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Clean Energy Leadership in the Rockies:

Competitive Positioning in the Emerging Green Economy

Photo courtesy Denver International Airport

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Competitive Positioning in the Emerging Green Economy

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ABOUT HEADWATERS ECONOMICS

Headwaters Economics is an independent, nonprofit research group. Our mission is to improve community development and land management decisions in the West.

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INTRODUCTION

This report focuses on the economic activities associated with clean energy and energy efficiency in the five states we call the Rocky Mountain Energy Producers—Colorado, Montana, New Mexico, Utah, and Wyoming—because these energy-related activities are now among the strongest segments of the green economy and show promise during challenging economic times.

Competitiveness in an investment climate marked by a focus on energy innovation stems hinges on demonstrated policy commitment to diversifying energy sources and curbing inefficient energy consumption. This report assesses progress among the Rocky Mountain Energy Producers, focusing on indicators of green economic success as well as policy leadership.

In most cases, green jobs have demonstrated a rate of growth significantly in excess of growth in total employment. In New Mexico, for example, while the number of total jobs in 2007 was 13 percent greater than in 1995, green jobs were 62 percent more numerous. Taking the study region as a whole, from 1995 to 2007 overall job growth across the economy of the five states was 19 percent, while job growth in the core green economy was 30 percent. Nationwide, overall jobs grew by ten percent, compared to green job growth of 18 percent from 1995 to 2007.[1]

In 2008, the Rocky Mountain Energy Producers attracted more than half-a-billion dollars in clean energy-oriented venture capital, a ten-fold increase compared to 2000 levels. Competitive stimulus funding awarded through the Department of Energy totaled nearly $1 billion, with Colorado and New Mexico together claiming 70 eprcent of the region's total, in addition to the millions of federal stimulus dollars delivered through formula-based grants.

The current and expected future growth in clean energy and efficiency means that the Rocky Mountain Energy Producers are experiencing an energy transition. Thanks to an abundance of fossil fuel resources, the five states already have major roles in the current system of energy production in the United States. Remarkably, these same states have equally striking command over a host of renewable energy resources. In addition, some of the states contain other assets—skilled workforces, leading public and private research institutions, and supportive state and local governments—necessary to encourage renewable energy generation and efficiency.

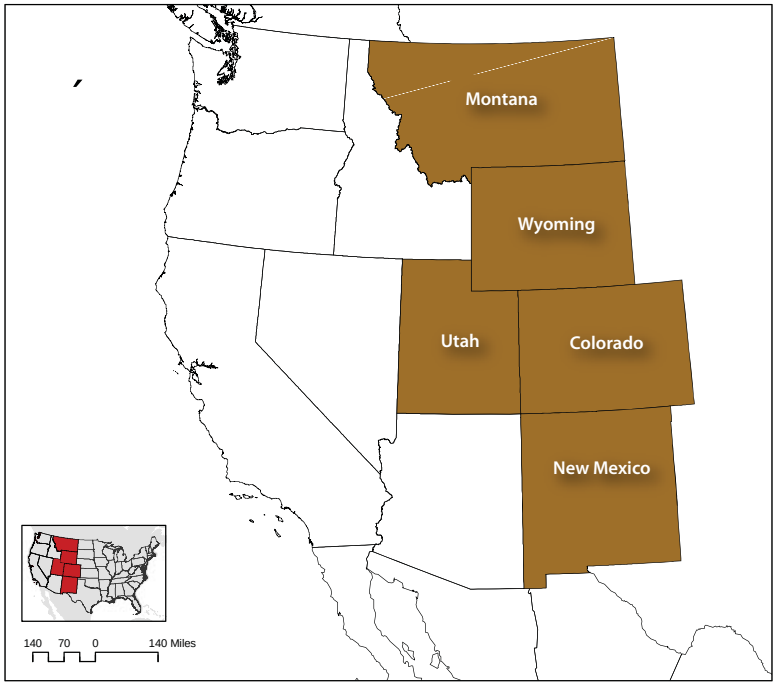
While traditional fossil fuels will remain the primary form of energy production, expanding the overall energy portfolio to include efficiency and diversity in energy sources is a national and international priority. Action will be rewarded with public and private investment, especially as the energy transition moves forward over the next two to three decades.

[1] Green Establishments Database, Collaborative Economics.

This study identifies many of the opportunities and challenges facing the Rocky Mountain Energy Producers as they experience a shift to a clean energy and energy-efficient future, and the implications for each state's economic prosperity. The report is divided into several sections followed by a conclusion and policy recommendations:

- We first provide a snapshot of the green economy, what activities it entails, employment sectors and trends, and how clean energy and efficiency is relevant to the five Rocky Mountain Energy Producers.
- The next portion profiles overall energy production in the study region and the contribution of renewable energy production to this overall profile. We then discuss the major influences on renewable production levels—such as public policy, market forces, or distribution bottlenecks—and offer an overview of the strategies that the five states have pursued to date.
- The following section examines each state's performance in terms of energy efficiency and what influences leadership in energy efficiency. By increasing economic output per unit of energy consumed, energy efficiency can encourage economic growth by avoiding costs, thus freeing up money for investment throughout the economy.
- Next, we measure the green economy's performance compared to overall economic performance in the five states in terms of growth, green establishments, total jobs, patents, and venture capital.
- The study concludes with an overview of the incentives, policies, and conditions necessary to foster clean energy and efficiency along with a set of policy recommendations for the local, state, and federal levels to encourage green economy development in the five Rocky Mountain Energy Producers.

Map 1. The Rocky Mountain Energy Producers



		Per Capita Real Gross Domestic Product by State (GDPS), 2008 *	Total Energy Production (Trillion BTU), 2007**	Employment in Mining[§] as Share of Total Employment, 2007 (2008)***
Colorado	Units	$41,102	2,335	1.3% (1.5%)
	Rank	10	10	9 (9)
Montana	Units	$28,170	1,214	1.2% (1.2%)
	Rank	48	14	10 (12)
New Mexico	Units	$30,935	2,553	3.1% (3.1%)
	Rank	40	8	6 (6)
Utah	Units	$32,049	1,087	0.9% (1.1%)
	Rank	39	16	12 (13)
Wyoming	Units	$40,837	10,290	12.6% (13.1%)
	Rank	11	2	1 (1)

[§] Includes fossil fuel development (oil and natural gas) as well as hard rock and coal mining.

Sources: *BEA, Regional Economic Accounts, GDP by State 2008, Release Date: June 2, 2009; **EIA State Energy Profiles, Release Date: March 18, 2010; ***U.S. Bureau of Labor Statistics, Quarterly Census of Wages and Employment, 2007 and 2008..

I. EXECUTIVE SUMMARY

The green economy is growing quickly, with Clean Energy and Energy Efficiency sectors leading.

This report focuses on the green economy of five states which we call the Rocky Mountain Energy Producers: Colorado, Montana, New Mexico, Utah, and Wyoming. Today these states, sparked in large part by the green economy, are experiencing an energy transition. As this occurs, the clean energy and energy efficiency sectors are increasing in importance to economic performance.

The green economy involves a variety of types of business activity and historically has been broken into five sectors: Clean Energy, Energy Efficiency, Environmentally Friendly Production, Conservation and Pollution Mitigation, and Training and Support. The largest category involves products and services associated with Conservation and Pollution Mitigation, which includes 65 percent of green jobs in the Rocky Mountain Energy Producers.

The dominance of this segment speaks to the powerful legacy of federal legislation established in the 1960s and 1970s, such as the Solid Waste Disposal Act, a bulwark of the recycling industry, and federal policies such as the Clean Air Act, Clean Water Act, and National Environmental Policy Act that support huge industries in environmental compliance.

Looking forward, the sectors that show the most promise to grow are those associated with the emerging policy emphasis on Clean Energy and Energy Efficiency. Policy trends and investment priorities suggest that support for these two sectors will continue to grow. The Clean Energy sector had a 12 percent share of all green jobs in 2007 and grew by an average increase of 78 percent over the same time. Correspondingly, the Energy Efficiency sector was 10 percent of total green jobs in 2007 and has grown substantially, with a 72 percent increase from 1995 to 2007.

This recent and rapid growth raises the possibility that clean energy and energy efficiency may dominate the green economy in the future, and the Rocky Mountain Energy Producers have every reason to expand their leadership in conventional energy production to include these emerging sectors. Honing capacity in these areas is a national and international priority, and action has been and will continue to be rewarded with public and private investment, especially as the energy transition moves forward over the next two to three decades.

The Rocky Mountain Energy Producers rank among the nation's top fossil fuel energy producers and also are well-situated to lead in renewable energy production.

Colorado, Montana, New Mexico, Utah, and Wyoming all rank among the nation's top 16 energy producers, thanks to development of abundant coal and natural gas resources. This energy leadership means that the Rocky Mountain Energy Producers largely are energy exporters, sending raw natural resources to other states. Wyoming is practically the coal mine to the nation, selling nearly four times as much coal in 2008 than the next runner-up, West Virginia.

With the exception of Colorado, the Rocky Mountain Energy Producers also produce electricity sell electricity through the region's grid, the Western Interconnection. This leading role in energy and electricity production also makes the states vulnerable to policy decisions about fuel and electrical supply made in other states or at the federal level.

In addition to containing a tremendous reserve of fossil fuel resources, the Rocky Mountain Energy Producers command the majority of the nation's wind, solar, and geothermal resources. Among the five states, Montana and Wyoming stand out for their wind and geothermal potential, Utah for its solar and geothermal, and Colorado and New Mexico for strength in all three.

While 2007 data from the Energy Information Administration shows that renewable energy is a small portion of the region's overall energy production, renewable energy production is growing in all five states. Recent data from the wind industry, for example, shows rapid recent growth: installed wind capacity among the five states increased by 3,000 megawatts since 1999, with more than two-thirds of that increase occurring in the past three years, 2006–2009.

For renewable energy production to maintain its current rate of growth, however, it must overcome several significant obstacles, including lack of capacity and connectivity in the regional electrical infrastructure, lack of capital, permitting slowdowns, price competition from fossil fuels, and high development costs.

The Rocky Mountain Energy Producers vary significantly in their policy approaches toward facilitating renewable energy production. While Colorado has the second-most ambitious Renewable Portfolio Standard (RPS) requirement in the country, Utah has a goal only with no enforcement, and Wyoming has neither. The use of incentives such as tax breaks for corporations varies significantly from state to state as well.

Renewable energy generators have choices when it comes to location in one state versus another. A state's demonstrated commitment to renewable energy sources is one factor affecting their decision.

Energy efficiency encourages economic growth.

As a region, the U.S. West appears to embrace the principle that energy efficiency is a cost-effective method to create economic growth by freeing up money that would otherwise be spent on energy for investment elsewhere in the economy. To promote this goal, the Western Governors Association has proposed a 20 percent energy efficiency goal for its 19 member Western states by 2020.

In practice, each of the Rocky Mountain Energy Producers has a mixed record in terms of energy consumption patterns and policy commitments to energy efficiency improvements. With the exception of Utah, all of the Rocky Mountain Energy Producers experienced net increases in per capita energy use at the residential level for the period 1997–2006.

The electrical power, industrial, and transportation sectors are the largest energy consumers in the region, but only Colorado and New Mexico are addressing overall efficiency in power generation through Energy Efficiency Resource Standards (EERS) programs—policies that set a quota for meeting future energy needs through energy efficiency measures by utilities.

Transportation efficiency also is not an area of strength for the Rocky Mountain Energy Producers. New Mexico has strong emission standards and Colorado operates a consumer incentives program for high efficiency vehicles, but none of the states spend money from their own budgets (e.g., other than federal) on state transit nor do they have programs that mandate coordinated land use and transportation planning.

Green jobs are outpacing overall job growth.

In most cases, green jobs have grown significantly faster than total employment. Nationwide, overall jobs grew by 10 percent, compared to green job growth of 18 percent from 1995 to 2007. Taking the five-state study region as a whole, overall job growth across the economy of the five states was 19 percent while job growth in the green economy was 30 percent from 1995 to 2007. In New Mexico total jobs in 2007 were 13 percent greater than in 1995 and green jobs grew by 62 percent.

Looking at the number of establishments, in 2007 the Rocky Mountain Energy Producers supported 3,567 green enterprises. Of these, 50 percent were based in Colorado, 16 percent were in Utah and in New Mexico, 11 percent in Montana, and 6 percent in Wyoming.

Colorado's green economy has the most energy-related (both Clean Energy and Energy Efficiency) jobs (both in number, and as a percent of total), while New Mexico has seen particularly striking growth, with the share of total increasing from 13 to 24 percent since 1995.

In the competition for private and public investment in the green economy, Colorado and New Mexico are well ahead of the rest of the energy producing states. With close to $800 million dollars in venture capital invested in the region for the period 1999 to 2008 (75% of total), Colorado ranked fifth among all U.S. states in terms of total venture capital invested (during the period 2006 to 2008). New Mexico is also a relatively important player, with its total investments of $239 million from 1999 to 2008 and a ranking of 12th nationwide during 2006 to 2008.

In public funding, Colorado is well ahead of the rest of the energy producing states and 15th among 52 receiving states and territories in competitively-awarded federal stimulus competitive grants from the Department of Energy, with $296 million in competitive grants and $241,000 in contracts. Utah and New Mexico fall toward the middle of the pack in the region and the nation. Utah received $85 million in competitive funds and New Mexico $27 million in competitive funds and $9 million in contracts, putting them 30th and 37th nationwide. Ranking 49th and 52d, Wyoming and Montana received $9.5 and $1.6 million in competitive funds respectively.

Colorado stands out as a regional leader in cultivating an expertise in engineering, computing, and scientific research, with more than 100,000 employees working in related businesses in 2008. New Mexico and Utah also show strength in these areas, while the more rural states of Montana and Wyoming lag behind. From the perspective of a business considering locations across the Rocky Mountain West, the employee pool in Colorado is likely to be most appealing.

Conclusions: Five Keys to Success in the Emerging Green Economy

The following are five basic strategies that emerged in our research as fundamentals in green economic development. We offer observations of states that have shown particular progress or lack of progress in pursuing these strategies.

1. Strategic Pairing of Incentives with Clear Policy Goals

Progress in clean energy production and energy efficiency depends on a smart mix of carrots and sticks. Because most renewable energy technologies involve high start-up costs, the renewable industry will locate and thrive in those geographies that provide the best incentives alongside the best access to reliable markets.

☑ Colorado leads the pack, and the nation, with clean energy and efficiency mandates that are matched by a suite of smart compliance and implementation policies and a wide portfolio of incentives.

☒ Utah could create competition for Colorado, given its large urban market for electricity and its access to university-based engineering and technology leadership. Salt Lake City has a nationally-recognized energy efficiency program. However the state's failure to create certainty for clean energy sectors—both its weak renewable mandate and fossil fuel-focused energy development incentive scheme—show evidence of a wavering commitment that has left the state behind in the green economy.

2. Encourage and Capture Large-Scale Investment

Private investment in clean energy technology has shown strength even in the context of the recession. The federal government also has demonstrated a commitment to the energy transition in the form of billions of dollars of federal funding for clean energy and energy efficiency enterprises. The most competitive states in attracting these important investment sources are those that have a complete package of serious policies, incentives, and proven record in developing technological expertise and a skilled workforce.

☑ Here again Colorado's growing momentum shows in the state's capture of 75 percent of the total venture capital in the region and 69 percent of energy-related competitive stimulus funding. Investors and public funding are rewarding the innovative and supportive environment that is a product of the state's policy commitments, good business environment, and research and development resources.

☒ Montana failed to capture any clean technology venture capital in the period 1999 to 2008 and ranked last (among 52 states and territories) in receipt of competitive clean energy public funding from the 2009 federal stimulus bill.

3. Cultivate a Well-Resourced Business Environment.
States are more likely to attract both private and public investment, and as a result to witness growth, if they create a competitive business environment that attracts key technology and business leaders. Innovative companies on the cutting edge of technological development benefit greatly from skilled workers and access to world-class research institutions, while companies seeking to manufacture and deploy energy-related products and services depend on appropriately-trained workers.

☑ Industry leaders are quick to recognize New Mexico's accomplishments in positioning itself at the heart of the North American solar industry. The state provides ample financial, logistical, and political support for the renewable energy industry and takes advantage of the location of several internationally significant research facilities in the state.

☒ Wyoming ranks among the best resourced states in terms of state revenues per capita. And the state's excellent wind resources have encouraged the creation of a nationally-recognized wind technology training program. Yet the graduates of that wind training program are often leaving to work in other states because the state has yet to devote its wealth to encouraging innovation and enterprise in the clean energy economy.

4. Leadership
Developers and manufacturers of clean energy and energy efficiency technologies operate in a highly competitive global environment. Demonstrated interest in and knowledge of the new energy economy on the part of state leaders can be a key element in attracting growth.

☑ Montana, New Mexico, and Colorado all have governors who have made an effort to reach out to the clean energy sector. These efforts have paid off with the successful recruitment of global corporations to each state, and perhaps equally important, the establishment of reputations as leaders—particularly in the case of Colorado and New Mexico—within the clean technology sectors.

☒ In Utah and Wyoming, unclear policies bordering on indifference to renewable energy and energy efficiency have played out in a reluctance of clean energy businesses and developers to focus their attention and their investments in these states.

5. Overcome Limited Infrastructure Capacity.
To fully cultivate their renewable energy resources, the Rocky Mountain Energy Producers must overcome an inadequate clean energy development infrastructure; which includes an outdated, overstressed electrical grid, as well as federal, state, and local governments that currently lack the capacity and the necessary plans to respond to permits for new construction (for new facilities and transmission lines).

☑ Wyoming has taken a lead regionally by being first to establish a state entity directly responsible for encouraging new transmission generation in 2004. The Wyoming Infrastructure Authority's strong financial and staff capacity has enabled it to attract several new transmission companies to the state.

☒ Colorado and New Mexico were later (2007) to establish state infrastructure authorities, and Colorado in particular is limited in bonding capacity by the state's cap on spending increases.

Implementation: Specific Policy Options

The Rocky Mountain Energy Producers vary significantly in their policy approaches to the clean energy economy and energy efficiency. The ideal policy portfolio of individual states differs based on the state's unique circumstances. Still each state can shape its competitive position with regards to clean energy production and energy efficiency.

1. Support for Clean Energy Markets

Across the renewable energy industry, business leaders agree that firm policies and financial support will expand clean energy markets, in turn generating new business and investment in the myriad services and technologies that make renewable energy generation and consumption possible. A clear commitment involves:

- Strong financial and logistical support for updates to state transmission infrastructure as well the regional electrical grid, the Western Interconnection
- Policies, such as Renewable Portfolio Standards, that include meaningful targets and are followed up with creative and practical approaches to compliance
- Integration of renewables into the electric grid and encouraging consumer-end use of renewables through net metering and interconnetion standards
- Incentives that reduce start-up costs for manufacturers and generators, and others that encourage investment in clean technology research and development
- Leaders who demonstrate knowledge of and interest in renewable energy and advocate for national clean energy policies

The table below measures the performance of each state with regard to the specific policies and tools described above. States that are ranked above average show national leadership, those ranked average are doing no more and no less than other states, while a below average score indicates a lack of commitment or activity in a given policy area.

Policy Performance: Clean Energy

	Colorado	New Mexico	Montana	Utah	Wyoming
Prioritizing infrastructure development	o	o	✓	o	✓
Robust policy mix	✓	✓	✓	(-)	(-)
Integration tools	✓	✓	o	o	o
Strong incentives	✓	✓	✓	o	(-)
Committed leaders	✓	✓	✓	(-)	(-)

✓ = above average o = average (-) = below average

2. Commit to Improving Energy Efficiency

Deploying the lowest cost energy source—energy saved through efficiencies—contributes to state economies by freeing up money otherwise spent on energy costs for circulation in other sectors of the economy. The goods and services associated with energy efficiency are fast-growing, especially as federal and state policy recognize the common-sense economic aspects of energy efficiency. States accelerate the energy efficiency economy through the following types of policies:

- Direct a certain portion of electric utility rates toward energy efficiency education and technical assistance programs
- Efficiency resource standards (EERS), similar to renewable portfolio standards, that direct utilities to accommodate a certain amount of projected future demand through energy savings. with meaningful targets and effective compliance
- Eliminate transportation inefficiencies by limiting sprawl and providing alternatives to car-based commuting
- Vehicle emissions standards and incentives for acquisition of fuel efficient vehicles
- Building and appliance standards that go beyond federal minimums

The table below measures the performance of each state with regard to the specific policies and tools described above. The scores makes it clear that energy efficiency is the area in which all of the Rocky Mountain Energy Producers stand to make significant progress.

Policy Performance: Energy Efficiency

	Colorado	New Mexico	Montana	Utah	Wyoming
Utility programs	o	o	o	o	(-)
Standards	✓	o	(-)	(-)	(-)
Transportation planning	(-)	(-)	o	(-)	(-)
Emissions policies	o	(-)	(-)	(-)	(-)
Building and appliance codes	o	o	o	o	(-)

✓ = above average o = average (-) = below average

In summary, the emerging green economy is distinguished by strong growth in clean energy and energy efficiency related activities. All of the states have opportunities to profit in these sectors. Those states with the fullest complement of policy leadership, resources, markets, access to knowledge and capital—namely Colorado and New Mexico—have a far better competitive position in the green economy than do states that have fewer of the key ingredients (Montana) or simply less demonstrated commitment (Utah and Wyoming).

II. ENERGY SECTORS LEAD EMERGING GREEN ECONOMY

The United States and other nations are engaged in a fundamental energy transition as the clean energy and energy efficiency sectors are growing in importance to economic performance. This section contains a preliminary snapshot to demonstrate the current connections between the green economy and the clean energy and energy efficiency sectors.

Questions Answered in this Section:

- What Activities Occur in the Green Economy?
- What is the Role of Clean Energy Production and Energy Efficiency in the Green Economy?

What Activities Occur in the Green Economy?

In this report, we use the following definition of the green economy.[2]

> *The green economy comprises all of those enterprises and individuals who work to provide products, services, and knowledge associated with: clean energy production, energy efficiency, natural resource conservation, and efforts to curb and cleanup environmental pollution.*

As described in Appendix 1, numbers reported here come from a survey of business establishments by California-based Collaborative Economics, in which firms were identified according to whether the products and services they offer meet a definition of green business activity. Jobs numbers were developed by tallying employee numbers for each firm. The database breaks green enterprises into five major segments, comprising a total of sixteen types of business activities. The categories are shown below, with data and more detail developed on the following few pages.

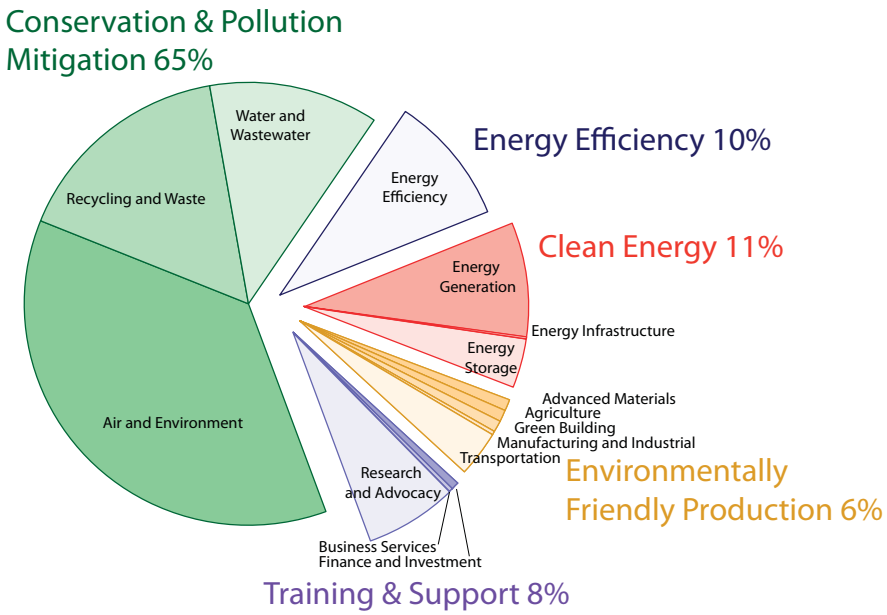
Table 1. Five Categories of the Green Economy (After Pew, 2009)

Clean Energy Building sustainable energy for the future	**Energy Efficiency** Reducing and managing energy demands	**Environmentally Friendly Production** Improving the processes and products behind work and life (food, transportation, buildings, consumer products)	**Conservation and Pollution Mitigation** Recycling and remediating waste
Training and Support The critical auxiliary professional and financial support for all green businesses.			

Source: The Pew Charitable Trusts, "The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America," 2009. http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf.

[2] This methodology was developed by Collaborative Economics on behalf of Next10, a California-based nonprofit, for the California Green Innovation Index.

Figure 1. Green Jobs by Category among Rocky Mountain Energy Producers, 2007



Source: Green Establishment Database, Collaborative Economics.

Why is it Difficult to Measure the Green Economy?

Detailed reporting on economic trends, for example the number of jobs and businesses in a sector over time, typically draws on established public data sources, for example publications the U.S. Department of Commerce. Today however, there are no codes in any federal census data that accurately capture the green economy, either its key categories or in its entirety.

The U. S. Bureau of Labor Statistics is working to remedy this problem, but will make data available in 2011 at the earliest. In the absence of a reliable federal dataset, researchers have two choices. One option is economic models that estimate numbers of jobs and economic activity based on the market share of a given set of products and services. These models can be unreliable, particularly in cases where there is little in the way of published historical trend data on which to base fundamental assumptions, as is the case in the green economy. Another option, the one we chose—as executed by Collaborative Economics, is to literally count the number of businesses that meet a definition of "green." This is an exceedingly conservative method, as it makes no assumptions about the many jobs throughout the economy that support and receive partial support from the green economy, such as general accounting firms, repair shops, and so on.

