

ECONOMIC EXPANSION, ENERGY INDEPENDENCE AND ENVIRONMENTAL EFFICIENCY: RENEWABLES IN THE SOUTH

A SPECIAL SERIES REPORT



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August 2011

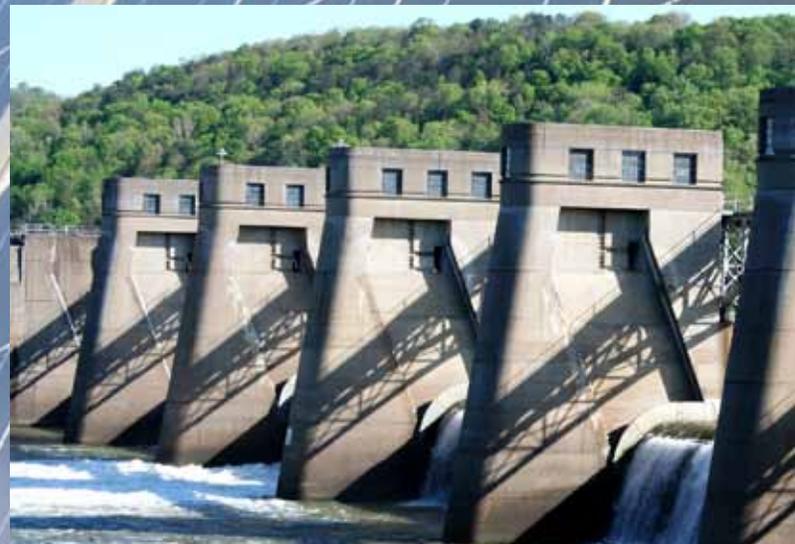
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S E R V I N G T H E S O U T H



Economic Expansion, Energy Independence and Environmental Efficiency

Renewables in the South

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Introduction

As states emerge from the Great Recession—the deepest, broadest and sharpest economic downturn experienced in the United States since the Great Depression—state policymakers confront an unenviable set of obstacles. Beyond the multiplicity of short-term challenges associated with balancing their states’ budgets,¹ as a result of the steep drop in revenues, policymakers also are struggling with a more structural weakness in our economy: the rapidly eroding manufacturing sector in the United States.

The manufacturing sector in the United States has lost more ground than every other sector of the economy. In the 1950s, manufacturing’s share of American gross domestic product (GDP) peaked at nearly 30 percent; today it has slumped to 11 percent, a decline made more pronounced since 2007 given the rigors of the Great Recession.² Even though globally the United States maintains its preeminence as a manufacturing powerhouse—the United States is still the world’s largest manufacturer with a global share of about 22 percent of global output, a ranking that has held steady over the last 30 years³—it is widely accepted that action is necessary at every level of government for the United States to expand its manufacturing prowess. There is growing awareness across multiple forums that a thriving manufacturing sector remains critical in propelling the American economy forward and sustaining America’s role as a global economic power. This notion is reinforced by the ongoing actions initiated by federal, state and local government officials to bolster the manufacturing sector. The manufacturing sector is an integral contributor to essential research and development, which in turn leads to numerous well-paying jobs and plentiful exports.

The Obama Administration has made revitalizing America’s manufacturing sector a central plank in its economic policy and the president often makes the point that “we’ve got to go back to making things.”⁴ In this regard, the president emphasizes that the clean energy sector* has to be a vital component of a future, revitalized manufacturing sector. In a speech on the

*This Special Series Report uses the terms “green economy,” “clean energy” and “renewable energy” interchangeably to refer to the broad range of industries (such as solar, wind, geothermal, hydro, biomass, landfill methane) that fall under this category.

economy he made in Parma, Ohio, in September 2010, President Barack Obama stressed the following: “[W]e see a future where we invest in American innovation and American ingenuity; where we export more goods so we create more jobs here at home; where we make it easier to start a business or patent an invention; that where we build a homegrown, clean energy industry—because I don’t want to see new solar panels or electric cars or advanced batteries manufactured in Europe or Asia. I want to see them made right here in the United States of America by American workers.”⁵

Even at the state level, there is increasing awareness that the array of clean energy industries has the potential to resuscitate the manufacturing base while generating a host of additional benefits. Directing America toward a cleaner and more secure energy future not only facilitates “developing in-state resources and related economic opportunities,” but also “addresses the growing energy demand, reducing energy costs, diversifying energy sources, and mitigating air pollution and greenhouse gas emissions.”⁶ This May 2010 National Governors Association (NGA) report elaborated that these state efforts to advance the green economic sector surfaced as “a new theme across the country” with as many as 39 states developing policies and making explicit investments to advance green economic development as part of their Great Recession recovery strategies.

In Tennessee, former Governor Phil Bredesen, in inaugurating the state’s first ever Governor’s Summit on Clean Energy Technology in October 2008, noted that, “[I]nnovation in the clean-energy tech sector is leading to higher skilled, better paying jobs. It also happens to be the right thing to do for energy and the environment. Globally, clean-energy technology

could be one of Tennessee's next great exports. We need to turn it to our advantage, and make it work for our great state."⁷ The potential for renewable energy sources to create a significant number of jobs, among other benefits, has spurred action among state legislators as well. For instance, Texas Representative Warren Chisum made the point earlier this year that, "[W]ind is a growing business and creates a lot of jobs [by taking] some of our smallest, most rural towns and making them pretty active."⁸ Representative Chisum also indicated that he would like to see Texas more proactive as it works on its energy future and focus on solar power and carbon sequestration as the state's next big economic opportunities.

Joining President Obama and state leaders in this call for jump-starting a revolution in clean energy has been a panoply of business leaders, including founder of Microsoft, Bill Gates; former chairman and chief executive officer of DuPont, Chad Holliday; former chairman of Lockheed Martin, Norm Augustine; chief executive officer of Xerox, Ursula Burns; and chief executive officer of General Electric (GE), Jeff Immelt, who coalesced to create the American Energy Innovation Council, stressing that the United States needs sizable, sustained investments in clean energy innovation of at least \$16 billion per year.⁹ These business leaders make the point that "there are profound public interests in having more energy options. Our national security, economic health and environment are at issue."

Citizens around the country have formed a variety of groups, organizations and coalitions to promote renewable energy sources in an effort to produce the

kind of objectives outlined earlier, such as economic development, environmental gains and energy independence. In New Orleans, Louisiana, for instance, Global Green and the Green Collaborative—a group of more than 65 organizations and businesses from the city and from around the Gulf Coast—released a Declaration of Energy Independence in early July 2010. This statement emphasized "important and widely-held views on energy efficiency, fuel conservation and other issues" and also called for "much greater urgency in pursuing renewable energy sources and technology."¹⁰ Similarly, in Florida, Citizens for Clean Energy, a coalition of businesses, educational institutions and community groups dedicated to bringing clean energy jobs, investment and technology to the state, continues to hold summits and meetings to prompt action on Florida's energy future.¹¹ These two examples encapsulate a groundswell of interest from citizens across the South and the country in pursuing renewable energy projects to promote economic development, environmental gains and energy independence.

