



ENERGY

Colorado Industry Cluster Profile

Colorado is rich in a variety of energy-generating resources, including fossil fuels, renewable energy, and alternative fuels. The state remains a strong producer of traditional energy resources such as coal, oil, and natural gas, while maintaining its position as an internationally recognized hub for advances in renewable energy that contribute to its competitive advantage in the energy marketplace. Despite the economic downturn, increased global demand for clean, renewable energy technologies, or cleantech, continues to fuel growth and innovation, create jobs, and keep the state on the leading-edge of global competition for a sustainable energy future.

While the majority of Colorado's fossil fuel extraction activity has traditionally taken place in western Colorado, many companies have Front Range refining and production facilities and Denver-area corporate offices. The state's energy cluster is organized around existing research assets and intellectual resources that fuel energy growth and encourage universities, research institutions, federal laboratories, and companies to deploy new technologies to the marketplace. Nanotechnology, biotechnology, robotics, and other advanced technologies are driving the next wave of energy products and strengthening links between fundamental science, commercialization, and innovation.

This report evaluates Colorado's energy industry in two subclusters: (1) fossil fuels and (2) cleantech. With 58,700 energy workers in approximately 4,590 companies in 2011, the state continues to expand its energy industry. 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 discretely, 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.

A number of key projects integrating fossil energy and cleantech support the state's energy economy. Loveland-based Harrison Resource Corp. unveiled plans for a 640-acre energy and technology park to be located on the Niobrara formation in Weld County. The Niobrara Energy Park will combine a range of traditional and alternative energy-production operations ranging from a natural gas-fired power plant to solar panels, geothermal energy equipment, and energy research. The location is an ideal mix of uses given its proximity to fossil and cleantech resources and a large fiber-optic line that runs along U.S. Highway 85. Another key example is ConocoPhillips' plan to redevelop the former 432-acre StorageTek campus in Louisville for a Global Technology and Corporate Learning Center to research and develop high-tech carbon fuels recovery and renewable energy technologies. The company is reconsidering project logistics now that it has split into two companies, one focused on exploration and the other focused on refining. Planning for the campus will begin in mid-2012 with completion of all three phases of development planned by 2032.

Colorado is characterized by its network of collaboration, innovation centers, and unique assets that leads to cross-cluster convergence. The energy industry combines these regional assets to strengthen partnerships and enhance growth opportunities across industry clusters such as aerospace, aviation, and software. New project developments include:

- The Cheyenne Mountain Air Force Base in Colorado Springs was selected among seven other military installations across the nation to receive fuel cell backup power systems as part of a joint U.S. Department of Energy (DOE) and U.S. Department of Defense partnership. The five year demonstration project will accelerate clean electricity technology operations and identify technical improvements to enhance fuel cell performance.
- Douglas County-based biofuels producer Gevo received a \$600,000 contract with the U.S. Air Force. Under the contract, Gevo will provide the Air Force with at least 7,000 gallons of jet fuel.
- Englewood-based Beyond Aviation, formerly Bye Energy, expanded its presence to Rocky Mountain Metropolitan Airport in Jefferson County and doubled its headquarters facility at Centennial Airport in 2011. The company began initial taxi tests on its electric Cessna 172 for its Green Flight Project, a collaborative effort between aerospace, aviation, and alternative energy industries to create an electric hybrid propulsion system for commercial application.

Cleantech

Colorado's cleantech energy products and technology, energy research centers, and industry partnerships support its thriving cleantech hub. Legislation passed in 2007 created the Colorado Renewable Energy Collaboratory, a partnership among the University of Colorado Boulder (CU-Boulder), the Colorado School of Mines, Colorado State University (CSU), and the National Renewable Energy Laboratory (NREL). The Collaboratory brings together vast capabilities in researching, developing, and commercializing energy technologies through its six research centers including the Colorado Center for Biorefining and Biofuels (C2B2), the Center for Revolutionary Solar Photoconversion (CRSP), the Solar Technology Acceleration Center (SolarTAC), the Center for Research and Education in Wind (CREW), the Carbon Management Center, and the Energy Efficiency and Management Center. Further, the Colorado Association for Manufacturing and Technology (CAMT) and NASA partnered to create the nation's first manufacturing park in northern Colorado to accelerate commercialization of new space and cleantech technologies, which will house up to 100 businesses interested in sharing services, equipment, and access to NASA and NREL expertise. The five-year pact commits NASA's name and expertise to the manufacturing park that could result in at least 10,000 new manufacturing jobs in the region.

Colorado is also one of only five states to have initiated an industry association dedicated entirely to cleantech—the Colorado Cleantech Industry Association (CCIA). Formed in 2008, CCIA provides advocacy, data and research, and education and training to the cleantech sector. CCIA joined the newly formed Advanced Energy Economy (AEE) to promote a supportive business and policy climate for the advanced energy sector. CCIA is one of the first regional cleantech organizations to become a chapter of the national AEE system.

Colorado's progressive energy policies and government funding continue to benefit the region's energy cluster. Legislation in 2010 created the nation's second-highest Renewable Energy Standard (RES) that mandated a minimum of 30 percent of the state's electricity come from renewable sources by 2020. Further, Colorado Gov. John Hickenlooper signed into law House Bill 11-1199 that established the Fair Permit Act to lower local and state permit fees for solar photovoltaic and thermal installations across the state. The new law extended existing caps on solar permit fees through 2018 and closed loopholes to further reduce costs and improve transparency in the permit process. Through 2011, government agencies and private companies across the state received \$900 million in American Recovery and Reinvestment Act (ARRA) funding, tax credits, loan guarantees, and grants. A number of notable awards included loan guarantees totaling \$491 million to Abound Solar and Cogentrix, \$75 million in tax credits distributed to six companies to build factories in Colorado, 257 energy projects received \$185 million under the grants in lieu of tax credits program, and grants totaling more than \$140 million to dozens of companies.

Colorado has one of the highest concentrations of federally funded science, research, and engineering laboratories in the nation. The state's 24 federal laboratories contributed \$1.5 billion to Colorado's economy in 2010 and accounted for nearly 16,500 direct and indirect jobs totaling \$743.7 million in wages and benefits. The federal laboratories provide significant support to the state's high-tech industries and stimulate technology transfer between local educational facilities and companies. Of the 24 laboratories, NREL is key to Colorado's energy industry. Golden-based NREL is the DOE's only laboratory dedicated to renewable energy efficiency research and

development across 13 research areas ranging from advanced vehicles and fuels to biomass, concentrating solar power, and wind resources.

The energy cluster is supported by the state's strong academic environment tied to clean energy and energy efficiency. Increasingly, the state's research universities, private institutions, community college system, and other support programs expanded offerings and certificates to train students in a variety of cleantech disciplines. CU-Boulder announced plans for a state-of-the-art geosciences complex at its East Campus that will house its Environmental Studies Department. The \$100 million complex will include an 83,710-square-foot wet lab building and the renovation of its existing 280,000-square-foot laboratory and classroom building slated for completion in 2014. Ecotech Institute in Aurora—the first and only college focused on training students for careers in cleantech—and Redstone College in Broomfield offer certificates and degree programs for a variety of cleantech careers.

