

Industry Overview

Colorado's balanced energy economy is attributable to a wealth of fossil fuels and renewable energy resources. The state's diverse geography and geology include substantial deposits of coal, natural gas, and petroleum. Renewable resources, including an abundance of solar and wind, support Colorado's position as a leader in renewable energy generation.

Electric power generation in the state is provided based on location by either two investor owned utilities (IOUs), 29 municipal providers, or one of the 22 rural cooperatives. Colorado has one major refinery located in the nine-county Metro Denver and Northern Colorado region¹ that produces gasoline, diesel, and asphalt.



Colorado's progressive energy policy positions, such as a requirement for the state's largest utility to make the transition from coal-fired generation to cleaner burning forms of generation, have facilitated the expansion of natural gas development and renewable energy. Voters led the charge to the first renewable energy standard for the state in 2004, which has been updated three times. Currently, the state's IOUs must generate 30 percent of their power from renewables by 2020 and cooperatives or municipals must meet a 10 to 20 percent mix of renewables dependent on their size. As a result, significant renewable energy projects have come online in the last several years. Wind is the fastest growing energy resource on the grid and is the predominant renewable resource in Colorado, with over 3,029 megawatts (MW) of installed capacity. The state has a mature solar industry that includes a mix of utility-scale generation, community solar gardens, and distributed generation at customer locations. In 2017, about 19 percent of the power generation in the state was from renewable resources, 27 percent from natural gas, and 54 percent from coal-fired generation.

The diversity of energy resources also support the state's world-class hub for energy research and technology innovation at universities, energy incubators, and federal facilities. With 33 federally funded laboratories, Colorado has one of the highest per-capita concentrations of federally funded research facilities in the nation.

The state's energy industry is a significant source of economic activity in Colorado. Combined, the 66,820 direct energy workers earning \$6.5 billion in the state support an additional 194,060 indirect workers earning \$7.5 billion in all industries throughout the state. In total, the energy industry in Colorado supports 260,880 workers in all industries earning \$14 billion annually.

Cluster Definition and Methodology

This report evaluates Colorado's energy industry in two subclusters: (1) cleantech and (2) fossil fuels. The fossil fuels subcluster includes companies involved in the extraction of naturally occurring fuels used to produce energy as well as the generation, transmission, and distribution of energy resources. The cleantech subcluster includes companies developing and delivering products and technologies across solar, wind, biomass, and sustainable transportation sectors that improve operational performance, efficiency, or productivity, while reducing energy costs and energy consumption.

It is often difficult to distinguish how an organization's operations are divided between fossil fuels and cleantech components. For example, research is a critical component of all energy industries, from oil and gas to solar and wind energy. So that the two subclusters may be analyzed independently, all energy research entities are included in the cleantech subcluster while all energy transmission and distribution activities are included in the fossil fuels subcluster, even though a portion of the energy may be coming from renewable resources.

¹ The nine-county region is comprised of two principal areas, Metro Denver and Northern Colorado. Metro Denver consists of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson counties. Northern Colorado consists of Larimer and Weld counties.

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Cleantech Economic Profile

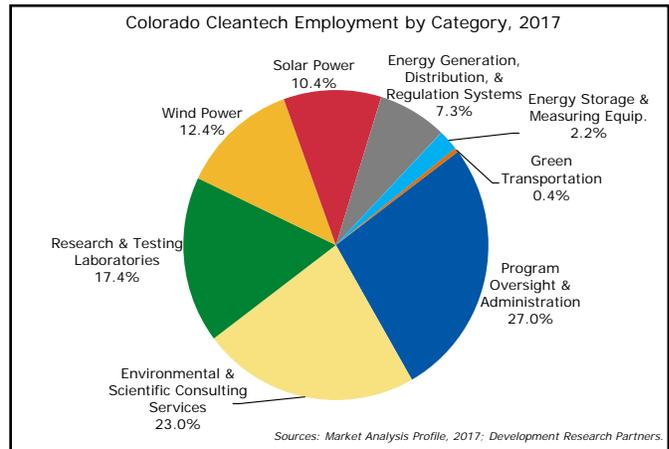
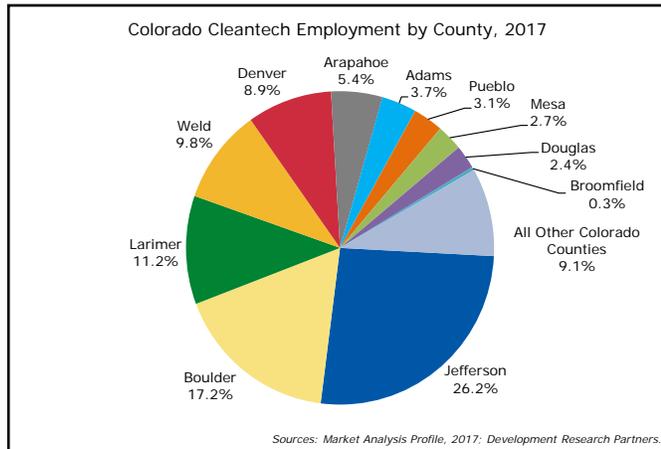
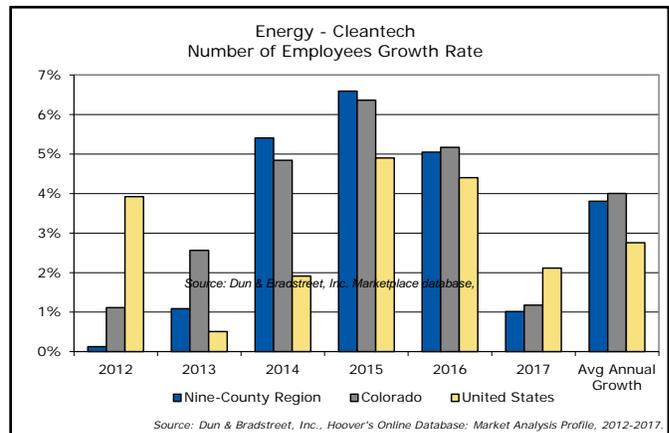
The cleantech industry, for purposes of this subcluster, includes companies that produce energy from wind, solar, biomass, fuel cells, and hydroelectric resources. It also includes manufacturers of renewable energy equipment, battery storage, and businesses that provide engineering and other support services. Energy research companies that provide laboratory testing, scientific and technical consulting services, and institutional research related to the environment, natural resources, and energy are included as well. The cleantech subcluster consists of 29, six-digit North American Industry Classification System (NAICS) codes.