Given the tendency for available models to either over or underestimate green economic activity, it makes sense to draw upon a series of other indicators. For reasons that are explained in this report, in the Clean Energy and Energy Efficiency sectors, economic performance is closely linked with performance in the policy arena. An equal, perhaps more meaningful measure of competitiveness to counting jobs and businessess, are measures of the policy commitments states have made in anticipation of the energy transition.

Types of Establishments in the Green Economy

Categories and Definitions from the Green Establishment Database (Collaborative Economics).

Category	Subsegment	Description of Products and Services
Clean Energy	Energy Generation	Renewable energy generation (all forms of solar, wind, geothermal, biomass, hydro, marine & tidal, hydrogen, co-generation) Renewable energy consulting services Research and testing in renewable energy Associated equipment, controls, and other management software and services
	Energy Infrastructure	Consulting and management services Cable & equipment
	Energy Storage	Advanced batteries (Li-Ion, NiMH) Battery components & accessories Fuel cells
Energy Efficiency	Energy Efficiency	Energy conservation consulting and engineering services Building efficiency products and services Energy efficiency research Energy efficiency meters & measuring devices Alternative energy appliances (solar heating, lighting, etc.)
Environmentally Friendly Production	Advanced Materials	Bioplastics New materials for energy efficiency
	Agriculture	Sustainable land management and business consulting services Sustainable supplies and materials Sustainable aquaculture
	Green Building	Design and construction Building materials Site management Green real estate & development
	Manufacturing and Industrial	Advanced packaging Process management Industrial surface cleaning
	Transportation	Alternative fuels (biodiesel, hydrogen, algae and biowaste-ethanol and feedstock-neutral ethanol infrastructure) Motor vehicles and equipment
Conservation and Pollution Mitigation	Air and Environment	Emissions monitoring & control Environmental remediation Environmental consulting (environmental engineering, sustainable business consulting)
	Recycling and Waste	Consulting services Recycling (paper, metal, plastics, rubber, bottles, automotive, electronic waste and scrap) Recycling machinery manufacturing Waste treatment
	Water and Wastewater	Water conservation (control systems, meters & measuring devices) Pump technology Consulting services Water treatment/purification products Research and testing
Training and Support	Finance and Investment	Emissions trading and offsets Venture capital/private investment Project financing (e.g., solar installations, biomass facilities, etc.)
	Research and Advocacy	Organizations and institutions focused on renewable energy, alternative fuels, and transportation
	Business Services	Environmental law legal services Green business portals Green staffing services Green marketing and public relations

Strong Clean Energy Policies Drive Green Job Creation

The chart and tables shown here reinforce a critical point: policy has a significant impact on the size and growth of sectors within the green economy.

Sixty-five percent of green jobs in the Rocky Mountain Energy Producers are in the Conservation and Pollution Mitigation category, with 37 percent in the Air and Environment subsegment, which includes emissions monitoring and control and environmental remediation. The dominance of these segments speaks to the powerful legacy of federal legislation established in the 1960s and 1970s, such as the Solid Waste Disposal Act, a bulwark of the recycling industry, and the Clean Air Act, Clean Water Act, and National Environmental Policy Act that support a huge industry in environmental compliance.[3]

Table 2. Green Jobs by Category and Subsegment among Rocky Mountain Energy Producers, 2007

Category	Subsegment	Number of Jobs 2007	Share of Total Green Jobs 2007	Percent Change, 1995-2007
Clean Energy	Energy Generation	2,534	8%	81%
	Energy Infrastructure	26	<1%	86%
	Energy Storage	1,059	4%	68%
Energy Efficiency	Energy Efficiency	2,939	10%	72%
Environmentally Friendly Production	Advanced Materials	210	<1%	68%
	Agriculture	323	1%	77%
	Green Building	201	<1%	56%
	Manufacturing and Industrial	55	<1%	n/a*
	Transportation	1,059	4%	31%
Conservation and Pollution Mitigation	Air and Environment	11,261	37%	43%
	Recycling and Waste	4,892	16%	14%
	Water and Wastewater	3,735	12%	-10%
Training and Support	Business Services	159	<1%	94%
	Finance and Investment	59	<1%	1375%
	Research and Advocacy	2,079	7%	-4%

Source: Green Establishment Database. Data shown on this page is aggregated for CO, MT, NM, UT, and WY.

[3] For an overview of peer-reviewed studies documenting the link between waste management policy and growth in the recycling sector, see http://www.ilsr.org/recycling/recyclingmeansbusiness.html as well as the E.P.A.'s "U.S. Recycling Economic Information Project" (2000), conducted in consortium with 19 cooperating state and national agencies, available at: http://www.epa.gov/waste/conserve/rrr/rmd/rei-rw/index.htm/.

Looking closely at the growth rates reported in Table 2, the sectors that show the most promise for the future are those associated with an emerging policy emphasis on Clean Energy and Energy Efficiency. At a federal level, these policies include long-standing programs such as the Environmental Protection Agency's Energy Star Program, established in 1992, as well as more recent policy measures in both the recent Bush administration and the Obama administration focused on incentives for renewable energy production. A flurry of state policies emerging in the Rocky Mountain states in the past ten years reflects a similar priority on energy efficiency and renewable energy production. (See Sections III and IV for more information.)

Correspondingly, some of the most significant growth in the number of green jobs in the Rocky Mountain Energy Producers comes from energy-related activities. The category Clean Energy had a 12 percent share of all green jobs in 2007. Its three subsegments—Energy Generation, Infrastructure, and Storage—demonstrated a combined average percent increase of 78 percent in the period 1995 to 2007. The Energy Efficiency segment was 10 percent of total green jobs (2007), and also has grown substantially, with a 72 percent increase from 1995 to 2007.

Looking at the current numerical strength of the Conservation and Pollution Mitigation category, with an understanding that this sector is supported by a longstanding constellation of policies at the state and federal level, raises the question of whether the current policy environment signals the potential for similar growth and dominance by the Clean Energy and Energy Efficiency sectors in the future. This exploration is a critical task of this report.

Maintaining economic growth while reducing our dependence on carbon-based energy sources constitutes one of the most pressing problems of our age. Thus, in the sense of creating clean energy sources to fuel economic growth, activity in the Clean Energy and Energy Efficiency sectors of the green economy also offers a solution to the critical social problem of climate change.

Thanks to an abundance of fossil fuel resources, the Rocky Mountain Energy Producers have major roles in the current system of energy production in the United States. Remarkably, these same states have equally striking command over a host of renewable energy resources. In addition, some of the states are in command of other assets—skilled workforces, leading public and private research institutions, and supportive state and local governments—necessary to encourage not only renewable energy generation but entrepreneurship throughout the energy innovation spectrum.

Perhaps most significantly in the current economic and political environment, the ability to attract and capitalize on federal support directed at greening energy production and reducing energy waste is a critical element of state economic competitiveness. Progress on this issue is a measure of the region's capacity to adapt to a changing global economy. Pew Charitable Trust's Report titled "Who's Winning the Clean Energy Race?" points out that in relative terms China's investment in clean energy in 2009 dwarfed investment by the U.S. at a scale of three to one.[4] The report also

[4] Pew Charitable Trusts, "Who's Winning the Clean Energy Race? Growth, Competition, and Opportunity in the World's Largest Economies." 2010, 5. http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Global_warming/G-20%20Report.pdf

notes that Clean Energy has proved among the most resilient in the current economic downturn, garnering $162 billion in investment worldwide in 2009.[5]

In sum, the Rocky Mountain Energy Producers have every reason to expand their Leadership in conventional energy production to the Clean Energy and Energy Efficiency sectors. Honing capacity in these areas is a national and international priority, and action in these sectors will be rewarded with public and private investment, especially as the energy transition moves forward over the next two to three decades.

Summary Findings:

- The green economy involves a variety of types of business activity. Its largest category involves products and services associated with Conservation and Pollution Mitigation, which reflects the influence of historic environmental protection policies that have supported growth in fields such as recycling, waste management, and water protection.
- The fastest-growing categories in the green economy in the Rocky Mountain Energy Leading states are the Clean Energy and Energy Efficiency categories.
- Policy trends and investment priorities suggest that support for clean energy and energy efficiency will continue to grow, and with them, the economic significance of those sectors.
- Available resources suggest that the energy production legacy of the Rocky Mountain Energy Leading states could be mirrored with similar accomplishments in Clean Energy and Energy Efficiency.

[5] Pew Charitable Trusts, "Who's Winning the Clean Energy Race?," 4.

III. ENERGY PRODUCTION AND THE ROLE FOR CLEAN ENERGY

This section profiles energy production in the region and examines contributions of renewable energy production to this overall profile. We then discuss the major influences on renewable production levels and offer an overview of the strategies that the Rocky Mountain Energy Producers have pursued to date.

Questions asked in this section:

3. How Are the States in this Report Energy Producers?
4. What Do Renewable Resources Contribute to the Region's Overall Energy Profile?
5. What Influnces Leadership in Renewable Energy Production?

Study States Among Nation's Most Important Energy Producers

Table 3 displays energy production information for the five states for 2007, compiled by the U.S. Energy Information Administration based on statistics for the volumes of coal, crude oil, and natural gas produced in each state.[6] These five states are among the highest producers of energy in the nation. By far, the largest producer of energy is Wyoming, which produces more than four times as much energy as any of the other states.

Table 3. Energy Production by State, with National Rankings, 2008

	Total Energy Production (Billion Btu), 2007	Rank (among 50 states and D.C.)	Total Energy Production (Billion Btu), Per Capita, 2007	Rank (among 50 states and D.C.)
Colorado	2,335,331	10	0.48	10
Montana	1,214,895	14	1.27	6
New Mexico	2,553,760	8	1.30	5
Utah	1,087,452	16	0.41	13
Wyoming	10,290,489	2	19.66	1

Source: U.S. EIA, State Energy Data, 2007 (Production)

[6] U.S. Energy Information Administration, State Energy Data 2007: Consumption. http://www.eia.doe.gov/emeu/states/sep_sum/html/pdf/sum_btu_1.pdf.

As Net Energy Exporters, Rocky Mountain Energy Producers Vulnerable

Table 4 illustrates another critical point about the five Rocky Mountain Energy Producers. With energy resources well in excess of demand within their own borders, these states are energy exporters. As energy exporters, states such as New Mexico and Wyoming are poised to benefit when demand for domestic fuels such as natural gas and coal are high, but they also can be exposed when demand falls, due either to market forces such as the recent recession or changing energy policy priorities.

Table 4. Energy Supply Statistics, with National Rankings, 2007

	Natural Gas Available for Export, 2007 (MMcf)*	Rank (among 50 states and D.C.)	Coal Disposition (Thousand Short Tons), 2008**	Rank (among 30 coal-producing states)
Colorado	669,605	5	33,463	18
Montana	41,450	10	44,272	5
New Mexico	1,214,628	3	23,468	13
Utah	153,993	6	25,833	12
Wyoming	1,735,724	2	465,365	1

*Natural Gas Produced Less Natural Gas Consumed. Source: EIA, Natural Gas Annual Supply and Disposition by State. http://tonto.eia.doe.gov/dnav/ng/ng_sum_snd_a_EPG0_VC0_Mmcf_a.htm.
**EIA Annual Coal Report 2008, http://www.eia.doe.gov/cneaf/coal/page/acr/acr_sum.html.

Source: U.S. EIA, State Energy Data, 2007 (Consumption)

The Rocky Mountain Energy Producers export raw natural resources, especially coal and natural gas, for use in homes and power plants to other states. Wyoming is practically the coal mine to the nation: it sold nearly four times as much coal in 2008 than the next runner-up, West Virginia, and more than the Central Appalachian coal region (Pennsylvania, Kentucky, and West Virginia) as a group. The five states in this study ranked in the nation's top ten states for natural gas available for export in 2007.

The states vary significantly with regards to how closely tied their overall economies are to energy markets.[7] Wyoming is the only state that has a significant dependence on energy production, with 12 percent of total state employment in mining (includes fossil fuels) in 2007, the most of any state in the country. In the other states, the percentage of total employment in mining (and related services) is at most 3 percent (New Mexico), indicating that state economies are diversified to the point that the state as a whole does not suffer because fossil fuel prices decline.

[7] See Map 1. For more information, see Headwaters Economics, 2008. Energy Development and the Changing Economy of the West. http://www.headwaterseconomics.org/energy.

Nonetheless the leadership role of these states in energy production creates significant vulnerability to demand-side issues within the energy production sector and in certain geographies within states where energy production is a mainstay of the local economy.

A recent rapid decline in the natural gas industry in parts of Wyoming, Colorado, and New Mexico that were booming in the early 2000s provides a painful reminder of the human costs of vulnerability through energy dependence. In addition to market dynamics like national recessions, energy policies that penalize $C0_2$ emissions could potentially affect the demand for coal significantly. Diversifying energy production represents a proactive approach to anticipating the impacts of market fluctuations and changing regulatory trends, and has the potential to offer much needed economic diversity in energy-dependent regions within states.

Map 2 demonstrates that these states provide energy to the nation not only in the form of raw fossil fuels, but also in the form of electricity through the grid. Map 2 shows the interconnectedness of electricity supply and demand, indicating the major electrical grid for the region, the Western Interconnection, along with figures for net interstate flow of electricity to and from each state.

The numbers for each state on the map indicate both the amount of electricity generated and the amount of interstate trade in electricity (Million KWh) by the Rocky Mountain Energy Producers. Montana, New Mexico, and Utah are net exporters, and Wyoming sells more electricity by nearly double of any other state in the West except Arizona. The exception is Colorado, which depends on a small amount of electricity from out-of-state.[8]

Selling electricity into the Western Interconnection makes the Rocky Mountain Energy Producers vulnerable to the policy decisions about electricity supply made in other states. For example, when a consuming state mandates that a portion of the state's energy supply be derived from renewable sources or otherwise penalizes electricity from sources with high $C0_2$ emisisons, a producing state's electricity exports may lose value. With 94 percent of its electricity generated from coal in 2008, Wyoming stands out as a state especially vulnerable in this respect.[9]

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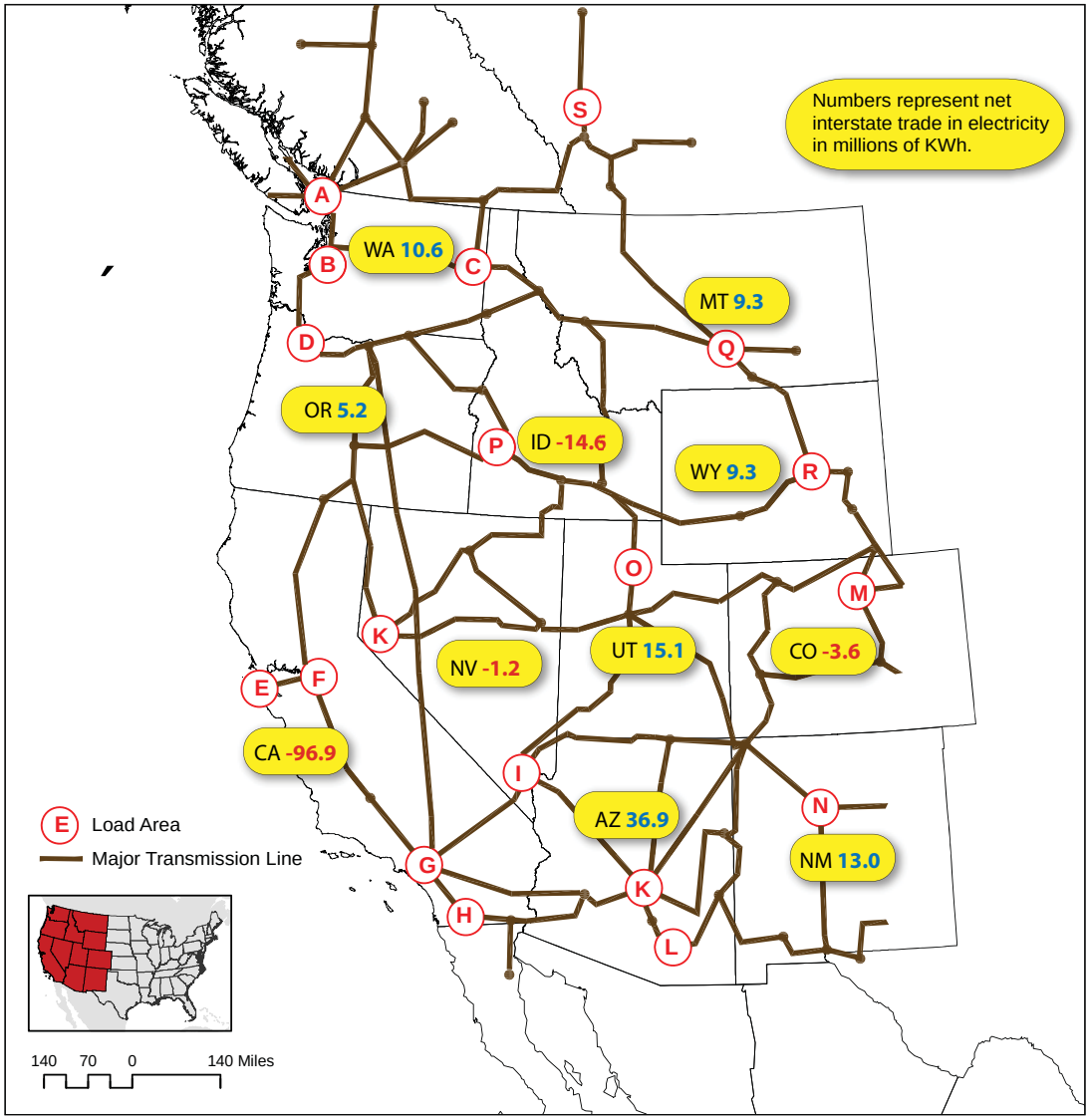
[8] EIA State Electricity Profiles, Table 10. Supply and Disposition. Release Date: Sept 10, 2009. http://www.eia.doe.gov/cneaf/electricity/st_profiles/. Net Interstate Trade is the difference between Total Supply and Total Disposition.

[9] EIA State Electricity Profiles, Table 5. Electric Power Net Generation by Primary Energy Source and Industry Sector, 1998, 2002–2008. Release Date: Sept 10, 2009. The percentages of electricity from coal for the other states are: Colorado 65%, Montana 62%, New Mexico 73%, and Utah 82%.

Map 2. The Electric Grid and Net Interstate Trade in the Western U.S.

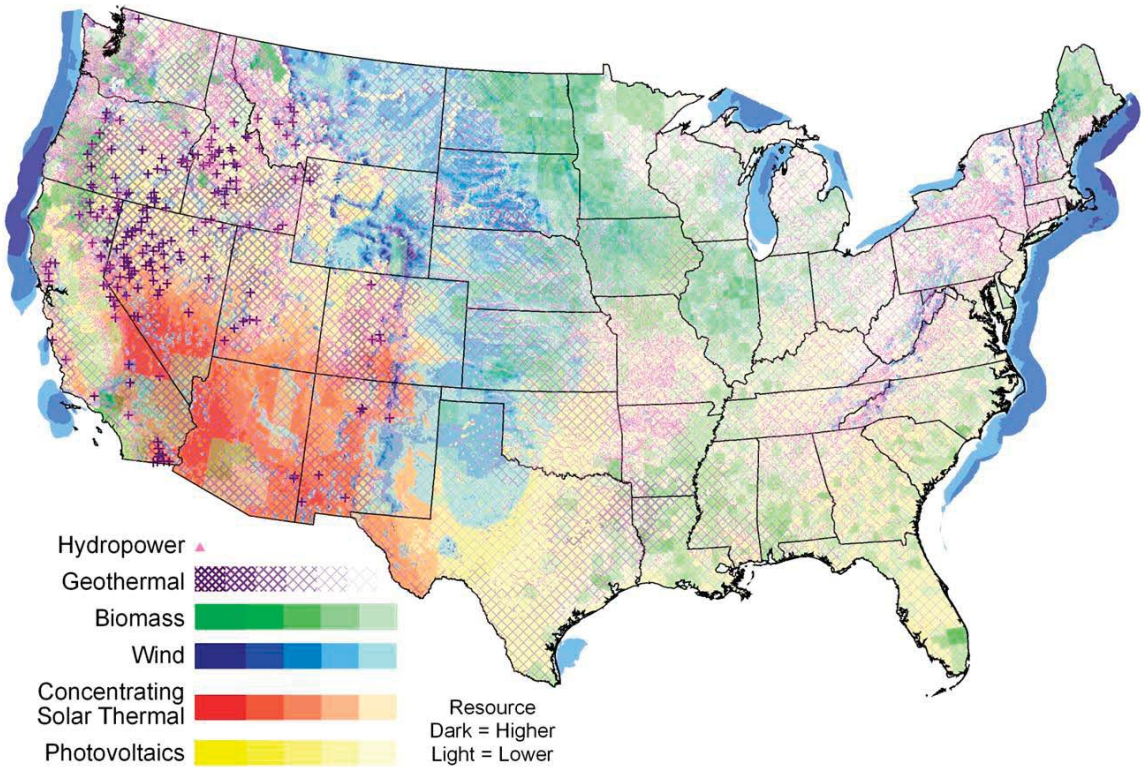


Sources: Transmission Infrastructure: WGA/ZITA Planning Group. Transmission Segments Map. http://www.westgov.org/. Electricity supply: EIA State Electricity Profiles, Table 10. Supply and Disposition, Release Date: Sept 10, 2009.

How Do Renewable Resources Contribute to the Region's Energy Profile?

In addition to commanding tremendous fossil fuel reserves, the Rocky Mountain Energy Producers occupy important geographic positions with respect to renewable energy, as shown in Map 3. The western states command the majority of the nation's wind, solar, and geothermal resources. Among the Rocky Mountain Energy Producers, Montana and Wyoming stand out for their wind and geothermal potential, Utah for its solar and geothermal, and Colorado and New Mexico for strength in all three. (Darker colors indicate higher concentrations of available resources.)[10]

Map 3. Locations of Renewable Resources in the United States, NREL



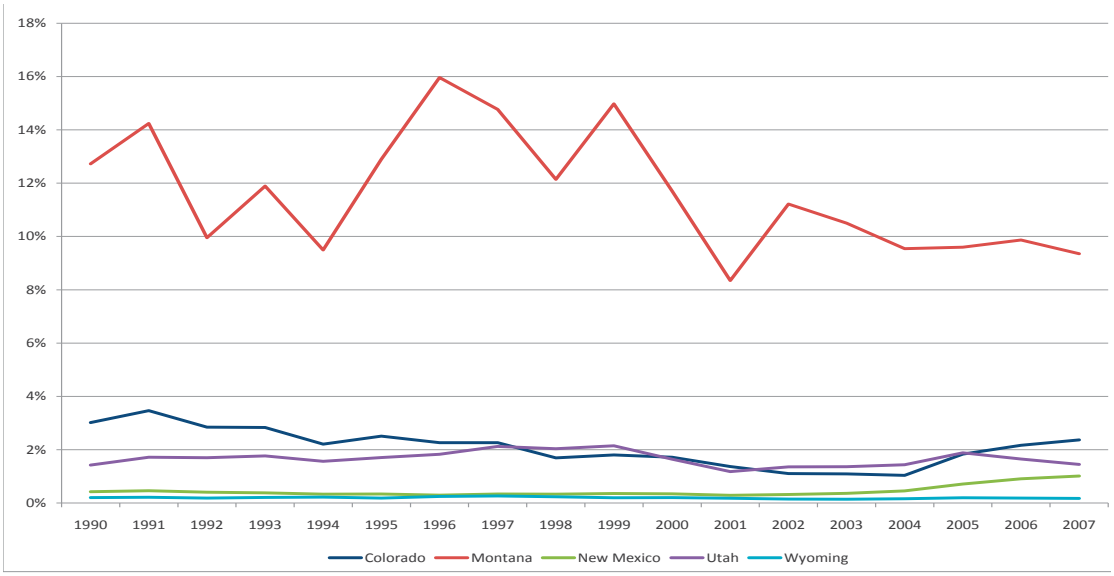
Source: NREL, Renewable Energy Technology Resources Maps.

[10] Hydroelectric power is considered a renewable resource, but the majority of policies aimed at generating new renewable energy, such as state quotas for purchasing electricity from renewable sources, exclude existing hydroelectric projects from qualification as 'renewable.'

Renewable energy sources today are a relatively small part of each state's energy profile, with the exception of Montana, where renewable sources are 9.4 percent of total energy produced. This is due to the state's high productivity of hydroelectric power (fifth in the nation). (A more complete discussion follows later in this section.) A fundamental point is that while renewable energy production has increased in recent years, fossil fuels continue to play a dominant role in the overall energy mix due to the nation's reliance on coal and the recent boom in natural gas production in the Rocky Mountain West.

Figure 2 shows the contribution of all renewable sources (fuel ethanol, geothermal, conventional hydroelectric, solar (themal and photovoltaic), wind, wood and biomass waste) to total energy production in each of the five states from 1990 to 2007, the most recent data available that tallies energy across a variety of sources.[11] Because this chart considers all energy production, increases at the start of the decade in coal and natural gas production in places like New Mexico, Colorado, and Wyoming have a dampening effect on renewable energy's share of total.