Colorado continues to attract and retain wind energy companies and skilled talent to take advantage of the state's abundant, clean-energy resources. Key wind company announcements and new project developments in 2011 included:

- Xcel Energy, Renewable Energy Systems Americas Inc., and BP Wind Energy partnered to add 500 megawatts (MW) of wind energy to Xcel's existing statewide capacity. Additionally, Xcel partnered with Florida-based NextEra Energy to build a 200-MW wind farm in eastern Colorado. The Limon Wind Energy Center is slated for completion in 2012 and could satisfy Xcel's RES eight years ahead of schedule.
- Vestas Wind Systems partnered with French renewable energy company EDF Energies Nouvelles to provide EDF with at least 30 percent of its onshore wind installations in the U.S. and 50 percent of the equipment for European installations from Vestas. The agreement could generate at least 2,000 MW in new Vestas orders.
- Vestas opened its second blade factory in Brighton in 2011. The company opened its Windsor blade factory in March 2008, followed by the nacelle factory in Brighton and the world's largest tower factory in Pueblo in 2010. Altogether, the four manufacturing facilities on three campuses in Brighton, Windsor, and Pueblo could produce up to 1,500 turbines per year and will employ more than 2,000 people at full capacity.

Colorado remains a leader in the solar industry and is home to many companies engaged in solar energy research and development to meet the increasing demand. Some key solar energy projects and company developments in 2011 included:

- North Carolina-based power company Cogentrix Energy LLC received a \$91 million U.S. DOE loan guarantee to finance the world's largest concentrated photovoltaic power plant north of Alamosa. The Alamosa Solar Generating Project could power more than 6,500 homes and reduce carbon dioxide emissions by more than 43,000 metric tons per year. The project is slated for completion in 2012.
- Xcel Energy and SunPower Corp. completed the largest solar photovoltaic (PV) plant in the state. The Greater Sandhill Plant will produce 19 MW of power that could supply the energy needs of 5,000 homes in Alamosa County. Nearby, SunPower is building a second PV plant in the San Luis Valley. The 30-MW San Luis plant could be operational by early 2012.
- General Electric (GE) selected Aurora as the site for its highly anticipated thin-film solar panel manufacturing plant. The company cited the state's skilled workforce, proximity to academic institutions, and an existing facility that could easily be retrofitted for solar panel production as key factors in its location decision. The \$300 million solar plant will produce enough panels each year to supply power for 80,000 homes and could begin retrofits as early as January 2012 and solar panel production beginning in 2013.
- SMA America LLC, the domestic branch of the world's largest solar inverter manufacturer, located operations in Denver with 300,000 total square feet at two facilities at the Enterprise Park in Stapleton.
- Solar design and installation company Sunetric opened its third office outside of Hawaii in Denver in 2011. The company cited the region as an ideal location to pursue commercial and utility-scale projects throughout the west and midwest regions.
- Abound Solar expanded its Loveland office space and added 8,000 square feet to its Certification and Reliability Laboratory. As a result of the facilities expansion, the company added a number of new jobs at the sites.

Colorado is at the forefront of new technologies devoted to commercial and residential building efficiency. The U.S. Environmental Protection Agency (EPA) awarded eight of the 22 buildings in the Denver West Office Park ENERGY STAR certification. Through a series of energy efficient upgrades, Denver West prevented more than 2,500 metric tons of greenhouse gas emissions equivalent to the electricity use from 310 households per year. US e-Chromic LLC launched operations to commercialize technology developed by NREL. The new Boulder-based company utilizes NREL's electrochromic thin-film to retrofit existing commercial windows to reduce energy consumption. Denver-based RavenBrick LLC plans to open a Metro Denver manufacturing facility in 2012. The company will produce a product that deflects the sun's heat to reduce a building's power use.

Colorado is a growing leader in green transportation technologies. Colorado joined a multi-state initiative to encourage the production of affordable natural gas vehicles. Under the agreement, Colorado, Oklahoma, Utah, Wyoming, and Pennsylvania will plan a pooled purchase order to replace government-owned fleets with natural gas vehicles. Grand Valley Transit in Mesa County plans to replace its 25 diesel buses with compressed natural gas (CNG) buses by 2020. The transit company will be one of the first in the state to run buses on CNG technology. Siemens AG awarded CSU a \$44.5 million grant—the largest in-kind software grant in university history—for its involvement in a national hybrid/electric vehicle design competition called EcoCAR2. The university is one of 16 selected across the country that will help convert a Chevrolet Malibu into a hybrid/electric vehicle. Longmont-based UQM Technologies Inc. provided its PowerPhase electric propulsion systems to test Audi's A1 e-tron all-electric vehicle in 2011. The company's power-dense, lightweight motor and controller can be supplied with up to 125 kW of peak power. VanDyne SuperTurbo Inc. relocated its corporate headquarters to Fort Collins and added a new multibay engine research facility to test its energy and fuel efficient SuperTurbochargers.

Fossil Fuels

Colorado has strong fossil fuel-rich basins, significant coal deposits, and is home to some of the nation's largest natural gas fields. The majority of drilling activity is concentrated along the Western Slope of the Rocky Mountains and in Weld County, while many fossil fuel companies conduct business operations from the Metro Denver region. Colorado's active wells totaled more than 46,700 as of December 2011, with 58 percent of total active wells in Weld and Garfield Counties.

A number of companies expanded operations in the Niobrara Shale Formation, a 7,000-foot-deep geographic layer covering northern Colorado, northwest Kansas, southwest Nebraska, and southeast Wyoming, which could have as much as two billion barrels of oil in the formation. The increasing activity in the Niobrara has created new jobs, mineral rights purchases, and exploratory drilling wells, in addition to significant severance tax revenues should Niobrara prove as profitable as expected. Key company announcements and new project developments in 2011 included:

- Oklahoma City-based Chesapeake Energy Corp. partnered with CNOOC Ltd.—China's largest offshore oil and natural gas producer—to accelerate oil shale drilling activity in northern Weld County and the southern Wyoming section of the formation. Chesapeake sold one-third of its 800,000 acres in the formation to CNOOC and funds will help boost Chesapeake's rig count. The company also opened a Denver office in 2011 to support local drilling operations.
- Magellan Petroleum plans to relocate its Portland, Me. headquarters to Denver. The company's subsidiary, the Nautilus Group LLC, already has a Denver office.
- Houston-based Oil States International Inc. selected Johnstown as the site for its new manufacturing plant. The company will build remote site accommodations to support U.S. and Canadian markets and could create up to 250 new jobs over the next five years. The facility is expected to be operational in early 2012.
- Texas-based U.S. Development Group LLC opened its new crude oil terminal in northern Weld County. The Niobrara Crude Terminal will ship crude oil via the Union Pacific rail line to Gulf Coast refineries and has the capacity to support up to 35,000 barrels per day.
- TransWest Express LLC's planned 725-mile power line project is one of seven transmission projects selected to participate in the DOE's accelerated federal permitting pilot program. The proposed \$3 billion TransWest project will run power lines across northwestern Colorado, Wyoming, Utah, and Nevada to transmission lines near Las Vegas.