Rankings²

Nine-County Region	
Cleantech direct employment concentration rank	6th
Cleantech direct employment rank	6th
Colorado	
Cleantech direct employment concentration rank	4th
Cleantech direct employment rank	9th

Cleantech Employment and Company Profile, 2017			
	Nine-County Region	Colorado	United States
Direct employment, 2017	22,440	26,400	885,930
Number of direct companies, 2017	1,620	2,140	59,240
One-year direct employment growth, 2016-2017	1.0%	1.2%	2.1%
Five-year direct employment growth, 2012-2017	20.5%	21.7%	14.6%
Avg. annual direct employment growth, 2012-2017	3.8%	4.0%	2.8%
Direct employment concentration	1.0%	0.8%	0.5%

Sources: Dun & Bradstreet, Inc., Hoover's Online Database; Market Analysis Profile, 2012-2017; Development Research Partners.



² Direct employment rank based on the number of employees in the industry cluster in a state or region. Employment concentration rank based on the direct cluster employment in a state or region expressed as a percent of total employment in all industries in the same state or region. Rankings are for the 50 largest metropolitan statistical areas (MSAs) and 50 largest states. No multiplier effects are included. 1st = highest for both rankings.

Cleantech Overview

Colorado is a leader in cleantech employment, R&D, and investment. The national laboratories and university resources create new opportunities in energy efficiency and renewable energy that allow for cleaner and more efficient use of energy. Companies in the cleantech subcluster create jobs, fuel economic growth, and stimulate innovation and technology development.

Cleantech Company Announcements

General Cleantech

- The **National Renewable Energy Laboratory (NREL)**, **Xcel Energy**, **Panasonic Enterprise Solutions**, **LC Fulenwider Inc.**, and **Denver International Airport (DEN)** partnered to develop the 382-acre Peña Station NEXT as a transit-oriented, carbon neutral community between the airport and downtown on the Regional Transportation District's light rail line. The initiative leverages innovative technologies including renewable energy, battery storage, carbon capture, and grid modeling capabilities. The cost-effective, net-zero development infrastructure could be replicated and adopted across the U.S. in future developments.
- **United Power** and **SoCore Energy** plan to build the state's largest commercial-scale energy storage system in Firestone. The 4-MW/16-MWh battery storage system will help curb peak demand to reduce costs and improve overall efficiency for more than 82,000 meters.
- **The Wells Fargo Foundation** added **\$20 million to NREL's Innovation Incubator** to grow and sustain cleantech startups, and expand to other vertical markets. The Incubator provides a grant of up to \$250,000 to help cleantech startup companies improve their technology and test their various products at Wells Fargo buildings.
- **AMP Robotics** was selected as a finalist in The Ecolab Award for Circular Economy Tech Disruptor. The Circulars, an initiative of the World Economic Forum and the Forum of Young Global Leaders, is the world's premier circular economy award program. The Circulars event will be held at the World Economic Forum Annual Meeting in Davos, January 2018. AMP Robotics was formed with the goal of bringing artificial intelligence and robotics to the recycling industry to fundamentally change the costs of recycling. They have successfully developed a new kind of sorting technology for recycling facilities called the [Cortex robot](#).
- Louisville-based, **Solid Power**, a leading developer of solid-state rechargeable batteries, announced a partnership with BMW to develop next generation electric vehicle batteries. The BMW Group will assist Solid Power in advancing its technology in order to achieve production levels required for high-performance electric vehicles. Established in 2012 as a spin-out company from the University of Colorado Boulder, Solid Power is focused on developing and scaling competitive solid-state batteries, paying special attention to safety, performance, and cost.

Solar Energy

- Boulder-based **Namasté Solar Inc.** raised \$3.1 million from more than 91 investors, the second-largest amount ever raised by an employee-owned cooperative in the U.S. The company relocated to larger space to accommodate growth and is the leading solar installer in the state.
- Utah-based **Vivint Solar Inc.** opened a new sales office in Centennial to service the Metro Denver region. Vivint is a leading full-service residential solar provider offering integrated residential solar solutions for the entire customer lifecycle. Through an exclusive collaboration with Mercedes-Benz Energy in the U.S., Vivint offers solar plus storage systems with batteries from Mercedes-Benz.
- Fort Collins-based **Ampt** raised \$15 million in new funding to expand the company's product portfolio and accelerate global growth, which brings their total investment to over \$50 million. The company provides power conversion technology for solar power plant optimization.
- **Renewable Energy Systems (RES)** completed construction of the 3 MW Penitente Solar Project in Saguache County providing power to the San Luis Valley Rural Electric Cooperative. RES has constructed over 370 MW of renewable energy projects in Colorado.
- Weld County is the site of several utility-scale solar farms.
 - The 30-acre Platte Valley Solar Farm in Kersey provides power for the **Poudre Valley Rural Electric Association**. The 3.5-MW project constructed by **Silicon Ranch Corporation** generates enough power to support 600 homes.
 - The 16-MW Platteville Solar Farm began operating in late 2017 as the largest cooperative solar farm in the state. It was constructed and is owned and operated by **Silicon Ranch**

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Corporation. The 175-acre farm will supply power to about 3,000 of **United Power's** customers.

