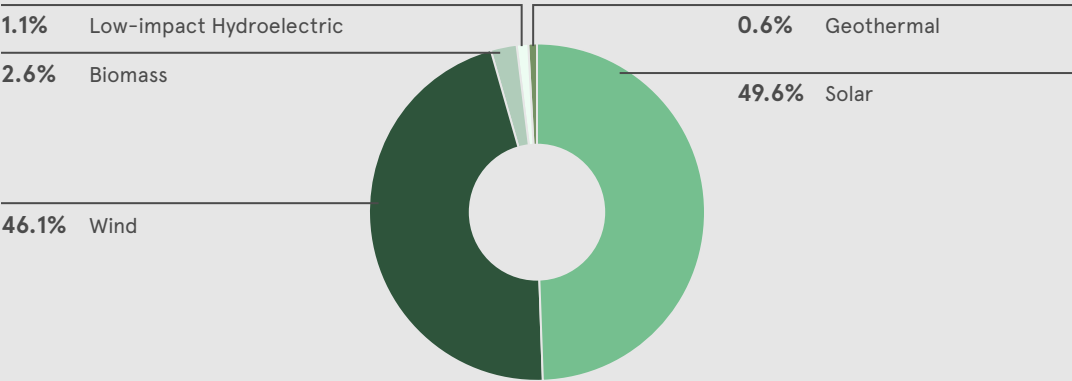


Fig. 7: Renewable energy jobs by sector

⁷ <http://www.eia.gov/state/?sid=CO>
⁸ <http://awea.files.cms-plus.com/FileDownloads/pdfs/Colorado.pdf>
⁹ <https://www.colorado.gov/pacific/energyoffice/wind>
¹⁰ <http://www.bizjournals.com/denver/news/2016/11/11/wind-and-solar-power-the-colorado-plains.html>

Golden West Wind Energy Project *Case Study*

In Calhan, Golden West Wind Energy Project helps revitalize rural Colorado



One of nearly 150 wind turbines at the Golden West Wind Energy Project. The wind farm is generating lease payments for landowner like Richard Wilson. (Photo courtesy of Richard Wilson)

OUT ON THE PLAINS, 35 miles northeast of Colorado Springs, the small community of Calhan is thriving. The persistent wind, which ranchers once cursed while feeding hay, is now breathing new life to the sleepy town. Nearly 150 wind turbines grace the farms and ranchland, bringing revenue to more than 100 landowners.

The 250 MW Golden West Wind Energy Project, owned by NextEra Energy, was more than 10 years in the making, and just began its second year of operation. Landowner and rancher, Richard Wilson,

supported the project from the beginning. He understood the lease revenue from the turbines would improve the economy of the entire community. There has been an increase in tax revenues for schools, libraries, the fire department and more, plus the lease payments have a multiplying effect—more money is being spent at local businesses. Farmers and ranchers who could barely afford to keep their land can now count on receiving steady income for decades.

There have been other benefits. The project added a dozen local, good-paying, permanent turbine maintenance jobs. During the six months of construction, the contractor, Blattner Energy worked with landowners and upgraded county roads. Instead of subdividing the land for housing, the area has been preserved for traditional farming and ranching—securing Colorado's rural quality of life for future generations. Wilson said his cattle freely roam among the wind turbines and even seek the shade they cast during hot summer days.

What was once a contentious town issue is now regarded as a positive. Wilson said renewable energy and diversifying our energy mix is extremely important—not only for Calhan, but for the state and the nation. As wind energy projects continue to be developed across Colorado, rural economies could realize increased employment, economic stability, low-cost renewable energy, and even cleaner air.