- The Williams Cos. Inc. plans to split into two separate businesses—one focused on exploration and production and the other on natural gas pipelines and infrastructure. Williams will spinoff a portion of the exploration and production business to shareholders in 2011 and the remainder in 2012 and is the largest natural gas producer in the Piceance Basin.
- Houston-based Merchant Energy Holdings, LLC began construction on its East Cheyenne Gas Storage project near Sterling, Colo. The storage field could hold up to 19 billion cubic feet of natural gas and will begin operations as early as 2012.
- Anadarko Petroleum Corp. will invest an additional \$1 billion each year in the Wattenberg oil field located north of Denver. The company plans to double its count of active Colorado rigs and expand its Wattenberg field processing plant.
- Noble Energy Inc. will invest between \$1 billion and \$1.5 billion each year in the Wattenberg area. The company also unveiled plans for a new field office in Greeley by 2012.
- DCP Midstream LLC plans to build a natural gas processing plant in Weld County. The \$270 million plant will increase DCP's processing capacity in the Denver-Julesburg basin by 27 percent and will prepare the company for increased output from the Niobrara play.
- ConocoPhillips purchased 46,000 acres of leasehold in Adams, Arapahoe, Douglas, and Elbert Counties in the Niobrara Shale Formation from Kansas-based Lario Oil & Gas Company. The new land leases will give the company a major investment near Denver.
- Schneider Energy Services Inc. opened a second office in Greeley to accommodate its growing workforce and Anadarko Petroleum Corp. consolidated its local offices into a new, 42,000-square-foot building in Evans.
- Halliburton plans to open a \$20 million Fort Lupton facility that could support at least 300 jobs.

Energy Economic Profile

Fossil Fuels

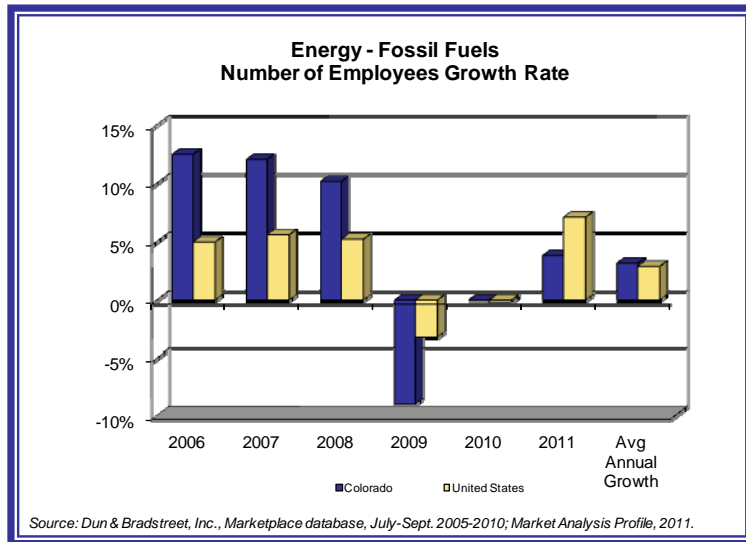
The fossil fuels subcluster includes companies that extract naturally-occurring mineral liquids, gases, and solids used to produce energy. The fossil fuels subcluster also includes mining machinery manufacturers and companies that provide mining, exploration, and related support services. Companies providing generation, transmission, and distribution of energy resources are also included. The fossil fuels subcluster consists of 30, six-digit North American Industry Classification System (NAICS) codes.

Colorado ranked 10th out of the 50 states for fossil fuels employment concentration in 2011. With direct employment in the fossil fuels subcluster of about 37,700 workers, Colorado ranked seventh out of the 50 states in absolute employment. While Colorado's drilling and mining activity tends to be concentrated primarily in the Rocky Mountains and along the Western Slope, fuel refineries and headquarters facilities are located throughout the Front Range.

	Colorado	U.S.
Direct Employment, 2011	37,700	1,688,630
Number of Direct Companies, 2011	2,520	71,400
One-Year Direct Employment Growth, 2010-2011	3.8%	7.1%
Five-Year Direct Employment Growth, 2006-2011	16.6%	15.0%
Avg. Annual Direct Employment Growth, 2006-2011	3.1%	2.8%
Direct Employment Concentration	1.5%	1.2%

Sources: Dun & Bradstreet, Inc. Marketplace database, July-Sept. 2006-2010; Market Analysis Profile, 2011; Development Research Partners.

Fossil Fuels Employment



- The fossil fuels subcluster directly employed about 37,700 workers in Colorado in 2011.
- Fossil fuels companies accounted for 1.5 percent of Colorado's total employment base, compared with a 1.2 percent national employment concentration.
- Fluctuating energy prices contributed to declining fossil fuels employment in 2009 and 2010. However, renewed interest in developing energy resources and the continued development of Colorado shale oil plays such as the Niobrara led to robust employment gains in 2011.

- Employment in Colorado's fossil fuels subcluster increased 16.6 percent between 2006 and 2011, compared with a 15 percent increase nationally.
- Approximately 44 percent of Colorado's fossil fuels employees worked in petroleum and natural gas exploration and extraction support activities for oil and gas operations. Another 16 percent of employees worked in generation, transmission, and distribution of energy resources.
- More than 60 percent of Colorado's fossil fuels subcluster employment was concentrated in the City and County of Denver and in Adams, Weld, Mesa, and Garfield Counties. The remaining employment was dispersed fairly evenly throughout the rest of the state.

Fossil Fuels Wages

The 2010 average annual salary for a fossil fuels worker was \$95,800 in Colorado, compared with the national average of \$88,450. Colorado payroll in the fossil fuels subcluster reached nearly \$3.5 billion in 2010.

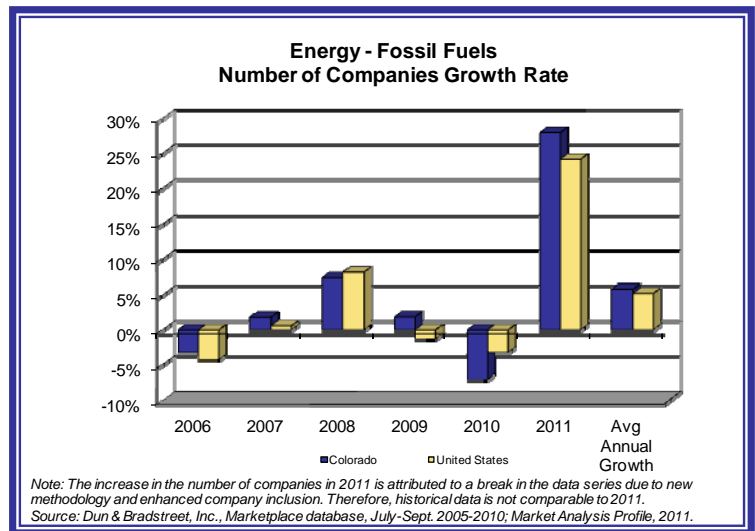
Colorado Occupational Salaries, 2010 Annual Average

Petroleum Engineers	\$128,060
Mining and Geological Engineers	\$93,880
Geological and Petroleum Technicians	\$62,190
Petroleum Pump System and Refinery Operators	\$62,170
Plant and System Operators	\$49,300

Source: U.S. Bureau of Labor Statistics, *State Occupational Employment and Wage Estimates, May 2010*, www.bls.gov.