- The **Poudre Valley Rural Electric Association** partnered with Denver-based **GRID Alternatives Colorado** and the **Colorado Energy Office** to construct a 9-acre community solar farm with portions designated for low-income households and nonprofit organizations. Approximately 35 percent of the 1.95-MW Coyote Ridge Community Solar Farm will be dedicated to members whose household income is at or below 80 percent of the median income in Larimer County.
- Denver hosted the **2017 DOE Solar Decathlon** competition which attracted over 60,000 visitors. The international contest challenges collegiate teams to design, build, and operate solar-powered houses that are cost-effective, energy-efficient, and attractive. Eleven finalists reconstructed their full-size homes for judges and the public to visit.
- Denver-based **RGS Energy Inc.** signed a licensing deal for The Dow Chemical Co.'s Powerhouse solar-shingle system, which has been deployed on 1,000 homes. RGS will lead all commercial activities for the product, including supply-chain management, marketing, sales, installation, and warranty.
- **Ascent Solar Technologies, Inc.** headquartered in Thornton, closed a private placement of \$1.7 million of new investment. Ascent is the developer and manufacturer of state-of-the-art, flexible thin-film photovoltaic (PV) solutions.
- As part of Xcel's Solar*Rewards program, **NextEra Energy Resources** will install a 6 MW solar array at the IBM facility in Boulder. It will be Boulder's largest solar project covering 54 acres of IBM's site.

Wind Energy

- Construction is underway at **Xcel Energy's** 600-MW **Rush Creek Wind Project** and 83-mile transmission line in eastern Colorado. The \$1.1 billion project will include 300 Vestas wind turbines and would be the state's largest wind farm, which is slated for completion in late 2018.
- Denmark-based **PolyTech Wind Power Technology Inc.** leased 20,323 square feet of warehouse space in Greeley. The company will use the space to store components for wind turbine blades shipped to the U.S. before distributing them to Vestas Wind Systems' plants in Windsor and Brighton.
- **Black Hills Energy** constructed a 34-turbine, 60-MW wind power station near Walsenburg. The **Peak View Wind Project** will supply enough power for 28,000 homes.
- **Vestas Wind Systems**, which employs about 3,500 people at its four Colorado factories, led the nation in wind turbine orders for the first half of 2017. Globally, the company broke its previous record for equipment with 10,595 MW of order intake for 2017. In the first half of 2017, Vestas' Colorado operations [were boosted by February order](#) for 174 wind turbines that will be made in Colorado. The Danish corporation said the 174 turbines will produce 348 megawatts of energy. In 2016, Colorado ranked 4th in the nation for wind employment with 17 manufacturing facilities producing a variety of components for the wind industry.

Biomass

- **Colorado State University** received a three-year, \$3.5 million U.S. Department of Energy grant to improve the way algae-based biofuels and bioproducts are manufactured. The project goal will be to double the yield of biofuel precursors from algae.

Green Transportation

- Loveland-based **Lightning Systems**, formerly Lightning Hybrids, moved to a larger headquarters facility at the Rocky Mountain Center for Innovation and Technology. The 45,000-square-foot space will accommodate new product development, increased production, and additional staff.
- **Ford Motor Company** selected Lightning Systems and Longmont-based **UQM Technologies** to participate in the Advanced Fuel Qualified Vehicle Modifier (eQVM) program. UQM will provide eQVM with its electric motors and components and Lightning will provide a product that converts a gasoline engine to an all-electric vehicle.
- Louisville-based **Solid Power Inc.** partnered with **BMW Group** to make solid-state batteries for electric vehicles. BMW will help Solid Power advance its technologies to create batteries for high-performance vehicles with increased driving range a longer shelf-life that can withstand higher temperatures.
- **EasyMile**, a French manufacturer of driverless shuttles, opened its U.S. headquarters and a warehouse at the Panasonic campus near DEN.

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Major Cleantech Companies

Battery Storage

- Nikola Power
www.nikolapower.com
- Solid Power
www.solidpowerbattery.com

Energy Efficiency

- GE
www.ge.com
- Woodward
www.woodward.com

Engineering & Technical Services

- AECOM
www.aecom.com
- ARCADIS
www.arcadis.com
- Chicago Bridge & Iron
www.cbi.com
- TestAmerica Laboratories
www.testamericainc.com
- Tetra Tech
www.tetrattech.com

Solar

- Abengoa Solar
www.abengoasolar.com
- Ascent Solar Technologies, Inc.
www.ascentsolar.com
- Namasté Solar
www.namastesolar.com
- SolarCity
www.solarcity.com

Wind

- Aluwind
www.aluwind.com
- Senvion USA Corp.
www.repower.com
- Vestas
www.vestas.com

Major Renewable Energy Government and Research Facilities

- Colorado Energy Office
www.colorado.gov/energyoffice
- Colorado Energy Research Collaboratory
www.coloradocollaboratory.org
- Colorado Energy Research Institute
www.ceri-mines.org
- JILA
www.jila.colorado.edu
- National Center for Atmospheric Research
www.ncar.ucar.edu
- National Institute of Standards & Technology
www.nist.gov
- National Oceanic & Atmospheric Administration
www.noaa.gov
- National Renewable Energy Laboratory
www.nrel.gov
- U.S. Bureau of Reclamation
www.usbr.gov
- U.S. Dept. of Energy, Golden Field Office
www.energy.gov/eere
- U.S. Environmental Protection Agency
www.epa.gov
- U.S. Geological Survey
www.usgs.gov
- Western Area Power Administration
www.wapa.gov

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Fossil Fuels Economic Profile