A typical, 250-megawatt wind farm like Golden West can support nearly 1,100 jobs across the supply chain, according to a 2012 report. (Photo courtesy of Richard Wilson)

Motor Vehicle Jobs

While alternative-fuel vehicles account for less than 3 percent of cars on the road in Colorado, even the most conservative forecasts predict the number of electric cars will jump at least 12-fold over the next 15 years.¹¹

Four transportation technologies support almost 2,500 jobs in the state: Hybrid vehicles, natural gas vehicles, plug-in electrics, and fuel cell cars. Hybrid and plug-in hybrid electric vehicle workers comprise about four in 10 workers, with another four in 10 jobs coming from nat-gas-powered cars. Hydrogen fuel has yet to make meaningful inroads, making up just four percent of clean-energy motor vehicle firms in the state.

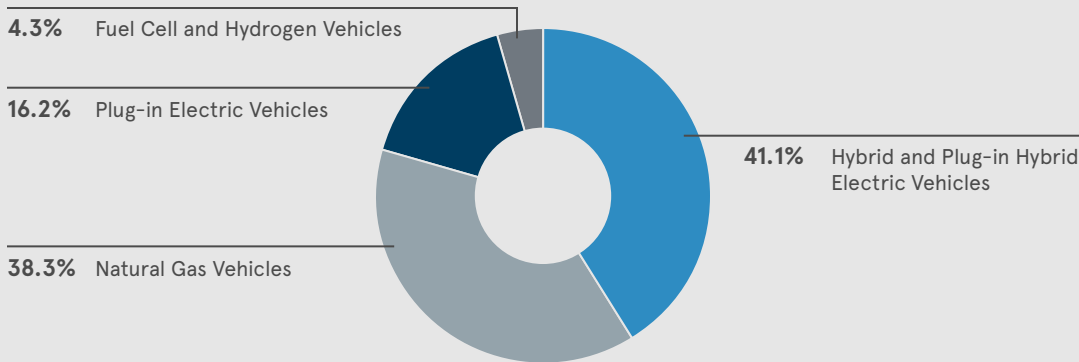


Fig. 8: Motor vehicle jobs by sector

Clean Fuels Jobs

The state's advanced biofuel sector is small but focused, with more than three-quarters of employment focused on corn ethanol and other non-woody biomass (2,390 workers). The remaining 695 jobs came from woody biomass—for example, trees laid to waste by the state's pine beetle infestation.¹² In total, the sector supports 3,085 clean energy workers.

Smart Grid and Advanced Storage

Clean transmission supports almost 2,200 jobs across the state. Fifty-nine percent of these employees (1,274) work with smart grid technologies, while 42 percent (904 workers) are in advanced storage technologies. National Car Charging, for example, is helping to expand electric vehicle charging stations in the City of Aurora, the University of Denver, and other places. About \$61 million in funds from the settlement with Volkswagen over its cheating on emissions should further boost EV infrastructure that's technically part of the grid.¹³

¹¹ P. 3, p. 14

¹² <http://aspenpublicradio.org/post/gypsum-biomass-plant-first-its-kind-state#stream/o>

¹³ https://www.e2.org/wp-content/uploads/2016/10/E2-CO-Clean-Energy-Future-Report_final-low-resolution.pdf

Other Key Findings

Of the vendors that serve Colorado's clean energy industry, nearly 60 percent are located outside the state, while almost two-thirds of the industry is focused on installing, maintaining, and repairing clean energy sources. The remaining third focuses on engineering, research and trade; manufacturing accounts for just 1 percent of the activity.

Most firms in the state (63 percent) serve primarily in-state customers, while about 31 percent are focused out-of-state and 5 percent operate internationally.

Small firms, hungry for talent, dominate the industry. Three-quarters of companies have fewer than 25 employees, and the majority (72 percent) report qualified labor is somewhat or very hard to find. However, schools like Echotech Institute, founded in 2010 and based in Aurora, help educate students seeking careers in fast-growing industries like wind and solar.