Fossil Fuels Companies

- About 2,520 fossil fuels companies operated in Colorado in 2011.
- Nearly 68 percent of Colorado's fossil fuels companies employed fewer than 10 people, while 0.8 percent employed 250 or more.
- Approximately 54 percent of Colorado's fossil fuels companies provided petroleum and natural gas exploration and extraction services and support activities for oil and gas operations.
- More than half of the state's fossil fuels companies were located in the City and County of Denver and in Jefferson, Arapahoe, and Mesa Counties. The remaining companies were dispersed fairly evenly throughout the rest of the state.



Major Fossil Fuels Companies

- A&W Water Service, Inc.
www.awwaterservice.com
- Anadarko Petroleum Corporation
www.anadarko.com
- Arch Coal, Inc. (West Elk Mine)
www.archcoal.com
- BP America
www.bp.com
- Berry Petroleum Company
www.bry.com
- Bill Barrett Corp.
www.billbarrettcorp.com
- Chesapeake Energy Corp.
www.chk.com
- Cimarex Energy
www.cimarex.com
- Colorado Energy Management LLC
www.coloradoenergy.com
- Colorado Springs Utilities
www.csu.org
- ConocoPhillips Co.
www.conocophillips.com
- DCP Midstream
www.dcpmidstream.com
- Encana Corporation
www.encana.com
- Endeavour International North America
www.endeavourcorp.com
- Forest Oil
www.forestoil.com
- Halliburton
www.halliburton.com
- InfraSource, Inc.
www.infrasourceus.com
- Intermountain Rural Electric Association
www.intermountain-rea.com
- Kinder Morgan
www.kindermorgan.com
- Magellan Petroleum Corporation
www.magellanpetroleum.com
- MarkWest Energy Partners, L.P.
www.markwest.com
- Noble Energy, Inc.
www.nobleenergyinc.com
- Schlumberger Ltd.
www.slb.com
- Schneider Energy Services, Inc.
www.schneiderenergy.com
- Shell Exploration and Production
www.shell.com
- SM Energy Co.
www.sm-energy.com
- Suncor Energy Inc.
www.suncor.com
- TransMontaigne Inc.
www.transmontaigne.com
- Tri-State Generation & Transmission Assoc.
www.tristategt.org
- TwentyMile Coal Co. (Peabody Energy)
www.peabodyenergy.com
- United Power
www.unitedpower.com
- Venoco, Inc.
www.venocoinc.com
- Westmoreland Coal Company
www.westmoreland.com
- Whiting Petroleum Corp.
www.whiting.com
- Williams
www.williams.com
- Xcel Energy
www.xcelenergy.com

Cleantech

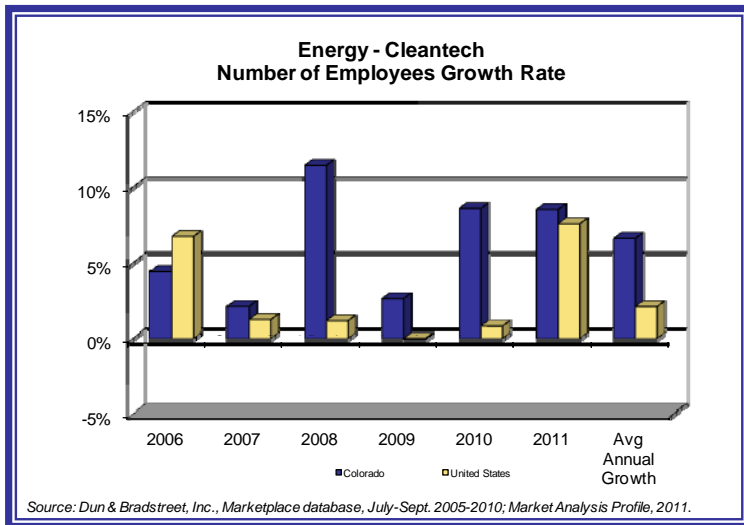
The cleantech subcluster includes companies that produce and conserve energy using wind, solar, biomass, fuel cells, hydroelectric resources, and green transportation technologies. Companies that manufacture renewable energy equipment, storage, and power transformers, and businesses that provide engineering and other support services are also included. The subcluster includes energy research companies that provide laboratory testing, scientific and technical consulting services, and institutional research related to the environment, natural resources, and energy. The cleantech subcluster consists of 29, six-digit North American Industry Classification System (NAICS) codes.

Colorado ranked fourth out of the 50 states in cleantech employment concentration in 2011. With direct employment of about 21,000 workers, Colorado's cleantech subcluster ranked 11th out of the 50 states in absolute employment.

	Colorado	U.S.
Direct Employment, 2011	21,000	744,170
Number of Direct Companies, 2011	2,070	60,750
One-Year Direct Employment Growth, 2010-2011	8.5%	7.5%
Five-Year Direct Employment Growth, 2006-2011	37.5%	10.8%
Avg. Annual Direct Employment Growth, 2006-2011	6.6%	2.1%
Direct Employment Concentration	0.8%	0.5%

Sources: Dun & Bradstreet, Inc. Marketplace database, July-Sept. 2006-2010; Market Analysis Profile, 2011; Development Research Partners.

Cleantech Employment



- The cleantech subcluster directly employed about 21,000 people in Colorado in 2011.
- The state's growing solar- and wind-related energy companies, cutting-edge technologies, and industry partnerships fueled a 37.5 percent increase in Colorado's cleantech subcluster between 2006 and 2011, compared with a 10.8 percent increase nationwide.
- Cleantech companies employed 0.8 percent of Colorado's total employment base, compared with a 0.5 percent employment concentration nationwide.

- More than half of Colorado's cleantech employees provided cleantech research, environmental consulting, and air, water, and solid waste management services.
- Nearly 67 percent of Colorado's cleantech employment was located in Jefferson (28 percent), Boulder (15 percent), and Larimer (12 percent) Counties, and the City and County of Denver (12 percent).

Cleantech Wages

The 2010 average annual salary for cleantech employees was \$73,420 in Colorado, compared with the national average of \$71,710. Colorado's cleantech payroll totaled \$1.4 billion in 2010.

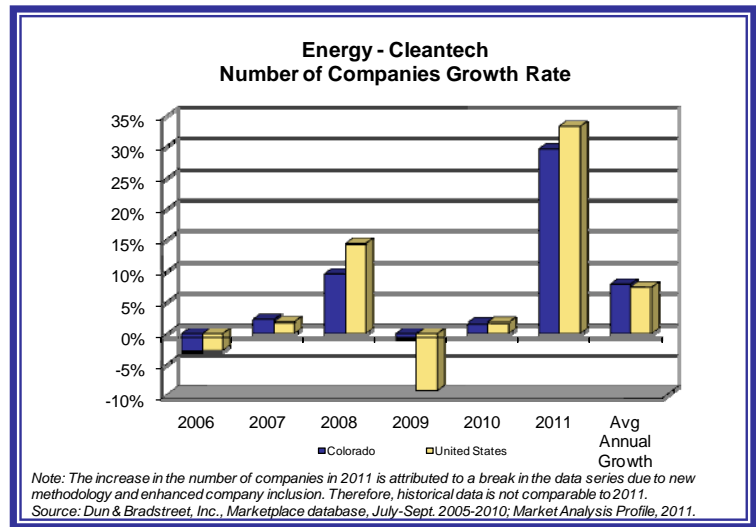
Colorado Occupational Salaries, 2010 Annual Average

Geoscientists	\$96,610
Electrical Engineers	\$87,290
Environmental Engineers	\$85,100
Environmental Scientists and Specialists	\$76,150
Environmental Engineering Technicians	\$45,200

Source: U.S. Bureau of Labor Statistics, State Occupational Employment and Wage Estimates, May 2010, www.bls.gov.