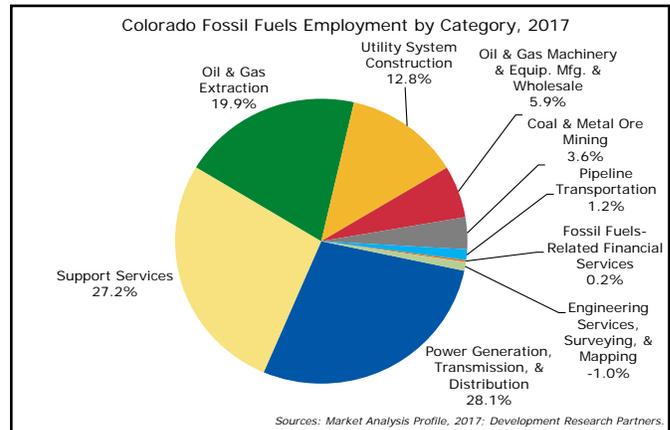
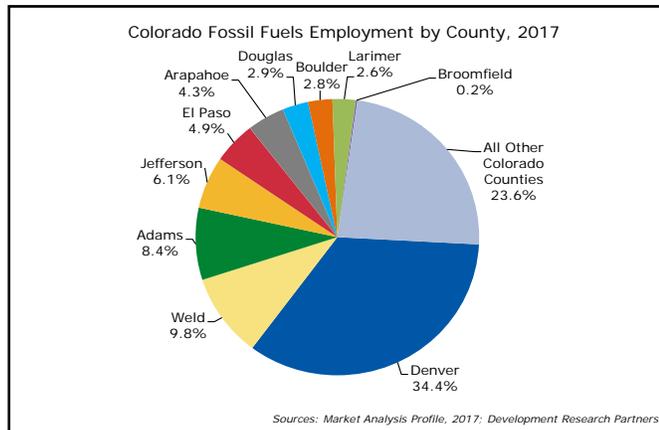
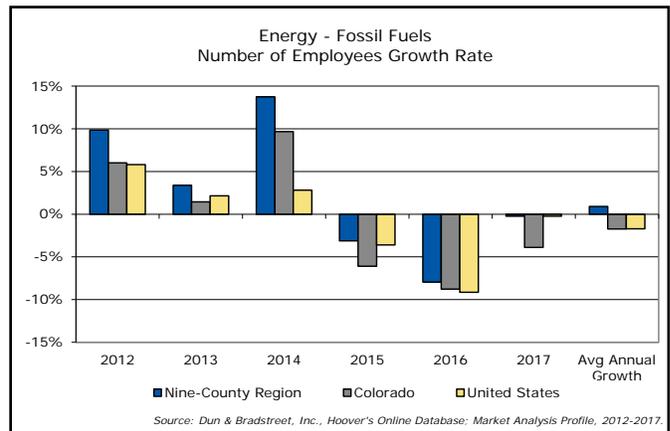
The fossil fuels subcluster includes companies that extract naturally occurring mineral liquids, gases, and solids used to produce energy. The fossil fuels subcluster also includes mining machinery manufacturers and companies that provide mining, exploration, and related support services. Companies providing generation, transmission, and distribution of energy resources are also included. The fossil fuels subcluster consists of 29, six-digit North American Industry Classification System (NAICS) codes.

Rankings³

Nine-County Region	
Fossil fuels direct employment concentration rank	9th
Fossil fuels direct employment rank	5th
Colorado	
Fossil fuels direct employment concentration rank	9th
Fossil fuels direct employment rank	9th

Fossil Fuels Employment and Company Profile, 2017			
	Nine-County Region	Colorado	United States
Direct employment, 2017	28,840	40,420	1,628,100
Number of direct companies, 2017	1,860	2,610	72,210
One-year direct employment growth, 2016-2017	-0.2%	-3.9%	-0.2%
Five-year direct employment growth, 2012-2017	4.6%	-8.4%	-8.2%
Avg. annual direct employment growth, 2012-2017	0.9%	-1.7%	-1.7%
Direct employment concentration	1.2%	1.3%	0.9%

Sources: Dun & Bradstreet, Inc., Hoover's Online Database; Market Analysis Profile, 2012-2017; Development Research Partners.



³ Direct employment rank based on the number of employees in the industry cluster in a state or region. Employment concentration rank based on the direct cluster employment in a state or region expressed as a percent of total employment in all industries in the same state or region. Rankings are for the 50 largest metropolitan statistical areas (MSAs) and 50 largest states. No multiplier effects are included. 1st = highest for both rankings.

Fossil Fuels Overview

Fossil fuels play an integral role in Colorado's economy, offering significant deposits of coal, natural gas, and petroleum. While many fossil fuel companies conduct business operations from the Metro Denver region, the majority of the drilling is concentrated along the Western Slope of the Rocky Mountains and in the Northeastern Weld County. Colorado's active wells totaled nearly 55,160 in 2017, with about 64 percent of total active wells located in Weld and Garfield counties.

Colorado continues to recover from the oil and gas downturn, record low prices, and ongoing policy challenges in the fossil fuels industry. These challenges have continued to improve prospects for the use of directional drilling and hydraulic fracturing technologies. Primary oil producing basins—the Niobrara shale formation in the Denver-Julesburg (DJ) Basin and the Piceance Basin—have led to substantial new production, job creation, technology deployment, and growing export possibilities. Further, state and local governments benefit from taxes on energy production. According to the Colorado Office of State Planning and Budgeting, severance tax collections increased slightly to \$19.5 million in fiscal year 2016-17, after \$18.9 million in revenue was collected in fiscal year 2015-16.

Northwestern Colorado overlays part of the Green River oil shale, a kerogen-rich formation that, by some estimates, could be the world's largest crude oil resource. Colorado has one petroleum refinery in Commerce City near Denver. Recent upgrades enable the refinery to process more crude oil from Colorado producers. Colorado is among the major natural gas-producing states in the nation and the state holds substantial estimated recoverable coal reserves, including bituminous, subbituminous, and lignite coals. Coal mining is currently focused in the Green River, Piceance, and San Juan Basins.