Figure 2. Renewable Energy Production as a Percent of Total Energy Production

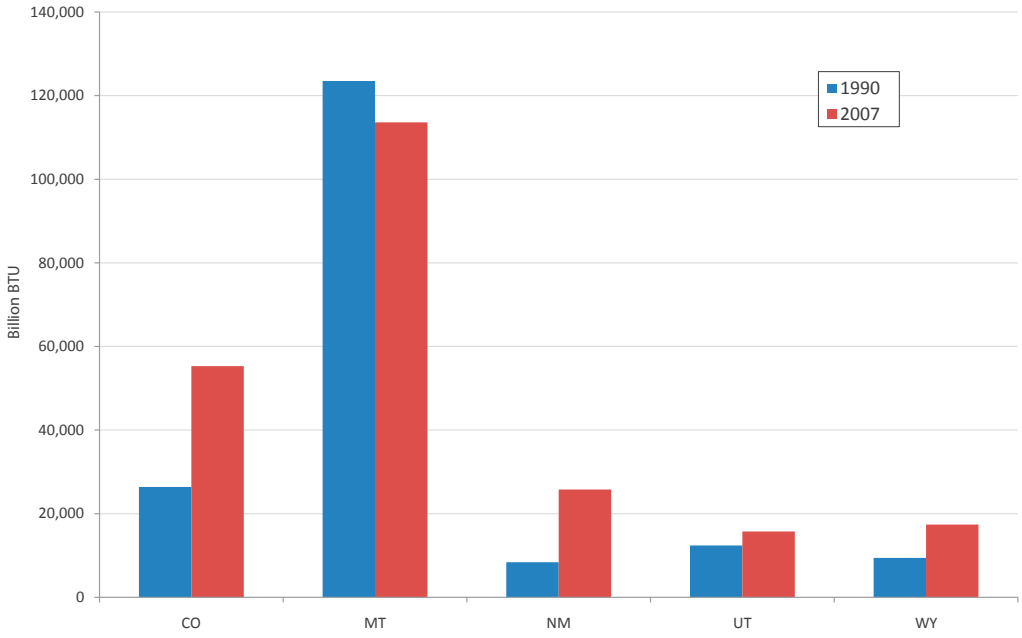


Source: EIA State Energy Data, 2007 (Production).

[11] According to the U.S. Energy Information Administration, "Over half of renewable energy goes to producing electricity. About 9 percent of U.S. electricity was generated from renewable sources in 2008. The next largest use of renewable energy is the production of heat and steam for industrial purposes. Renewable fuels, such as ethanol, are also used for transportation and to provide heat for homes and businesses." http://tonto.eia.doe.gov/energyexplained/index.cfm?page=renewable_home. In the study area states, fuel ethanol is a significant component of total renewable production only in Colorado and New Mexico (in 2007, 20% in Colorado and 11% in New Mexico). (EIA SEDS, Production by State 2007.)

In fact, renewable energy production is growing rapidly in each of the five states. Growth trends are shown in Figures 3 and 4. The first is based on the most recent data for renewable production from the U.S. Energy Information Administration and shows growth in renewable production for all sources (fuel ethanol, geothermal, hydroelectric, solar, wind, wood and waste) through 2007. Total energy output from renewable systems increased in all states except Montana, where changes in ownership and management of the state's large hydroelectric facilities affected production levels.

Figure 3. Renewable Energy Production, 1990 and 2007

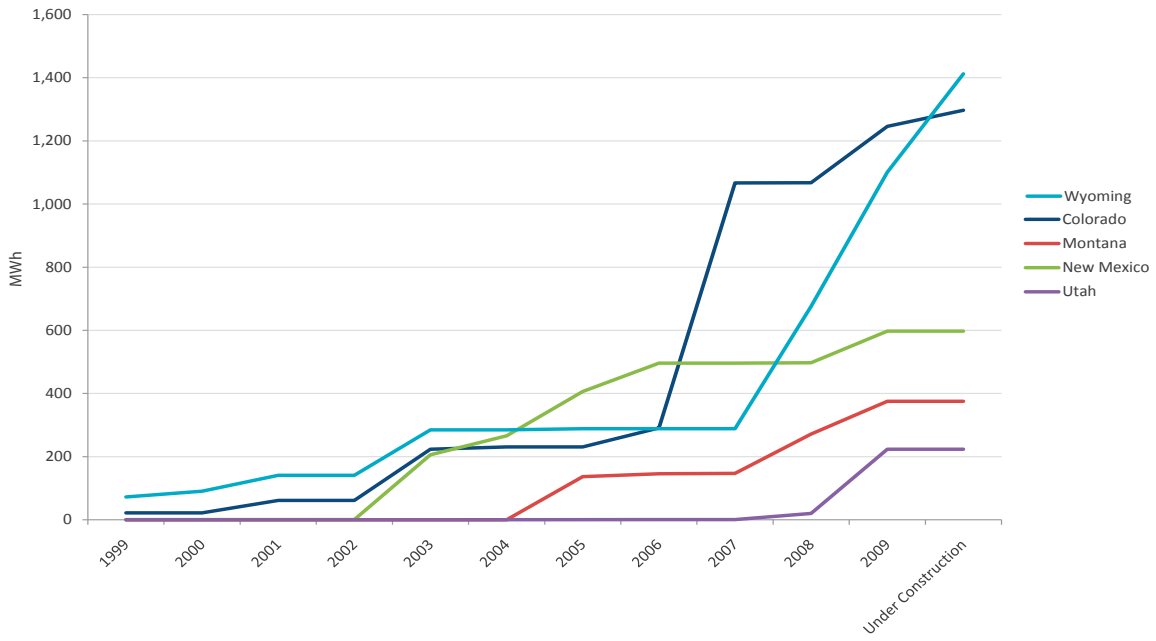


Source: U.S. EIA, State Energy Data Systems (SEDS), 2007 Production (Oct. 30, 2009 release).

Wind energy represents the area of most significant growth in new renewable energy in the five states. In 1999, there were 145 turbines spinning in the five states, generating about 985 MWh of electricity. At the end of 2009, there were 2,389 turbines generating nearly 3,500 MWh of electricity.[12] Figure 4, based on the most recent data available from the wind energy industry, shows growth in installed wind capacity for each state since 1999, suggesting that growth in the past two years has been substantial.

[12] American Wind Energy Association, Project Database. http://www.awea.org/projects/, accessed 3/17/2009.

Figure 4. Installed Wind Capacity, 1999-2009, plus Under Construction in 2010



Source: American Wind Energy Association, Project Database.

Table 5 below shows the amount of installed wind capacity in each state at the end of 2009, ranking that capacity against other states both in terms of available wind resources and installed capacity. What emerges is a clear leadership role for Wyoming and Colorado both in terms of native wind potential and installed capacity.

Table 5. Wind Potential and Installed Capacity in 2009

State	National Ranking by Potential Wind Capacity	2009 Installed Wind Capacity (MWh)	National Ranking by Installed Wind Capacity (MWh)
Colorado	11	1245.75	9
Montana	5	375.0	18
New Mexico	12	597.48	16
Utah	26	201.6	22
Wyoming	7	1101.06	12

Source: American Wind Energy Association, Project Database.

Leadership in Renewable Energy Production Demands Dedication

A number of factors affect trends in renewable energy production including the geographic location of resources, infrastructure, siting concerns, demand, and policy.

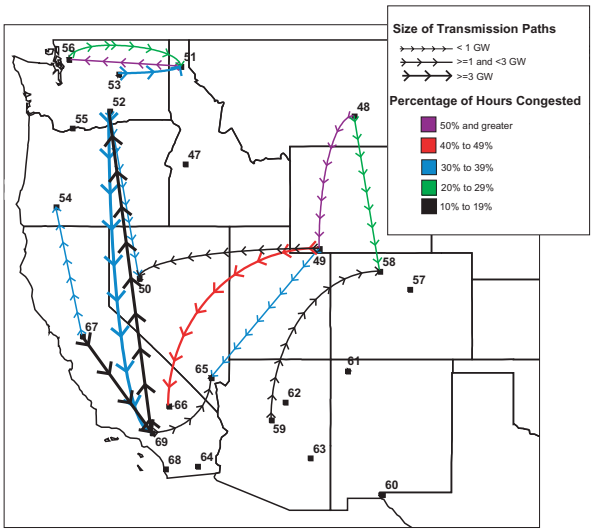
As Map 3 indicated, there is no shortage of renewable resources in the Rocky Mountain Energy Producers. The Western Governors Association (WGA), representing 19 states (and Guam, the Northern Mariana Islands and American Samoa), has put Clean Energy generation among its top platform priorities.[13] In 2006, the WGA announced a goal of adding 30,000 megawatts of clean energy by 2015.[14]

The development of new renewable energy sources hinges on overcoming two major barriers: a lack of supporting infrastructure and high costs of development.

Addressing Regional Infrastructure Constraints

The Western Interconnection, along with most of the nation's electrical transmission grid, is under stress.

Map 4. Congestion in the Western Interconnection



Source: Department of Energy, "National Transmission Grid Study," 2002.

Map 4, reproduced from a Department of Energy Report on the National Transmission Grid, illustrates bottlenecks in the Western Interconnection.

Unable to handle demands in the delivery of conventionally-generated energy, the Western Interconnection is further inadequate when it comes to integrating renewable sources. Renewable sources present unique and serious transmission challenges due to their intermittency (solar and wind) and the remoteness of the site of generation.

Lack of capacity and connectivity helps to explain why Montana's tremendous wind resources—the state is fifth in the

[13] The WGA includes "Advanced Fossil Fuels" such as 'clean' coal among its clean energy sources.

[14] When the organization released the first (and to date, only) update on progress toward this goal in mid-2007, it observed that the wind represented 93% of the new renewable energy developed in 2004 and 2005. The WGA projected that if growth rates observed in 2004 and 2005 continue, the region could add as much as 70,000 MW in clean energy generating capacity by 2015. WGA, "Clean Energy, a Strong Economy and a Healthy Environment, 2007 Update," 2.

nation in potential wind capacity—are less well developed than those in Colorado and Wyoming. Updating national and regional transmission grids to accommodate renewable energy production is a major priority for both the Obama administration and the Western Governors Association.[15]

Updating the transmission system will require extensive coordinated planning. New transmission lines, like new renewable power projects, often involve review processes from multiple permitting agencies, many of which have been overwhelmed by dozens of new proposals in the past several years.[16]

[15] See also WGA Western Renewable Energy Zones Phase 1 Report.

[16] For example, the BLM has over 200 pending applications for solar development that cannot be processed until the agency has completed the Programmatic Environmental Impact Statement process. Three current applications for large installations in California would potentially add 2,000 MW of capacity according to a BLM news release. For the solar PEIS, see http://solareis.anl.gov/documents/index.cfm. Press Release: BLM Q&A 6/29/09, https://www.interior.gov/news/09_News_Releases/SolarEnergyQA.pdf.

Bringing Renewables to Market: Transmission Development

Transmission development is challenging from both commercial and public policy aspects, involving as it does projects of enormous scale, both geographic and financial.

State infrastructure authorities

Recognizing the need for more investment in transmission and the tremendous potential for renewable energy generation, many states have created transmission infrastructure authorities.* These agencies are designed to facilitate transmission infrastructure development in their respective regions. Among their activities are administering public-private partnerships and local, state, and regional planning efforts related to transmission siting.

States help to ensure the success of transmission infrastructure authorities by providing them adequate budgets, requisite planning information (such as environmental inventories), staff capacity, as well as clear policy direction. Wyoming was an early leader in this field and has a well-staffed infrastructure authority that has ample authority and financial support from the state.

Federal Renewable Portfolio Standard

Many in the transmission and utlity sector note that a federal commitment would create the needed security for investors to support large-scale transmission projects with necessary financing.

Targeted tax policy

Another option states have is to tackle high tax rates on transmission development. In 2007, the Montana General Assembly reduced state taxes on transmission lines from 12 to three percent; and provided a further 50 percent cut (so down to 1.5%) for the first twenty years of the line.

*See National Wind Coordinating Committee, "State Transmission Infrastructure Authorities, 2007. http://www.nationalwind.org/asset.aspx?AssetId=158

Cost Issues and Policy Options

Renewables also face cost hurdles based on competition from a heavily-subsidized fossil fuel industry as well as their high fixed costs, especially equipment.[17] As an example, a recent analysis observes that while the cost per kilowatt of a wind station may compare with a that of a coal-fired power station, because the capacity of an individual wind station is much smaller than that of a large coal plant, the economy of scale is far smaller making the power more expensive.[18] Short of a straight penalty on carbon-emitting power sources (e.g., a federal carbon tax) that would affect their competitiveness, the policy solutions to the cost barriers to renewable energy production include both incentives and regulatory mandates.

Feed-in Tariffs

The most familiar form of production incentive is a so-called feed-in tariff. These are long-term contracts designed to subsidize renewable energy through the guarantee of grid access coupled with long-term purchase agreements involving purchase prices based on cost of generation (and thus helping the renewable source to be competitive with the conventional energy industry). Although popular in Europe, feed-in tariffs have had relatively little traction as a model in the United States.[19]

Where feed-in tariffs have trended is toward integration and encouragement of distributed renewable energy generation (e.g., building-scale systems).[20] Montanans with solar installations conected to the grid for example, have the option to sell "green tags" based on their surplus capacity to a non-profit regional collector operating in Oregon, Washington, Idaho, and Montana.[21]

A more common solution to helping private industry make the development of renewable resources competitive in the United States, including the western states, has been to couple other financial support—tax incentives, grants, and other subsidies—with a regulatory mandate, most commonly a quota system called Renewable Portfolio Standards. The two approaches and their use in the five states are discussed below.

Incentives: Grants, Tax Credits, and Other Capital Support

States have a variety of tools at their disposal when it comes to offering incentives to residential, commercial, and industrial scale renewable energy providers. Table 6 lists the types of incentive

[17] Environmental Law Institute, "Estimating U.S. Government Subsidies to Energy Sources: 2002-2008." Sept. 2009.

[18] Richard Green, "Climate-change Mitigation from Renewable Energy: Its Contribution and Cost," in Dieter Helm and Cameron Hepburn, eds. "The Economics and Politics of Climate Change." Oxford Univ. Press, 2009: 284-301, 299.

[19] Feb 9, 2009, Green Inc. "Feed-in Tariffs Contemplated in the U.S." by Kate Galbraith. http://greeninc.blogs.nytimes.com/2009/02/09/feed-in-tariffs-contemplated-in-the-us/.

[20] See: Database of State Incentives for Renewables & Efficiency, http://www.dsireusa.org/glossary/.

[21] For program descriptions see; Northwest Solar Cooperative, http://www.nwsolarcoop.org/ and Xcel Energy Solar Rewards Program, http://www.xcelenergy.com/New%20Mexico/Residential/RenewableEnergy/Solar_Rewards/Pages/home.aspx The only industrial-scale production incentive in the region is in New Mexico.

programs at the state level in the Rocky Mountain Energy Producers.

Table 6. State Incentive Programs for Renewable Energy

	CO	MT	NM	UT	WY
Tax Credits					
Personal		*	*	*	
Corporate		*	*	*	*
Sales Tax Incentives					
State exemption	*				
Local government option	*				
Rebate Programs					
State					*
Utility/Local-Run	*			*	
Public Benefits Fund		*			
Property Tax Credits					
State	*	*			
Local	*				
Loan Programs					
State		*			
Local	*				*
Grant Programs					
State	*				
Local	*	*			

Source: Database of State Incentives for Renewable Energy (www.dsireusa.org), current as of April 2010.

Incentive offerings and funding sources vary widely from state to state. Two of the Energy producing states, Colorado and Montana, provide direct funding for renewable energy development through grant and loan programs that typically target generation at the scale of residential or commercial buildings. For example, Colorado will allocate $2 million in grants towards renewables from 2009 ARRA (federal) funding through the Governors Energy Office while Montana offers a grant program to subsidize small-scale renewable installations via a state-mandated systems benefits fund maintained by the state's large private utility.[22] Montana's revolving fund loans up to $40,000 per renewable project.

The Energy Producers demonstrate differing levels of generosity when it comes to deploying

[22] Northwest Energy's Renewable Enregy Program awards $750,000 anually for renewable energy projects—the cap is set for $10,000 for wind projects. $6,000 for solar; making the program most applicable for small-scale installations. http://www.northwesternenergy.com/display.aspx?Page=Renewable_Energy_Program.

corporate tax incentives for industrial-scale renewable production. One approach is to offer a property tax break to corporations on the assessed value of renewable installations (which can be high). Colorado simply taxes renewable facilities at a rate based on the per KWh value of a conventional facility, while Montana offers a graduated reduction scheme, subject to local government approval.

Each of the five states except Wyoming offers credits on corporate income tax to renewable energy providers. These programs range in specifics. While New Mexico offers a per KWh credit, Montana offers a net 35 percent exemption. Utah's policy gives the Governor's Office of Economic Development Board the the option to waive all state tax revenues for qualified projects.[23] An official we spoke with in the energy office noted that Utah developed this legislation to attempt to

[23] A 2010 provision expanded the legislation to include unconventional fossil fuels such as oil shale and tar sands.

Colorado Businesses Prosper from a Smart Policy Mix: Boosting Renewable Generation through Incentives and Mandates

Independent Power Systems (IPS) offers design, engineering, and installation services of distributed renewable energy systems in the Rocky Mountain West, with offices in Bozeman, Montana and Boulder, Colorado.

According to IPS spokesperson JoElyn Newcombe, what IPS staff will remember about the 2008-2009 recession is the phenomenal pace at which they were working and the welcome challenges of managing rapid growth. Average annual growth for the company from 2007 to 2009 ranged from 40 to 155 percent.

Former IBM engineer and company founder, Tony Boniface opened IPS in Bozeman, Montana in 1996. Business in Montana grew steadily from mostly off-grid projects, expanding to include grid-tied projects. Once business was fantastic in Montana: In 2000, Northwest Energy contracted IPS to install 20 grid-tied systems in a single construction season.

However, it was Colorado's Renewable Portfolio Standard, which went into effect in 2005, that raised activity at IPS to a whole new level. Recognizing the market potential embodied in the state's commitment to renewable energy, Boniface opened an IPS branch in Colorado and began working on installations in 2006.

In 2006, the company had a staff of four in Montana. Today, the company has seven staffers in Montana, and 28 in Colorado. In 2009, the Colorado IPS staff installed 140 solar projects, totaling three-quarters of a MW in capacity.

Newcombe points out that a number of factors have contributed to their prosperity, including continued federal support, state-level incentives for commercial and residential customers as well as its commitment to net metering, and local policies including Boulder County's unique PACE program. But strongest among the field of forces encouraging IPS's strong growth is the solar rebate offered by Colorado's largest utility, Xcel Energy, to property owners. The rebate was initiated to facilitate compliance with the state's RPS.

*www.solarips.com

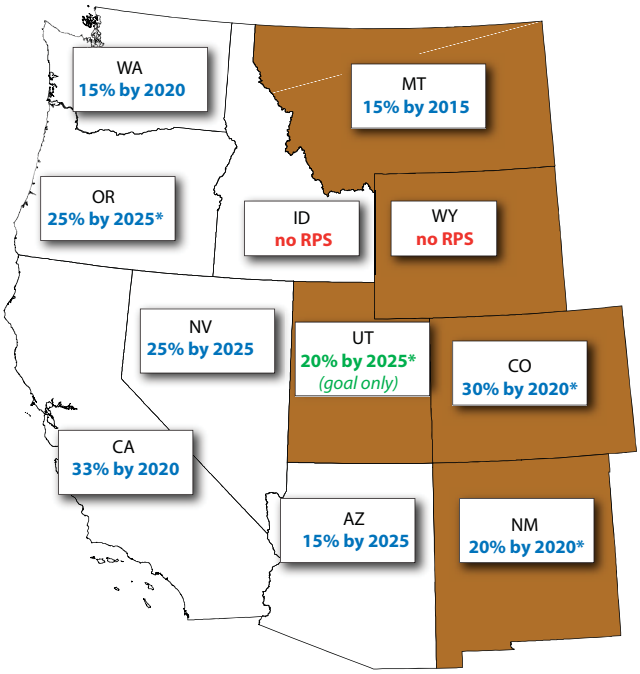
attract renewable energy installations that the state felt were going elsewhere in response to more favorable tax packages.[24]

The Regulatory Approach: Renewable Portfolio Standards

Renewable Portfolio Standards (RPS) require "electricity suppliers [to] procure a minimum quantity of eligible renewable energy or capacity, measured in either absolute units (kWh or kW) or as a percentage share of retail sales."[25] The basic policy goal is to strengthen the position of renewable sources in the overall electricity supply mix.

RPS options originated in policy discussions California in mid-1990s, and have proliferated at the state level since early 2000s. Currently 27 states, including every western state except Idaho and Wyoming, have RPS programs (See Map 5). Many states have refined or upgraded their RPS mandates subsequent to their initial passage. The most aggressive RPS requirements are in place in California (33% by 2020) and Colorado (30% by 2020). Although federal RPS requirements have been considered, Congress has failed to reach consensus on most energy policy, including a federal RPS.

Map 5. Renewable Portfolio Standards in the Western U.S.



Source: Database of State Incentives for Renewables and Efficiency, www.dsireusa.org. Accessed 6/8/2010.

[24] Personal Communication, Jason Berry, Manager, Utah State Energy Program, 12/8/2009.
[25] Wiser et. al. "Renewable Portfolio Standards: A Factual Introduction to Experience from the United States." Lawrence Berkeley National Laboratory, 2007.

State RPS programs vary in their specifics, as follows:

Applicable Sectors and Timelines vary from state to state. Several states, including Colorado and New Mexico, have different quotas with different timelines for their investor-owned utilities (IOUs) than for rural electrical cooperatives and/or municipal utilities. RPS policies are often relaxed for rural co-ops and are more aggressive for IOUs or commercial utilities.

Resource Eligibility and Mix can differ from state-to-state, typically reflecting a given state's priorities for the development of new renewable resources. New Mexico, for example, has quotas in its RPS for specific resources that are aimed at a "fully diversified energy portfolio."[26] A related criteria is the date of establishment—Montana's RPS qualifies only those installations that date from 2005 and later, effectively excluding existing hydroelectric plants.

Compliance and Enforcement strategies range from fines for every unit of renewable energy missed by target dates to the suspension of licenses. Or, there can be no enforcement mechanism, as in the case of the state of Utah's Renewable Portfolio goal. As many RPS programs are in their infancy, the implementation of compliance strategies remains untested for most states.

Tradeable Renewable Energy Certificates (RECs), essentially tradeable credits for a unit (MWh) of energy produced by approved methods, are a tool that help states meet their RPS goals by increasing flexibilty in procurement (namely from out-of-state sources). They could also help to create auxiliary markets that encourage renewable production. All of the states in the West that have RPS programs (every state except Wyoming and Idaho) allow the use of RECs.

Although California's largest utilities have relied heavily on out-of-state renewable power to build toward the state's ambitious RPS target, the use of RECs was only recently formalized in the state. California's Public Utilities Commission ruled in favor of the use of RECs toward the state RPS in March 2010. Given the size of California's electricity market and its aggressive RPS quotas (33% by 2020) a decision in favor of RECs that could have significant boosting effects on out-of-state renewable production. The details of the decision, in particular a 25 percent cap on the use of RECs toward a utility's renewable obligation, are a concern for out-of-state providers. [27]

The Western Electricity Coordinating Council (WECC) oversees the Western Interconnection. WECC developed the Western Renewable Energy Generation Information System (WREGIS) to oversee the Renewable Energy Credit system (RECs). "WREGIS is an accounting system designed to issue, register and track renewable energy certificates (RECs) for use in verification of compliance with state and provincial regulatory and voluntary market programs." A majority of the states in the WECC that have RPS programs that permit the use of Renewable Energy Credits are participating in the WREGIS tracking system. Notable exceptions are Arizona and Nevada.[28]

WREGIS was implemented in 2007 and as of 2009, administered a total 18.7 million MWh

[26] New Mexico RPS profile, DSIRE database. http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NM05R&re=1&ee=1

[27] Chad Marriott, "Tradable RECs Now Count Toward California's RPS" 3/16/2010 post to the "Renewable + Law" Blog of the law firm Stoel Rives. http://www.lawofrenewableenergy.com/admin/trackback/191506. For a transcript of the decision, see the California Public Utilities Commission web site: http://docs.cpuc.ca.gov/PUBLISHED/AGENDA_DECISION/114750.htm.

[28] Andrea Coon, WREGIS Program Director, Personal Communication, 3/9/2010, and WREGIS web site: http://www.wregis.org/.

of energy. Thirty-nine percent of the credits are from wind, with geothermal and hydroelectric contributing 16 and 20 percent respectively.

Cost Caps, such as New Mexico's "reasonable cost threshold," are sometimes written into legislation as a hedge against rapid rate hikes. They offer an escape valve for utilities, and protect consumers by relaxing penalties, or even excusing the RPS quotas, in the event that high prices for renewable energy-sourced electricity contribute to rapid increases in costs.

Attracting Clean Energy Employers Hinges on Many Factors, Chief Among them Evidence of State Government Commitment

In the competitive business of attracting and retaining new employers in the clean energy sectors, anecdotes abound about what drives business location decisions. Location decisions are complex . They are at once shaped by concrete issues, such as tax breaks and proximity to markets, skilled workers, and transportation hubs, as well as qualitative issues, such as perception of the state's commitment to clean energy industries.

Founded in 2008, Twin Creeks Technologies, Inc. is a venture backed, solar technology company, headquartered in San Jose, California with engineering and manufacturing locations in Boston, Massachusetts and San Jose. Early in 2010, the company reported plans to build and operate a large manufacturing facility in Northern Mississippi after visiting 25 possible sites in six states. The facility represents a $175 million investment by the company and will create 180 permanent jobs. The following excerpt from a Q&A with Twin Creek executives demonstrates the many factors that influence location choice. [29]

Q. Why did you choose Mississippi?

A. There are several reasons.

- The **Governor played a big role** in recruiting us to the State. He visited our facilities in Boston and San Jose. He met with our key investors. He was personally involved and we are very impressed by him.
- We appreciate the **bi-partisan approach that the State Legislature took** when it enacted the special legislation, and want to thank Speaker McCoy, Chairman Watson; Lt. Governor Bryant, and Senator Kirby for their efforts.
- We are impressed with the **positive business climate** in the State – especially towards manufacturing.
- The community of Senatobia gave us a **warm welcome** – the industrial park met all of our needs.
- The **proximity to Northeast Community College and Ole Miss**.
- The **proximity to the Memphis distribution hub and international airport** were also important considerations.
- Finally, we believe that **we can recruit a highly motivated workforce** that will help us to succeed.