Cleantech Companies

- Approximately 2,070 cleantech companies operated in Colorado in 2011.
- About 82 percent of Colorado's cleantech companies employed fewer than 10 people, while 0.5 percent employed 250 or more.
- Approximately 61 percent of Colorado companies in the cleantech subcluster provided environmental and scientific consulting and earth sciences services.
- More than 54 percent of the state's cleantech companies were located in the City and County of Denver and in Jefferson, Boulder, and Arapahoe Counties.



Major Cleantech Energy Companies

- Abengoa Solar
www.abengoasolar.com
- Abound Solar, Inc.
www.abound.com
- Adobe Solar
www.adobesolar.com
- Aluwind Inc.
www.aluwind.com
- Ambient Energy Inc.
www.ambient-e.com
- American Zephyr Corp.
www.americanzephyr.com
- Ascent Solar Technologies, Inc.
www.ascentsolar.com
- Bella Energy
www.bellaenergy.com
- Beyond Aviation
www.beyond-aviation.com
- BioEnergy of Colorado, LLC
www.bioenergycolorado.com
- Blue Sun Biodiesel
www.gobluesun.com
- Boulder Wind Power
www.boulderwindpower.com
- Envirofit International, Ltd.
www.envirofit.org
- Evergreen Energy Inc.
www.evgenergy.com
- GE Energy
www.gepower.com
- Gevo Inc.
www.gevo.com
- juwi Wind/Solar
www.juwi.com
- Lightning Hybrids, Inc.
<http://lightninghybrids.com>
- Namasté Solar
www.namastesolar.com
- Nokero
www.nokero.com
- RavenBrick, LLC
www.ravenbrick.com
- Rentech, Inc.
www.rentechinc.com
- REpower USA Corp.
www.repower.de
- RES Americas, Inc.
www.res-americas.com
- Siemens Energy
www.siemens.com
- SkyFuel Inc.
www.skyfuel.com
- SMA America, LLC
www.sma-america.com
- Sundrop Fuels, Inc.
www.sundropfuels.com
- Tetra Tech Inc.
www.tetrattech.com
- UQM Technologies, Inc.
www.uqm.com
- URS Corporation
www.urscorp.com
- VAIREX Corporation
www.vairex.com
- Versa Power Systems
www.versa-power.com
- Vestas
www.vestas.com
- Woodward
www.woodward.com

Major Renewable Energy Government and Research Facilities

- CO Department of Natural Resources
www.dnr.state.co.us
- CO Department of Public Health & Environment
www.cdph.state.co.us
- CO Department of Regulatory Agencies
www.dora.state.co.us
- Colorado Energy Research Institute
www.ceri-mines.org
- Colorado Renewable Energy Collaboratory
www.coloradocollaboratory.org
- Governor's Energy Office
www.rechargecolorado.com
- JILA
<http://jila.colorado.edu>
- National Center for Atmospheric Research
www.ncar.ucar.edu
- National Renewable Energy Laboratory
www.nrel.gov
- National Institute of Standards & Technology
www.nist.gov
- U.S. Bureau of Reclamation
www.usbr.gov
- U.S. Dept. of Energy, Golden Field Office
www.eere.energy.gov/golden
- U.S. Environmental Protection Agency
www.epa.gov
- U.S. Geological Survey
www.usgs.gov
- Western Area Power Administration
www.wapa.gov

Key Reasons for Energy Companies to Locate in Colorado

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

- **Coal** - Colorado produced more than 25 million short tons of coal, or 2.3 percent of the nationwide supply in 2010. Colorado was the 11th-most productive coal mining state and borders Wyoming, the nation's largest producer of coal. (U.S. Department of Energy, Energy Information Administration, 2011)
- **Natural Gas** - Colorado was the nation's fifth-largest producer of natural gas in 2009. The state also had the nation's largest reserve of coalbed methane, a fuel source that accounts for roughly half of Colorado's natural gas production and nearly 30 percent of all coalbed methane produced in the nation. (U.S. Department of Energy, Energy Information Administration, 2011)
- **Oil** - Colorado produced 26.1 million barrels of crude oil in 2010 and ranked as the 10th-largest crude oil producer in the nation. As of 2009, Colorado had 279 million barrels of proved oil reserves. In addition, an estimated 1.5 trillion barrels of recoverable oil reserves lies in Western Colorado's Piceance Basin—as much oil as the entire world's proven oil reserves. (U.S. Department of Energy, Energy Information Administration, 2011; U.S. Geological Survey, 2011)
- Colorado transports natural gas to the Midwest and East Coast via the Rockies Express Pipeline that became fully operational in 2009. The 1,679-mile, high-speed pipeline is the largest of its kind constructed in the last 20 years and moves about 1.8 billion cubic feet per day of natural gas from Colorado to markets outside of the state. (U.S. Department of Energy, Energy Information Administration, 2011; Kinder Morgan, 2011)
- Colorado is strategically located along America's Energy Corridor, which runs from Canada to Mexico.
- Colorado has 10 of the nation's 100 largest natural gas fields and three of the 100 largest oil fields. (U.S. Department of Energy, Energy Information Administration, 2011)

Colorado is a top 10 cleantech location with newly enacted requirements for renewable energy generation and access to clean energy resources.

- **Wind** - Colorado ranked eighth in the nation for total installed wind power capacity and 12th in potential wind power capacity in 2011. Colorado is one of 11 states that generate more than five percent of total electricity from wind. Wind energy supports between 5,000 and 6,000 direct and indirect workers in Colorado. (American Wind Energy Association, 2010; SNL Financial Operating Dataset, 2011)

- **Biomass** - Biomass accounted for one percent of the state's renewable energy generation in 2009. Colorado could produce an estimated 2.6 million dry tons of biomass for energy each year. (U.S. Department of Energy, Energy Information Administration, 2011; Governor's Energy Office, 2011)
- **Solar Energy** - Colorado had the fourth-highest installed solar generation capacity, with the majority of capacity generated in south-central Colorado. The U.S. Department of Energy (DOE) has classified the south-central Colorado region a high potential solar resource area that could satisfy about half of the state's peak power demand. (SNL Financial, 2011; Interstate Renewable Energy Council, 2010)
- **Water** - Colorado is at the headwaters of five major U.S. rivers. The state has more than 60 operating hydropower facilities that produced more than 1.7 million megawatt hours (MWh) of hydroelectric power in 2010. Nearly four percent of electricity generated in Colorado is produced by hydroelectric resources. (U.S. Department of Energy, Energy Information Administration, 2011; National Renewable Energy Laboratory, 2011)
- Colorado is home to four solar energy zones in the San Luis Valley. The zones were identified by the Bureau of Land Management and the DOE as a means to accelerate renewable energy development and the project approval process. Colorado's zones have the highest solar energy potential and fewest environmental and resource conflicts. (Bureau of Land Management, 2011; U.S. Department of Energy, 2011)
- Colorado ranked 18th in the nation in 2009 for the percent of electricity generated from renewable sources. Increased private and public investment, coupled with recent initiatives in mandated use of renewable energy sources contributed to Colorado's ranking. (U.S. Department of Energy, Energy Information Administration, 2011)