Fossil Fuels Company Announcements

- **Colorado's oil and gas industry contributed nearly \$31.4 billion** to the state's economy in 2015, according to PricewaterhouseCoopers. Oil and gas jobs across the state accounted for nearly 7 percent of total state employment and school districts received nearly \$202 million from companies paying property taxes in the state.
- **BP Lower 48** is moving their headquarters from Houston to downtown Denver. The company anticipates the office will open with at least 200 employees in early 2018, with more staff to be added later. The new office will improve access to key fossil fuel producing basins in the region and will create a strategic platform for growth. In early 2015, BP began operating its U.S. Lower 48 business as a separate business, with its own governance, processes, and systems.
- **Noble Energy Inc.** will shift about 100 workers from its Denver office to Greeley and Houston as a result of company restructuring and efficiency measures. Noble planned to invest more than \$850 million in the DJ Basin in 2017, which accounts for about 47 percent of the company's \$1.8 billion budget for U.S. onshore operations.
- **Xcel Energy** will invest \$612 million over the next six years to equip homes and businesses in Colorado with smart meters to allow customers to closely track their energy usage. The upgrades will also include equipment to control voltage on Xcel's system, saving about 2 percent of the electricity now sold that goes to waste.
- **Encana Corp.** renewed its lease for 335,000 square feet in Republic Plaza in downtown Denver until 2026. Encana's Denver office manages its U.S. operations in Texas and in the natural gas fields of the Piceance Basin in western Colorado.
- **Tallgrass Energy Partners** and **Saddle Butte Pipeline** partnered to develop a new oil terminal in Platteville. The Tallgrass Grasslands Oil Terminal Complex will interconnect with Saddle Butte's DJ Basin crude oil gathering system to ultimately move at least 80,000 barrels of crude oil per day by mid-2018.
- **Williams** is constructing a new natural gas liquids pipeline in Parachute. The 2,000-foot pipeline will connect to the company's nearby gas processing plant.
- **Anadarko Petroleum Corp.** planned to invest \$950 million in the DJ Basin in 2018 and will operate five drilling rigs and three fracking crews. Using new technology, the company boosted the amount of oil, natural gas, and liquids it could extract from the DJ Basin by over 30 percent to more than 2 billion barrels of oil equivalent.
- **United Power** purchased a 130,117-square-foot facility in Longmont to expand its administrative, service, and maintenance capabilities. The building will allow the company to centrally locate these functions with quick access to highways.

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- Denver-based **Extraction Oil & Gas Inc.** will build a pipeline to transport oil out of the Triple Creek drilling site in Greeley. Drilling on the 22-well site began in December 2016, with oil expected to start flowing from the wells in early 2018. The company expects to invest up to \$840 million in Colorado in 2018.
- **Ursa Resources** plans to drill over 55 wells in its second phase of oil and gas development in Battlement Mesa. The first phase included drilling 50 wells in early 2017.
- Late in 2017, Noble Midstream Partners, the pipeline unit of Noble Energy, announced a joint venture with **Greenfield Midstream** to buy Colorado's **Saddle Butte Pipeline** for \$625 million.
- **PDC Energy Inc.** plans to invest \$480 million in the Wattenberg Field in 2018. The company plans to drill 131 new wells, using three drilling rigs and will begin producing oil and gas at 139 wells in the area.
- The Bureau of Land Management approved expansions of **GCC Energy LLC's** King II coal mine near Hesperus and the West Elk coal mine in Somerset. King II's lease will expand by up to 950 acres, which will extend the mine's active life by an estimated 5 to 7 years. West Elk's lease modifications totaled 1,721 acres, gaining access to 10.1 million tons of additional coal.

Merger and Acquisition Activity

- Denver-based **DCP Midstream Partners LP** acquired the assets of a joint venture between **Phillips 66** and **Spectra Energy Corp.** to create the largest natural gas liquids producer and gas processor in the U.S. The \$11 billion combined company will be renamed **DCP Midstream LP** and will help simplify its corporate structure and expand its projects in key U.S. producing basins, including the DJ Basin.
- Denver's **Caerus Oil and Gas LLC** purchased \$735 million of **Encana Corp.'s** natural gas assets in the Piceance Basin. With the acquisition, Caerus has more than 800 wells that are spread across more than 500,000 acres of mineral rights. The wells involved in the purchase produced an average 240 million cubic feet per day of natural gas plus 2,178 barrels per day of associated liquids (such as butane and propane) during the first quarter of 2017.
- **Hilcorp San Juan L.P.** acquired **ConocoPhillips** oil and gas assets in the San Juan Basin, totaling 1.3 million acres. The \$2.5 billion deal will support Hilcorp's goal to increase production in southwestern Colorado.
- **Noble Energy** divested approximately 30,200 net acres from the company's non-core DJ Basin acreage in Weld County to **SRC Energy Inc.** The \$608 million transaction is anticipated to close on two separate dates, with acreage and non-operated production included in the initial closing by the end of 2017, followed by a second closing for operated producing properties by mid-2018.

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Major Fossil Fuels Companies

Infrastructure

- Kinder Morgan
www.kindermorgan.com
- Northern Pipeline Construction
www.gonpl.com
- Q3 Contracting
www.q3contracting.com

Oil & Gas Extraction

- Anadarko Petroleum Corporation
www.anadarko.com
- Encana Corporation
www.encana.com
- Noble Energy, Inc.
www.nblenergy.com
- Suncor Energy Inc.
www.suncor.com

Oil & Gas Field Services

- Halliburton
www.halliburton.com
- Schlumberger Ltd.
www.slb.com
- Superior Energy Services Co.
www.superiorenergy.com

Power Generation & Transmission

- Black Hills Corporation
www.blackhillscorp.com
- Colorado Springs Utilities
www.csu.org
- Intermountain Rural Electric Association
www.irea.coop
- Tri-State Generation & Transmission Assoc.
www.tristategt.org
- United Power
www.unitedpower.com
- Xcel Energy
www.xcelenergy.com

