

Executive Summary

America's clean energy economy is dawning as a critical component of the nation's future.

Research by The Pew Charitable Trusts shows that despite a lack of sustained policy attention and investment, the emerging clean energy economy has grown considerably—extending to all 50 states, engaging a wide variety of workers and generating new industries. Between 1998 and 2007, its jobs grew at a faster rate than overall jobs. Like all other sectors, the clean energy economy has been hit by the recession, but investments in clean technology have fared far better in the past year than venture capital overall. Looking forward, the clean energy economy has tremendous potential for growth, as investments continue to flow from both the government and private sector and federal and state policy makers increasingly push for reforms that will both spur economic renewal and sustain the environment.

By 2007, more than 68,200 businesses across all 50 states and the District of Columbia accounted for about 770,000 jobs that achieve the double bottom line of economic growth and environmental sustainability (Exhibit 1).

In today's tough financial climate, when millions of jobs have been lost, those numbers may sound modest. Three quarters of a million jobs represent half a percent of all jobs in the United States today. But Pew's research shows that between 1998 and 2007, clean energy economy jobs—a mix of white- and blue-collar positions, from scientists

and engineers to electricians, machinists and teachers—grew by 9.1 percent, while total jobs grew by only 3.7 percent. And although we expect job growth in the clean energy economy to have declined in 2008, experts predict the drop in this sector will be less severe than the drop in U.S. jobs overall.

Pew's research indicates a strong start for a new economy still very much in its infancy. To put our clean energy economy numbers in perspective, consider the following. Biotechnology, which has developed applications for agriculture, consumer products, the environment and health care and has been the focus of significant public policy and government and private investment, employed fewer than 200,000 workers, or about a tenth of a percent of total U.S. jobs in 2007, according to a 2008 Ernst & Young report. And the well-established traditional energy sector—including utilities, coal mining and oil and gas extraction, industries that have received significant government investment—comprised about 1.27 million workers in 2007, or about 1 percent of total employment.

Growing attention and financial support from both the private and public sectors indicate that the clean energy economy is poised to expand significantly. Signaling interest in new market opportunities, venture capital investment in clean technology crossed the \$1 billion threshold in 2005 and continued to grow substantially, totaling about \$12.6 billion during the past three years. Although they have dropped significantly in recent months because of the recession, investments in clean

technology are actually faring better than other industries: They were down 48 percent in the first three months of 2009 compared with a year earlier, while total venture capital across all sectors was down 61 percent for the same period. “It’s important not to miss the forest for the trees,” Nicholas Parker, executive chairman of the Cleantech Group, said in January 2009. “In 2008, there was a quantum leap in talent, resources and institutional appetite for clean technologies. Now, more than ever, clean technologies represent the biggest opportunities for job and wealth creation.”

Between 2006 and 2008, 40 states and the District of Columbia attracted venture capital investments in technologies and industries aimed at economic growth and environmental sustainability. And all states will receive a major infusion of federal funds through the recently enacted American Recovery and Reinvestment Act (ARRA), which allocates nearly \$85 billion in direct spending and tax incentives for energy- and transportation-related programs.

Every State Has a Piece of the Clean Energy Economy

With traditional manufacturing jobs declining during the past decade, states have been working aggressively to develop new industries and create jobs that will endure—and remain within U.S. borders. They also have been working to address the public’s concerns about high energy prices, national security and our dependence on foreign oil, and global warming—all with an understanding that America is on its way to being a carbon-constrained country. “While our economic engine has for years been powered by relatively inexpensive energy,

there is evidence that this era is coming to a close,” a National Governors Association report noted in 2007. “Meanwhile, we are increasingly aware of the serious impacts of global climate change—and how America’s consumption of fossil fuels is contributing to a warming Earth.”

Pew’s analysis shows that every state has a piece of America’s clean energy economy. Texas, for instance, generates more electricity from wind than any other state, had more than 55,000 clean energy economy jobs in 2007, and attracted more than \$716 million in venture capital funds for clean technology between 2006 and 2008. Tennessee has succeeded in cultivating jobs in recycling, waste treatment and water management, among other conservation industries; jobs in Tennessee’s clean energy economy grew by more than 18 percent between 1998 and 2007, compared with 2.5 percent growth in all jobs in the state. Colorado has raised the amount of power electricity providers must supply from renewable energy sources to stimulate job growth in solar and wind power and other forms of clean energy generation. Ohio ranked among the top five states with the most jobs in clean energy, energy efficiency and environmentally friendly production in 2007. Idaho, Kansas, Mississippi and South Dakota are among more than a dozen states where the number of jobs in the clean energy economy in 2007 was modest, but the average annual growth rate of those jobs was among the highest in the country. All told, in 38 states and the District of Columbia, job growth in the clean energy economy outperformed total jobs growth between 1998 and 2007. In a number of states, job gains in the clean energy economy have helped lessen total job losses.