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

- Of Colorado's adult population, about 36 percent has completed a bachelor's or higher-level degree. That makes Colorado the second-most highly educated state in the nation behind Massachusetts. (U.S. Census Bureau, 2010 American Community Survey)
- Colorado led the nation for solar jobs per capita and ranked second for the overall number of solar jobs behind California, according to the Washington, D.C.-based Solar Foundation's *National Solar Jobs Census 2011*. Rankings were based on near-term hiring expectations and current staff levels of solar power employers. Colorado's solar power companies employ roughly 6,200 workers and the number of solar workers that spend at least 50 percent of their time on solar-related projects increased 16 percent since last year. (The Solar Foundation, 2011)
- The American Wind Energy Association suggests Colorado has the nation's third-highest number of workers in jobs related to wind energy. Colorado's wind power companies employed more than 5,000 workers and continue to grow due to investments made by Vestas and other wind companies across the state. (American Wind Energy Association, 2011)
- The Colorado Energy Coalition (CEC), a consortium of leaders and stakeholders in Colorado's diverse energy industry, works to make Colorado an even more competitive place for all energy-related sectors to do business and to market Colorado's dynamic energy economy nationwide.
- Metropolitan State College of Denver, the Colorado School of Mines, the Community College of Denver, and the Cherry Creek School District partnered to develop the Colorado Academy for the Development of STEM-related Careers in 2010. The program was developed to stimulate interest in science, technology, engineering, and math (STEM). The academy plans to provide specialized training and certifications to connect its targeted communities to job readiness and career enhancement, coordinate with state Workforce Centers, and assist in job placement.
- The U.S. Department of Labor awarded the Colorado Department of Labor and Employment (CDLE) a \$5 million grant in 2011 to retrain and prepare 800 workers for careers in advanced manufacturing, information technology, and STEM. The state will partner with local workforce centers, businesses, and nonprofit organizations to target workers for training and skill advancement.

2. Proximity to energy-related higher education programs

- Colorado ranked 14th in the number of science and engineering graduate students per 1,000 individuals ages 25 to 34 years old in 2007. Universities such as the Colorado School of Mines, the University of Colorado Boulder (CU-Boulder), and Colorado State University (CSU) all offer competitive science and engineering doctorate programs and research facilities. (National Science Foundation, 2011)
- Colorado ranked 16th for research and development expenditures among academic institutions in fiscal year 2009. Research and development spending indicates a strong entrepreneurial economy and substantial federal investments in Colorado universities. (National Science Foundation, 2011)
- The Colorado School of Mines in Golden is one of the few universities in the world to offer programs from baccalaureate through doctorate levels in all key fields related to energy. These fields include geological engineering, geophysical engineering, mining engineering, petroleum engineering, chemical engineering, energy economics, materials science, engineering, physics, and others. (Colorado School of Mines, 2011)
- Education Corporation of America's Ecotech Institute launched in 2010 and is the first and only college focused on training students for careers in cleantech. The Institute offers two-year associate's degrees in renewable energy technology, solar and wind energy technology, electrical engineering and environmental technology, and several other disciplines designed for graduates' direct entry into the cleantech workforce. The Institute cited Colorado's vast renewable energy resources, proximity to major cleantech companies, and the state's green-friendly political environment as key factors in its location decision. (Ecotech Institute, 2011)
- The Colorado Fuel Cell Center opened at the Colorado School of Mines in 2006. The Center collaborates with government organizations, academic institutions, and industry stakeholders to develop and commercialize fuel cell technologies. The Colorado Fuel Cell Center opened the Slater Laboratory for Energy Conservation that will allow researchers to explore precision ink-jet processes for fabrication of solid-oxide fuel cells. (Colorado Fuel Cell Center, Colorado School of Mines, 2011)
- The Colorado School of Mines is home to the Colorado Energy Research Institute (CERI). Since 2004, CERI has worked to identify and develop energy-related research and educational programs for government, industry, colleges and universities, and the public. The Colorado School of Mines and CERI host the annual Oil Shale Symposium, which draws participants from around the world. (Colorado School of Mines, 2011)
- The Colorado Renewable Energy Collaboratory is a research partnership among the Colorado School of Mines, CU-Boulder, CSU, and the National Renewable Energy Laboratory (NREL). The Collaboratory combines resources from each of the four institutions and works with members of industry to perform research, develop renewable energy technologies, and commercialize these technologies. Six Collaboratory-sponsored research centers and partnerships include the Colorado Center for Biorefining and Biofuels (C2B2), the Center for Revolutionary Solar Conversion (CRSP), the Solar Technology Acceleration Center (SolarTAC), the Center for Research and Education in Wind, the Carbon Management Center, and the Energy Efficiency and Management Center. (Colorado Renewable Energy Collaboratory, 2011)
- CRSP launched in 2008 as part of the Colorado Renewable Energy Collaboratory. The Center researches and pursues advanced approaches to convert solar energy into highly efficient, low-cost fuels and electricity. Since its inception, CRSP has funded two rounds of solar research projects totaling \$2 million and launched its first Sponsored Research Program effort between Konarka Technologies and CSU. As part of six research centers formed by the Collaboratory, CRSP focuses on cost-competitive solar energy utilization. (Center for Revolutionary Solar Photoconversion, 2011)
- C2B2 was formed in 2007 as a cooperative research and education center of the Colorado Renewable Energy Collaboratory devoted to the conversion of biomass to gasoline, diesel fuels, and other products. The center focuses on six research areas including feedstock engineering, plant biotechnology and crop science, biochemical engineering, thermochemical and process engineering, product engineering, and system assessment and analysis. C2B2 is sponsored by public and private entities and has

nearly 15 industry sponsors, more than any bioenergy research center in the nation. (Colorado Center for Biorefining and Biofuels, 2011)

- The Engines and Energy Conversion Laboratory (EECL) at CSU delivers significant, meaningful solutions to meet the global energy challenges and opportunities of the 21st century. The EECL unveiled plans for a \$16 million expansion that will add classrooms, laboratories, offices, and innovative renewable designs. The new Energy Innovation Center is slated for completion by 2013 and will continue to focus on market-driven solutions and product development in partnership with industrial sponsors to reduce pollution in the atmosphere. (Colorado State University, 2011)
- The Solar Technology Acceleration Center (SolarTAC)—the largest test facility for solar technologies in the nation—celebrated the grand opening of its 74-acre facility in Aurora in 2011. SolarTAC formed under a public-private partnership between Xcel Energy, Abengoa Solar, SunEdison, the city of Aurora, the Colorado School of Mines, CSU, and the University of Colorado. The facility allows members to collaborate in solar energy research and testing for both proprietary and public projects.
- Seven Colorado institutions earned *The Princeton Review's* “green school” designation. The *2011 Guide to 311 Green Colleges* named the University of Denver, CU-Boulder, CSU, Naropa University in Boulder, Colorado College in Colorado Springs, Western State College of Colorado in Gunnison, and Fort Lewis College in Durango. Criteria for the ranking included the school’s ongoing commitment to sustainable activities, career preparation, and campus infrastructure. (*The Princeton Review*, 2011)