Industry Affiliates, Associations, & Partnerships

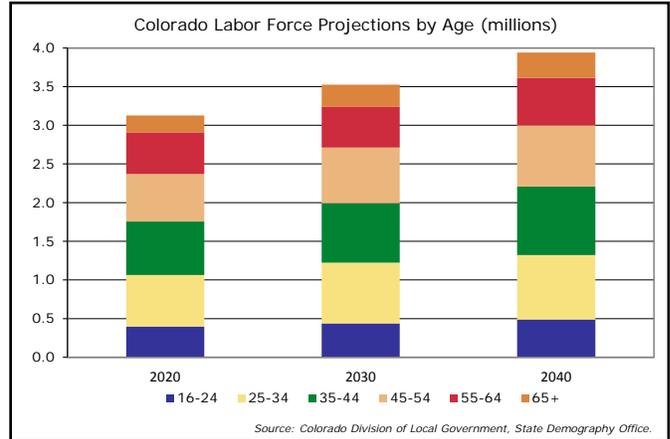
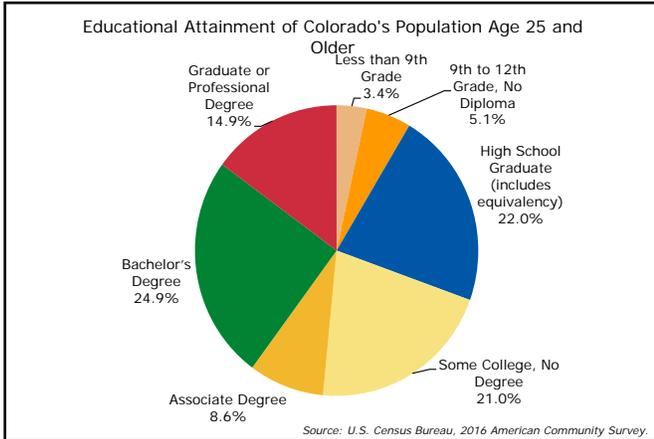


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Colorado Workforce

- Nearly half of the state's 5.6 million residents are under the age of 35.
- Of Colorado's adult population, 39.9 percent are college graduates and 91.4 percent have graduated from high school.
- The state's population is expected to grow 31.6 percent from 2020 to 2040, driving a 26 percent increase in the state's labor force over the same period.

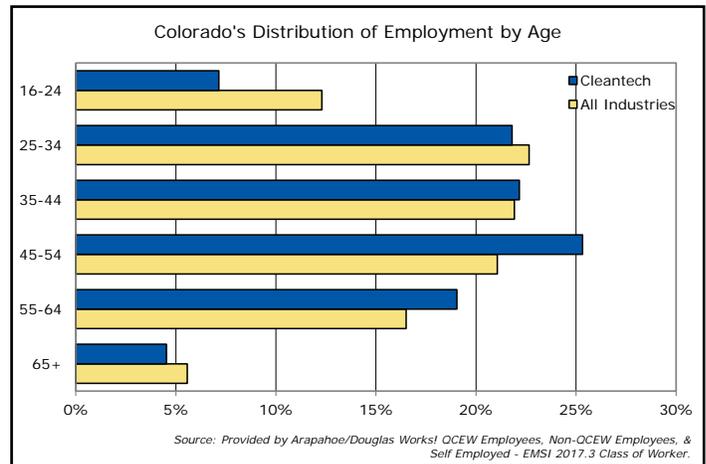


Energy Workforce Profile

Cleantech Workforce Profile

The subcluster has a larger share of employees that are between the ages of 35 and 64 years old (66.5 percent), compared with the age distribution of all industries across the state (59.5 percent).

The Occupation & Salary Profile below includes the 10 largest cleantech occupations in the state. For these 10 largest occupations, the chart details the total number of workers employed in that occupation across all industries, the number of available applicants that would like to be working in that occupation, the number of recent graduates that are qualified for that occupation, and the median and sample percentile annual salaries.



Wages

- 2016 average annual salary was \$81,110, compared with the national average of \$79,480.
- Cleantech payroll reached more than \$2.1 billion in 2016.

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Colorado Cleantech Occupation & Salary Profile, 2017

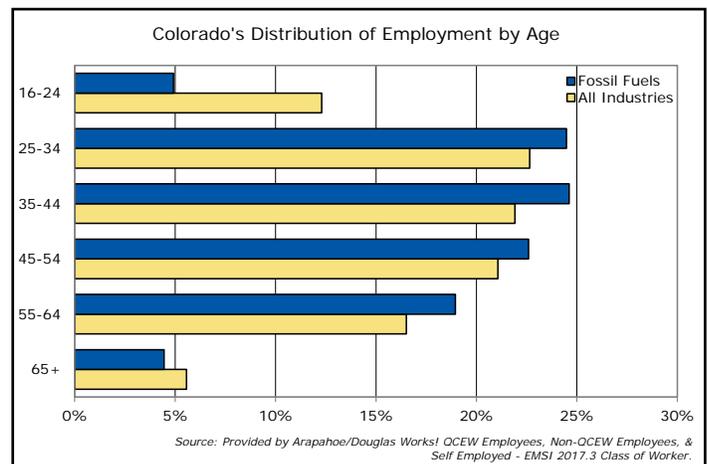
10 Largest Cleantech Occupations in Colorado	Total Working Across All Industries (2017)	Number of Available Applicants (2017)	Number of Graduates (2016)	Median Salary	10th Percentile Salary	25th Percentile Salary	75th Percentile Salary	90th Percentile Salary
1. Electricians	18,363	451	300	\$47,684	\$29,565	\$35,058	\$60,456	\$73,478
2. Business operations specialists, all other	42,109	1,035	21	\$73,904	\$41,931	\$54,939	\$97,753	\$125,027
3. Engineers	43,594	1,071	4,594	\$94,765	\$61,069	\$73,757	\$123,906	\$154,149
4. Plumbers, pipefitters, & steamfitters	10,089	248	138	\$45,912	\$29,993	\$34,943	\$58,433	\$70,845
5. Office clerks, general	55,044	1,353	0	\$35,824	\$21,080	\$27,323	\$47,210	\$60,879
6. Secretaries & administrative assistants, except legal, medical, & executive	59,368	1,459	100	\$36,039	\$22,260	\$28,683	\$45,059	\$53,952
7. Physical scientists	11,360	279	1,562	\$89,648	\$49,837	\$65,978	\$119,434	\$151,133
8. Heating, air conditioning, & refrigeration mechanics & installers	5,964	147	255	\$51,892	\$30,809	\$37,181	\$62,427	\$75,166
9. Information & record clerks, all other	9,396	231	0	\$40,726	\$26,915	\$33,488	\$49,088	\$58,698
10. Life, physical, & social science technicians	8,793	216	953	\$44,283	\$28,226	\$33,530	\$57,574	\$73,029

Notes: The number of available applicants is a point-in-time measurement of the number of people who have registered in Colorado's workforce development system's statewide database, Connecting Colorado, as being able and available to work in a particular occupation. Results should be interpreted with caution since registration in Connecting Colorado is self-reported. In addition, the skills rubric may assign up to four occupation codes for each registrant. Therefore, the number of available applicants could be inflated. *Source: Provided by Arapahoe/Douglas Works!; OCEW Employees, Non-OCEW Employees, & Self Employed - EMSI 2017.3 Class of Worker.*

Fossil Fuels Workforce Profile

The subcluster has a larger share of employees that are between the ages of 25 and 64 years old (90.6 percent), compared with the age distribution across all industries (82.1 percent).