Given the broad spectrum of interest among public officials, business leaders and concerned citizens, there is overwhelming evidence pointing at activity in practically every state to promote clean energy industries, not only as a mechanism to create jobs and spur economic development, but also as a strategy to develop new and innovative technology, reduce our dependence on foreign oil, address environmental concerns and provide energy security. This Special Series Report explores actions in the SLC states in recent years designed to advance the clean energy economy and accomplish the laudable goals outlined above.

Methodology

The scope of this report extends to the economic development, energy and environmental actions on the renewable energy front in the SLC states. As in a number of other SLC Special Series Reports, a key element in this report involves the state sections. Key officials were contacted in relevant SLC state economic development and energy offices for information. One of the objectives of this SLC Special Series Report is to explore the efforts initiated by the Southern states and document the progress made in recent years pertaining to actions related to developing the renewable energy sector.

On September 3, 2010, a survey was forwarded to the economic development department officials seeking current information from their states on renewable energy projects (see Appendix A for this survey). Responses were received from the following states: Arkansas, Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, South Carolina, Tennessee, Texas, Virginia and West Virginia. Of the 15 SLC states, responses were secured from 11 states; survey responses were not provided by four states (Alabama, Florida, Missouri and North Carolina).

Similarly, on September 3, 2010, a survey was forwarded to SLC state energy department officials seeking information pertaining to the impact renewable energy programs have on conservation and energy efficiency (see Appendix B for this survey). The SLC received responses from 10 states: Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, Oklahoma, Tennessee and West Virginia. The following states did not provide survey responses: Florida, Georgia, South Carolina, Texas and Virginia.

This report is divided into three parts. Part 1 explores the economic development component of the renewable energy sector with details on how the renewable sector could rejuvenate the nation's eroding manufacturing sector and job creation trends (direct, indirect and induced) at both the national and state levels

related to the renewable energy sector. Part 2 focuses on the energy component and includes details on the status, nationally and regionally, of such renewable components as hydro, solar, wind, biomass and geothermal; renewable portfolio standards and the general move toward renewable sources as a domestic and local source of reliable and sustainable energy; composition of the contemporary energy market; national and regional trends; and, finally, an assessment of the environmental and public health benefits to developing renewable energy. Part 3 delves into the SLC state profiles and relies mostly on the responses provided by states to the SLC surveys with such details as financial incentives proffered for energy efficiency at both the residential and commercial levels; energy savings and environmental impacts; financial incentives for renewable energy provided to both attract and/or retain corporations to the different SLC states; and a sampling of the different renewable energy projects either active or pending in the states.

It is important to note that the survey responses received from the states are not presented verbatim, as the SLC took editorial license to maintain content uniformity. However, the individual state sections were forwarded to the relevant state department officials for review, comment and updates prior to publication.

Part 1

The Economic Case for Focusing on the Renewable Energy Sector

For a number of years, a surfeit of American business leaders have been vocal about the importance of focusing on modern manufacturing in the United States while promoting the science and engineering skills necessary to propel manufacturing as a vital cog in our contemporary economy.¹² These top-line business officials emphasize that relying on the service sector alone for economic sustenance and neglecting manufacturing results in significant economic losses, including the off-shoring of high-tech, high-wage jobs and raising national security concerns as a result of a diminished industrial and manufacturing sector. A vocal advocate for a more aggressive approach in rebuilding America's manufacturing sector is former chairman and founder of Intel, Andrew S. Grove. According to Mr. Grove,

“Startups are a wonderful thing, but they cannot by themselves increase tech employment. Equally important is what comes after that mythical moment of creation in the garage, as technology goes from prototype to mass production. This is the phase where companies scale up. They work out design details, figure out how to make things affordably, build factories, and hire people by the thousands. Scaling is hard work but necessary to make innovation matter.

The scaling process is no longer happening in the U.S. And as long as that's the case, plowing capital into young companies that build their factories elsewhere will continue to yield a bad return in terms of American jobs.”¹³

Another high-level business executive touting the importance of investing in the American manufacturing sector is the chief executive officer of the world's leading industrial company General Electric (GE), Jeffrey Immelt. In May 2010, while addressing manufacturing items ranging from household appliances to high-tech jet engines, Mr. Immelt noted the following:

“So the next generation of those products are going to be made in the U.S. ... Places that don't have good markets but might have low costs are

going to lose jobs, places that have substantial markets are going to get jobs. I just think the way we look at it is we are probably going to put more manufacturing jobs in the U.S., both to be an exporter, but also to support some of the local production.”¹⁴

Beyond stressing the importance of reviving and resuscitating our manufacturing sector as a critical factor in advancing our national economic fortunes, a range of business and public officials also have reiterated the importance of renewable energy industries emerging as an important component in a reenergized American manufacturing sector. The unfortunate development, as evident in a number of examples, involves the fact that, even though a particular manufacturing item might have been an American invention, and even though this item was subsequently pioneered as a household application by the United States, there is a high probability that the product is not manufactured in the United States. Intel founder Andrew Grove cites a telling example of this scenario in his July 2010 *BusinessWeek* column:

“Photovoltaics, for example, are a U.S. invention. Their use in home energy applications was also pioneered by the U.S. Last year, I decided to do my bit for energy conservation and set out to equip my house with solar power. My wife and I

talked with four local solar firms. As part of our due diligence, I checked where they get their photovoltaic panels—the key part of the system. All the panels they use come from China. A Silicon Valley company sells equipment used to manufacture photo-active films. They ship close to 10 times more machines to China than to manufacturers in the U.S., and this gap is growing. Not surprisingly, U.S. employment in the making of photovoltaic films and panels is perhaps 10,000—just a few percent of estimated worldwide employment.”¹⁵

Reinforcing this point made by Mr. Grove was a development related to Evergreen Solar.¹⁶ After securing at least \$43 million in assistance from the commonwealth of Massachusetts, Evergreen Solar parlayed its innovative solar technology to emerge in the last three years as the third-largest manufacturer of solar panels in the United States. In January 2011, the company announced that it was closing its main U.S. factory, laying off 800 workers and moving production to a joint venture with a Chinese company in central China. In explaining this action, Evergreen cited appreciably larger government support available in China.