[29] Press Release, Governor Barbour's Office, Mississippi, April 2010. Accessed online: http://www.governorbarbour.com/news/2010/apr/TwinCreeksQandA.pdf

Summary Findings

- Colorado, Montana, New Mexico, Utah, and Wyoming rank among the nation's top 16 energy producers, thanks to development of abundant coal and natural gas resources.
- With the exception of Colorado, the Rocky Mountain Energy Producers produce electricity well in excess of in-state demand to sell through the region's grid, the Western Interconnection.
- Selling fossil fuels and fossil-fuel based electricity out of state makes the Rocky Mountain Energy Producers vulnerable to policy decisions about fuel and electrical supply made in other states as well as at the federal level.
- The Rocky Mountain Energy Producers are poised to lead in production of renewable energy thanks to an abundance of wind, solar, and geothermal resources.
- According to 2007 data from the U.S. Energy Information Administration, renewable energy is a small portion of the region's energy production profile. However, more recent data from the wind industry shows rapid recent growth: installed wind capacity among the five states increased by 3,000 megawatts since 1999, with more than two-thirds of that increase occuring in the past three years (2006–2009).
- Renewable energy production faces significant obstacles including lack of capacity and connectivity in the regional electrical infrastructure, permitting slowdowns, and high development costs.
- The Rocky Mountain Energy Producers vary significantly with regards to policy approaches to helping renewable production overcome key obstacles, such as transmission, access to capital, and price competition from fossil fuels. While Colorado has the second-most ambitious RPS requirement in the country, Utah has a goal, and Wyoming has no RPS requirement. The use of incentives such as tax breaks for corporations varies significantly from state to state as well.
- Because producer states like Wyoming and Montana respond strongly to external market demands, like California's RPS program, having an RPS of their own may not be significant as a market force driving renewable growth. However, the RPS can be a key indicator of the state's readiness to embrace renewable energy, which is important to generators and manufacturers of renewable energy equipment.

IV. CREATING ENERGY EFFICIENCY IS ECONOMIC COMMON SENSE

Strategic efforts to address ever-expanding patterns of energy consumption are critical complements to changes in energy production. In fact, in its review of the most current research on climate change mitigation, the Intergovernmental Panel on Climate Change observed:

> It is often more cost-effective to invest in end-use energy efficiency improvement than in increasing energy supply to satisfy demand for energy services. Efficiency improvement has a positive effect on energy security, local and regional air pollution abatement, and employment.[30]

Recognizing the links between renewable energy policies and energy efficiency practices both in terms of efficacy and economic potential, this report turns here to addressing energy consumption patterns and to evaluating how the Rocky Mountain Energy Producers perform with regard to energy efficiency.

Questions Answered in this Section:

1. What is the Economic Significance of Energy Efficiency?
2. How are the Energy Leading States Performing in Energy Efficiency?
3. What Influences Leadership in Energy Efficiency?

Energy Efficiency Encourages Economic Growth

Energy consumption is a critical component in the relationship between energy use and economic growth. In theory, prosperous economies are those that can leverage the most economic growth per unit of energy consumed. Increases in energy efficiency can encourage economic growth by avoiding costs, thus freeing up money for investment throughout the economy. Simply put, when consumers spend less on energy, they can spend more on other goods and services. A number of research efforts confirm this link.

In a 2009 study, McKinsey Global Energy and Materials identified a 'best-case' scenario of energy use innovation across all non-transportation segments in the United States. The study predicts the scenario would reduce end-use consumption by 23 percent of projected demand by 2020, yielding $1.2 trillion in gross energy savings (more than offsetting the $520 billion upfront investment attached to the scenario).[31]

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[30] IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. 13. Accessed online: http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf, 4/3/2010.

[31] McKinsey Global Energy and Materials, 2009. "Unlocking Energy Efficiency in the U.S. Economy." http://www.mckinsey.com/clientservice/electricpowernaturalgas/us_energy_efficiency/.

According to a series of research papers by University of California, Berkeley economist David Roland-Holst, energy efficiency measures have significant economic impacts. Roland-Holst developed an estimate that 70 percent of state Gross Domestic Product (GDPS) comes from household expenditures.[32] Energy efficiency mandates work to reduce per capita demand as well as energy costs at the household level. According to Roland-Holst, money that would have gone toward energy costs is freed up to spend on other goods and services.

California's various mandates and incentives, for example, have contributed to a decline in per capita electricity use to 40 percent below the national average. Roland-Holst estimates that energy efficiency gains at the household level in California resulted in a savings of $56 billion, from 1972 to 2006. (By freeing up money to be spent on other goods and services, an estimated 1.5 million new jobs were created, with a total payroll of $56 billion.)[33]

It is not only large economies that can enjoy benefits associated with leadership in energy efficiency.

A striking example is the small rural state of Vermont, where one of the lowest per capita GDPs in the country ($21,697 in 2008[34]) makes state residents very aware of the benefits of energy savings. In 2000, Vermont implemented an energy efficiency program targeting a two percent annual decline in energy use. Enacted in 2000, the energy savings program met five percent of the state's electricity requirements in 2006.[35] In recent testimony in the U.S. House of Representatives, City of Burlington Mayor Robert Kiss noted that a $30 million investment in energy efficiency programs returned $90 million in savings to consumers in the period 1990 to 2009.[36]

The Western Governors Association commissioned a study to evaluate the potential impacts of energy efficiency goals in the western U.S. The WGA's study estimated that $53 billion in net economic benefits to consumers would accrue from a 20 percent by 2020 goal.[37] In promoting a 20 percent energy efficiency goal for its 19 member Western states in the WGA by 2020, the WGA stated:

> Energy efficiency and conservation are our cheapest, cleanest, least risky and least controversial energy strategies. Increasing the efficiency of energy use in Western states, without reducing productivity, will provide a broad range of benefits, including: saving consumers and businesses money on their energy bills; reducing vulnerability to energy price spikes; reducing peak demand and improving the utilization of the electricity system; reducing the risk of power shortages; supporting local businesses and stimulating economic development; reducing

[32] David Roland-Holst, "Energy Efficiency, Innovation, and Job Creation in California." Center for Energy, Resources, and Economic Sustainability, University of California, Berkeley, October, 2008: 3.
[33] Ibid, 26.
[34] U.S. BEA, Regional Economic Accounts, GDP by State 2008, Release Date: June 2, 2009.
[35] ACEEE Scorecard, 15.
[36] "Clean Energy Jobs, Climate-related Policies and Economic Growth." Written testimony of The Honorable Robert Kiss, Mayor of Burlington, VT Before the Committee on Environment and Public Works and Sub-committee on Green Jobs and the New Economy, United States Senate. July 21, 2009.
[37] WGA, "Clean Energy," 2006, 5.

water consumption and reducing pollutant emissions by reducing the need to construct new power plants.[38]

How are the Five States Performing in Energy Efficiency?

While energy efficiency can be tricky to evaluate on a large scale, two common metrics are 1) the ratio of energy consumed per unit of GDP and 2) trends in energy consumed per capita. These metrics are reported here for the five Rocky Mountain Energy Producers.

Consumption Patterns

Several ways of reviewing consumption trends are detailed on the following pages. States with small populations that produce a great deal of energy such as Wyoming and Montana are also among the highest consumers of energy in the nation. This is primarily due to the use of coal to produce electricity, including electricity that is ultimately used out of state.

Table 7. Energy Consumption by State, with National Rankings, 2007

	Total Energy Consumption (Billion Btu), 2007	Rank (among 50 states and D.C.)	Total Energy Consumption (Billion Btu), Per Capita, 2007	Rank (among 50 states and D.C.)
Colorado	1,479,277	27	0.31	34
Montana	462,140	42	0.48	6
New Mexico	710,666	38	0.36	20
Utah	805,422	35	0.30	36
Wyoming	496,352	41	0.95	2

Total Energy Consumed refers to energy consumed in the four end-use sectors in each state, Residential, Commercial, Industrial, and Transportation. Specifically, the energy consumed includes the following sources: coal, natural gas, all petroleum products, fuel ethanol, electricity from conventional hydroelectric power, wood, waste, geothermal direct use energy and geothermal heat pumps, solar thermal direct use energy, photovoltaic electricity net generation, and electricity sales.
*Renewable includes: Geothermal, Conventional Hydroelectric, Solar (thermal and photovoltaic), Wind, and Wood.

Source: EIA State Energy Data, 2007.

Figures 5 and 6 on the next page chart trend data for each state since 1970. They show that while total energy consumption is increasing among the Rocky Mountain Energy Producers (Figure 5), per capita energy consumption (Figure 6) has remained fairly flat, except in Wyoming where it is high and shows dramatic fluctuations, especially in the context of the energy bust in the 1980s.

In Colorado, per capita use of energy has remained at the same level as 1970, thanks to rapid

[38] Ibid, 5.

population growth in that state. New Mexico and Utah have seen declines suggesting that population growth there has outpaced energy consumption as well. Per capita energy use has risen in Montana, likely because energy production in the state has outpaced population growth.

Figure 5.Total Energy Consumption, 1970–2007

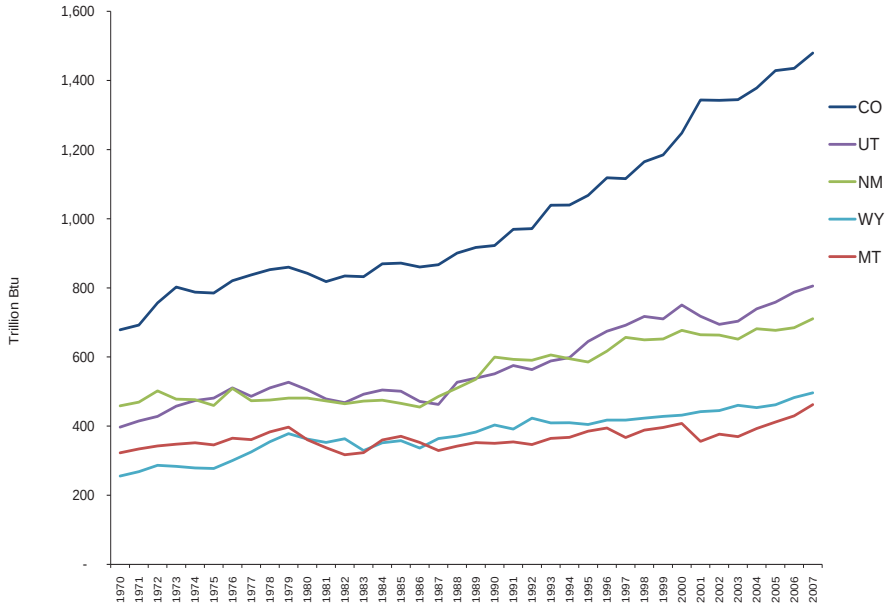
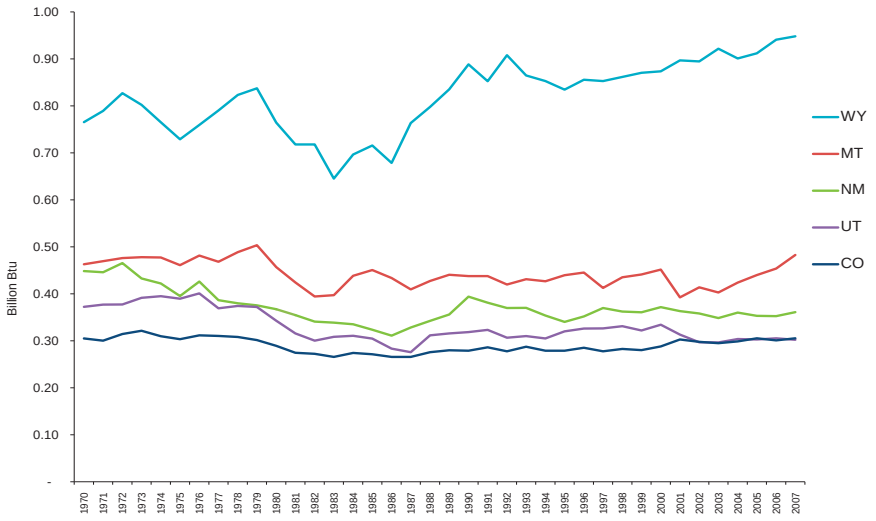


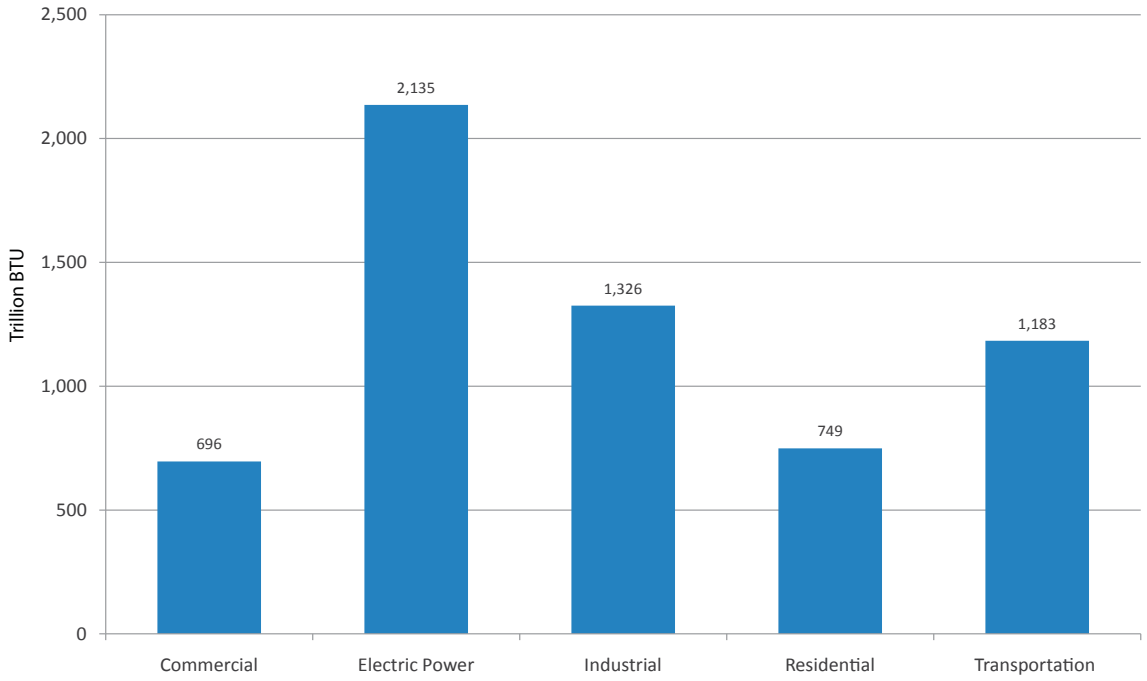
Figure 6. Energy Consumption Per Capita, 1970–2007



Source (both figures): EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release.

Figures 7 and 8 provide a profile of energy consumption in the states by major sector.[39] Energy use for the five states combined totalled 12.2 Quadrillion BTU in 2007 (total use in the United States was just over 100 Quadrillion BTU). Figure 7 indicates that non-residential sectors, including electric power production, industrial, and transportation are the biggest consumers of energy.

Figure 7. Energy Consumption by Sector (5-State Aggregate Total) 2007



Source: EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release.

[39] Following are abbreviated versions of the EIA's sector definitions, available in State Energy Data 2007: Consumption, Technical Notes (pp. 5-6), http://www.eia.doe.gov/emeu/states/_seds_tech_notes.html

Residential: consists of living quarters for private household, common energy uses: space heating and cooling, water heating, lighting, refrigeration, appliances.

Commercial Sector: service-providing facilities in government and private sector, including religious and other fraternal groups, common energy uses: space heating and cooling, water heating, lighting, refrigeration, appliances.

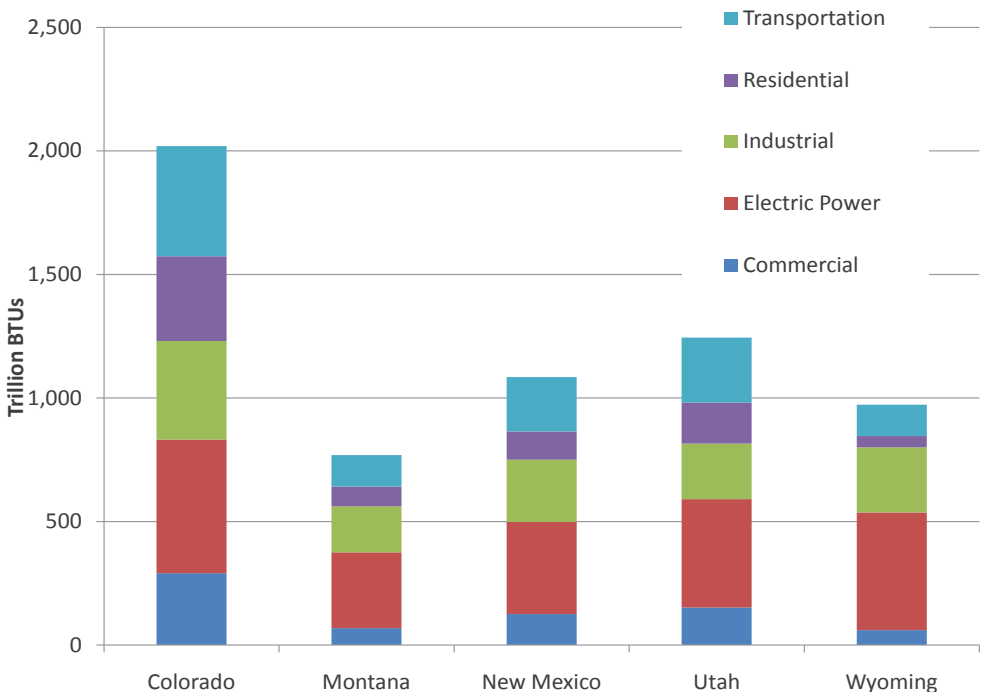
Industrial: all facilities and equipment used for producing, processing, or assembling goods, esp. agricultural, forestry, manufacturing, mining, and construction. Energy use largely for process heating and cooling and powering machinery.

Transportation: all vehicles whose primary purpose is transporting people or goods (automobiles, trucks, buses, motorcycles, trains, subways and trains, ships and barges, and aircraft.

Electric Power: electricity-only and combined heat-and-power facilities that sell electricity or electricity and heat to the public.

Figure 8 compares the states with regards to the volume of total energy consumed and the role of various sectors. It becomes clear that key targets for efficiency (as a function of volume of energy consumed) vary from state to state. For example, Colorado potentially has more to gain from energy efficiency policies focused on residential and transportation patterns, while Wyoming might benefit most by focusing on the industrial and electric power sectors. [40]

Figure 8. Total Energy Consumption by Sector and State, 2007



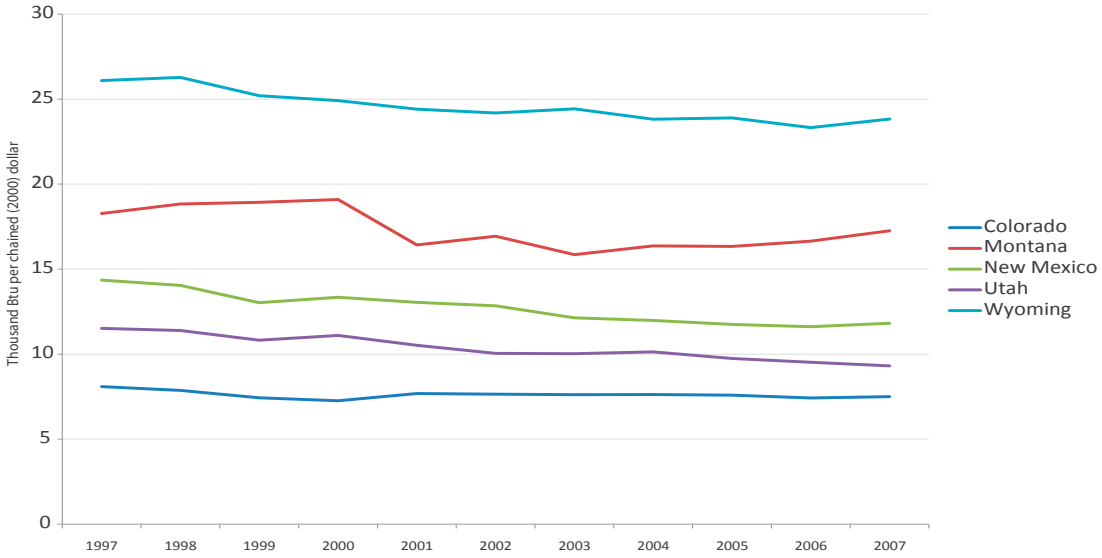
Source: EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release. Values are Billion BTU.

[40] According to the EIA, "In general, total energy consumed by the four end-use sectors by State and the U.S. total include the following energy sources: coal, natural gas, all petroleum products, which includes fuel ethanol blended into motor gasoline for 1993 forward, fuel ethanol (EN) for 1960 through 1992, electricity from conventional hydroelectric power, wood, waste, which includes non-biomass waste prior to 2001, geothermal direct use energy and geothermal heat pumps, solar thermal direct use energy, and photovoltaic electricity net generation, and electricity sales." Technical Notes, State Energy Data System 2007: Consumption.

Efficiency Trends

The following three figures consider trends in energy efficiency in three key areas: GDP per unit of energy; electricity per capita consumption in the residential sector, and per capita consumption in transportation.

Figure 9. Total Energy (Thousand Btu) Consumed per State GDP (millions constant dollars), 1990–2007

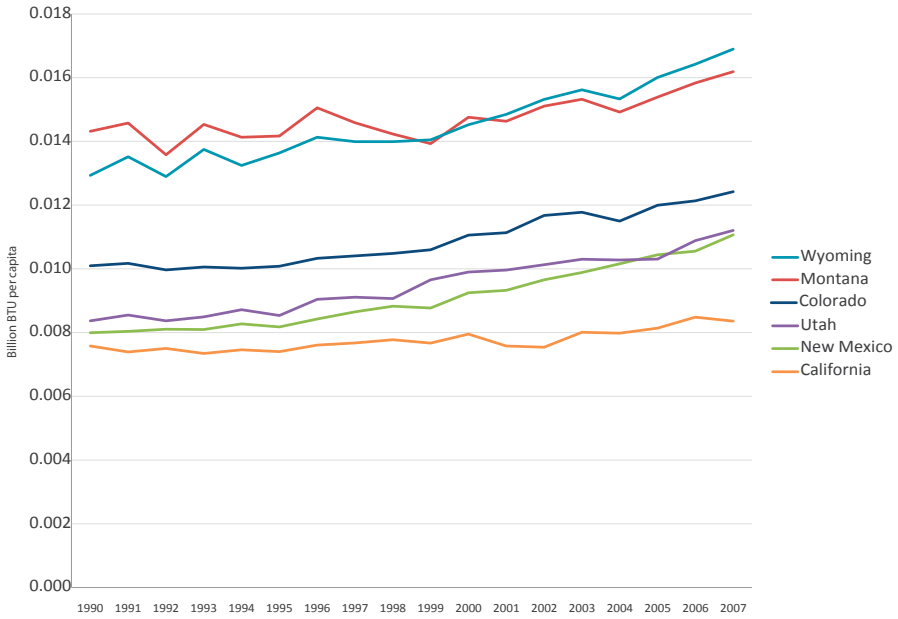


Source: EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release.

Figure 9 charts the relationship between energy consumption and state economic performance. The trends suggest that the Rocky Mountain Energy Producers are becoming more efficient in their use of energy in the sense that state economic performance outpaced growth in energy consumption trends for the period 1990 to 2007. However, given that this period was one of the most unique periods of economic expansion in the recent history of the United States, in this case this ratio may not be the best measure of economic efficiency from an energy standpoint.

Furthermore, when we look at trends in energy use in terms of consumption of electricity per capita (Figure 10) and in transporation (Figure 11), the data suggest that any gains in efficiency in GDP per unit of energy have not been matched by efficiencies in energy use in every day life. Few states have achieved measurable efficiencies as of 2007, with residential energy use per capita increasing. As California's energy gains have shown (Figure 10), this is not an inevitability.

Figure 10. Electricity Consumed per Capita in the Residential Sector, 1990-2007



Source: EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release.

Sidebar: Attempts to Refine Energy Consumption Indicators

Researchers at Humboldt State University's Schatz Energy Center are focused on improving methods for linking energy efficiency trends to the outcomes of energy efficiency policies.

Researchers there have generated an index of residential energy consumption based on per capita BTU consumption that they then adjusted to compensate for climate variability over time. This allows the index to focus on a valid comparison of year-to-year trends for the states, as weather trends (mild versus extreme temperatures) can strongly affect a state's energy consumption index in a given year. The result is an adjusted Energy Consumption Index (aECI).

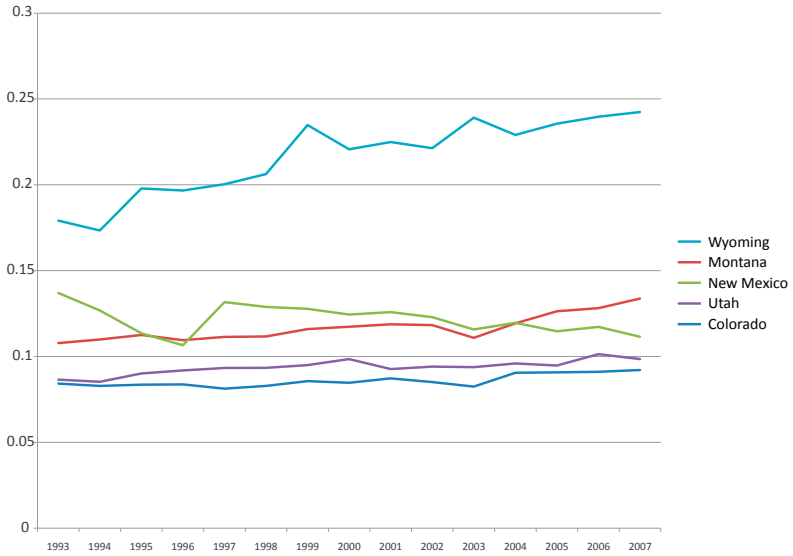
The Schatz Center's method then observes trend data to look for whether the baseline trend in a state is negative (increased efficiency) or positive (decreased efficiency). They report the slope of a state's annual aECI over a ten year period, noting: "The states with the largest number of negative slopes (in a ten-year period) are the ones that have consistently decreased their aECI over the time period."[41]

Producers in the final analysis of the period 1997 to 2006 included the states Washington, Texas, and California (ranked first, second, and third) for consistent declines in adjusted energy consumption. Utah, ranked fifth, was the only Rocky Mountain Energy Leader demonstrating a negative slope (net decline in aECI). The other states all showed increases in aECI with New Mexico ranked 26th, Colorado ranked 31st, Montana 43rd, and Wyoming 44th.