The Occupation & Salary Profile below includes the 10 largest fossil fuels occupations in the state. For these 10 largest occupations, the chart details the total number of workers employed in that occupation across all industries, the number of available applicants that would like to be working in that occupation, the number of recent graduates that are qualified for that occupation, and the median and sample percentile annual salaries.



Wages

- Wages in the fossil fuels subcluster are among the highest across all industry clusters.
- 2016 average annual salary was \$103,780, compared with the national average of \$101,890.
- Fossil fuels payroll reached nearly \$4.4 billion in 2016.

ENERGY:

Colorado and Metro Denver and Northern Colorado Industry Cluster

Colorado Fossil Fuels Occupation & Salary Profile, 2017

10 Largest Fossil Fuels Occupations in Colorado	Total Working Across All Industries (2017)	Number of Available Applicants (2017)	Number of Graduates (2016)	Median Salary	10th Percentile Salary	25th Percentile Salary	75th Percentile Salary	90th Percentile Salary
1. Civil engineers	9,175	225	448	\$81,419	\$53,342	\$64,869	\$103,632	\$127,993
2. Roustabouts, oil & gas	2,519	62	1	\$38,382	\$28,544	\$33,041	\$51,702	\$61,088
3. Electrical power-line installers & repairers	2,614	64	125	\$71,282	\$36,059	\$49,424	\$87,710	\$97,703
4. Construction laborers	29,659	729	17	\$30,697	\$22,412	\$26,641	\$37,196	\$44,451
5. Mechanical engineers	5,661	139	930	\$86,236	\$56,440	\$69,475	\$114,212	\$151,552
6. Business operations specialists, all other	42,109	1,035	21	\$73,904	\$41,931	\$54,939	\$97,753	\$125,027
7. General & operations managers	44,197	1,086	9,896	\$107,271	\$45,133	\$67,357	\$166,721	\$247,434
8. Secretaries & administrative assistants, except legal, medical, & executive	59,368	1,459	100	\$36,039	\$22,260	\$28,683	\$45,059	\$53,952
9. First-line supervisors of construction trades & extraction workers	16,063	395	612	\$62,220	\$35,947	\$46,748	\$77,900	\$96,420
10. Accountants & auditors	38,920	957	1,485	\$66,998	\$42,630	\$52,694	\$89,535	\$117,912

Notes: The number of available applicants is a point-in-time measurement of the number of people who have registered in Colorado's workforce development system's statewide database, Connecting Colorado, as being able and available to work in a particular occupation. Results should be interpreted with caution since registration in Connecting Colorado is self-reported. In addition, the skills rubric may assign up to four occupation codes for each registrant. Therefore, the number of available applicants could be inflated. *Source: Provided by Arapahoe/Douglas Works!; OCEW Employees, Non-OCEW Employees, & Self Employed - EMSI 2017.3 Class of Worker.*

Education & Training

Colorado's higher education system provides an excellent support system for businesses in the state. There are 28 public higher education institutions in Colorado, consisting of 13 four-year and 15 two-year public institutions offering comprehensive curricula. There are more than 100 private and religious accredited institutions and more than 350 private occupational and technical schools offering courses in dozens of program areas throughout the state. The state higher education system served about 255,510 students in FY 2015-16, while 86,070 students received a degree, diploma, certificate, or other formal award over the same period of time. Although not exhaustive, a list of the major, accredited educational institutions with the greatest number of graduates for each of the 10 largest energy occupations in Colorado are included below. A directory of all higher education institutions with corresponding websites may be accessed via <http://highered.colorado.gov>.

- Colorado School of Mines www.mines.edu
- Colorado State University www.colostate.edu
- Colorado State University Global Campus www.colostate.edu
- Front Range Community College www.frontrange.edu
- Metropolitan State University of Denver www.msudenver.edu
- Red Rocks Community College www.rrcc.edu
- Regis University www.regis.edu
- University of Colorado Boulder www.colorado.edu
- University of Colorado Colorado Springs www.uccs.edu
- University of Colorado Denver www.ucdenver.edu
- University of Denver www.du.edu

ENERGY:

Colorado and Metro Denver and Northern Colorado Industry Cluster

Key Reasons for Energy Companies to Locate in Colorado

Colorado is a top-10 fossil resource location offering access to one of the most energy rich regions in the United States.

- **Coal** - Colorado was the 10th-largest coal-producing state in the nation as of year-to-date 2017 and borders Wyoming, the nation's largest coal producer. Colorado produced 2.1 percent of the nationwide supply. (U.S. Department of Energy, Energy Information Administration, 2017)
- **Natural Gas** - Colorado was the nation's sixth-largest producer of natural gas as of year-to-date 2017, accounting for 5.9 percent of U.S. natural gas production. (U.S. Department of Energy, Energy Information Administration, 2017)
 - Colorado is home to over 30 interstate and intrastate oil and gas pipelines totaling 45,000 miles. One of the largest pipelines in Colorado, the Rockies Express Pipeline, moves about 1.8 billion cubic feet per day of natural gas capacity from Colorado to markets in the Midwest. (U.S. Department of Energy, Energy Information Administration, 2017)
- **Oil** - Colorado ranked as the seventh-largest oil producer in the nation as of year-to-date 2017, supplying more than 3 of every 100 barrels of U.S. crude oil production. (U.S. Department of Energy, Energy Information Administration, 2017)
- Eleven of the nation's 100 largest natural gas fields and one of the 100 largest oil fields are located in Colorado. (U.S. Department of Energy, Energy Information Administration, 2017)

Colorado was the nation's sixth-largest producer of natural gas in 2017.