While Mr. Grove outlines specific policy measures to reverse this trend, including creating specific financial incentives by levying an extra tax on products manufactured through off-shore labor, it is prudent to review the relative importance of manufacturing in U.S. GDP in the past 80 years to determine overall trends. In fact, as the following tables demonstrate, the United States has been losing ground on the manufacturing front for more than six decades, specifically since 1947, when the manufacturing sector’s relative share of gross domestic product peaked at 41 percent of personal consumption expenditures. This component of U.S. GDP, the largest, is one of four that includes gross private domestic investment (such as fixed investment); net exports of goods and services; and government consumption expenditures and gross investment (including federal, state and local).

A breakdown of the contribution of goods and services to U.S. GDP between 1929 and 2009 provides a snapshot of the declining importance of the manufacturing sector. In this connection, it is important to note that the data for goods and services in GDP in Table 1 only involves their contribution to personal consumption expenditures, one of the aforementioned four elements that constitute U.S. GDP. Nevertheless, a review of their relative contribution over the years clearly establishes the diminishing role played by manufacturing.

A graphical representation of the trends associated with the contributions of goods and services to GDP between 1929 and 2009 is provided in Figure 1.

As evident in Table 1 and Figure 1, the relative importance of goods to total GDP began declining in the 1930s despite the massive World War II effort that manufactured military equipment and armaments during that period. After a temporary boost in the 1940s, specifically in 1947, when the goods-producing sector increased to 41 percent of total GDP, the manufacturing sector has been in a state of decline. This is perhaps the most striking finding to most policymakers and analysts since it often is assumed that the decline in U.S. manufacturing commenced in more recent decades. Concurrently, the role played by the service sector in U.S. GDP has been rising, peaking at 48 percent in 2009, in contrast to the 23 percent clinched by the manufacturing sector in that year, the latest on record.

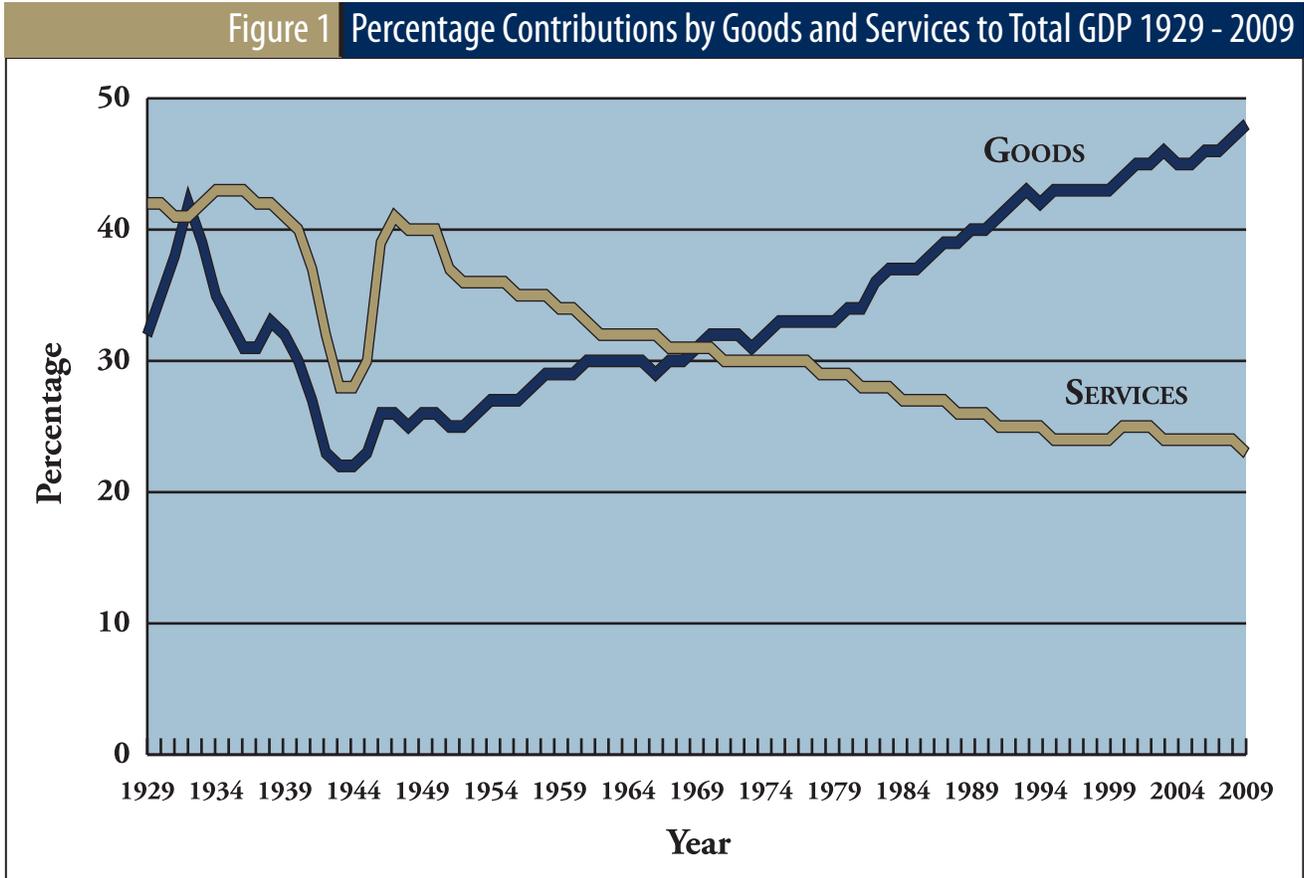
There are other salient data sets that further amplify this decline in manufacturing. For instance, details on U.S. GDP, broken down by industry is another striking example of the shrinking role played by manufacturing in the U.S. economy. Table 2 presents details from the federal government’s Bureau of Economic Analysis on this breakdown for the period 1947 to 2009.

Exploring the breakdown of individual elements in Table 2 of U.S. GDP reveals two main categories: private industries and government. Under the rubric of private industries, a number of categories surface including agriculture, forestry, fishing, and hunting; mining; utilities; construction; manufacturing (durable and non-durable goods); wholesale trade; retail trade; transportation and warehousing; information (publishing industries, broadcasting industries); finance, insurance, real estate, rental, and leasing; professional and business services; educational services, healthcare, and social assistance; arts, entertainment, recreation, accommodation, and food services; and, other services, except government. Once again, the manufacturing sector was one of the largest contributors to GDP, and the trend that surfaces is one where the sector’s contribution is in a downward trajectory during the review period, 1947 to 2009. From as high as 27 percent in 1957, manufacturing’s contribution to GDP declined to a mere 11 percent by 2009, a precipitous decline. In fact, as a result of the Great Recession, the sector’s contribution, even in actual terms, declined from \$1.7 trillion in 2007, to \$1.6 trillion in 2009, further evidence of the eroding contribution of manufacturing to overall U.S. economic GDP and activity. Figure 2 presents this information.