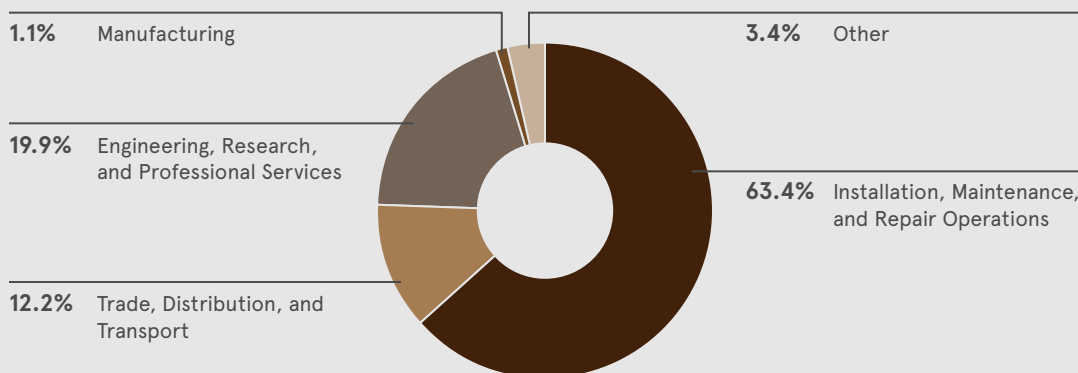


Fig. 9: Value chain activity

Policies Matter

Renewable Portfolio Standard

Colorado's electric grid remains predominantly reliant on coal, which supplies more than half the state's electricity, and natural gas, which provides 29 percent.¹⁴ But these are no longer the cheapest sources of energy, nor the ones providing the most jobs in the state when you factor in Colorado's high number of energy efficiency jobs. The Centennial State should continue to drive down its dependence on fossil fuels to achieve clean energy industry growth and clearer air.

As prices for wind and solar power continue to drop, Colorado has more reason than ever to build on its precedent-setting renewable energy portfolio standard, the nation's first to be approved by ballot initiative in 2004. The current standard requires investor owned utilities to produce 30 percent of their energy from renewable sources including wind, solar, hydropower, geothermal and biomass by 2020.

Quick Facts

~60%

of vendors serving CO are located out-of-state

3/4

of companies have fewer than 25 employees

72%

of employers say qualified labor hard to find

Quick Facts

30%

renewable energy required of investor-owned utilities to be produced by 2020

¹⁴ EIA <https://www.eia.gov/state/analysis.cfm?sid=CO>

In addition, the state has several tax credits and loan programs, with the aim to incentivize renewable energy generation. Colorado supplements these with other regulatory programs, to remove potential barriers to renewable energy generation. Some—like the Solar, Wind, and Energy Efficiency Easements and Rights Laws—prohibit restrictions on solar or wind production, while others require utilities to provide cost comparisons between photovoltaic systems and traditional power services.

Co-ops and municipal utilities have a lower target than investor-owned utilities under the current standard: 20 percent renewable energy by 2020 for large electric cooperatives, 10 percent for smaller entities. Yet this group delivers 41 percent of the state's power, leaving a significant gap in the number of power providers covered by the highest standard.

To add jobs and grow Colorado's economy, the state should increase its standard before the current one expires in three years.

Federal Investment Tax Credit

It's an opportune moment for Colorado to develop more renewable energy projects. The December 2015 extensions of the federal production and investment tax credits (PTC and ITC) provide the near-term certainty developers seek when securing renewable energy projects. Solar projects get a 30-percent rebate for the next three years before the rate drops to 10 percent in 2022, while the credit for wind steps down from 24 to 12 percent over three years before expiring.¹⁵

Efficiency Incentives

Colorado has several energy efficiency policies and programs, from building standards to consumer incentives for smart appliances, but it lags behind other states in many areas. The state ranked 14th in the American Council for an Energy Efficient Economy (ACEEE) 2016 scorecard, placing it just below the seventy-fifth percentile nationwide. New appliance standards for plumbing fixtures went into effect in September 2016, for example, but these improvements can be extended to building materials, lighting and HVAC fixtures. Energy efficiency standards established in 2007 drove a savings of nearly 2.6 billion kilowatt hours—enough to power 332,000 households—in 2015 alone. But efficiency targets are only defined up to 2020, while municipal utilities and electric cooperatives are entirely exempt from them.¹⁶