[41] Colin Sheppard, Charles Chamberlain, and Arne Jacobson, Schatz Energy Research Center, Humbold State University, "Chapter 7: Measuring Performance in State Energy Efficiency—Residential Sector." In ACEEE "The State Energy Efficiency Scorecard" October 2009, Report E097, Washington, D.C. www.acee.org and see http://www.schatzlab.org/projects/psep.

Figure 11 illustrates the percent change in per capita energy consumption in the transporation sector between 1999 to 2006. Figure 12 breaks down energy consumption in that sector for 2006, helping to signal those fuel sources (for example diesel versus jet fuel) that may have influenced trends in per capita consumption.

Figure 11. Percent Change in Energy Consumed Per Capita in Transportation Sector from 1999 to 2006



Source: EIA SEDS, Consumption, Prices and Expenditures, 2007. Aug 28, 2009 Release.

Taken together, energy efficiency trends show variability, but every state has room for improvement in some sectors. The following discussion draws heavily from a scorecard developed by the American Council for an Energy Efficient Economy (ACEEE) to compare and evaluate state policy approaches to achieving energy efficiency.

State Commitment Drives Leadership in Energy Efficiency

Many western leaders, as reflected in the WGA goal of 20% efficiency gains by 2020, recognize the importance of efficiency measures. However, the potential savings of energy efficiency depend on a policy portfolio that couples incentives with regulations. California's gains in energy efficiency were brought about only through regulation, made possible because of the severity of the state's energy crisis. And while some Producers are showing important initiative at the state level, many analysts believe that turning energy efficiency into an economic driver depends on linking policies across the federal, state, and local scales.

The ACEEE Energy Efficiency Scorecard

The American Council for an Energy Efficient Economy releases an Annual Scorecard[42] that evaluates state performance in energy efficiency policy across a series of key target areas: utilities, transportation, building codes, combined heat and power systems, state government, and appliance and equipment standards.

The ACEEE scorecard (See Table 8, next page) demonstrates a significant difference between top- and lowest-performing states. Those with highest rankings for policy approaches and cumulative energy savings had markedly slower growth in per capita energy consumption, in energy costs, and energy spending. Significantly, the top ten states on the ACEEE's scorecard experienced an average 19 percent price increase in energy costs from 1990-2007, while the ten worst performing states witnessed a 58 percent price increase.[43]

These rankings merit review because they operate outside of those energy metrics, such as per capita production, that appear to penalize states like Montana and Wyoming with high energy production and small populations. Here the focus is whether states have meaningful policies in place to encourage energy efficiency. The rankings indicate that efficiency initiatives and policies is an arena in which the Rocky Mountain Energy Producers will need to make progress in order to help the WGA achieve its 2020 energy efficiency goal.

Overall, the scorecard findings place the Rocky Mountain Energy Producers across a spectrum, with Colorado ranking 16th in the nation and named in the most-improved category based on comparisons to previous years. Wyoming ranked last in the nation and placed in the most needs to improve category. Utah received high marks for utility-focused efficiency policies and for state building codes, but received a zero in the transporation category. New Mexico and Montana rank 30th and 31st respectively, with decent performance regarding building codes, but weaker scores for their utilities programs. Wyoming received a zero in every category but one, and ranked last in the nation overall.

[42] http://aceee.org/pubs/e097.pdf?CFID=4716330&CFTOKEN=73457011

[43] Reported in Mark Cooper, "Building on the Success of Energy Efficiency Programs to Ensure an Affordable Energy Future: State-by-State Savings on Residential Utility Bills from Aggressive Energy Efficiency Policies." Report by Consumer Federation of America, Washington, D.C. February 2010.

Table 8. American Council for an Energy Efficienct Economy Scorecard, 2009

	State	Rank	Utility and Public Benefits Efficiency Programs Score	Transportation Score	Building Energy Code Score	Combined Heat and Power Score	State Government initiatives score	Appliance efficiency standards score	Total Score
Max. possible points			**20**	**8**	**7**	**5**	**7**	**3**	**50**
Top 5 States	CA	1	18.5	6	7	5	5	3	44.5
	MA	2	17	4	7	4	5	2	39
	CT	3	17	5	4	5	4.5	2	37.5
	OR	4	14	5	6	4.5	2	2	36.5
	NY	5	14	5	4.5	5	5	1	34.5
Rocky Mountain Energy Produc-ers	CO	16	11	1	3	3	3	0	22
	UT	23	9.5	0	4	1	2	0	16.5
	NM	30	5	2	3.5	2	2	0	14.5
	MT	31	6.5	0	3	1	3	0	14.5
	WY	51	1	0	0	0	0	0	1

Source: American Council for an Energy Efficient Economy Annual Scorecard, aceee.org

Energy Efficiency Policy Approaches

The following are examples of the kinds of policy tools that are available to states to address energy efficiency.[44]

State Energy Savings Targets or Energy Efficiency Resource Standards (EERS) An EERS sets a quantitative long-term energy savings target for utilities. An EERS is the Energy Efficiency partner parallel to a Renewable Portfolio Standard. The policies set a quota for meeting future energy needs through energy efficiency measures and establish binding mechanisms to ensure compliance. The policies vary by percent of the quota, the path toward reaching it, and whether the targets are binding.

Among the Rocky Moutain Energy Producers, only Colorado and New Mexico have established EERS programs—Colorado's, implemented in 2009, established a goal of saving 11.5 percent for investor-owned utilities by 2020 and is binding. New Mexico's program, established in 2008, is less aggressive with a 10 percent by 2020 target and an exit strategy that allows the state utility commission to change the targets if utilities are having difficulty meeting them.

[44] Information in this section from the ACEEE State Energy Policy Database, http://aceee.org/energy/state/index.htm.

Utility and Public Benefits Efficiency Funds A longstanding policy approach to energy efficiency is diverting a fraction of utility rates to a "public benefits" fund that is administered either by the utility or by a state agency to encourage energy efficiency as well as low-income energy assistance and renewable energy support. Montana has a dedicated Public Benefits Fund, administered by Northwest Energy. Out of a possible five points for spending on Energy Efficiency programs as a percent of total utility revenues, the ACEEE scorecard awarded the following scores: Utah 2.5, Montana 2, Colorado 1.5, New Mexico 1, and Wyoming 0. The states with a perfect 5 (Vermont, Washington, California, Oregon, and Connecticut spent two percent or greater on energy efficiency programs).[45]

Addressing Disincentives in Utility Payment Schemes Many states are exploring or have implemented changing utility regulations to address disincentives whereby utility revenues and profits are linked to sales volumes, meaning that energy efficiency gains create "lost revenues" for utilities. The means to address this are programs that "decouple" revenues from sales volumes and performance incentives that reward efficiency gains financially. In a decoupled model, utilities charge fixed service fees rather than a per unit fee.

Colorado received the best score in this area from the ACEEE for having a decoupling program (natural gas only) and a strong performance-based incentive for both electric and natural gas utilities. Utah and New Mexico both have decoupling and performance-based programs on the books, but have not implemented them yet.

Transportation In contrast to utilities-focused laws, in which states have a great deal of discretion, much of the governing transportation policy is federal, such as fuel efficiency and emissions standards for vehicles. Nonetheless, states have the opportunity to fast track transportation efficiency gains through several approaches including emissions standards that are stronger than federal standards, policies to reduce vehicle miles traveled, funding for public transit, and incentives to consumers to purchase high efficiency vehicles.

This is not an area of strength for the Rocky Mountain Energy Producers. New Mexico has strong emission standards and Colorado operates a consumer incentives program for high efficiency vehicles, but none of the states spend money from their own budgets (e.g., other than federal) on state transit nor do they have programs that mandate coordinated land use and transportation planning, believed by many to be the backbone of arresting unchecked growth in vehicles miles traveled (VMT).[46]

Building, Appliance, and Equipment Standards This is also an area in which the federal government has taken the lead. The best-known efficiency program in the country is the EPA's voluntary appliance labeling program, Energy Star.[47]

States can mandate that the retail sale of appliance and equipment be limited to those items that

[45] ACEEE, page 9.
[46] ACEEE, p. 28.
[47] The current administration is attempting to create a federal plan dubbed "Home Star" which would utilize tax incentives to encourage consumers to pursue energy-efficiency measures such as insulation or switching to energy efficient appliances. If approved by Congress, this program could be a major component of a second wave of stimulus funding.

meet certain efficiency criteria. Similar to building standards, government bodies can also require that any equipment (such as vehicles) and appliances meet efficiency standards. California has been a leader nationwide in this approach, generating standards that supercede federal standards or that apply to items not covered by federal policy. None of the Rocky Mountain Energy Producers have standards in place that exceed federal law.

A mandate in the American Reinvestment and Recovery Act of 2009 that makes State Energy Program funds contingent on adoption of residential and commercial building codes and planning for compliance means that this field is shifting rapidly. Wyoming is the only state that has no mandatory state energy code for buildings. Codes in Colorado, Montana, New Mexico, and Utah are sufficient, but could be more aggressive according to the ACEEE report.[48]

Combined Heat and Power Initiatives Combined Heat and Power systems (also known as co-generation systems) are a highly efficient because they capture and use the surplus heat generated in the production of electricity. CHP systems can range in size from residential to utility-scale. Despite having a strong federal goal for co-generated systems (20% of U.S. capacity by 2020[49]), there is no effective federal mandate regarding adoption of co-generation, making state policy highly influential. States influence the adoption of CHP programs, according to the ACEEE, through the following methods: developing interconnection standards to integrate CHP in the grid, a favorable rate policy for standby services to CHP systems, financial incentives for CHP systems, and making CHP systems eligible toward RPS and EERS requirements.

None of the Rocky Mountain Energy Producers currently target CHP in any serious way, none have incentive programs, and only Colorado and New Mexico have interconnection standards that facilitate CHP adoption.

State Government Initiatives The ACEEE devotes this category to catch all of the various ways in which states establish commitment to energy efficiency by funding financial and educational incentives, through example in requirements that state building and fleets meet efficiency goals, and through research, development and deployment efforts.

Montana and Colorado received the highest scores in this area, thanks to incentive programs such as Montana's "Energy Investment Tax Credit" and Colorado's Energy Star Mortgage Program (in which the state partnered with a bank to offer mortgage rate discounts to Energy Star certified homes).

[48] ACEEE Scorecard, page 31.
[49] DOE citation.

Summary Findings

- As a region, the U.S. West appears to embrace the principle that energy efficiency creates economic growth by freeing up money that otherwise would be spent on energy for investment elsewhere in the economy and also offers is a cost-effective response to climate change mitigation. The Western Governors Association proposed a 20 percent energy efficiency goal for its 19 member Western states by 2020.
- In practice, the Rocky Mountain Energy Producers have a mixed record in terms of energy consumption patterns and policy commitments to energy efficiency improvements.
- With the exception of Utah, the Rocky Mountain Energy Producers experienced net increases in per capita energy use at the residential level for the period 1997–2006.
- The industrial and transportation sectors are the largest energy consumers in the region, behind the electric power sector.
- Among the Rocky Moutain Energy Producers, only Colorado and New Mexico are addressing overall efficiency in power generation through Energy Efficiency Resource Standards programs, policies that set a quota for meeting future energy needs through energy efficiency measures by utilities.
- Transportation efficiency is not an area of strength for the Rocky Mountain Energy Producers. New Mexico has strong emission standards and Colorado operates a consumer incentives program for high efficiency vehicles, but none of the states spend money from their own budgets (e.g., other than federal) on state transit nor do they have programs that mandate coordinated land use and transportation planning.

V. COMPETING TO CAPTURE THE GROWING GREEN ECONOMY

The Rocky Mountain Energy Producers vary significantly in their policy approaches to the energy transition. This section considers the proven, as well as potential, benefits of charting a clear course with regards to clean energy and energy efficiency.

In particular, this section looks more closely at economic trends in the Clean Energy and Energy Efficiency categories of the green economy, including jobs and enterprises, workforce skills, and innovation and investment.

What emerges from the data is a strong leadership position for the state of Colorado, a position which we argue is explained by the state's ability to use policy to support and enhance existing competitive strengths in both the private and public sector.

Questions Answered in this Section:

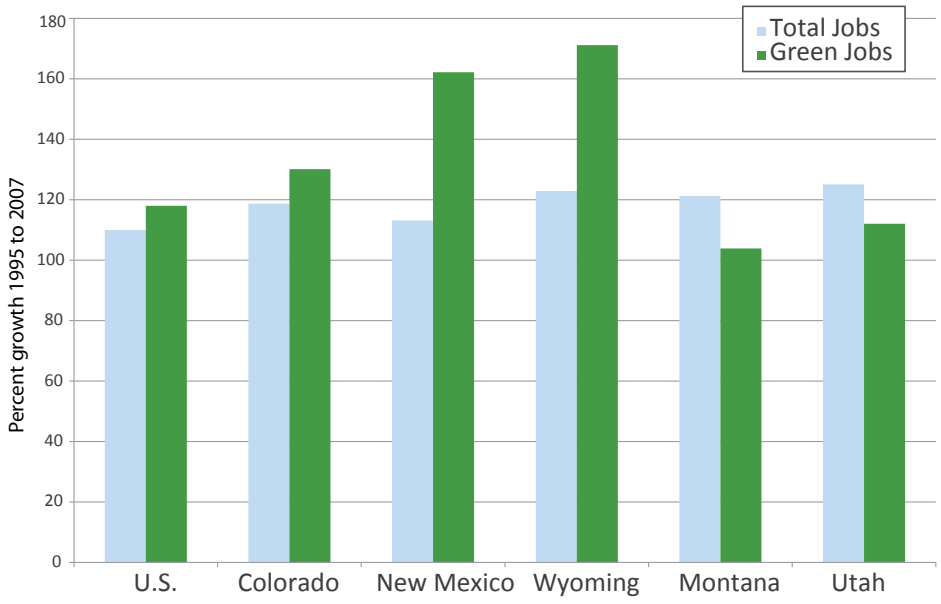
- How Does Green Economic Performance Compare to Overall Economic Performance?
- Who Leads the Region in Green Economic Performance?
- How Do States Compare with Regards to Economic Performance in Clean Energy and Energy Efficiency Sectors?

Green Economic Performance Outpaces Overall Economic Performance in Colorado, New Mexico, and Wyoming

In most cases, green jobs demonstrate a rate of growth significantly in excess of growth in total employment. This is shown in Figure 12. nationwide, green jobs grew by 18 percent from 1995 to 2007, compared to overall job growth of 10 percent. Certain state examples are striking: In New Mexico green jobs were 62 percent more numerous in 2007 than in 1995 compared to 13 percent growth in overall jobs.

As measured in the most reliable database on green jobs—e.g., accounting only for those establishments with a specific 'green' objective and their employees, and not for green-related jobs that span the broader employment spectrum—green jobs have a small share of total employment.[50] This is true nationwide as well as the five study states. In both the U.S. and in the Rocky Mountain Energy Producers, green jobs were about one-half of one percent of total jobs in 2007.

Figure 12. Growth in Green Jobs v. Total Jobs, 1995–2007



Source: Green Establishment Database.

[50] Except when specifically noted otherwise, all data on jobs and establishments in the core green economy reported herein have the following source: Data from Green Establishment Database, property of Collaborative Economics, 2009.

Taking the study region as a whole, job growth in the core green economy was 30 percent from 1995 to 2007, while overall job growth across the economy of the five states was 19 percent.

Colorado and New Mexico Lead the Region in Green Economic Performance

Jobs and Establishments

In 2007, the Rocky Mountain Energy Producers supported 3,567 green establishments.[51] Fifty percent of these establishments were based in Colorado, with New Mexico and Utah having the next greatest share at 16 percent each. Eleven percent of the region's green establishments were based in Montana and 6 percent in Wyoming.

Table 9 puts the performance of the study area states in perspective. Colorado has a leading green economic sector that ranked 14th in terms of number of establishments and 15th in number of jobs (in 2007) in the nation. Montana, New Mexico, and Utah have less impressive green jobs and establishments with respect to national rankings, although to be fair, their rankings are relatively proportional to the size of their economies (in terms of GDP by state relative to other states, see page 3 for GDP by state). An exception to this is Wyoming, a state that has a large economy with regard to GDP by state thanks to the high value of its conventional energy products, but the smallest green economy in the nation, as measured by number of jobs and establishments.

Table 9. 2007 Green Establishments, and Green Jobs by State and National Rankings

	Number Green Establish-ments, 2007	Rank (among 50 states)	Number Green Jobs , 2007	Rank (among 50 states)
Colorado	1,778	14	17,008	15
Montana	408	40	2,155	46
New Mexico	577	34	4,810	35
Utah	579	39	5,199	34
Wyoming	225	47	1,419	50

Source: Green Establishment Database.

[51] Establishment numbers were generated through a process that invovled querying multiple data sources, including proprietary business and finance databases that report on enterprises in various sectors. Dun & Bradstreet business unit data was utilized to associate numbers of jobs associated with each enterprise. See Appendix 1 for more information.

How Do States Compare with Regards to Performance in the Clean Energy and Energy Efficiency Sectors?

This report earlier discussed the fast-growing nature of the Clean Energy and Energy Efficiency categories of the Green Economy. These terms describe two categories into which four segments of the green economy fall. Under Clean Energy we find enterprises engaged in Energy Generation, Energy Infrastructure, and Energy Storage; while Energy Efficiency is a standalone category.

Clean Energy and Energy Efficiency Category Definitions

Based on the Collaborative Economics methodology, Clean Energy and Energy Efficiency enterprises include the following categories and related activites.

CLEAN ENERGY

Energy Generation --> Renewable Energy Generation; Renewable Energy consulting services; Research and testing in renewable energy; Associated equipment, controls, and and other management software and services.

Energy Infrastructure --> Consulting and management services; Cables and equipment.

Energy Storage --> Advanced batteries (Li-Ion, NiMH); Battery components & accessories; Fuel cells.

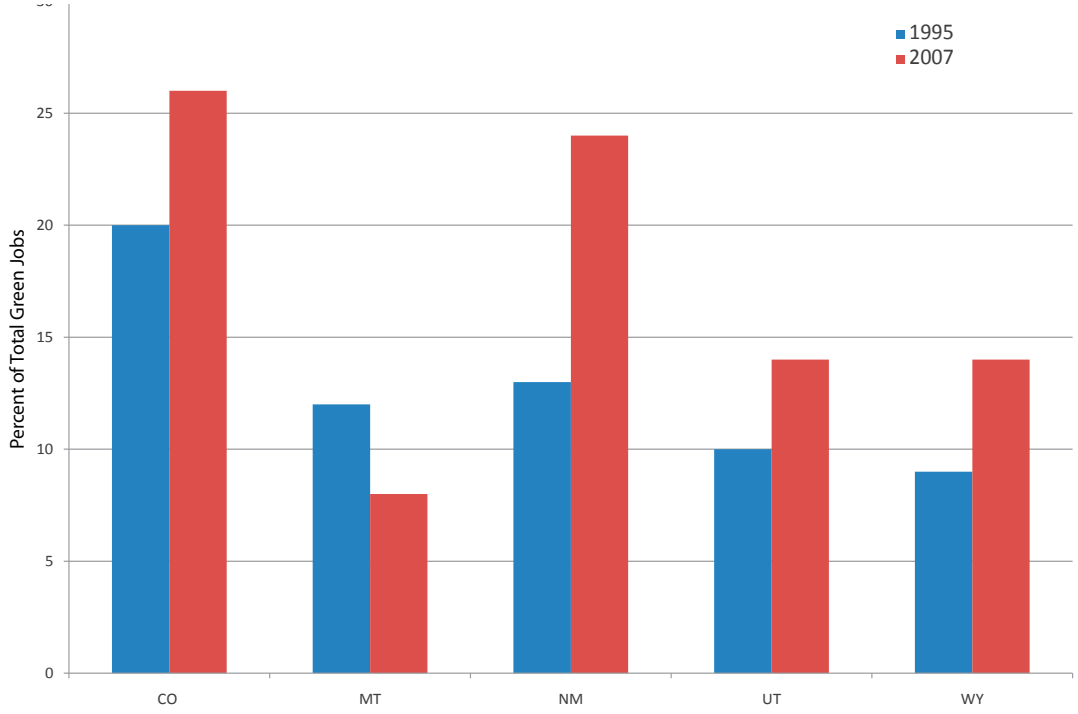
ENERGY EFFICIENCY

Energy Efficiency --> Energy conservation consulting and engineering services; Building efficiency products and services; Energy efficiency research; Energy efficiency meters & measuring devices; Alternative energy appliances (solar heating, lighting, etc.)

Figure 13 shows the share of total of these categories in 1995 and 2007 for each of the five states with respect to all green jobs. Colorado's green economy has the most energy-related (both Clean Energy and Energy Efficiency) jobs (both in number, and as a percent of total), while New Mexico has seen particularly striking growth, with the share of total increasing from 13 to 24 percent since 1995.

In Utah and Wyoming, jobs in Clean Energy and Energy Efficiency are a smaller share of total green jobs (10% and 9% respectively), but show an increase in share of total since 1995. Montana is the only state among the Rocky Mountain Energy Producers to experience a decrease in the share of total green jobs in Clean Energy and Energy Efficiency jobs. This development appears to be related to a 33 percent decrease in the number of jobs in the Energy Efficiency category. While the numbers involved are quite small (198 jobs in Energy Efficiency in 1995, 132 in 2007), the trend nonetheless suggests that Montana faces challenges in developing this sector.

Figure 13. Clean Energy and Energy Efficiency Jobs, Share of Total Green Jobs, 1995 and 2007



Source: Green Establishment Database.

While the Collaborative Economics methodology for quantifying green businesses focuses on the enterprise and its activities, rather than specific occupations, the description of the business activities indicates that a majority of the jobs in these fields are skill and knowledge intensive. For this reason, attracting and retaining firms in the clean energy and energy efficiency sectors demands a workforce that has relevant skills and training.

Green Innovation

Another indicator of competitiveness in the energy-oriented sectors of the green economy is state leadership in innovation in terms of patented technologies. We obtained data on patents in the Clean Energy sector from a database that uses eight categories to distinguish among clean technology sectors: Batteries, Solar Energy, Fuel Cells, Wind Energy, Hybrid Systems, Energy Infrastructure, Geothermal Energy, and Hydro Power.[52]

Nationwide, patents in cleantech grew by 44 percent between 1996 and 2008. The Rocky

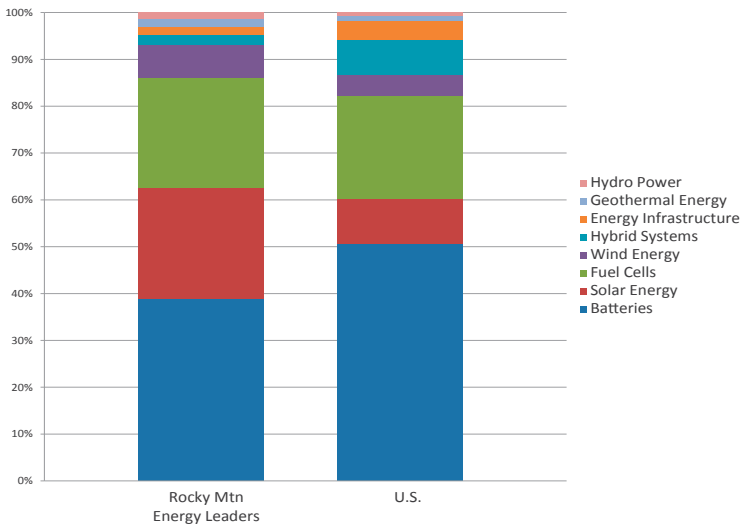
[52] Collaborative Economics, by 1790 Analytics, based on an analysis of U.S. Patent and Trade Office records.

Mountain Energy Producers experienced similar growth rates, with 1,674 patents recorded in 1996 and 2,407 in 2008, for an increase of 44 percent.

Figure 14 compares the region to the nation in terms of the share of total of the eight categories of cleantech patents for the period 1994-2008. The study states (as a group) are distinguished from the nation with a greater share of total patents in Solar Energy (24% for the region versus 9% for the nation). The nation is somewhat more focused (51% versus 39%) on Battery technology than the region.

These areas of specialization are explained by looking at the two states that lead the region in cleantech patents, between them claiming 80 percent of all patents. Colorado and New Mexico received 50 and 28 percent of the region's total patents, respectively. The presence in both states, of excellent solar resources along with a cluster of federal- and state-level research institutions (National Renewable Energy Laboratory, Los Alamos National labs, etc.) enables these states to be leaders in solar technology.

Figure 14. Cleantech Patents by Category, 5 States versus United States, 1994-2008



Sources: 1790 Analytics, Patents by Technology; USPTO Patent File and Collaborative Economics.

Patents also speak to areas of growth. A 2009 Pew report, The Clean Energy Economy, finds that nationwide patents in wind are on the rise, with solar patents slowing.[53] This pattern is not replicated in the study area, where the number of Solar Energy patents has remained steady, and the number of wind patents rose for the period 2000-2005, but slowed slightly in 2006-2008. Based on these trends, it is not clear that the area's focus on solar technology is a weakness, but there is also room to consider whether and how the region could compete for a more competitive position in the emerging wind technology sector.

[53] Pew Charitable Trusts, The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America. June 2009, 24.

In addition to jobs and enterprises, other useful measures of green economic performance are accomplishments in attracting and cultivating innovative people and enterprises. We can understand this by looking at success in terms of patents in clean technology, venture capital investments, and public funding.