Another data set that documents the eroding contribution of manufacturing to the overall U.S. econ-

	1929	1939	1949	1959	1969	1979	1989	1999	2009
GDP, Billions of Dollars	\$103.6	\$92.2	\$269.1	\$506.6	\$984.4	\$2,562.2	\$5,482.1	\$9,353.5	\$14,119.0
Goods, Billions of Dollars	\$43.8	\$37.9	\$107.4	\$172.6	\$304.7	\$737.9	\$1,423.8	\$2,290.0	\$3,230.7
Services, Billions of Dollars	\$33.6	\$29.3	\$67.6	\$145.1	\$300.4	\$853.2	\$2,170.7	\$4,052.8	\$6,770.6
Goods as Percent of GDP	42%	41%	40%	34%	31%	29%	26%	24%	23%
Services as Percent of GDP	32%	32%	25%	29%	31%	33%	40%	43%	48%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Table 1.5.5. Gross Domestic Product, Expanded Detail



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Table 1.5.5. Gross Domestic Product, Expanded Detail

omy is a tabulation of the number of full-time employees (FTEs) working in the manufacturing sector as a percent of the total number of full-time employees in the entire economy. Table 3 presents this information for the 80-year period between 1929 and 2009.

Prior to reviewing trends over this 80-year period, a quick snapshot of trends in the last 10 years also remains instructive. Table 4 provides this information for the period 1999 to 2009, enabling a review of more recent trends.

Tables 3 and 4 depict the shrinking importance of manufacturing jobs in the U.S. economy, once again, a development that began more than 60 years ago. As in the case of the relative importance of the manufacturing sector's overall contribution to GDP begin-

ning a decline in 1947, the decline in the number of manufacturing-related jobs also began around that time. Specifically, manufacturing jobs in the United States also reached their zenith in 1947, when 32.3 percent of all jobs in the country were related to this sector. It should be noted that in 1942, at the height of the massive war effort that was underway, the proportion of manufacturing jobs also reached 32.3 percent. However, as demonstrated in Tables 3 and 4, the sector has experienced a stunning reversal in terms of its relative importance in the overall employment sector. For much of the 1950s, 1960s and 1970s, the sector garnered between 29 percent and 23 percent of total jobs but, beginning in the 1980s, this number began an even faster descent resulting in a drop to the mid-teens.

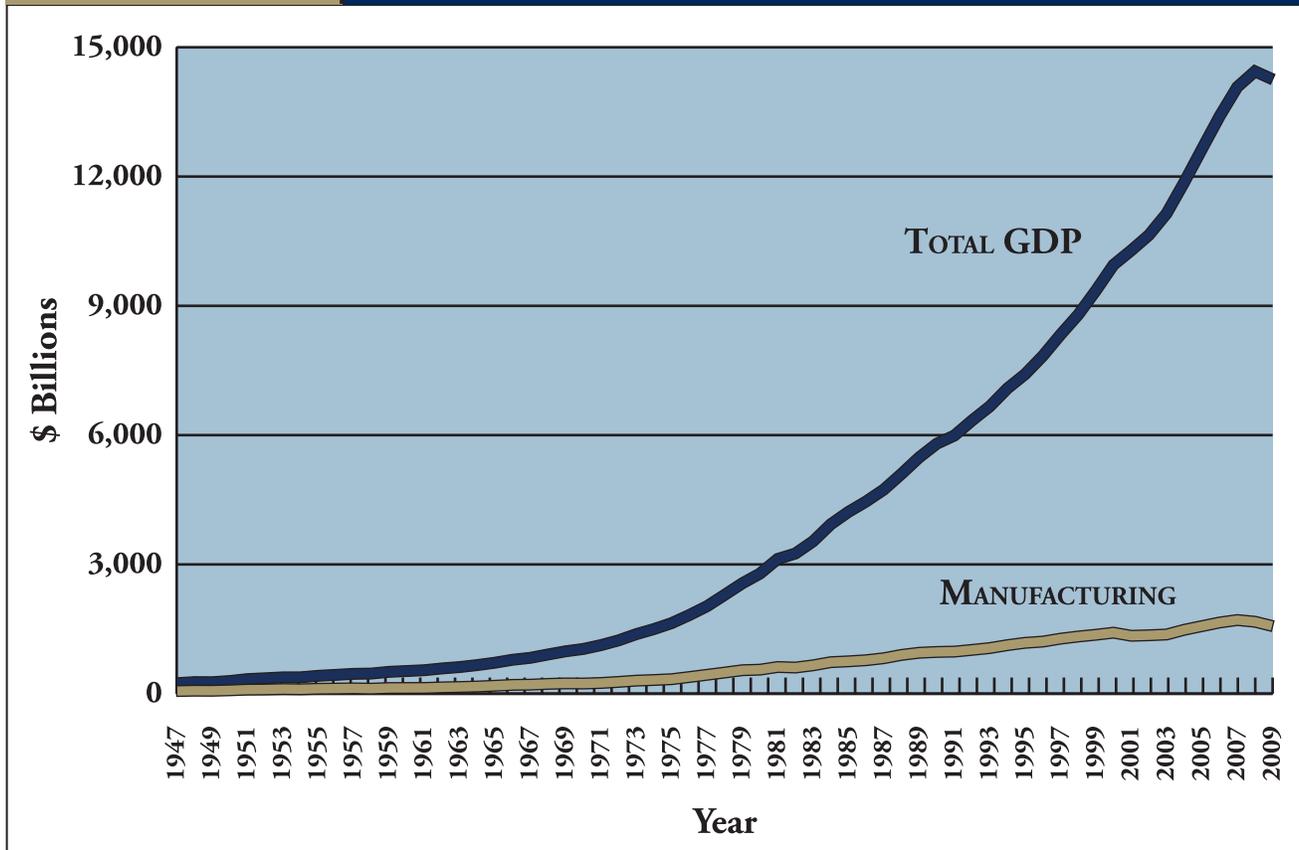
Table 2

Gross-Domestic-Product-by-Industry Accounts -
Value Added by Industry 1947 - 2009

	1947	1957	1967	1977	1987	1997	2007	2009
GDP Billions of Dollars	\$244	\$461	\$832	\$2,030	\$4,736	\$8,332	\$14,078	\$14,256
Manufacturing Billions of Dollars	\$62	\$124	\$210	\$439	\$823	\$1,277	\$1,709	\$1,569
Percent of Manufacturing in GDP	26%	27%	25%	22%	17%	15%	12%	11%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Gross-Domestic-Product-by-Industry Accounts, http://www.bea.gov/industry/gpotables/gpo_action.cfm

Figure 2 Value Added to Total GDP by Manufacturing Industry 1947 - 2009



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Gross-Domestic-Product-by-Industry Accounts, http://www.bea.gov/industry/gpotables/gpo_action.cfm

Finally, in the 1990s, the decline became even more pronounced, with the effects of the 2001 recession contributing to the drop to 12.3 percent in 2002 followed by an erosion to single digits (9.5 percent) in 2009.