Commercial property owners now have new incentive to modernize their buildings with the state's implementation of C-PACE, the Commercial Property Assessed Clean Energy program. C-PACE allows owners to finance efficiency improvements and renewable energy additions, covering the up-front costs with repayment terms up to 20 years.¹⁷

41%

of state's power produced by co-ops and municipal utilities, but they face lower renewable production target

14th

ranking for Colorado in ACEEE 2016 scorecard

~2.6B

kWh savings in 2015 as a result of energy efficient standards

¹⁵ <http://energy.gov/savings/business-energy-investment-tax-credit-itc>

¹⁶ <http://www.swenergy.org/Data/Sites/1/media/documents/programs/utilities/dsm-factsheets/CO-DSM-fact-sheet-2016.pdf>

¹⁷ http://www.bizjournals.com/denver/blog/earth_to_power/2016/09/commercial-building-owners-have-a-new-way-to-pay.html

Transportation Incentives

The state offers up to \$6,000 in tax credits for buyers of alternative fuel cars, and sales of those cars are increasing. Now it has an opportunity to strengthen the economic and physical support for such vehicles. Colorado needs a more robust charging infrastructure, but current law prohibits investor-owned utilities, the most likely developers of such projects, from recovering costs for such infrastructure in their rates, which has discouraged them from investing in the network. To maximize the system benefits of EV charging,¹⁸ it should also encourage utilities to offer off-peak discounts for car charging.¹⁹

Businesses Respond to Stronger Policies

Robust clean energy policies at the federal and state level make a difference to Colorado's industry. Sixty-six percent of employers point to the renewable energy ITC as a contributor to business success, while 33 percent credit the state's renewable energy standard, followed by other general tax exemptions, credits, and rebates, at 16 percent.