3. Access to the research of a broad collection of federal laboratories and private R&D activities

- NREL is the only federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies. The presence of NREL in Golden is a \$714 million annual economic impact on Colorado’s economy, according to a recent report conducted by CU-Boulder’s Leeds School of Business. NREL directly or indirectly supports 5,500 jobs in the state. (University of Colorado, 2011; National Renewable Energy Laboratory, 2011)
- Key federal offices located in Colorado include the National Center for Atmospheric Research; the Office of Surface Mining Reclamation and Enforcement; the U.S. Bureau of Land Management; the U.S. Bureau of Ocean Energy Management, Regulation and Enforcement; the U.S. Bureau of Reclamation; the U.S. Department of Energy; the U.S. Environmental Protection Agency; the U.S. Geological Survey; and the Western Area Power Administration.
- Firms with fossil fuel energy R&D programs include Anadarko Petroleum, BP America, Encana, Noble Energy, Shell Exploration & Production, and Suncor Energy.
- Legislation passed in 2011 will ensure future growth and success of Colorado’s energy cluster. Senate Bill 11-047 established the Clean Technology Discovery Evaluation Grant Program—a sustainable funding program requiring the state to divert 50 percent of any future increase in income tax collections from businesses in the cleantech industry—to establish a pool of funds to support research and development of new products and technologies, early-stage companies, and develop infrastructure. The new law could generate as much as \$2 million each year in new seed money for the cleantech industry.

Energy Industry Cluster Definition

NAICS Code*	NAICS Description	SIC Code	SIC Description
Fossil Fuels			
211111	Crude petroleum & natural gas extraction	1311	Crude petroleum & natural gas
211112	Natural gas liquid extraction	1321	Natural gas liquids
212111	Bituminous coal & lignite surface mining	1221	Bituminous coal & lignite surface mining
212112	Bituminous coal underground mining	1222	Bituminous coal underground mining
212291	Uranium-radium-vanadium ore mining	1094	Uranium-radium-vanadium ores
213111	Drilling oil & gas wells	1381	Drilling oil & gas wells
213112	Support activities for oil & gas operations	1382	Oil & gas field exploration services
213112	Support activities for oil & gas operations	1389	Oil & gas field services, NEC
213113	Support activities for coal mining	1241	Coal mining services
221111	Hydroelectric power generation	4911	Electric services
221111	Hydroelectric power generation	4931	Electric & other services combined
221111	Hydroelectric power generation	4939	Combination utilities, NEC
221112	Fossil fuel electric power generation	4911	Electric services
221112	Fossil fuel electric power generation	4931	Electric & other services combined
221112	Fossil fuel electric power generation	4939	Combination utilities, NEC
221113	Nuclear electric power generation	4911	Electric services
221113	Nuclear electric power generation	4931	Electric & other services combined
221113	Nuclear electric power generation	4939	Combination utilities, NEC
221119	Other electric power generation	4911	Electric services
221119	Other electric power generation	4931	Electric & other services combined
221119	Other electric power generation	4939	Combination utilities, NEC
221121	Electric bulk power transmission & control	4911	Electric services
221121	Electric bulk power transmission & control	4931	Electric & other services combined
221121	Electric bulk power transmission & control	4939	Combination utilities, NEC
221122	Electric power distribution	4911	Electric services
221122	Electric power distribution	4931	Electric & other services combined
221122	Electric power distribution	4939	Combination utilities, NEC
221210	Natural gas distribution	4923	Natural gas transmission & distribution
221210	Natural gas distribution	4924	Natural gas distribution
221210	Natural gas distribution	4925	Mixed, manufactured, or liquefied petroleum gas production and/or distribution
221210	Natural gas distribution	4931	Electric & other services combined
221210	Natural gas distribution	4932	Gas & other services combined
221210	Natural gas distribution	4939	Combination utilities, NEC
237120	Oil & gas pipeline & related structures construction	1623-00	Water, sewer, and utility lines
237120	Oil & gas pipeline & related structures construction	1623-01	Oil, gas line & compressor station construction
237120	Oil & gas pipeline & related structures construction	1623-9900	Water, sewer, and utility lines, nec
237120	Oil & gas pipeline & related structures construction	1623-9903	Pipe laying construction
237120	Oil & gas pipeline & related structures construction	1623-9904	Pipeline construction, nsk
237130	(P) Power & communication line & related structures construction	1623-9901	Electric power line construction
237130	(P) Power & communication line & related structures construction	1623-9906	Underground utilities contractor
237130	(P) Power & communication line & related structures construction	1629-0503	Oil refinery construction
237130	(P) Power & communication line & related structures construction	1629-9905	Power plant construction
324110	Petroleum refineries	2911	Petroleum refining
325110	Petrochemical mfg.	2869-04	Fuels
333131	Mining machinery & equipment mfg.	3532	Mining machin & equip., except oil and gas field machin & equip.