A graphical representation of the declining influence played by full-time manufacturing jobs in overall American jobs is presented in Figures 3 and 4.

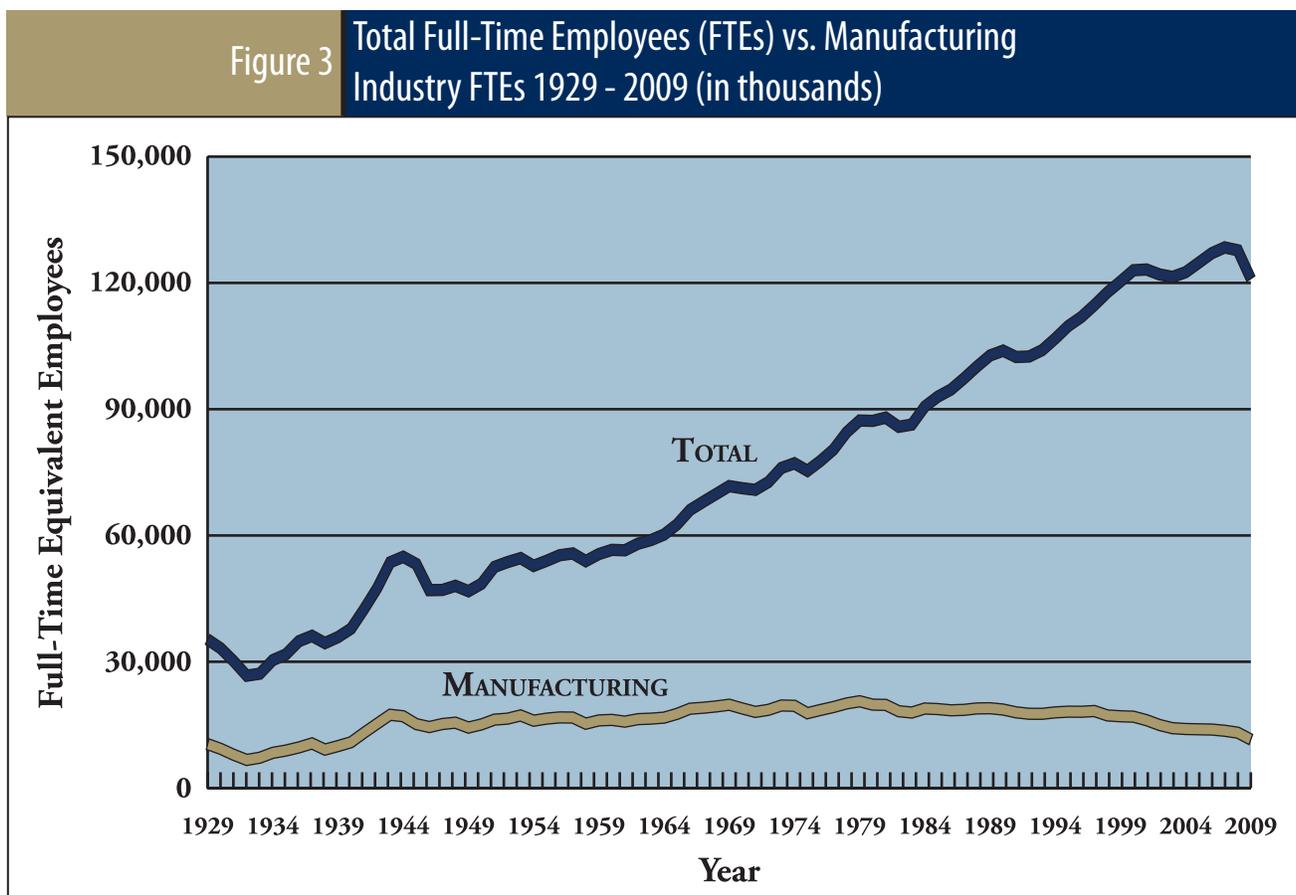
Demonstrating this waning influence of the manufacturing sector in the United States, not only in terms of economic output but also in terms of manufacturing-related jobs, corroborates the efforts by a plethora of individuals, groups and corporations to promote this sector if the United States is to regain its

preeminence in the global economy. A large, influential and growing segment of these groups and individuals also has continued to emphasize that one of the potential paths to regaining its former dominance in the manufacturing arena is by focusing on the renewable energy sector.

Also of importance is the startling fact that, despite the contracting influence of the manufacturing sector to the overall U.S. economy in the past several decades, America's manufacturing output continues to be the largest in the world. A mid-2010 report released by IHS/Global Insight, a company immersed in global economic and financial analysis, forecasting and mar-

	1929	1939	1949	1959	1969	1979	1989	1999	2009
Total FTEs in U.S. Economy	35,286	35,857	46,769	55,574	71,718	87,302	102,755	120,328	121,014
Manufacturing FTEs	10,428	9,967	14,368	16,060	19,789	20,611	18,954	17,051	11,529
Manufacturing FTEs as Percentage of Total FTEs	29.6%	27.8%	30.7%	28.9%	27.6%	23.6%	18.4%	14.2%	9.5%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Full-Time Equivalent Employees by Industry, Table 6.5-A¹⁷



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Full-Time Equivalent Employees by Industry, Table 6.5-A

ket intelligence for more than 40 years, reveals that the United States continues as a world leader in terms of manufacturing size and growth. The report also estimates that China's manufacturing sector will continue to make impressive progress vis-à-vis United States output and that it will reach the U.S. size "sometime around 2013-2014."¹⁸ Table 5 presents details on the size and growth of the world's largest manufacturing nations from this IHS/Global Insight report.

Table 5 demonstrates the dwindling contribution of American manufacturing in the last five years and the rise of the Chinese manufacturing sector. In addition, the IHS/Global Insight notes that an analysis of the composition of the different kinds of manufactur-

ing in both nations indicates that, while China has a commanding lead in lower tech areas such as textiles, apparel, appliances and several other commodities, the United States continues to dominate the higher tech areas such as aircraft, special industrial machinery (machine tools, turbines, construction equipment and mining), medical and scientific equipment and media-related industries (publishing and printing).