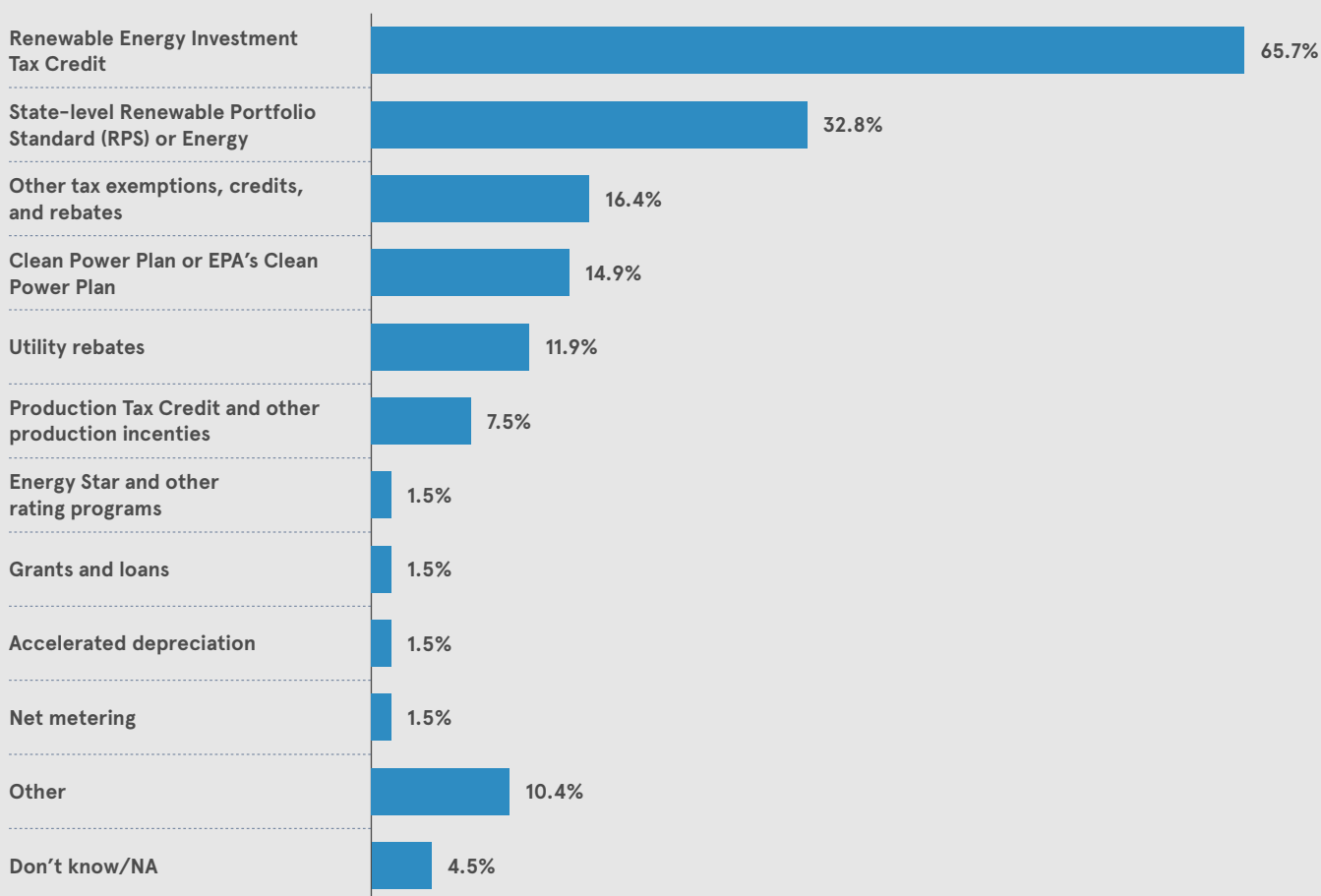


Fig. 10: Policies that have contributed to firm success

¹⁸ http://statebillinfo.com/bills/bills/12/1258_enr.pdf

¹⁹ <http://www.refuelcolorado.com/market-developments/clean-cities/colorados-relationship-electric-vehicles>

Conclusion

With ample sun and wind, a growing workforce, and a strong community of entrepreneurs and scientists, as well as the national experts at the National Renewable Energy Laboratory, the Colorado Renewable Energy Society, the Colorado Energy Research Collaboratory and other institutions, Colorado has the resources to grow its burgeoning clean energy economy even further. Now is the time to re-up the state's renewable energy standard, strengthen efficiency incentives and accelerate the market for electric cars by increasing charging infrastructure. With a clean energy job force that's already more than 60,000 workers strong, Colorado can expand its range of attractive, resilient employment by fully embracing its clean energy potential.

About the BW Research Energy Employment Index

Data for this year's report is derived from the comprehensive BW Research Energy Employment Index (EEI). The Index is the result of a rigorous survey effort of traditional and clean energy establishments across all 50 states, based in part on the methodology refined for the 2015 Rhode Island Clean Energy Industry Report. Final employment figures are extrapolated based on the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW, Q2). Though QCEW datasets track energy employment across traditional production, transmission, and distribution subsectors, the current structure of the North American Industry Classification System (NAICS) assigns a portion of the nation's energy and energy efficiency work into broad categories of non-energy specific industries, such as construction, wholesale trade, and professional services.