Defining the Clean Energy Economy

Pew partnered with Collaborative Economics, Inc., a public policy research firm based in California, on the research. While organizations on both sides of the political spectrum have weighed in with forecasts and economic modeling to estimate the size of the clean energy economy, Pew’s analysis is the first of its kind to count actual jobs, businesses and investments for each of the 50 states and the District of Columbia. Our numbers are conservative and may be lower than some other reports for three reasons: First, we developed a stringent definition of the clean energy economy; second, we used a new, labor-intensive methodology that counted only companies that we could verify online as being actively engaged in the clean energy economy; and third, we counted businesses and jobs supplying products and services generated by the clean energy economy, not the companies using these products and services to make themselves “greener” (i.e., we counted only companies and jobs on the supply side, not the demand side, of the clean energy economy).

Policy makers, business leaders and the public need credible, reliable data to ground their policy deliberations and choices, and to understand where emerging economic opportunities lie. They also need a clear, concrete and common definition of what constitutes the clean energy economy so they can track jobs and businesses and gauge the effectiveness of public policy choices and investments.

Based on significant research and input from experts in the field, including the advisory panel that helped guide this study, Pew developed the following definition:

A clean energy economy generates jobs, businesses and investments while expanding clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources.

The clean energy economy cuts across five categories: (1) Clean Energy; (2) Energy Efficiency; (3) Environmentally Friendly Production; (4) Conservation and Pollution Mitigation; and (5) Training and Support.

While specific jobs and businesses will change in the coming decades, the five categories of the clean energy economy will not—providing a clear, practical and consistent framework for federal, state and local policy makers and the private sector to track investments, job and business creation, and growth over time.

Jobs of Today, and Jobs of Tomorrow

Pew’s framework takes into account that technology, scientific research, market forces and public policy will continue to drive innovation and competition, so the largest segments of today’s clean energy economy may not be its driving forces tomorrow.

Our data show that 65 percent of today’s clean energy economy jobs are in the category of Conservation and Pollution Mitigation—a sector that reflects the growing recognition among the public, policy makers and business leaders of the need to recycle waste, conserve water and mitigate emissions of greenhouse gases and other pollutants. But three other categories—Clean Energy, Energy Efficiency and Environmentally Friendly Production—are growing at a far faster clip. And about 80 percent of venture capital investments in 2008 were in the sectors of Clean Energy and Energy Efficiency: businesses and jobs working to develop clean, renewable energy

sources such as wind and solar and products and services that reduce our overall energy consumption—all of which will help meet the demands of a carbon-constrained economy.

The flow of venture capital indicates which sectors are most attractive to investors and have the greatest growth potential. The number of jobs and businesses in Clean Energy and Energy Efficiency will grow over time—and as the country increases the amount of power it draws from renewable sources, we will generate less waste, reduce our reliance on foreign oil and produce fewer carbon emissions that cause global warming. That does not mean that jobs in the Conservation and Pollution Mitigation category will disappear. As other countries seek to follow America's lead, they increasingly will need help managing their finite natural resources and addressing the adverse effects of their use of fossil-fuel energy sources—creating a new market for our products, technology and know-how.

Public Policy's Role in Driving the Clean Energy Economy

Public policy is another important indicator of the future of the clean energy economy.

Policies intended to advance the clean energy economy—from comprehensive energy plans, renewable energy standards and energy efficiency measures to the development of alternative fuels, job retraining and waste reduction efforts—have been adopted or are being actively considered by both the federal government and states. It is too early to tell to what degree these efforts will succeed in stimulating U.S. job growth, strengthening America's competitiveness, curbing pollution and conserving resources. But Pew's analysis indicates such policies have great potential

because they create significant incentives for both the private and public sectors to develop new technologies, infrastructure and processes for clean energy, efficiency and conservation. Now that we have baseline data in hand, Pew will conduct follow-up research to assess which approaches are particularly effective in generating jobs, businesses and investments in the clean energy economy.