The diminishing contribution of the American manufacturing sector in the past several decades, both in terms of economic output and in terms of employment numbers, requires attention. The increasing significance of the service sector—at the expense of the goods sector—in the American economy is a trend that

Table 4

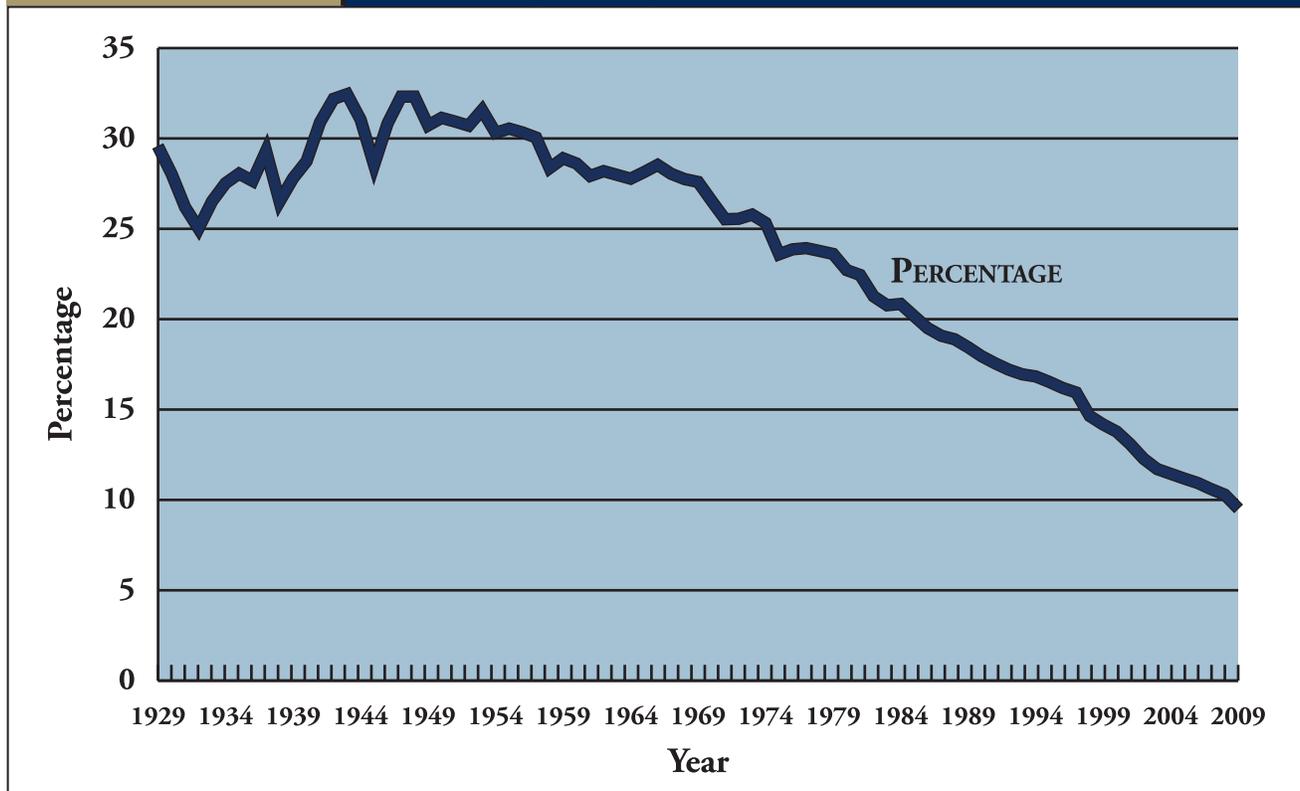
Manufacturing FTEs as a Percentage of Total FTEs in U.S. Economy 1999 - 2009 (in thousands)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total FTEs in U.S. Economy	120,328	123,013	123,185	122,013	121,427	122,546	124,779	127,044	128,431	127,757	121,014
Manufacturing FTEs	17,051	16,948	16,121	14,976	14,216	14,024	13,954	13,897	13,609	13,149	11,529
Percent of Manufacturing FTEs to Total FTEs	14.2%	13.8%	13.1%	12.3%	11.7%	11.4%	11.2%	10.9%	10.6%	10.3%	9.5%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Full-Time Equivalent Employees by Industry, Table 6.5-A

Figure 4

Percentage of Total FTEs Represented by the Manufacturing Industry 1929 - 2009



Source: U.S. Department of Commerce, Bureau of Economic Analysis, Full-Time Equivalent Employees by Industry, Table 6.5-A

has been in motion for over a half century.¹⁹ Finally, even though the American manufacturing sector continues to remain at the pinnacle of the world's largest manufacturing nations, China's manufacturing sector is rapidly gaining ground and expected to secure the top spot in a few years.

In the context of this unfortunate outlook, what are the prospects for individual states to re-capture at least a portion of this American prowess by leveraging manufacturing in the renewable energy sector? Can this sector take the lead in catapulting America's manufacturing sector to the forefront and, along the way, generate abundant economic development opportu-

nities, mitigate the need for foreign oil from unreliable and/or unstable nations, create positive externalities related to the environment by lowering reliance on fossil fuels and, finally, facilitate a range of positive American foreign policy objectives as a result of the diminishing reliance on fossil fuels from volatile areas of the world? A number of national research studies document the tremendous potential for achieving all these goals. Details from several of these studies are highlighted in this report.

In September 2008, researchers at the Political Economy Research Institute at the University of Massachusetts, Amherst, released a report entitled *Green*

*Recovery—A Program to Create Good Jobs and Start Building a Low-Carbon Economy.*²⁰ This report demonstrated that a short-term \$100 billion green economic recovery package would generate the following impressive benefits:

- » Create four times more total jobs than from an equivalent cash infusion into the oil industry;
- » Generate 300,000 more jobs than a similar amount of spending directed toward household consumption; and
- » Produce roughly triple the number of good jobs—paying at least \$16 dollars an hour—as spending the same amount of money within the oil industry.

The report also concluded that such a \$100 billion investment combining tax credits and loan guarantees for private businesses with direct public-investment spending would facilitate growth and help further boost the recovering economy, setting the stage for the adoption of a comprehensive clean energy agenda.

Another major national study, conducted by The Pew Charitable Trusts, entitled *The Clean Energy Economy: Repowering Jobs, Businesses and Investments across America* (released in June 2009), presents a persuasive case about the potential of clean energy development.²¹ This Pew Study defines a clean energy economy as one that “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 review period undertaken by the report’s authors involved nearly a decade, 1998 to 2007.