Identifying energy-related employment within these broad industry sectors is particularly important for understanding employment trends across emerging renewable energy and advanced fuel technologies and infrastructures, such as solar, wind, geothermal, biomass, storage, and smart grid. Since rising deployment of efficiency-related technologies has carved out new opportunities for firms in traditional trades to research, manufacture, or install energy efficient products and upgrades, parsing out this employment is especially useful to determine the level of job growth across the nation's energy efficiency subsectors. However, energy efficiency and other clean energy workers are not exactly captured through traditional NAICS alone. For example, a subset of semiconductor manufacturers produces solar panels, while others assemble computer components or medical equipment. Even though the NAICS classifications include a "solar electric generation" subsector, important elements of the solar value chain, such as research, installation, manufacturing, sales, and distribution are embedded within these other broad NAICS categories. While federal labor market data alone presents an incomplete picture of the clean energy workforce, inclusion of these additional manufacturing or construction industries in their entirety would result in exaggerated employment figures, while their exclusion underestimates the clean economy and its workforce.

The data in this report are neither a replacement of the existing BLS data series nor do we attempt to reclassify the current system of industry codes. The Energy Employment Index instead provides an additional layer of employment analysis and may be viewed as a filter that identifies and apportions energy-related jobs from within the broad NAICS classifications and into their respective clean energy or energy efficiency technologies and sub-technologies. The EEI methodology has been used across local, state, and federal energy-related data collection and analysis for nearly a decade, including The first annual Department of Energy's U.S. Energy and Jobs Report, The Solar Foundation's National Solar Job Census series, and other clean energy industry reports for the Commonwealth of Massachusetts, State of Rhode Island, and numerous other nonprofit agencies across the United States. Both the U.S. Departments of Labor and Energy have reviewed the methodology used for this supplemental survey.

The survey was conducted with a stratified sampling plan represented by industry code (NAICS), establishment size, and geography; these variables are used to determine the proportion of establishments across energy-related technologies and value chain activities. Data from the Index is applied to existing the existing QCEW series in order to filter the universe of potential clean energy establishments from industries such as manufacturing and construction and allocate jobs into their component renewable energy or energy efficient technologies.

The survey was administered by both telephone and web; Castleton Polling Institute conducted phone calls, while the web instrument was programmed internally. All respondents are given a unique ID in order to prevent duplication. In order to participate, respondents must pass a set of screener questions that determine their involvement in the clean energy economy based on technology and employee time dedicated to the clean energy portion of business.

A clean energy firm is defined as being directly involved in the research, development, production, manufacture, installation, sale, or distribution of goods and services related to renewable energy and energy efficiency, including clean fuels and transportation; firms engaged in services

such as consulting, finance, tax, and legal services that support the clean economy are also included in this report.

The sample is split into two categories, referred to as the known and unknown universes; these are treated entirely separate until the employment figures from each are added together to produce final clean energy employment. The unknown universe encompasses the entire range of NAICS codes that could potentially support clean energy workers – agriculture, mining, utilities, construction, manufacturing, wholesale trade, professional services, repair, and maintenance. The known universe is comprised of establishments previously identified as energy-related, either with prior research or through industry associations and government programs. These establishments and their associated employment totals are removed from the unknown universe for both sampling and final employment extrapolations.

The distribution of QCEW establishments within potential energy-related industries was carefully analyzed in order to develop representative sampling clusters for the unknown universe. Incidence rates are developed based off employer responses from the unknown universe – the propensity of

firms that report they are involved in clean energy work is applied to the QCEW dataset to derive final clean energy establishment and employment totals.

For the transport of clean vehicle parts and supplies, this report utilizes a methodology developed by the Department of Energy and the National Renewable Energy Laboratory. Employment related to clean vehicle transport via truck, rail, air, and water was calculated by dividing the value of commodity shipments by the total commodity value for each state. The proportional value of clean vehicle transport was applied to QCEW employment totals for truck, water, air, and rail transportation.

As with previous studies, this report excludes any employment in the retail trade NAICS codes – fuel dealers, motor vehicle dealership, appliance and hardware stores, and other retail establishments. The survey was administered between September 15, 2015 and November 24, 2015 and averaged 14 minutes in length. A total of 548 establishments took the survey and the margin of error at the 95% level of confidence for energy establishments in Colorado is +/- 4.13%.



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