State policies. Governors and legislators across the country are seeking to get to the double bottom line of economic growth and environmental sustainability by adopting policies to advance the clean energy economy.

- *Financial incentives.* Forty-six states offer some form of tax incentive to encourage corporations and residents to use renewable energy or adopt energy efficiency systems and equipment. Thirty-three states provide residential, commercial and industrial loan financing for the purchase of renewable energy or energy efficiency systems or equipment. And 22 states and the District of Columbia offer rebate programs to promote the installation of solar water heating or solar panels for electricity generation.
- *Renewable portfolio standards.* Twenty-nine states and the District of Columbia have adopted renewable portfolio standards, which require electricity providers to supply a minimum amount of power from renewable energy sources.
- *Energy efficiency standards.* Nineteen states have established energy efficiency standards for energy generation, transmission and use.

EXECUTIVE SUMMARY

- *Regional clean energy initiatives.* Twenty-three states are participating in three major regional initiatives seeking to increase renewable energy generation and reduce carbon pollution from power plants that causes global warming.
- *Vehicle emissions standards.* Fourteen states and the District of Columbia have adopted (and three more states are poised to adopt) California's vehicle emissions standards, which allow states the right to require automakers to reduce carbon emissions from new cars and light trucks more aggressively than federal standards mandate. On May 19, 2009, President Barack Obama established national limits on vehicle emissions by adopting fuel efficiency standards that match California's.

Federal policies. The federal government also has played a critical role, adopting policies and making investments that have spurred economic growth and environmental protection from coast to coast. Laws enacted in the 1960s and 1970s helped develop the recycling, waste reduction and waste management industries. The EPA's Energy Star and Water Sense certification and labeling initiatives long have helped consumers choose and use products that conserve energy and water. And for almost two decades, the U.S. Department of Commerce has helped manufacturers improve efficiency, reduce waste and develop clean technologies and products.

In the last three years, federal policy makers have taken major steps to drive the clean energy economy forward. President Obama's recent efforts to enact stronger fuel efficiency

standards built on earlier legislation. In 2007, President George W. Bush signed into law the first congressionally mandated increase in fuel efficiency standards for cars and light trucks in more than 30 years. The Energy Independence and Security Act of 2007 is projected to save consumers \$25 billion at the gas pump, save 1.1 million barrels of oil a day and reduce greenhouse gas emissions.

Enacted in February 2009, ARRA—the federal stimulus bill—includes an array of provisions to spur clean energy generation and energy efficiency businesses, jobs and investments. Among the almost \$85 billion the package allocates to energy- and transportation-related spending, about \$21 billion is dedicated to extending tax incentives for wind, solar and other renewable energy manufacturers. ARRA also provides more than \$30 billion for direct spending on clean energy programs, including \$11 billion to modernize the nation's electricity grid; \$2 billion for advanced battery technology; more than \$6 billion for state and local efforts to achieve energy efficiency; \$5 billion for weatherization of low-income homes; \$500 million for job training to help workers participate in the clean energy economy; and \$300 million to purchase thousands of new, fuel-efficient vehicles for the federal fleet from American auto companies.

Moving forward. Given America's need to create enduring jobs and industries while conserving natural resources and reducing carbon emissions, federal leaders are deliberating additional measures to spur the clean energy economy.

President Obama has signaled his support for a federal clean energy plan to reduce greenhouse gas emissions by at least 80 percent by 2050, and a national renewable

EXECUTIVE SUMMARY

portfolio standard that would require that 25 percent of the nation's energy supply be derived from renewable sources by 2025. At this writing, the U.S. House of Representatives is considering the American Clean Energy and Security Act, a market-based proposal that would limit overall greenhouse gas emissions and distribute tradable federal allowances for each ton of pollution emitted. The program

would apply to electric utilities, oil companies and other entities that produce more than 25,000 tons of carbon dioxide each year. The bill would increase significantly the amount of energy derived from low- or zero-carbon sources, including renewables—meaning that businesses and jobs would be generated to develop clean energy sources to meet the demand.