The report makes very clear that governors and state legislators alike, in practically every state, grasped the importance of encouraging this clean energy sector and enacted specific policies to secure this goal. At the time of the report’s publication, there were 46 states providing tax incentives to corporations and residents as an incentive to deploy renewable energy or adopt energy efficiency systems and equipment; 33 states offering 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) extending rebate programs promoting the installation of solar water heating or solar panels for electricity generation. In addition, the report documented that 29 states (and the District of Columbia) enacted a renewable portfolio standard (RPS), i.e., requiring electricity providers to supply a minimum amount of power from renewable energy sources. While 19 states established energy efficiency standards for energy generation, transmission and use, 23 states are participating in three major regional initiatives designed to promote renewable energy production

Table 5 World’s Largest Manufacturing Nations, Size and Growth in Real Terms: Manufacturing Value Added 2006 - 2009 (in billions of real 2005 USD)					
Nation	2006	2007	2008	2009	Percent Change (CAGR*) 2007 -2009
United States	1,788	1,853	1,790	1,696	-1.37%
China	873	994	1,168	1,302	14.25%
Japan	1,035	1,061	1,023	794	-8.45%
Germany	593	612	610	502	-5.41%
South Korea	227	241	227	223	-0.54%
India	134	148	156	166	7.39%
Taiwan	82	87	85	79	-1.45%

Source: IHS/Global Insight, May 2010

Note: * = CAGR refers to Compound Annual Growth Rate

and lower carbon pollution. Additionally, 14 states (and the District of Columbia) had adopted California’s vehicle emissions standards in an effort to reduce carbon emissions from new cars and light trucks.

The Pew report also documented that the clean energy sector has fared admirably despite significant obstacles, such as the lack of sustained policy, attention and investment at multiple levels of public and private sectors and the onset of the Great Recession in 2007. Specifically, the sector had a strong presence in all 50 states, employed a broad array of workers, generated new industries and, most importantly, had a faster job growth rate than overall jobs in the United States. In total, the report documented that, by 2007, more than 68,200 clean energy businesses across all 50 states and the District of Columbia accounted for about 770,000 jobs, an impressive number. In fact, the report documented that the number of clean energy jobs compared very favorably when stacked against the biotechnology sector (fewer than 200,000 jobs across the United States, according to a 2008 Ernst & Young report) and the traditional energy sector (1.27 million workers in 2007 in such areas as utilities, coal mining and oil and gas extraction). Importantly, in contrast to the clean energy sector, both the biotechnology and traditional energy sector have received generous government investments and private sector assistance—along with public and private policy focus—for decades. Table 6 documents the growing influence of the clean energy sector on the U.S. economy.

Table 6 U.S. Clean Energy Economy

State	Clean Energy Businesses 2007	Clean Energy Jobs 2007	Clean Energy Job Growth 1998-2007 (Percent)	Overall Job Growth 1998-2007 (Percent)	Venture Capital 2006-2008 (\$1,000s)
Alabama (SLC)	799	7,849	2.20	1.60	0
Alaska	350	2,140	9.4	15.7	0
Arizona	1,123	11,578	21.3	16.2	\$31,106
Arkansas (SLC)	448	4,597	7.8	3.5	22,845
California	10,209	125,390	7.7	6.7	\$6,580,427
Colorado	1,778	17,008	18.2	8.2	\$622,401
Connecticut	857	10,147	7.0	-2.7	\$30,050
Delaware	211	2,368	-2.3	-8.9	\$3,342
District of Columbia	280	5,325	18.8	-7.1	\$89,877
Florida (SLC)	3,831	31,122	7.9	22.4	\$116,980
Georgia (SLC)	1,827	16,222	10.8	15.7	\$179,686
Hawaii	356	2,732	43.6	7.3	\$12,304
Idaho	428	4,517	126.1	13.8	\$27,890
Illinois	2,176	28,395	-2.5	-2.5	\$108,519
Indiana	1,268	17,298	17.9	-1.0	\$26,000
Iowa	729	7,702	26.1	3.6	\$149,237
Kansas	591	8,017	51.0	-0.3	\$13,275
Kentucky (SLC)	778	9,308	10.0	3.6	0
Louisiana (SLC)	995	10,641	19.5	3.0	0
Maine	725	6,000	22.7	3.3	0
Maryland	1,145	12,908	-2.4	1.3	\$323,996
Massachusetts	1,912	26,678	4.3	-4.4	\$1,278,462
Michigan	1,932	22,674	10.7	-3.6	\$55,099
Minnesota	1,206	19,994	11.9	1.9	\$49,938
Mississippi (SLC)	454	3,200	24.8	3.6	\$30,384
Missouri (SLC)	1,062	11,714	5.4	2.1	\$24,480
Montana	408	2,155	0.20	12.7	0
Nebraska	368	5,292	108.6	-4.9	0
Nevada	511	3,641	28.8	26.5	\$19,804
New Hampshire	465	4,029	2.0	6.8	\$66,917
New Jersey	2,031	25,397	-9.6	-2.7	\$282,568
New Mexico	577	4,815	50.1	1.9	\$147,913
New York	3,323	34,363	-1.9	-2.6	\$209,590
North Carolina (SLC)	1,783	16,997	15.3	6.4	\$82,571
North Dakota	137	2,112	30.9	9.4	0
Ohio	2,513	35,267	7.3	-2.2	\$74,224
Oklahoma (SLC)	693	5,465	6.8	2.4	\$5,192
Oregon	1,613	19,340	50.7	7.5	\$70,002
Pennsylvania	2,934	38,763	-6.2	-3.1	\$232,897
Rhode Island	237	2,328	0.7	0.6	\$22,845
South Carolina (SLC)	884	11,255	36.2	2.2	0
South Dakota	169	1,636	93.4	4.9	0
Tennessee (SLC)	1,090	15,507	18.2	2.5	\$16,329
Texas (SLC)	4,802	55,646	15.5	6.7	\$716,894
Utah	579	5,199	-12.4	10.8	\$26,957
Vermont	311	2,161	15.3	7.4	\$53,747
Virginia (SLC)	1,446	16,907	6.0	6.6	\$70,828
Washington	2,008	17,013	0.5	1.3	\$635,109
West Virginia (SLC)	332	3,065	-4.1	0.7	\$5,741
Wisconsin	1,294	15,089	-5.2	3.4	\$46,743
Wyoming	225	1,419	56.4	14.0	\$6,942
U.S. Total	68,203	770,385	9.1	3.7	\$12,570,110

Source: The Clean Energy Economy, The Pew Charitable Trusts, June 2009

Perhaps the most striking aspect of Table 6, enumerating the expansion in clean economy jobs, is the fact that job growth in this sector surpassed overall job growth in the economy between 1998 and 2007 quite significantly, i.e., 9.1 percent vs. 3.7 percent. In fact, job growth in the clean energy economy outperformed total job growth in 38 states and the District of Columbia. Furthermore, 26 states experienced double-digit growth rates, including more than half (eight) of the states in the SLC. While Idaho and Nebraska experienced triple-digit growth rates, of the SLC states, South Carolina's 36.2 percent ranked as the highest. Even though several of the states that demonstrated impressive rates of growth over the nearly decade-long review period had a modest number of total jobs (5,292 in Nebraska and 4,517 in Idaho), their rate of growth contains tremendous positive outflows and offers optimism for continued growth in this sector.