Technological Innovation Profits Entrepreneurs in New Mexico

When Schott Solar decided to locate a solar manufacturing facility in Albuquerque it cited New Mexico's two national laboratories—Sandia and Los Alamos—along with the state's universities and the presence of an existing Intel manufacturing plant as key factors in its decision.

Schott's experience is an important example of how technological expertise and a skilled workforce have played a key role in New Mexico's successful efforts to be at the center of the North American solar industry. The state's high-tech proficiency has given it a competitive edge in attracting new businesses; especially when combined with New Mexico's aggressive outreach to businesses, affordable land close to transmission lines, and committed political leadership stretching from the Governor to the state's congressional delegation to county commissioners.

In early 2008, Schott broke ground on its plant to build solar arrays and receiver tubes used in concentrated solar, and full production began in the spring of 2009. Today, the facility covers 200,000 square feet and employs 370 employees. Schott believes the plant eventually could be expanded to reach up to 800,000 square feet with 1500 workers.

Institutions such as Sandia or the University of New Mexico play a critical role in helping states attract new green energy businesses; through both the ongoing research they conduct and the many commercial partnerships they form with the private sector.

The technological and science centers also created a hub of highly trained and skilled workers, and New Mexico recognizes that workforce capacity can be a deciding factor when competing for new businesses. When attempting to lure Schott to the state, New Mexico already had an attractive workforce but also offered to pay to send employees hired by Schott to Europe for any necessary specialty training.

Because of these advantages, New Mexico's attractiveness for solar firms is likely to continue. One example is Signet Solar Inc., which currently is building the company's first North American solar production facility in Belen. When completed, the new plant will further expand New Mexico's clean energy manufacturing base with the potential of as many as 600 new jobs.

*http://www.schottsolar.com/
http://www.signetsolar.com

Green Investment

The ability for Rocky Mountain Energy Producers to increase their green economies hinges in large part on their ability to attract the necessary investments. Private capital is one element of this investment, public funding is another.

Featured in table below is information on the amount of venture capital invested in clean technologies in each state for the period 1999 to 2008. Colorado emerges as the overwhelming leader, with close to $800 million dollars in venture capital invested in the region for the period (75% of total). Colorado ranked fifth among all U.S. states in terms of total venture capital invested during the period 2006 to 2008. New Mexico is also a relatively important player, with its total investments of $239 million and a ranking of 12th in the nation during 2006-2008.

Table 10. Venture Capital Investment in Clean Technology by State, with National Rankings

	Total Cleantech Venture Capital (Millions) invested in State, 1999-2008	Rank (among 41 states*) for VC, 2006-2008
Colorado	$796	5
Montana	$0	--
New Mexico	$239	12
Utah	$26	29
Wyoming	$6.9	38

*41 states received venture capital in the Clean Technology sector during this time period.

Source: Cleantech Group.

The next figure compares state accomplishments in attracting competitive federal funds and contracts. The ARRA—the 2009 federal stimulus bill—directed $85 billion to energy-related spending, including $20 billion on business tax incentives for renewable energy generation and energy efficiency. The ARRA also allocated more than $30 billion for clean energy programs such as modernizing the electricity grid, improving battery technology, state energy efficiency programs, weatherization, and job training.[54]

Table 11 describes ARRA funds awarded through the U.S. Department of Energy on a competitive and contract basis. While the federal tax credits do not comprise the entirety of

[54] Pew, "The Clean Energy Economy," 40.

federal support for the green economy, because these grants and contracts are awarded to the best in category they are a good proxy for assessing where various states stand in regards to attracting serious investment in clean and renewable energy and energy efficiency.

Table 11 puts Colorado ahead of the rest of the energy producing states and 15th in the nation, with $296 million awarded in competitive funds and $241,000 in grants. Utah out-competed New Mexico with $85 million in competitive grants (including $53 million for a single smart grid research project). Ranking 49th and 52d among receiving states (and territories), Wyoming and Montana received $9.5 and $1.6 million in competitive funds respectively.

Table 11. Clean Energy-Related DOE Federal Stimulus Funds by State, with National Rankings

	ARRA Competitive Funds through DOE	ARRA Contract Funds through DOE*	Rank (among 52 states and territories)
Colorado	$296,585,819	$241,380	15
Montana	$1,626,980		52
New Mexico	$27,926,735	$9,482,739	37
Utah	$85,494,576		30
Wyoming	$9,484,248		49

*Includes funds awarded through the Department of Energy offices: Energy Efficiency and Renewable Energy, Office of Science, Advanced Energy Research Project-Energy, and Office of Electricity Delivery and Energy Reliability. (Excludes funds awarded by DOE Office of Environmental Management).

Source: U.S. Department of Energy, Energy Efficiency and Renewable Energy, at: http://www1.eere.energy.gov/recovery/. Accessed April 2, 2010.

What Table 11 does not illustrate is how much total funding is available to states that compete in the energy transition. Together the five leading states, Michigan, California, New York, Texas, and Indiana, garnered $4.2 billion in competitive funding and contracts, 39 percent of the total competitive and contracts funds awarded ($11 billion).

Capitalizing on Existing Strengths in Related Industries

In addition to policy support for renewable energy production and energy efficiency, New Mexico and Colorado are making progress in attracting investment because they offer an attractive business environment. As David Hill, Governors Energy Office, Colorado, notes, "You have to have a real market, business environment and well-trained workforce to achieve success and job growth. We have all three in Colorado."[55]

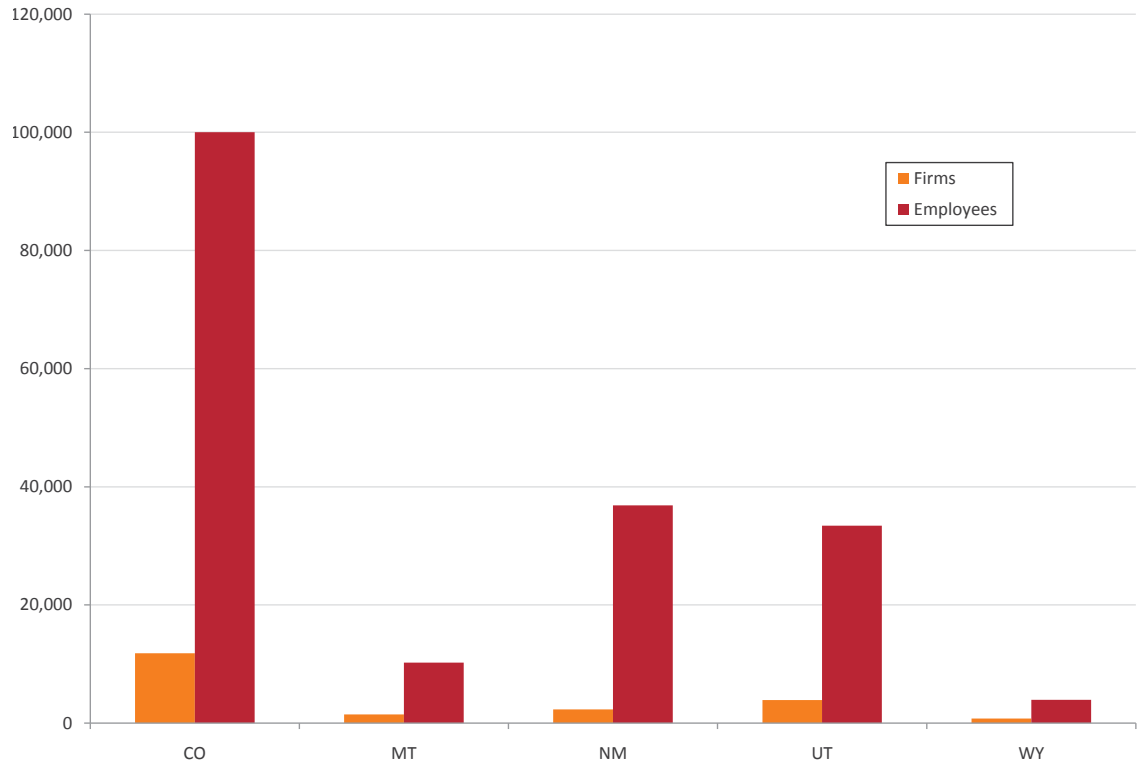
To understand the relative competitiveness of the Rocky Mountain Energy Producers with regards to the availability of employees with skillsets relevant to employers in clean energy and energy

[55] Interview in Colorado Energy News, Jan 26, 2010; http://coloradoenergynews.com/2010/01/the-colorado-energy-news-interview-tom-plant-of-the-governors-energy-office/.

efficiency related activities, we looked at the most recent public data on employment in three industries—Architecture and Engineering (NAICS 5413); Computer Systems and Design and Related Services (5415); and Scientific Research and Development (5417). While these categories comprise more firms and employees than those specifically engaged in clean energy or energy efficiency, they are a strong fit in terms of their demand for the same kinds of training and basic skillsets as those demanded in Clean Energy and Energy Efficiency enterprises.[56]

The results are shown in Figure 15 and in Figure 16. The first chart shows the volume of firms and employees in the three categories combined in each state in 2008. The second group of charts illustrates how growth in these three specialty categories compares to growth of firms in all sectors for the period 1997 to 2008.

Figure 15. Number of Firms and Employees in Three Industries in 5 States: Engineering and Architecture Services, Computer Systems and Design Services, and Scientific Research and Development, (Three Categories Combined) 2008

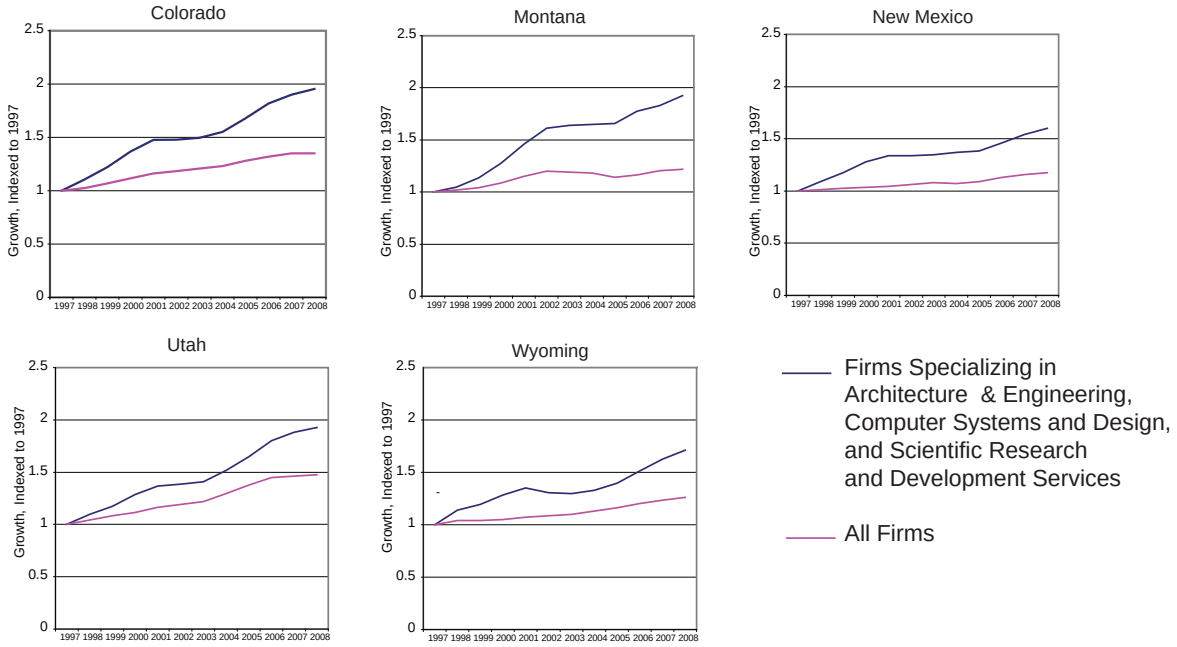


Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages. NAICS 4-digit codes = 5413, 5415, 5417.

[56] This includes private as well as federal, state, and local government "firms."

Colorado stands out as a regional leader in cultivating an expertise in engineering, computing, and scientific research, with more than 100,000 employees working in related businesses in 2008. New Mexico and Utah also show strength in these areas, while the more rural states of Montana and Wyoming lag behind. From the perspective of a business considering locations across the Rocky Mountain West, the employee pool in Colorado is likely to be most appealing.

Figure 16. Growth in the Number of Firms Three Industries in Rocky Mtn Energy Leading States: Engineering and Architecture Services, Computer Systems and Design Services, and Scientific Research and Development, (Three Categories Combined) Compared to Growth in All Firms, 1997-2008 (Indexed, 1997 = 1)



Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages. NAICS 4-digit codes = 5413, 5415, 5417.

The charts in Figure 16 compare, for each state over the time period 1997 to 2008 indexed (1997 = 1), growth rates for the number of firms in the three specialty categories combined (blue lines) to growth in the number of firms in all categories (pink). Growth in the number of enterprises in these three industries outpaced growth in all industries in each of the states, nearly doubling in number during the period 1997 to 2008 in Colorado, Montana, and Utah.

Figure 16 makes the case for Colorado's competitiveness another way, by showing that not only does the state have strength in numbers in these technology- and engineering-oriented industries, it has also experienced especially dynamic growth in these industries. This speaks to the compound benefits of cultivating strength in emerging high tech sectors.

A Skilled Workforce Attracts Dynamic Companies

Lawrence Firestone CEO Advanced Energy Industries, is a global company focused on power system and flow solution for alternative energy and IT markets. The company has 1,300 employees and has had its headquarters, R&D, and some manufacturing facilities in Fort Collins, Colorado since its founding in 1981.

Publicly traded, the company serves markets in Europe, Asia, and the United States. Solar-energy related products were identified as an opportunity for the company in early 2007, and since that time solar inverters, thin film cells, and passive-solar architectural glass have grown to roughly 20% of the company's total revenues, which were $385 million in 2007. The company received $1.4m to expand its Fort Collins manufacturing facility through the 2009 ARRA stimulus bill (48c tax credits).

Lawrence Firestone, Executive VP and CFO, spoke to the benefits of the company's Fort Collins, Colorado. "Colorado State University is a hub for power electronics which puts this region in a good light for attracting the engineering expertise that our business requires."

*http://www.advanced-energy.com/

Summary Findings

- According to the careful methodology used by our data provider, Collaborative Economics, green jobs have a small share of total employment. However, growth in green jobs outpaced overall job growth. Taking the five study states as a whole, growth in green jobs was competitive with two better-known sectors, Construction and Real Estate.
- In 2007, the Rocky Mountain Energy Producers supported 3,567 green establishments.[57] Fifty percent of these establishments were based in Colorado, 16 percent were in Utah and in New Mexico, 11 percent in Montana, 6 percent in Wyoming.
- Colorado's green economy has the most energy-related (both Clean Energy and Energy Efficiency) jobs (both in number, and as a percent of total), while New Mexico has seen particularly striking growth, with the share of total increasing from 13 to 24 percent since 1995.
- In the competition for private and public investment in the green economy, Colorado and New Mexico are well ahead of the rest of the energy producting states. With close to $800 million in venture capital invested in the region for the period (75% of total), Colorado ranked 5th among all U.S. states in terms of total venture capital invested during the period 2006 to 2008. New Mexico is also a relatively important player, with its total investments of $239 million and a ranking of 12th nationwide during 2006-2008.

[57] Establishment numbers were generated through a process that invovled querying multiple data sources, including proprietary business and finance databases that report on enterprises in various sectors. Dun & Bradstreet business unit data was utilized to associate numbers of jobs associated with each enterprise. See Appendix 1 for more information.

- In public funding, Colorado is well ahead of the rest of the energy producing states and 15th among 52 receiving states and territories in competitively-awarded federal stimulus competitive grants from the Department of Energy, with $296 million in competitive grants and $241,000 in contracts. Utah and New Mexico fall toward the middle of the pack in the region and the nation. Utah received $85 million in competitive funds and New Mexico $27 million in competitive funds and $9 million in contracts, putting them 30th and 37th nationwide. Ranking 49th and 52d, Wyoming and Montana received $9.5 and $1.6 million in competitive funds respectively.

- Colorado stands out as a regional leader in cultivating an expertise in engineering, computing, and scientific research, with more than 100,000 employees working in related businesses in 2008. New Mexico and Utah also show strength in these areas, while the more rural states of Montana and Wyoming lag behind. From the perspective of a business considering locations across the Rocky Mountain West, the employee pool in Colorado is likely to be most appealing.

SUMMARY AND CONCLUSIONS

This report concludes with an overview of five basic **keys to success**, followed by an evaluation of how each of the five states are positioned with regards to meeting **opportunities and challenges** in the green economy. Finally, we offer **specific policy recommendations** applicable to all of the study states.

1. Strategic Pairing of Incentives with Clear Policy Goals

Progress in clean energy production and energy efficiency depends on a smart mix of carrots and sticks. Because most renewable energy technologies involve high start-up costs, the renewable industry will locate and thrive in those geographies that provide the best incentives alongside the best access to reliable markets.

☑ Colorado leads the pack, and the nation, with clean energy and efficiency mandates that are matched by a suite of smart compliance and implementation policies and a wide portfolio of incentives.

☒ Utah could create competition for Colorado, given its large urban market for electricity and its access to university-based engineering and technology leadership. Salt Lake City has a nationally-recognized energy efficiency program. However the state's failure to create certainty for clean energy sectors—both its weak renewable mandate and fossil fuel-focused energy development incentive scheme—show evidence of a wavering commitment that has left the state behind in the green economy.

2. Encourage and Capture Large-Scale Investment

Private investment in clean energy technology has shown strength even in the context of the recession. The federal government also has demonstrated a commitment to the energy transition in the form of billions of dollars of federal funding for clean energy and energy efficiency enterprises. The most competitive states in attracting these important investment sources are those that have a complete package of serious policies, incentives, and proven record in developing technological expertise and a skilled workforce.

☑ Here again Colorado's growing momentum shows in the state's capture of 75 percent of the total venture capital in the region and 69 percent of energy-related competitive stimulus funding. Investors and public funding are rewarding the innovative and supportive environment that is a product of the state's policy commitments, good business environment, and research and development resources.

☒ Montana failed to capture any clean technology venture capital in the period 1999 to 2008 and ranked last (among 52 states and territories) in receipt of competitive clean energy public funding from the 2009 federal stimulus bill.

3. Cultivate a Well-Resourced Business Environment.
States are more likely to attract both private and public investment, and as a result to witness growth, if they create a competitive business environment that attracts key technology and business leaders. Innovative companies on the cutting edge of technological development benefit greatly from skilled workers and access to world-class research institutions, while companies seeking to manufacture and deploy energy-related products and services depend on appropriately-trained workers.

☑ Industry leaders are quick to recognize New Mexico's accomplishments in positioning itself at the heart of the North American solar industry. The state provides ample financial, logistical, and political support for the renewable energy industry and takes advantage of the location of several internationally significant research facilities in the state.

☒ Wyoming ranks among the best resourced states in terms of state revenues per capita. And the state's excellent wind resources have encouraged the creation of a nationally recognized wind technology training program. Yet the graduates of that wind training program often are leaving to work in other states because the state has yet to devote its wealth to encouraging innovation and enterprise in the clean energy economy.

4. Leadership
Developers and manufacturers of clean energy and energy efficiency technologies operate in a highly competitive global environment. Demonstrated interest in and knowledge of the new energy economy on the part of state leaders can be a key element in attracting growth.

☑ Montana, New Mexico, and Colorado all have governors who have made an effort to reach out to the clean energy sector. These efforts have paid off with the successful recruitment of global corporations to each state, and perhaps equally important, the establishment of reputations as leaders—particularly in the case of Colorado and New Mexico—within the clean technology sectors.

☒ In Utah and Wyoming, unclear policies bordering on indifference to renewable energy and energy efficiency have played out in a reluctance of clean energy businesses and developers to focus their attention and their investments in these states.

5. Overcome Limited Infrastructure Capacity.
To fully cultivate their renewable energy resources, the Rocky Mountain Energy Producers must overcome an inadequate clean energy development infrastructure; which includes an outdated, overstressed electrical grid, as well as federal, state, and local governments that currently lack the capacity and the necessary plans to respond to permits for new construction (for new facilities and transmission lines).

☑ Wyoming has taken a lead regionally by being first to establish a state entity directly responsible for encouraging new transmission generation in 2004. The Wyoming Infrastructure Authority's strong financial and staff capacity has enabled it to attract several new transmission companies to the state.

☒ Colorado and New Mexico were later (2007) to establish state infrastructure authorities, and Colorado in particular is limited in bonding capacity by the state's cap on spending increases.

Opportunities and Challenges for Each State

While issues that affect competitiveness in the green economy cannot be solved by states individually and require a federal solution, the good news for states is that they have policy options to better their competitive position as the energy transition continues.

By all measures, **Colorado** has made the most progress of any of the Rocky Mountain Energy Producers. The state has both an aggressive, and highly successful, RPS program and a newly minted, ambitious Energy Efficiency Resource Standard (EERS) to match. The state is committed to acquiring 30 percent of its energy from renewable sources by 2020 and to meeting some of this through a commitment to an 11.5 percent decline in energy use by investor-owned utilities by 2020.

Colorado also has outcompeted its neighbors in attracting venture capital in the clean technology sector (close to $800 million, 75% of the region's total between 1999 and 2008) and has more green jobs, including more jobs in the Clean Energy and Energy Efficiency categories, both in volume and as a share of total jobs than any other state in the region. These successes build on a number of existing strengths: excellent public research institutions, a skilled workforce, and a large population and by extension strong in-state market for clean energy.

Lastly, with the exception of corporate tax breaks, Colorado is deploying a wide variety of incentives at all scales, from residential through industrial.

New Mexico also has many of the key elements in place to ensure a competitive position as the energy transition continues. Particularly remarkable has been growth in the jobs in Clean Energy (152%) and Energy Efficiency (241%) during the period 1995-2007. The state also garnered over $430 million in competitive and contract funds from the Department of Energy from the 2009 American Recovery and Reinvestment (ARRA, also known as the federal stimulus bill), in addition to attracting some $236 million in private capital for clean technology during the 1999 to 2008 period.

New Mexico has been less ambitious than Colorado in supporting industry with clear mandates: both its RPS and EERS programs include exit strategies that could weaken their impact.

A mixed track record with regards to performance and policy describes **Utah's** green economy. In contrast to regional and national trends, the state's overall economy grew more quickly than its green economy as measured by jobs from 1995 and 2007. Nor has the state been a serious contender in terms of attracting private clean technology funding. On the other hand, Utah succesfully competed for nearly $85 million in federal funds and grants under the ARRA.

Utah is one of few states in the country that has a Renewable Portfolio Goal that offers utility a "cost-effectiveness" exit strategy, rather than a mandate backed up with penalties for non-compliance. In the absence of an enforcement mechanism, it is questionable how well the policy will succeed. Utah has made few commitments to energy efficiency and has performed poorly in transportation efficiency.

Montana also has a mixed track record. As a small rural state with a small economy (having the third smallest per capita GDP in the 50 states in 2008), Montana faces challenges when it comes to attracting and retaining private capital and supporting businesses in the energy efficiency and clean energy sectors.

On the other hand, the state has the fifth best wind resources in the nation and is a historic electricity exporter. With an adequate infrastructure in place to link renewable resources to the regional electricity grid, Montana is poised to become a leader in wind production. Montana is unique among the states in including a provision for community-owned wind in its moderately ambitious RPS.

In energy-producing states with high per capita consumption rates like Montana and Wyoming, the starting baselines for energy efficiency may seem high and the gains small in volume relative to bustling economies in neighboring states like Colorado. However, rural states like Wyoming and especially Montana with its low state GDP have much to gain from a focus on improving energy efficiency. Targeted efforts to address the energy needs of low-income residents have an obvious imperative, while citizens, communitites, and businesses throughout the state will prosper from the benefit of freeing up money to be utilized elsewhere in the economy.

As one of the nation's leading energy producing states, **Wyoming** has much at stake in the energy transition. In the event of federal cap and trade legislation or carbon tax, the state will face a greatly changed market for its enormous coal resources and the large amounts of fossil fuel-based electricity it sells out of state.

However, among all the Rocky Mountain Energy Producers, Wyoming demonstrates the greatest indifference to the green economy. The state basically has neither incentives nor mandates to encourage renewable energy production and ditto for energy efficiency. However, the absence of a development strategy at the state level has not prevented renewable energy producers, particularly industrial scale wind turbines, from exploiting the state's resources. In fact, Wyoming leads the region in installed wind energy capacity. The state's wind industry is responding to demands from other states, and profits from existing capacity in the state's electrical transmission system.

Implementation: Specific Policy Options

The Rocky Mountain Energy Producers vary significantly in their policy approaches to the clean energy economy and energy efficiency. The ideal policy portfolio of individual states differs based on the state's unique circumstances. Still each state can shape its competitive position with regards to clean energy production and energy efficiency.

1. **Support for Clean Energy Markets** Across the renewable energy industry, business leaders agree that firm policies and financial support will expand clean energy markets, in turn generating new business and investment in the myriad services and technologies that make renewable energy generation and consumption possible. A clear commitment involves:

    - Strong financial and logistical support for updates to state transmission infrastructure as well the regional electrical grid, the Western Interconnection
    - Policies, such as Renewable Portfolio Standards, that include meaningful targets and are followed up with creative and practical approaches to compliance
    - Integration of renewables into the electric grid and encouraging consumer-end use of renewables through net metering and interconnetion standards
    - Incentives that reduce start-up costs for manufacturers and generators, and others that encourage investment in clean technology research and development
    - Leaders who demonstrate knowledge of and interest in renewable energy and advocate for national clean energy policies

The table below measures the performance of each state with regard to the specific policies and tools described above. States that are ranked above average show national leadership, those ranked average are doing no more and no less than other states, while a below average score indicates a lack of commitment or activity in a given policy area.