EXHIBIT 1 THE U.S. CLEAN ENERGY ECONOMY BY THE NUMBERS

By 2007, 68,203 businesses in the United States had generated more than 770,000 jobs in the clean energy economy. And between 2006 and 2008, about \$12.6 billion of venture capital investments was directed toward clean technology businesses in 40 states and the District of Columbia. The U.S. clean energy economy is an emerging source of jobs that achieve the double bottom line of economic growth and environmental sustainability. Every state has a piece of America's clean energy economy.

	CLEAN BUSINESSES 2007	CLEAN JOBS 2007	CLEAN JOB GROWTH 1998-2007	OVERALL JOB GROWTH 1998-2007	VENTURE CAPITAL 2006-2008 (thousands)		CLEAN BUSINESSES 2007	CLEAN JOBS 2007	CLEAN JOB GROWTH 1998-2007	OVERALL JOB GROWTH 1998-2007	VENTURE CAPITAL 2006-2008 (thousands)
Alabama	799	7,849	2.2%	1.6%	\$0	Montana	408	2,155	0.2%	12.7%	\$0
Alaska	350	2,140	9.4	15.7	0	Nebraska	368	5,292	108.6	-4.9	0
Arizona	1,123	11,578	21.3	16.2	31,106	Nevada	511	3,641	28.8	26.5	19,804
Arkansas	448	4,597	7.8	3.5	22,845	New Hampshire	465	4,029	2.0	6.8	66,917
California	10,209	125,390	7.7	6.7	6,580,427	New Jersey	2,031	25,397	-9.6	-2.7	282,568
Colorado	1,778	17,008	18.2	8.2	622,401	New Mexico	577	4,815	50.1	1.9	147,913
Connecticut	857	10,147	7.0	-2.7	30,050	New York	3,323	34,363	-1.9	-2.6	209,590
Delaware	211	2,368	-2.3	-8.9	3,342	North Carolina	1,783	16,997	15.3	6.4	82,571
District of Columbia	280	5,325	18.8	-7.1	89,877	North Dakota	137	2,112	30.9	9.4	0
Florida	3,831	31,122	7.9	22.4	116,980	Ohio	2,513	35,267	7.3	-2.2	74,224
Georgia	1,827	16,222	10.8	15.7	179,686	Oklahoma	693	5,465	6.8	2.4	5,192
Hawaii	356	2,732	43.6	7.3	12,304	Oregon	1,613	19,340	50.7	7.5	70,002
Idaho	428	4,517	126.1	13.8	27,890	Pennsylvania	2,934	38,763	-6.2	-3.1	232,897
Illinois	2,176	28,395	-2.5	-2.5	108,519	Rhode Island	237	2,328	0.7	0.6	22,845
Indiana	1,268	17,298	17.9	-1.0	26,000	South Carolina	884	11,255	36.2	2.2	0
Iowa	729	7,702	26.1	3.6	149,237	South Dakota	169	1,636	93.4	4.9	0
Kansas	591	8,017	51.0	-0.3	13,275	Tennessee	1,090	15,507	18.2	2.5	16,329
Kentucky	778	9,308	10.0	3.6	0	Texas	4,802	55,646	15.5	6.7	716,894
Louisiana	995	10,641	19.5	3.0	0	Utah	579	5,199	-12.4	10.8	26,957
Maine	725	6,000	22.7	3.3	0	Vermont	311	2,161	15.3	7.4	53,747
Maryland	1,145	12,908	-2.4	1.3	323,996	Virginia	1,446	16,907	6.0	6.6	70,828
Massachusetts	1,912	26,678	4.3	-4.4	1,278,462	Washington	2,008	17,013	0.5	1.3	635,109
Michigan	1,932	22,674	10.7	-3.6	55,099	West Virginia	332	3,065	-4.1	0.7	5,741
Minnesota	1,206	19,994	11.9	1.9	49,938	Wisconsin	1,294	15,089	-5.2	3.4	46,743
Mississippi	454	3,200	24.8	3.6	30,384	Wyoming	225	1,419	56.4	14.0	6,942
Missouri	1,062	11,714	5.4	2.1	24,480	U.S. Total	68,203	770,385	9.1	3.7	12,570,110

NOTE: Venture capital values are adjusted for inflation and reported in 2008 dollars. See appendices for the complete data sets.
SOURCE: Pew Charitable Trusts, 2009, based on the National Establishment Time Series Database and data from the Cleantech Group™ LLC; analysis by the Pew Center on the States and Collaborative Economics