Energy Industry Definition Cont'd

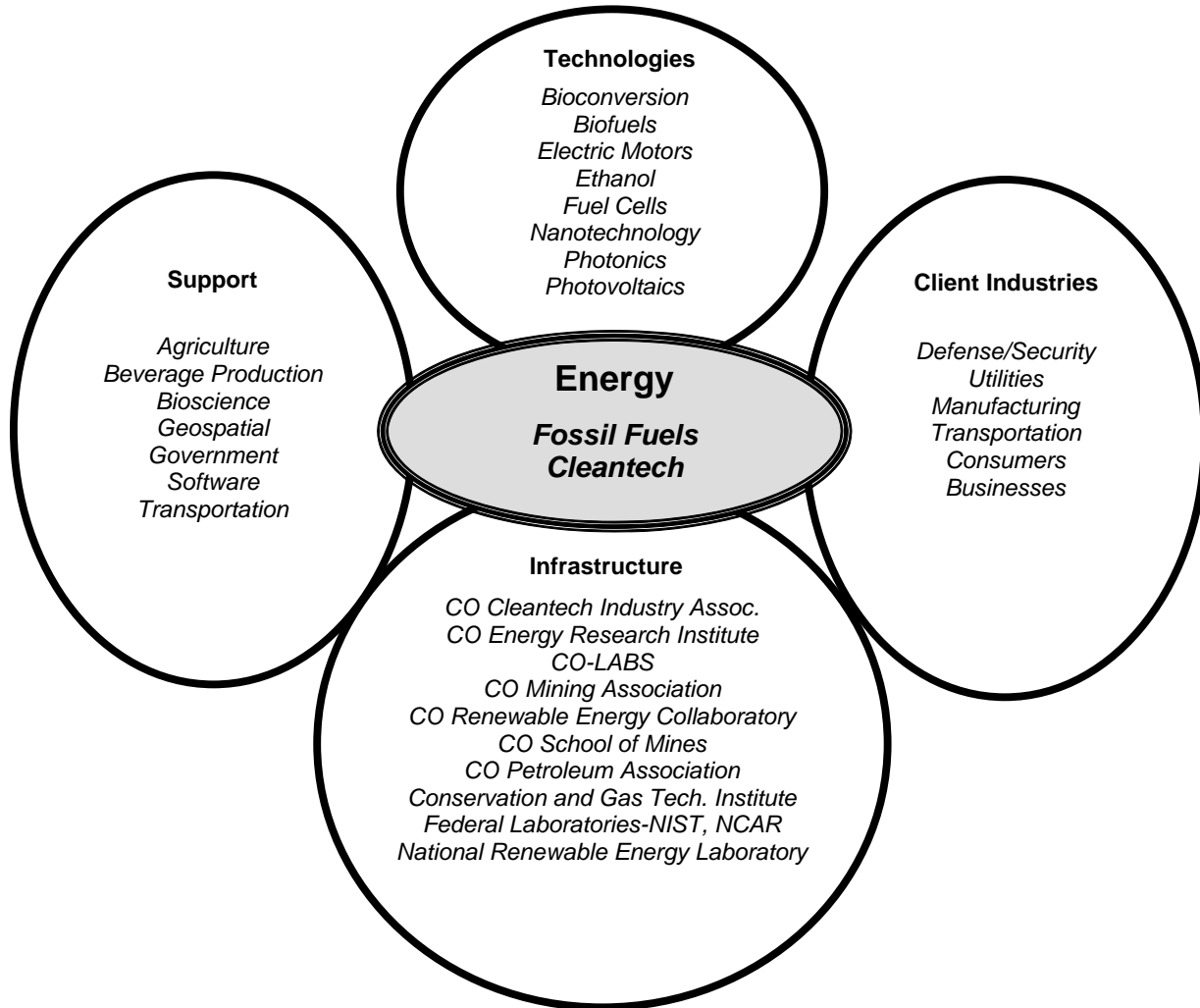
NAICS Code*	NAICS Description	SIC Code	SIC Description
333132	Oil & gas field machinery & equipment mfg.	3533	Oil & gas field machinery & equipment
423520	(P) Coal & other mineral & ore merchant wholesalers	5052	Coal & other minerals & ores
486110	Pipeline transportation of crude oil	4612	Crude petroleum pipelines
486210	Pipeline transportation of natural gas	4922	Natural gas transmission
486210	Pipeline transportation of natural gas	4923	Natural gas transmission & distribution
486910	Pipeline transportation of refined petroleum products	4613	Refined petroleum pipelines
523910	(P) Misc. intermediation	6792	Oil royalty traders
523999	(P) Misc. financial investment activities	6211-0303	Oil & gas lease brokers
523999	(P) Misc. financial investment activities	6211-0304	Oil royalties dealers
533110	(P) Lessors of nonfinancial intangible assets (except copyrighted works)	6792	Oil royalty traders
541330	(P) Engineering services	8711-03	Petroleum, mining, & chemical engineers
541360	(P) Geophysical surveying & mapping services	1382	Oil & gas field exploration services
Cleantech			
221330	(P) Steam & air-conditioning supply	4961-9904	Steam supply systems, including geothermal
237110	(P) Water & sewer line & related structures construction	1781-9901	Geothermal drilling
238210	(P) Electrical contractors & other wiring installation contractors	1731-0202	Energy management controls
238220	(P) Plumbing, heating & air-conditioning contractors	1711-0403	Solar energy contractor
238310	(P) Drywall & insulation contractors	1742-0204	Solar reflecting insulation film
314992	(P) Tire cord & tire fabric mills	2296-03	Cord and fabric for reinforcing fuel cells
325188	(P) All other basic inorganic chemical mfg.	2819-06	Fuels and radioactive compounds
325193	Ethyl alcohol mfg.	2869-0104	Ethyl alcohol, ethanol
333414	(P) Heating equipment (except warm air furnaces) mfg.	3433-9904	Solar heaters & collectors
333611	(P) Turbine & turbine generator set units mfg.	3511	Turbines & turbine generator sets
334413	(P) Semiconductor & related device mfg.	3674-0305	Photovoltaic devices, solid state
334413	(P) Semiconductor & related device mfg.	3674-0306	Solar cells
334413	(P) Semiconductor & related device mfg.	3674-9901	Fuel cells, solid state
334512	Automatic environmental control mfg. for residential, commercial, and appliance use	3822	Environmental controls
334515	(P) Instrument mfg. for measuring & testing electricity & electrical signals	3825-0305	Electrical power measuring equipment
334515	(P) Instrument mfg. for measuring & testing electricity & electrical signals	3825-0306	Energy measuring equipment, electrical
334519	(P) Other measuring & controlling device mfg.	3829-0218	Solarimeters
335311	(P) Power, distribution, and specialty transformer mfg.	3612	Power, distribution, & specialty transformers
335312	(P) Motor & generator mfg.	3621-03	Control equipment for electric buses & locomotives
335312	(P) Motor & generator mfg.	3621-9909	Windmills, electric generating
335911	Storage battery mfg.	3691	Storage batteries
335999	(P) All other misc. electrical equipment & component mfg.	3629-0102	Electrochemical generators (fuel cells)
336111	(P) Automobile mfg.	3711-0104	Cars, electric, assembly of
336399	(P) All other motor vehicle parts mfg.	3799-0302	Cars, off-highway: electric
423720	(P) Plumbing & heating equipment & supplies (hydronics) merchant wholesalers	5074-0208	Heating equipment & panels, solar
482111	(P) Line-haul railroads	4011-9901	Electric railroads
541380	(P) Testing laboratories	8734-00	Testing laboratories
541380	(P) Testing laboratories	8734-9902	Calibration & certification
541620	(P) Environmental consulting services	8748-9905	Environmental consultant
541620	(P) Environmental consulting services	8999-07	Earth science services
541620	(P) Environmental consulting services	8999-09	Scientific consulting

Energy Industry Definition Cont'd

NAICS Code*		NAICS Description	SIC Code	SIC Description
541690	(P)	Other scientific & technical consulting services	8748-9904	Energy conservation consultant
541712	(P)	Research & development in the physical, engineering, & life sciences (except biotechnology)	8731-0300	Natural resource research
541712	(P)	Research & development in the physical, engineering, & life sciences (except biotechnology)	8731-0301	Energy research
541712	(P)	Research & development in the physical, engineering, & life sciences (except biotechnology)	8731-0302	Environmental research
541712	(P)	Research & development in the physical, engineering, & life sciences (except biotechnology)	8733-9902	Research institute
924110	(P)	Administration of air & water resource & solid waste management programs	9511-00	Air, water, & solid waste management
924110	(P)	Administration of air & water resource & solid waste management programs	9511-01	Environmental agencies
926110	(P)	Administration of general economic programs	9611-9903	Energy development & conservation agency, gov't
926130	(P)	Regulation & admin. of communications, electric, gas, & other utilities	9631	Regulation, administration of utilities

**(P) indicates that only part of the NAICS industry category is represented in the industry cluster definition.
 Note: NEC indicates "not elsewhere classified."*

Energy Industry Cluster Relationships



For additional information, contact us:



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