Policy Performance: Clean Energy

	Colorado	New Mexico	Montana	Utah	Wyoming
Prioritizing infrastructure development	o	o	✓	o	✓
Robust policy mix	✓	✓	✓	(-)	(-)
Integration tools	✓	✓	o	o	o
Strong incentives	✓	✓	✓	o	(-)
Committed leaders	✓	✓	✓	(-)	(-)

✓ = above average o = average (-) = below average

2. **Commit to Improving Energy Efficiency** Deploying the lowest-cost energy source—energy saved through efficiencies—contributes to state economies by freeing up money otherwise spent on energy costs for circulation in other sectors of the economy. The goods and services associated with energy efficiency are fast-growing, especially as federal and state policy recognize the common-sense economic aspects of energy efficiency. States accelerate the energy efficiency economy through the following types of policies:

   - Direct a certain portion of electric utility rates toward energy efficiency education and technical assistance programs.
   - Efficiency resource standards (EERS), similar to renewable portfolio standards, that direct utilities to accommodate a certain amount of projected future demand through energy savings. with meaningful targets and effective compliance
   - Eliminate transportation inefficiencies by limiting sprawl and providing alternatives to car-based commuting
   - Vehicle emissions standards and incentives for acquisition of fuel efficient vehicles
   - Building and appliance standards that go beyond federal minimums

The table below measures the performance of each state with regard to the specific policies and tools described above. The scores makes it clear that energy efficiency is the area in which all of the Rocky Mountain Energy Producers stand to make significant progress.

Policy Performance: Energy Efficiency

	Colorado	New Mexico	Montana	Utah	Wyoming
Utility programs	o	o	o	o	(-)
Standards	✓	o	(-)	(-)	(-)
Transportation planning	(-)	(-)	o	(-)	(-)
Emissions policies	o	(-)	(-)	(-)	(-)
Building and appliance codes	o	o	o	o	(-)

✓ = above average o = average (-) = below average

In summary, the emerging green economy is distinguished by strong growth in clean energy and energy efficiency related activities. All of the states have opportunities to profit in these sectors. Those states with the fullest complement of policy leadership, resources, markets, access to knowledge and capital—namely Colorado and New Mexico—have a far better competitive position in the green economy than do states that have fewer of the key ingredients (Montana) or simply less demonstrated commitment (Utah and Wyoming).

APPENDIX 1. METHODOLOGY

In section III, we cite figures on the size of the green economy in terms of the number of green jobs and establishments in each state (and the nation) and the various segments they represent for the period 1995 to 2007. The principal data-gathering agency on economic and employment topics in the nation, the U.S. Bureau of Labor Statistics, has not yet developed a formal approach to quantifying and categorizing jobs in the green economy. In the absence of such a resource, we reviewed existing studies on the green economy and selected a dataset developed by a private research firm in California, Collaborative Economics.

The strength of this dataset is its specificity. Unlike other methods that survey industry on employment and apply multipliers to trends reported by industry, Collaborative Economics' methodology is based on actual accounting. This strength is also a liability in that collecting and analyzing business information in this manner is extremely laborious and time consuming. For that reason, we were not able to obtain data from 2008 or 2009.

Collaborative Economics describes their methodology this way:

The Core Green Economy

The lack of standardized industry data with information on "green" products, services and occupations has resulted in the development of multiple methodological approaches to defining "green jobs" and the green economy. The definitions of green vary largely depending upon the underlying unit of measurement (i.e. data available). Some approaches focus on the activities of occupations. Other approaches focus on businesses offering "green" products and services, while others focus on businesses that operate in a "green" manner regardless of the end products and services they sell. Different approaches are valid and, from different vantage points, contribute to a better understanding of the emerging green economy.

While there are many definitions of "clean energy" and "green," there are multiple facets to the economic changes underway and there is value in gaining the perspective from different viewpoints. In an effort to develop a definition that could be operationalized for analytical purposes, we understand the green economy from three different points of view: 1. Businesses that are "greening" their processes to conserve resources and reduce costs, 2. Businesses that were founded on principles of sustainability, and 3. Businesses that enable the "greening" of the entire economy (e.g., other businesses, residents, schools, etc.) through the products and services they provide.

At the core of these developments are the businesses in the third group which provide the products and services that enable the green transformation across all industries. We term this the "Core Green Economy," and it consists of businesses that provide products and services that do the following:

- Provide alternatives to carbon-based energy sources
- Conserve the use of energy and all natural resources
- Reduce pollution (including GHG emissions) and repurpose waste.

Collaborative Economics has developed an approach for identifying and tracking the growth of businesses with primary activities in the core green economy. This methodology, described below, was originally developed for work carried out on behalf of Next 10, a California-based nonprofit, and published in the California Green Innovation Index (2008, 2009, 2010 forthcoming) and Many Shades of Green: Diversity and Distribution of California's Green Economy (2009). Building on this work, Collaborative Economics designed and conducted the nationwide analysis of green business activity on behalf of the Pew Center on the States which reformatted the results of the analysis for The Clean Energy Economy (June 2009).

Green Business Establishments Database

The Green Establishments Database is a composite database that draws information from multiple sources (including New Energy Finance and the Cleantech GroupTM, LLC) for the identification and classification of green businesses and also leverages a sophisticated internet search process. CEI designed the parameters of the internet search platform which was engineered by QL2, a Seattle-based developer of business intelligence tools. The National Establishments Time-Series (NETS) database based on Dun & Bradstreet business-unit data was sourced to extract business information such as jobs.

The jobs numbers reported in the database reflect all jobs at each business location. In the case of multi-establishment companies, only the green establishments are included. While this approach does not examine specifically green occupations that are appearing across the entire economy (such as Chief Sustainability Officer), it does account for the businesses behind the products and services that these new professionals need to use in their jobs (such as advanced metering devices, co-generation equipment, and various high-efficiency materials).

The multilayered process involves both automated and manual verification steps of business establishments and their activities. In cases where the results were uncertain and the activities of a business establishment could not be verified (e.g., on a company's website), the establishment was dropped from the database. Therefore, the database offers a conservative estimate for the numbers of establishments and jobs in the core green economy.

Green Business Activity: Capital and Innovation

Green economic activity for the five states is also discussed in terms of venture capital investment and new patents in the clean technology sector. Venture capital data are provided by Cleantech Group LLC, and values are inflation-adjusted and reported in 2008 dollars, using the CPI for the U.S. City Average from the Bureau of Labor Statistics. (An exception is for 2009 dollar amounts, which are not adjusted.)

Green technology patents are based on detailed U.S. Patent data from the U.S. Patent & Trade office.

APPENDIX 2. STATE RENEWABLE PORTFOLIO STANDARDS

Note: Wyoming does not have a RPS. For more information see www.dsireusa.org

State	Colorado	Montana	New Mexico	Utah
Incentive Type	RPS	RPS	RPS	RPG (Goal)
Eligible Renewable/Other Technologies	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, "Recycled Energy", Anaerobic Digestion, Fuel Cells using Renewable Fuels	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Anaerobic Digestion, Fuel Cells using Renewable Fuels	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, Zero emission technology with substantial long-term production potential, Anaerobic Digestion, Fuel Cells using Renewable Fuels	Solar Water Heat, Solar Space Heat, Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, Geothermal Electric, CHP/Cogeneration, Hydrogen, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Ocean Thermal
Applicable Sectors	Municipal Utility, Investor-Owned Utility, Rural Electric Cooperative, (Only Municipal Utilities Serving 40,000+ customers)	Investor-Owned Utility, Retail Supplier	Investor-Owned Utility, Rural Electric Cooperative	Municipal Utility, Investor-Owned Utility, Rural Electric Cooperative
Standard	Investor-owned utilities: 20% by 2020 Electric cooperatives: 10% by 2020 Municipal utilities serving more than 40,000 customers: 10% by 2020	15% by 2015	Investor-owned utilities: 20% by 2020; Rural electric cooperatives: 10% by 2020	Goal: 20% of adjusted retail sales by 2025
Technology Minimum	Solar-electric (IOUs only): 4% of annual requirement (0.8% of sales in 2020); half of solar-electric requirement must be located on-site at customers' facilities	No	For IOUs only in 2020 Solar: 20% of RPS requirement (4% of sales) Wind: 20% of RPS requirement (4% of sales) Geothermal, biomass, certain hydro facilities and other renewables: 10% of RPS requirement (2% of sales) Distributed Renewables: 3% of RPS requirement (0.6% of sales)	No
Credit Trading	Yes	Yes	Yes	Yes
Authorizing statutes	CRS 40-2-124 passed 11/2/04, effective 12/1/04	MCA 69-3-2001 et seq. Date Enacted: 4/2005	NMAC 17.9.572 Date Enacted: 8/7/2007 Date Effective: 9/1/2007	Utah Code 54-17-101 et seq. Date Enacted: 3/18/2008
	4 CCR 723-3-3650 et seq. Date Effective: 7/2/2006	MONT. ADMIN. R. 38.5.8301 Date Effective: 6/2/2006	N.M. Stat. § 62-15-34 et seq. Date Enacted: 3/5/2007 Date Effective: 7/1/2007	Utah Code 10-19-101 et seq. Date Enacted: 3/18/2008
			N.M. Stat. § 62-16-1 et seq. Date Enacted: 3/2004	

APPENDIX 3. STATE TRENDS IN DETAIL

This appendix offers state-level detail for a number of the key indicators examined in the report.

Contents

1. State Facts

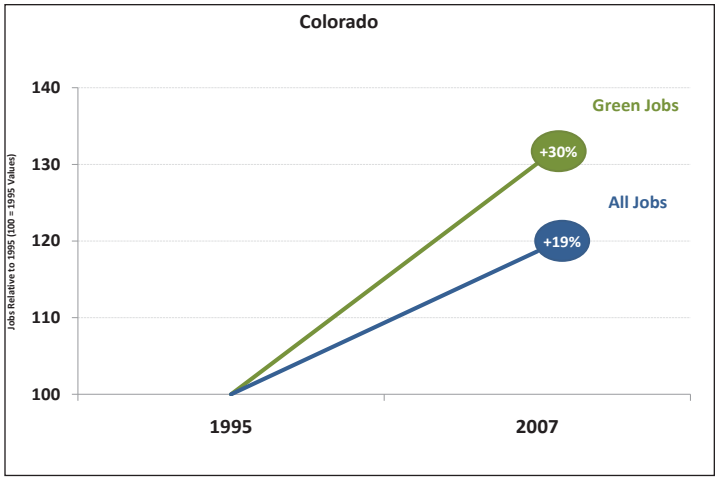
	Colorado	Montana	New Mexico	Utah	Wyoming
State Population, 2008*	4,935,213	968,035	1,986,763	2,727,343	532,981
Real State GDP, 2008 (milllions of chained 2000 dollars) §	203,024	27,253	61,835	87,700	21,752
Real State GDP Per Capita, 2008 (chained 2000 dollars)§	41,102	28,170	30,935	32,049	40,837
Total Employment, 2008¢ (All industries, public and private sectors)	2,295,449	437,591	825,736	1,221,052	286,333

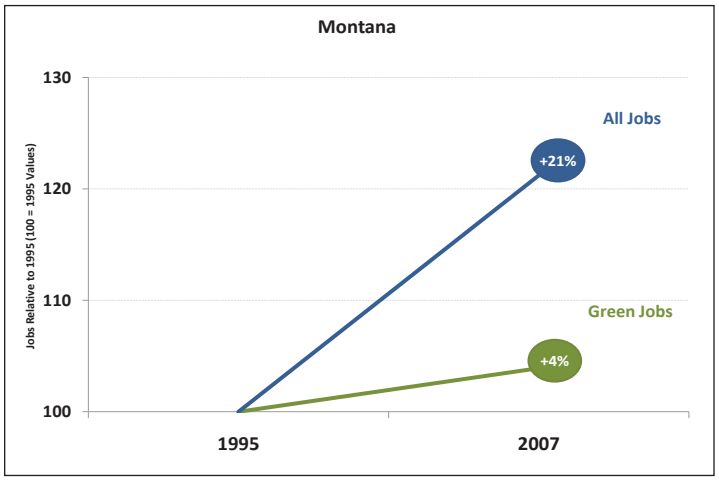
Data sources:* U.S. Bureau of the Census. Population Estimates, 2009.
§ BEA, REIS, Data extracted April 29, 2010.
¢ BLS, QCEW, Data extracted April 29, 2010.

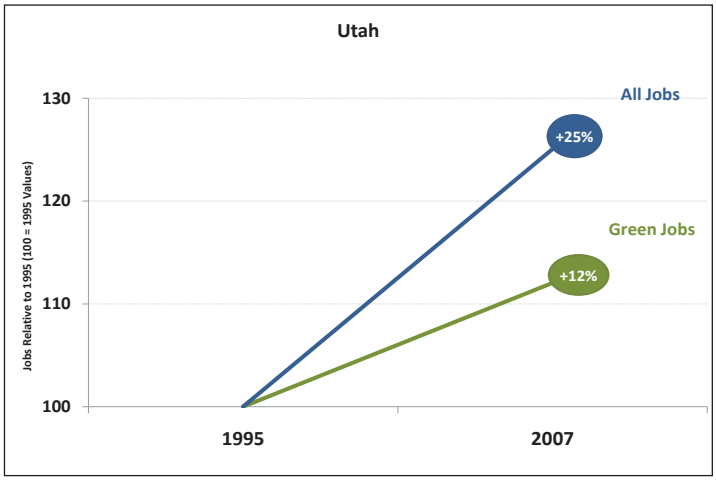
Why is this important?

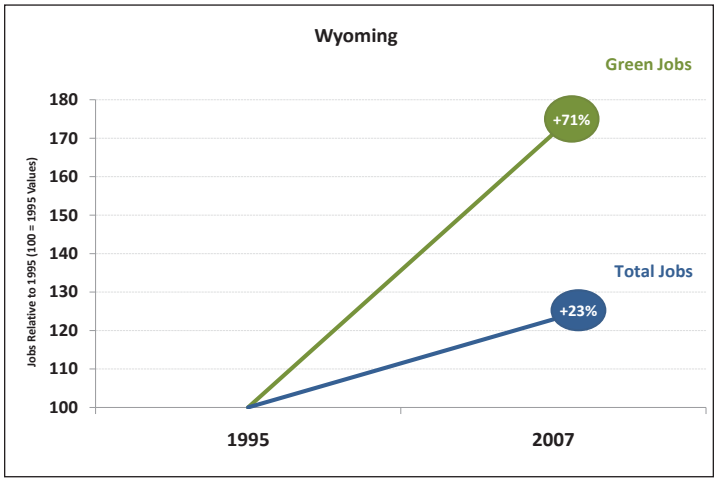
These data are critical to understanding the different economic challenges and opportunities facing each of the Rocky Mountain Energy Producers. Using state GDP as an indicator of the size of a state economy, the more populous states predictably have larger economies. Colorado is nearly twice as large by population and in terms of total employment than the next largest state, Utah. Colorado's economy is ten times larger than that of the most rural, least populated state, Wyoming. In making state-to-state comparisons, this report is sensitive to the different economic starting point of each state and utilizes indexed or relative data whenever possible.

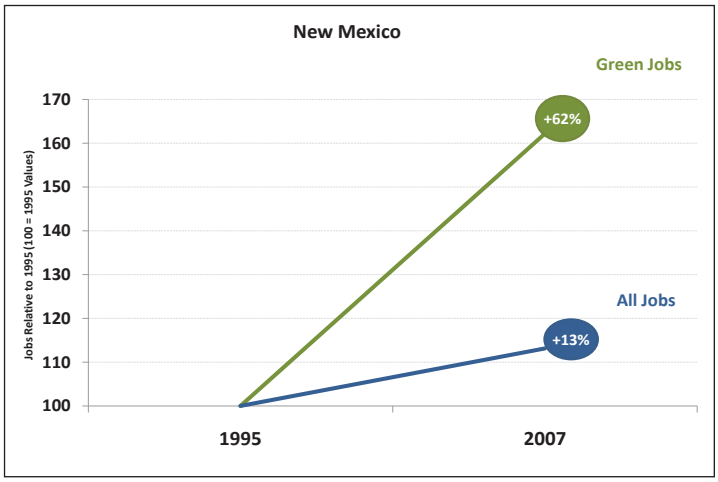
2. Growth in Green Jobs Compared to Growth in All Jobs, 1995–2007

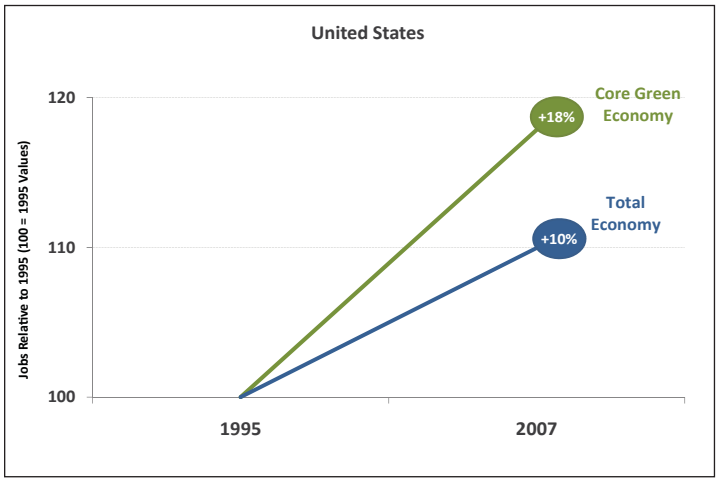












Data Source: Green Establishment Database.
Analysis: Collaborative Economics.

Why is this important?

In Colorado, New Mexico, and Wyoming, growth in green jobs outpaced growth in total jobs during the period 1995 to 2007. In Utah and Montana, however, green jobs grew more slowly than total jobs. Green job performance in the leading states outpaced green job growth nation-wide.

In this report, we use the following definition of the green economy (see page 9): *The green economy comprises all of those enterprises and individuals who work to provide products, services, and knowledge associated with: clean energy production, energy efficiency, natural resource conservation, and efforts to curb and clean-up environmental pollution.*

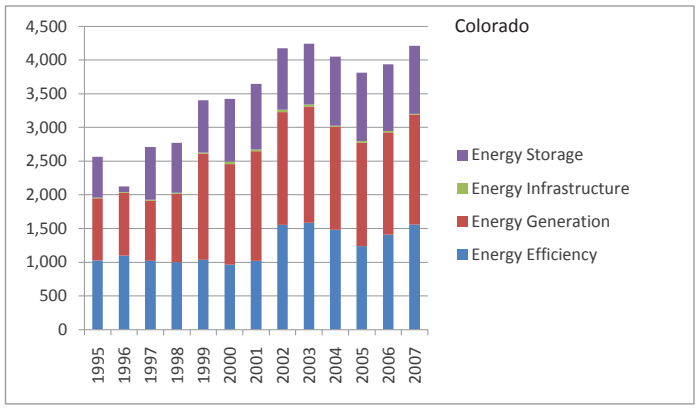
3. Green Jobs by Segment, 2007

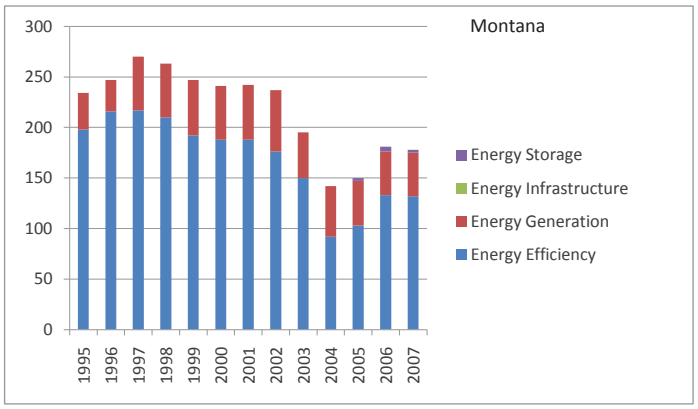
Data Source: Green Establishment Database.

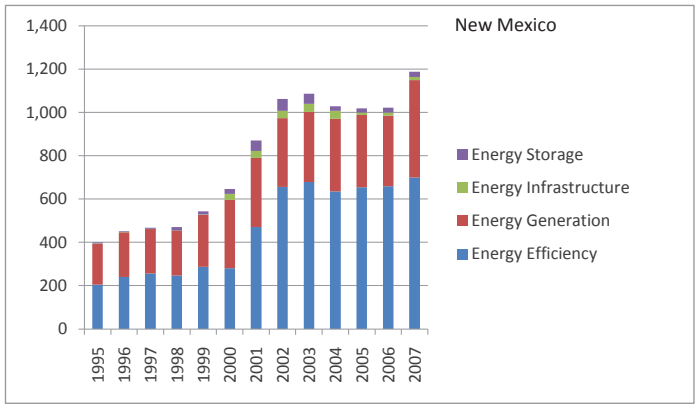
Why is this important?

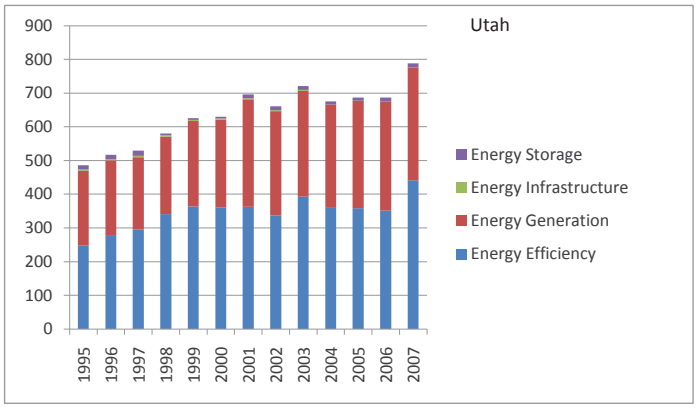
These pie charts show the size of different segments of the green economy in terms of the share of jobs in each category as a share of total green jobs. An indicator of leadership in the emerging clean energy economy is the number of green jobs in energy-related sectors. These sectors have been on average faster growing than other segments of the green economy. Colorado and New Mexico show the strongest results, with 25 percent of all green employment in energy-related categories.

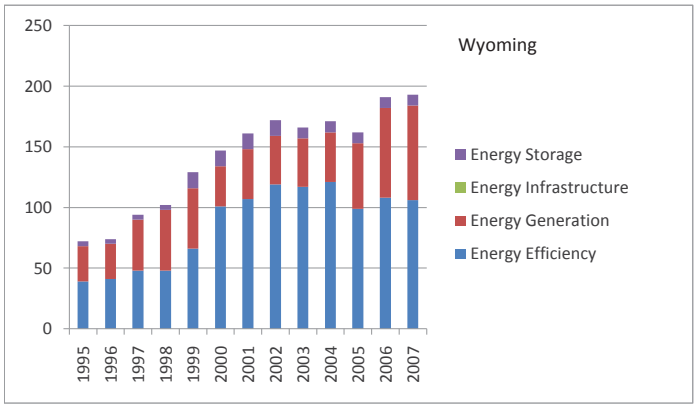
4. Energy-Related Green Job Trends, 1995–2007











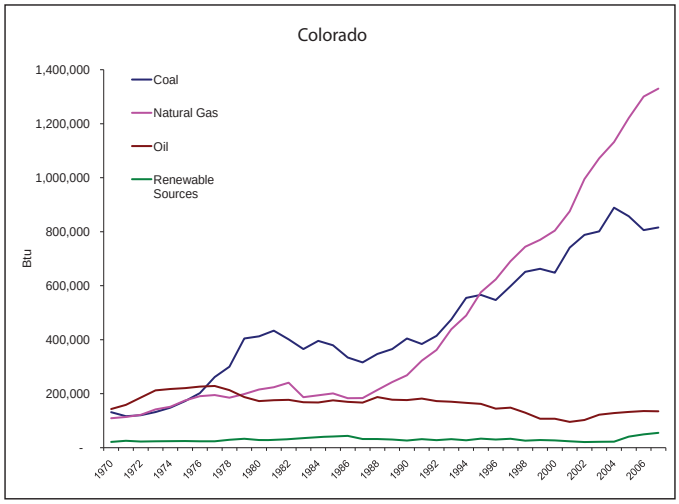
Data Source: Green Establishment Database.

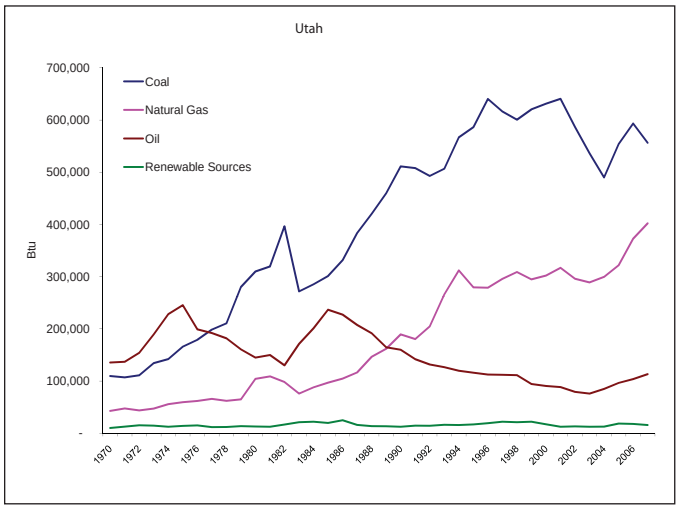
Why is this important?