—U.S. Department of Energy, 2017

Colorado is a top-10 cleantech location with access to clean energy resources and robust renewable energy generation requirements.

- **Wind** - Colorado ranked as the eighth-largest generator of wind energy in the nation and ranked 10th for total installed wind power capacity as of October 2017. (U.S. Department of Energy, Energy Information Administration, 2017; American Wind Energy Association, 2017)
 - Colorado ranked among the top 10 states in utility-scale wind generation in 2016. (Clean Edge, Inc., 2017)
 - Colorado ranked among the top 10 states for its reliance on wind power in 2016, with 17 percent of the in-state generation derived from wind. The state installed 27.3 MW of wind power between 2003 and 2016. (American Wind Energy Association, 2017)
- **Biomass** - Electricity generation from biomass sources increased 30.6 percent over the past five years and accounted for nearly 2 percent of the state's renewable energy generation. Research and development in this area is a key investment opportunity for companies looking to grow this sector of the energy mix. (U.S. Department of Energy, Energy Information Administration, 2017)
- **Solar** - Colorado ranked 11th in the nation for total installed solar capacity in 2017, with nearly 2.3 percent of homes in the state powered by solar. Of the state's total solar installations in 2017, utility-scale solar represented roughly 20 percent and residential solar represented over 50 percent. (Solar Energy Industries Association, 2017)
- **Hydroelectric** - Hydroelectric facilities contributed about one-sixth of all renewable electricity generation in the state. The state's extensive water resources offer significant hydroelectric power opportunities, including pumped-storage hydroelectricity. (U.S. Department of Energy, Energy Information Administration, 2017)
- Colorado ranked seventh for wind and solar generation as a percentage of electricity consumption in 2016. (Environment America Research & Policy Center, 2017)
- Colorado ranked 11th in the nation for renewable energy generation in 2015 (excluding hydroelectric power) and ranked among the top 20 in the nation for the percent of electricity generated from renewable resources. (U.S. Department of Energy, Energy Information Administration, 2017)
- Colorado ranked seventh on the Clean Edge 2017 "U.S. Clean Tech Leadership Index." (Clean Edge, Inc., 2017)
- Colorado ranked No. 7 in the nation in electric, hybrid, and plug-in vehicles per one million residents in 2016. (Clean Edge, Inc., 2017)
- Metro Denver ranked 12th in the "U.S. Metro Clean Tech Leadership Index" and ranked among the top 10 for green building usage, and cleantech investment, innovation, and workforce. (Clean Edge, Inc., 2017)

Colorado ranked as the eighth-largest generator of wind energy in the U.S.

—U.S. Department of Energy, 2017

ENERGY:

Colorado and Metro Denver and Northern Colorado Industry Cluster

Colorado is at the forefront of energy development, with a location that offers:

1. The ability to recruit and retain senior management and scientific talent

- Nearly 40 percent of Coloradans have at least a bachelor's degree, the second-highest college attainment rate in the nation behind Massachusetts. (U.S. Census Bureau, 2016 American Community Survey)
- Colorado ranked ninth for the number of science, engineering, and health graduate students per 1,000 individuals ages 25 to 34 years old. (National Science Foundation, 2017)
- Colorado ranked among the top 10 states for total solar employment, rising 20 percent between 2015 and 2016. (The Solar Foundation, 2017)
- Colorado ranked fourth for wind-related employment, accounting for nearly 6 percent of the nation's total wind-related jobs in 2016. (American Wind Energy Association, 2017)
- Colorado ranked No. 2 for the "Best States for Jobs" in 2017 and ranked first nationally for job opportunities. (WalletHub, 2017)

2. Proximity to energy-related higher education programs and research centers

- Colorado School of Mines (CSM) in Golden ranked first among the top 10 schools in the nation for an engineering degree in 2016. (College Factual, 2017)
- CSM is one of the few universities in the world to offer programs from baccalaureate through doctorate levels in all key fields related to energy and is the only institution in the world that offers doctoral programs in five of the major earth science disciplines. (Colorado School of Mines, 2017)
- The Ecotech Institute in Aurora is the world's first and only college entirely focused on preparing graduates for careers in renewable energy, sustainability, and energy efficiency. (Ecotech Institute, 2017)
- The Solar Technology Acceleration Center (SolarTAC) is the largest test facility for solar technologies in the U.S. (The Solar Technology Acceleration Center, 2017)

3. Access to the research of a broad collection of federal laboratories

- Colorado's federally funded research facilities collectively contribute an estimated \$2.6 billion to the state's economy annually and employs 17,600 people. Ten laboratories have active commercialization programs, from technology transfer and licensed technology to spin-off companies and public-private partnerships. (University of Colorado, 2017)
 - The National Renewable Energy Laboratory's Energy Systems Integration Facility offers industry, academia, and government partners access to an award-winning, state-of-the-art lab space and specialized scientists and engineers to accelerate the movement of renewable energy and energy-efficient solutions into practical solutions. More than 100 partners have signed on to use the facility including Panasonic, 3M, and Mercedes-Benz. (National Renewable Energy Laboratory, 2017)

Federally funded research facilities contribute \$2.6 billion to Colorado's economy annually.

—University of Colorado, 2017

4. Business organizations and public policy programs designed to encourage industry growth

- Sales and use tax is exempt for equipment used in R&D of clean technology. The exemption refunds up to \$50,000 per year in sales and use taxes for companies with less than 35 employees and more than 50 percent employed in Colorado. (Exemption clarified in Colorado House Bill 15-1180)
- The Advanced Industries Accelerator Programs include four types of grants and a global business support program to promote growth and sustainability in Colorado's advanced industries, including energy and natural resources, among others. The program has awarded over \$40 million in grants since its inception in 2013. (Colorado Office of Economic Development and International Trade, 2017)

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