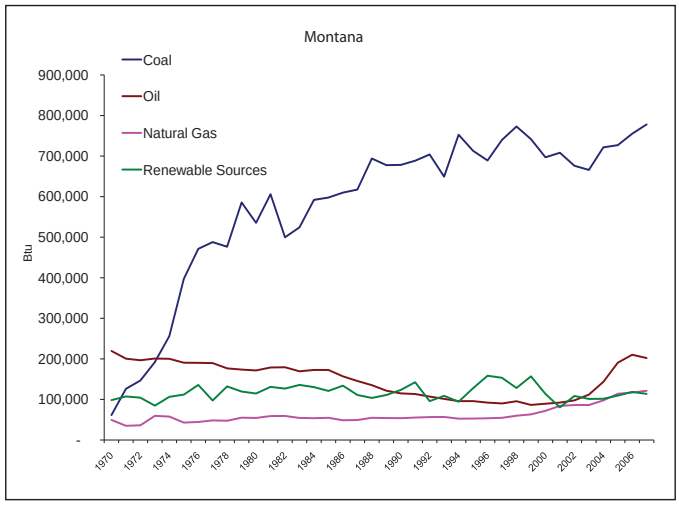
Note the variety in values on the Y (left-hand) axis. Colorado is a regional leader in the number and growth of energy-related jobs. New Mexico and Wyoming are among the states that also show substantial increases in these sectors. Growth in Colorado has been led by jobs in the energy generation sector, while in New Mexico and Wyoming, the energy efficiency sector has contributed to growth.

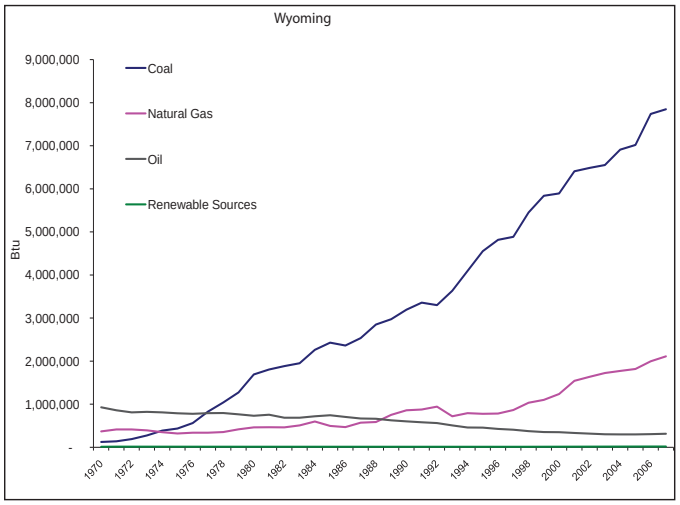
The number of jobs in New Mexico is six times the number in Wyoming. Utah has seen slower growth and has fewer jobs that New Mexico, despite being a peer in terms of the size of the state economy.

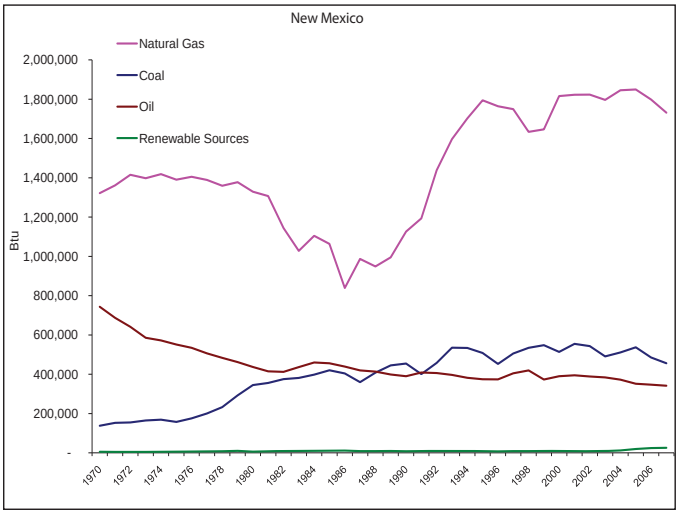
5. Energy Production Trends, 1970–2007











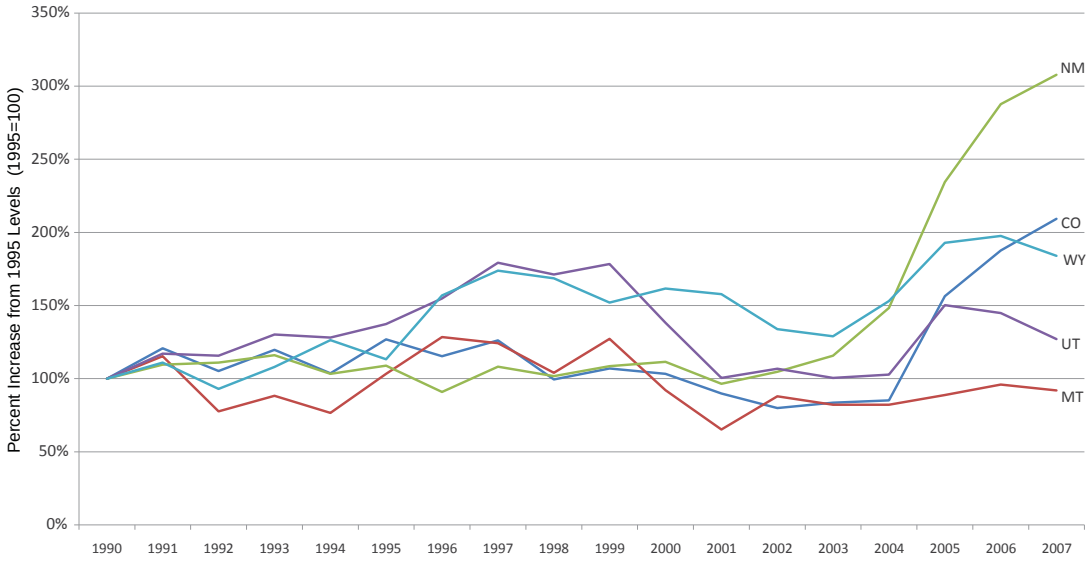
Data Source: U.S. EIA, SEDS (State Energy Data System). Released: October 30, 2009 (2007 Production).

Why is this important?

These graphs documents trends in the contribution, by volume, of different energy sources to energy production in each state. Note that the volume (Y-axis) varies significantly among the states. Coal tends to have steadier prices than other fuels. The natural gas industry has experienced significant volatility in 2008 and 2009, with impacts on what were boom industries in Colorado and New Mexico. Another clear message from these charts is the small contribution of renewable sources to overall energy production as of the most recent EIA data.

6. Renewable Energy Production Trends, 1990–2007

Growth of Renewable Energy Production by State, 1990–2007 (Indexed to 1990)



Data Source: U.S. EIA, SEDS (State Energy Data System).
Released: October 30, 2009 (2007 Production).

Why is this important?

While the data on renewable energy production that is available from the U.S. Energy information Administration lags behind industry reports, it remains the best source of unbiased accounting across states and renewable sectors.

Trend data, shown in the chart above, shows that renewable energy production was relatively static until the early 2000s. The initial spurt of growth in the 2000s is evidence of a shift in consumer, government, and private sector commitment to growth of renewable sources. This growth has continued through 2009, according to industry reports (see page 21).

Electric utilities are the primary consumer of renewable energy. The table below shows the contribution of various types of renewable energy to electric power generation in each state. Conventional hydroelectric is the largest source of renewable energy in the five states and the contribution from wind generation is increasingly significant.

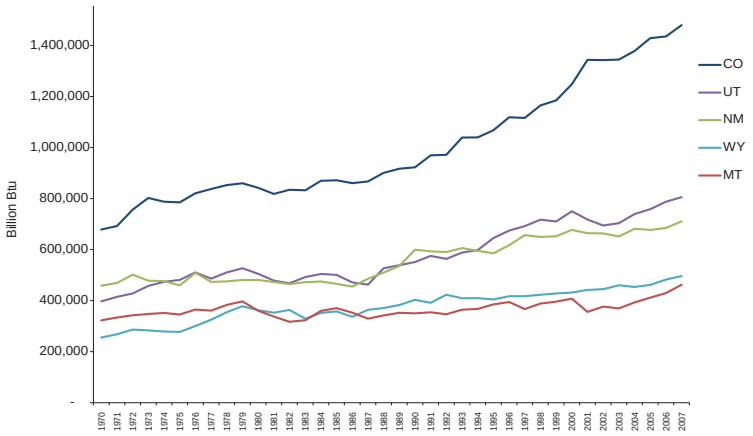
Renewable Electric Power Sector Net Generation by Energy Source and State, 2007 (Thousand KWh)

State	Biomass		Geothermal	Hydroelectric	Solar/PV	Wind
	Landfill Gas and Biogenic	Other Biomass				
Colorado		31,105		1,729,533	2,208	1,261,516
Montana				9,364,336		495,776
New Mexico		15,994		267,978		1,393,239
Utah	5,954		163,925	538,782		
Wyoming				729,424		754,881

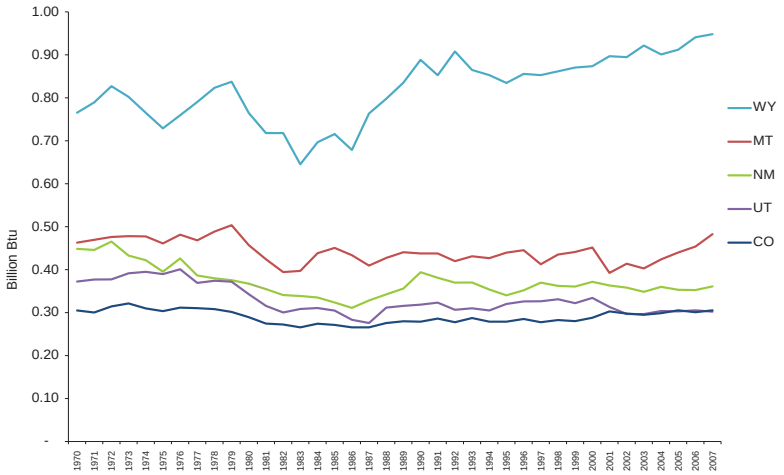
Data Source: U.S. EIA, SEDS (State Energy Data System).

7. Energy Consumption Trends, 1970–2007

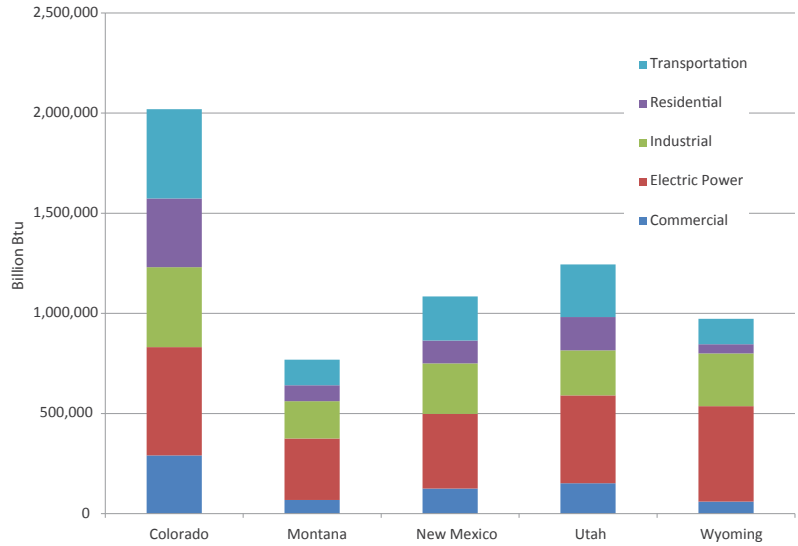
Total Energy Consumed, 1970–2007



Energy Consumed per Capita, 1970–2007



Total Energy Consumed by Sector, 2007



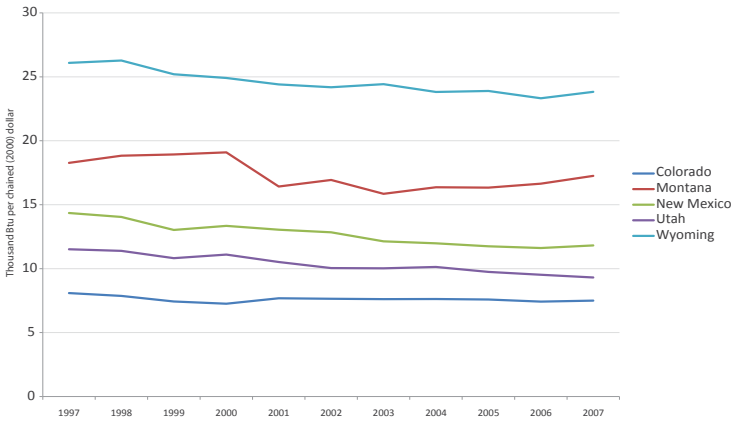
Why is this important?

These figures chart trends in energy consumption. Energy consumption has increased in every state, and is the greatest by volume in Colorado, which is the most populous of the five states. Per capita energy consumption has remained fairly stable in every state except Wyoming, where it appears to have fluctuated significantly with the bust in the energy economy in the 1980s. Among the non-utility sectors, transporation and residential are the largest energy consumers. Together with utility companies, these represent sectors where energy efficiency measures could have the greatest impact.

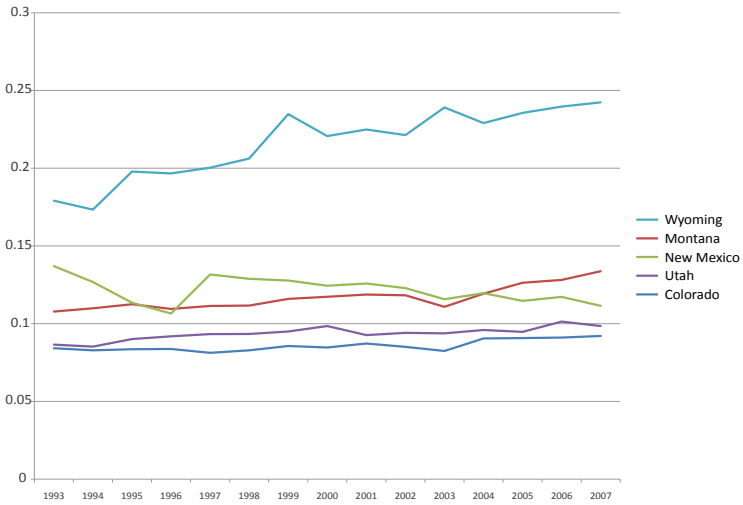
Data Source (all charts): U.S. EIA, SEDS (State Energy Data System).
Released: August 28, 2009 (2007 Consumption, Prices, and Expenditures).

8. Energy Efficiency Trends

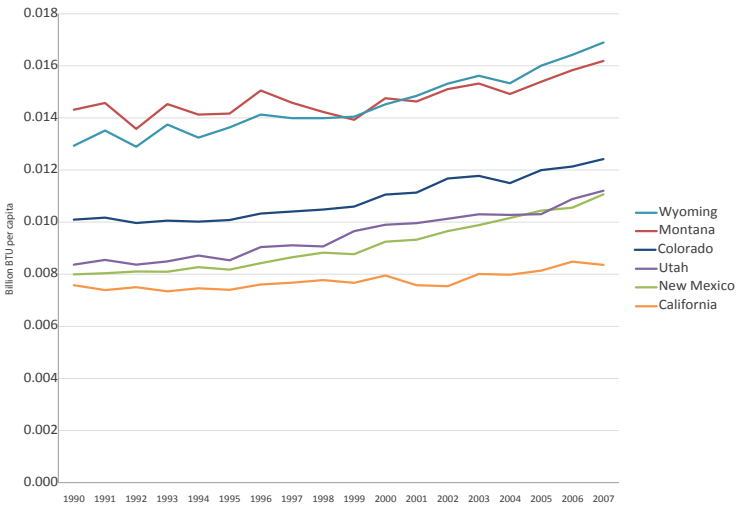
Energy Consumed per Dollar of State GDP, 1997–2007



Energy Consumed per Capita, Transportation Sector, 1993–2007



Energy Consumed per Capita, Residential Sector, 1990–2007



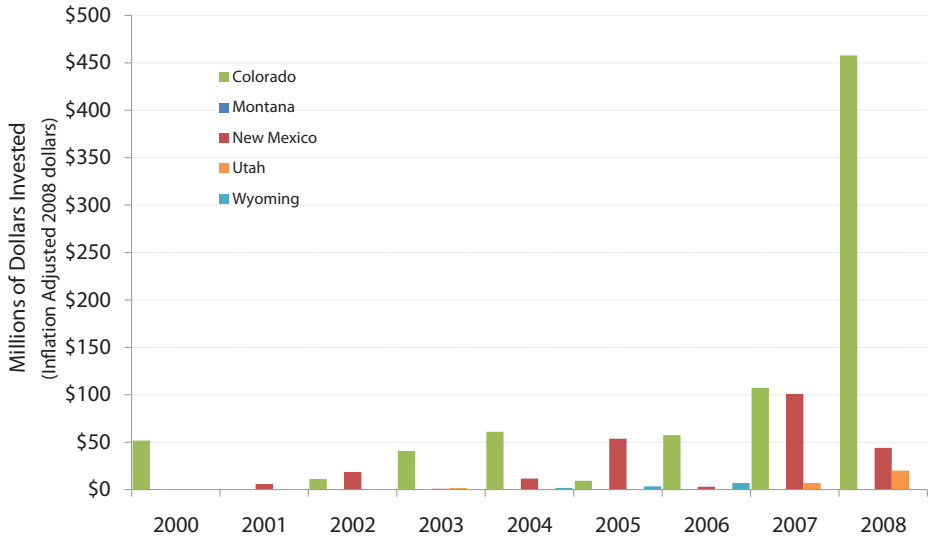
Why is this important?

These figures chart trend data for several measures of energy efficiency. Linking the total energy consumed in the state to units such as population (per capita) and economic growth (state GDP) can illustrate whether a state is making gains in energy efficiency. There is no evidence of gains in energy efficiency in the past ten years in the Rocky Mountain Energy Leading states, which is not surprising given that a serious policy discussions about energy efficiency in construction, appliances, and transportation has only emerged in the past few years, and have resulted in new, efficiency-focused legislation only in Colorado and New Mexico.

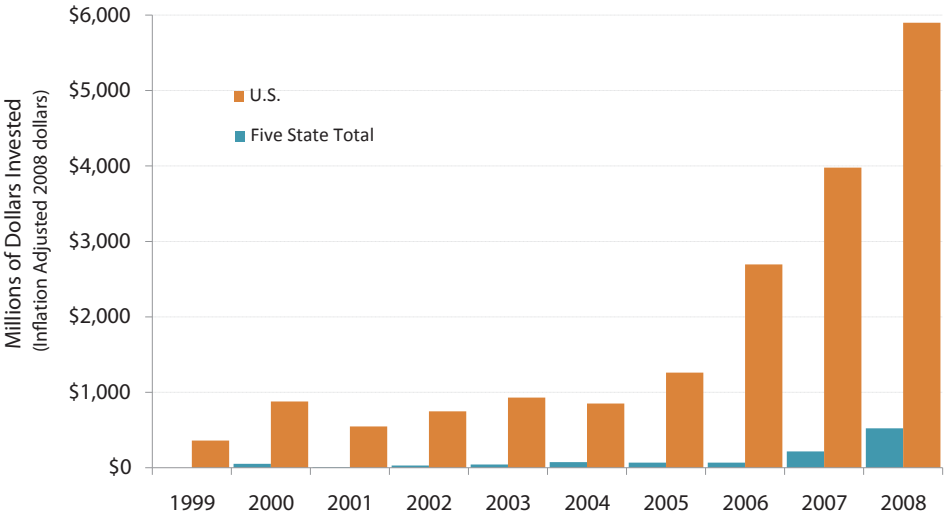
Data Source (all charts): U.S. EIA, SEDS (State Energy Data System).
Released: August 28, 2009 (2007 Consumption, Prices, and Expenditures).

9. Venture Capital Investment

Venture Capital Investment in Clean Technology, 5 States, 2000–2008



Venture Capital Investment in Clean Technology, 5 States v. U.S., 1999–2008

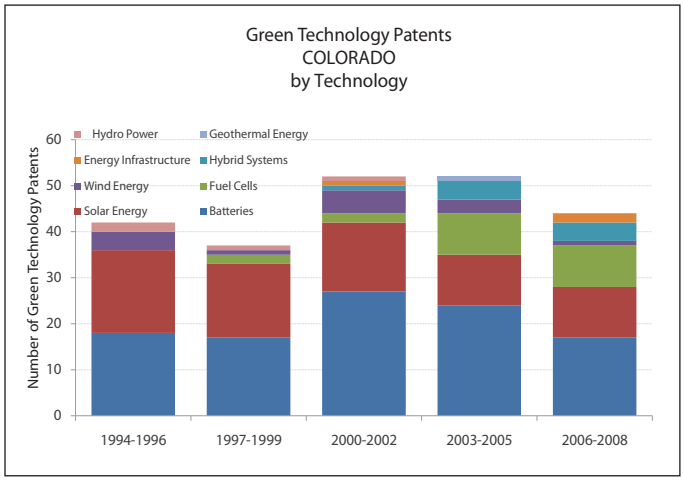


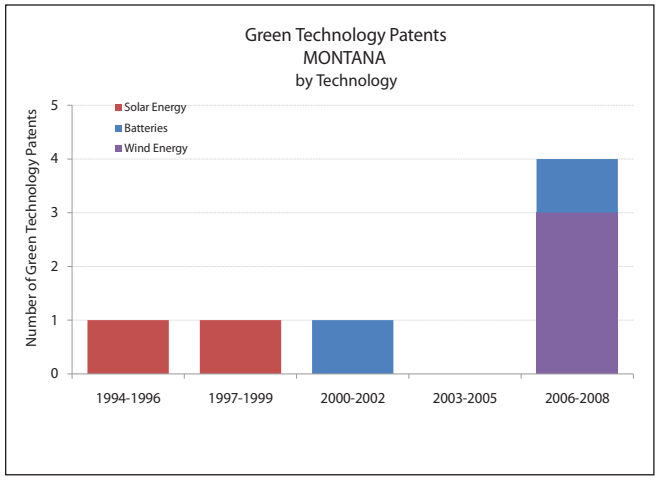
Data Source: Cleantech Group, LLC.
Analysis: Collaborative Economics.

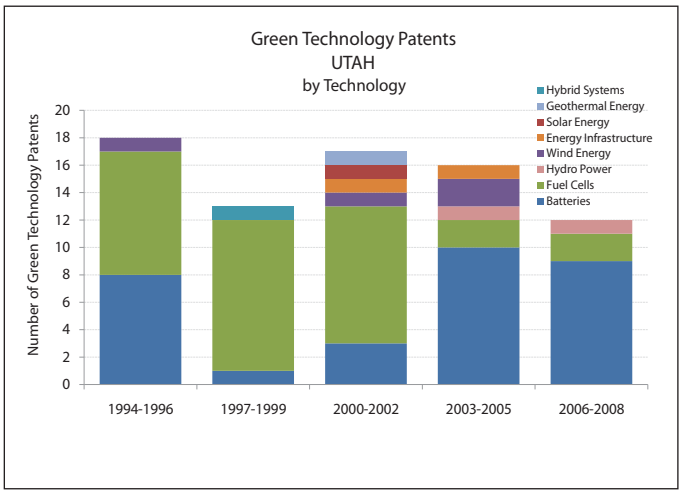
Why is this important?

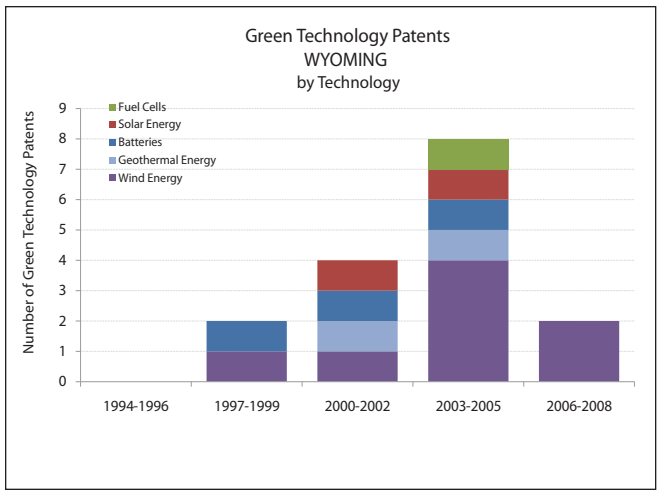
Venture capital investment is a critical element in the growth of the renewable and energy efficiency sectors. The "Cleantech" sector of investment has proven to be more resilient than many other investment sectors to the effects of the recession, signaling the confidence that investors have in clean technology's future performance. Along with the United States as a whole, the Rocky Mountain Energy Leaders have seen steady growth in private investment in venture capital since 2000. However, among the states, Colorado and New Mexico have been able to attract significantly more venture capital than the other three states.

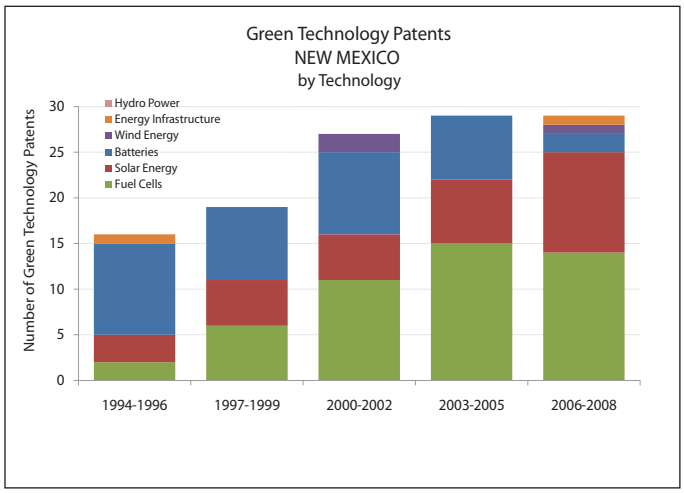
10. Clean Technology Patents











Data Source: 1790 Analytics, Patents by technology; US PTO Patent File.
Analysis: Collaborative Economics.

Why is this important?

The bar charts on this page show the number of patents awarded in each of the Rocky Mountain Energy Leading states in areas defined as pertaining to clean technology. These include technologies associated with renewable energy production as well as smart and clean energy strorage and transfer (such as batteries). Leadership in the number and diversity of patents received is one indicator of a thriving clean technology research and development sector. Here, Colorado and New Mexico have had the greatest success, with Utah also showing moderate accomplishments.

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