As the report illustrates, the record of the states in fostering the growth of the clean energy economy remains most impressive: "Texas, for instance, [which] 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." Similarly, "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."²²

Another report published in October 2010, *Clean Tech Job Trends 2010*, by Clean Edge Inc., the world's first research and advisory firm devoted to the clean tech sector, lucidly reinforces the point that "the clean energy sector continues to fuel the plans of many cities, states, nations, investors and companies as they look for the next wave of innovation and growth."²³ Using an expansive definition of the clean energy sector, the report amply documents the sector's dynamic growth path in electric vehicles (cars, trucks and rail), energy storage, green-building materials, advanced lighting, solar power, wind energy and the smart grid. The report concludes that funds invested in clean energy create "two to four jobs for every one job created if the money were spent on fossil fuel industries."

In highlighting the top five sectors for clean energy job creation in the United States in 2010, based on a review of job placements, job postings, public and private investments, the report ranked solar power; bio-fuels and bio-materials; smart grid and energy efficiency; wind energy; and advanced transportation/vehicles as offering the most potential. The report also ranked the top 15 metropolitan areas in the United

Table 7	
Top 15 U.S. Metro Areas for Clean Tech Job Activity 2010	
2010 Rank	Metro Area
1	San Francisco-Oakland-San Jose, CA
2	Los Angeles-Long Beach-Riverside, CA
3	Boston-Cambridge-Quincy, MA
4	New York-Northern New Jersey-Long Island, NY-NJ
5	Denver-Aurora-Broomfield, CO
6 (SLC)	Washington-Arlington-Baltimore, DC-VA-MD
7	San Diego-Carlsbad-San Marcos, CA
8 (SLC)	Houston-Sugarland-Baytown, TX
9	Chicago-Joliet-Naperville, IL-IN-WI
10 (SLC)	Austin-Round Rock-San Marcos, TX
11	Seattle-Tacoma-Bellevue, WA
12 (SLC)	Atlanta-Sandy Springs-Marietta, GA
13 (SLC)	Dallas-Fort Worth-Arlington, TX
14	Portland-Vancouver-Hillsboro, OR-WA
15	Sacramento-Arden-Arcade-Roseville, CA

Source: Clean Edge Inc., 2010

States for clean tech job seekers. This information is presented in Table 7.

As evident in Table 7, several SLC metropolitan areas feature prominently in the rankings and more important is the fact that the Houston area made the most significant leap, vaulting seven spots from 15th in 2009 to eighth in 2010. The report added that while bio-fuels and wind are Houston's strongest clean tech sectors, its city government ranks as the nation's top municipal purchaser of green power through Reliant Energy wind power. Furthermore, the report commented on two newcomers to the Top 15, the Atlanta (12th) and Dallas (13th) metropolitan areas.

The report's section on compensation documented that the clean energy sector offered careers and employment opportunities at both the entry-level and more experienced levels. This included positions in a broad spectrum of industries, activities, salaries, and job levels. The latest salary and compensation survey carried out for the 2010 report revealed that those with "a high school or associate degree can pursue positions in many popular fields like green building, solar power, and wind energy. HVAC service technicians (\$48,600), insulation workers (\$33,600), solar energy system installers (\$37,700), and wind turbine technicians (\$48,300) are only a few of the industry posts offering living-wage median pay to entry-level workers

without a bachelor's degree. For higher-ranking, more educated or experienced hands, positions like LEED architect (\$57,100), wind construction superintendent (\$76,700), senior electrical engineer (\$95,400), and environmental engineering manager (\$106,000) all are profitable career choices."²⁴

The report carried a special section on several examples of the impressive roster of manufacturing jobs created in specific locations across the United States in 2010, such as the following:

- » Colorado-based **Abound Solar** is retooling a shuttered auto transmission factory in Kokomo, Indiana, into one of the nation's largest photovoltaic plants designed to employ up to 850 people in the next three years. This project was boosted by a \$400 million U.S. Department of Energy loan guarantee along with an additional \$25 million in state and county incentives;
- » Spanish wind-turbine generator company **Inge-team** announced in March 2010 that it will employ about 270 workers at a new facility in Milwaukee, Wisconsin;
- » Also, in North Milwaukee, Wisconsin, Spain-based **Talgo** plans to hire 125 employees to build high-speed rail cars at a former auto parts factory;
- » Nine advanced electric vehicle battery plants have opened across the United States funded partially by the 2009 American Reinvestment and Recovery Act that contained \$2.4 billion allocated for that sector alone. Michigan, given its extremely high unemployment rate and decades-long prowess in the automobile industry, secured a significant share of the appropriation (\$1.4 billion). In July 2010, President Obama attended the groundbreaking for a new **Compact Power** battery factory in Holland, Michigan, projected to employ 300 workers making lithium-ion batteries for the Chevy Volt and electric Ford Focus starting in 2012; and
- » **Tesla Motors** acquired and began operations at the former New United Motor Manufacturing Inc. (NUMMI) facility in Fremont, California. The NUMMI plant, a joint venture between Toyota and General Motors, shut down in April 2010 after 26 years, laying-off 4,700

workers. The following month, Tesla and Toyota announced plans to build Tesla's all-electric Model S sedan at the plant, with Tesla aiming to produce the first models in 2012. This is another example of the clean energy sector rejuvenating previously boarded-up, old-line automobile plants.

The following conclusions regarding the vibrancy and growing prominence of the clean energy section may be reached:

- » In the past decade or so, there has been a flurry of pronouncements and calls to action by a number of American corporate luminaries on the importance of a thriving manufacturing sector in the United States;
- » This focus on rejuvenating the American manufacturing sector is a response to its diminishing impact on the overall American economy in recent decades, a decline that actually began in 1947, probably much earlier than most experts and policymakers would have assumed;
- » Alongside this declining manufacturing sector, the American economy has experienced a rise in the relative importance of the service sector;
- » Even though the American manufacturing sector continues to remain at the pinnacle of the world's largest manufacturing nations, China's manufacturing sector is rapidly gaining ground and is expected to secure the top spot in a few years;
- » In the midst of this shrinking manufacturing base, there is increasing interest in leveraging the nation's expertise in the renewable energy sector to bolster and reinvigorate the nation's manufacturing sector.

In fact, there is growing and ongoing research on this topic indicating that the renewable energy sector has the potential and capacity to bolster America's manufacturing sector to the forefront and, along the way, and as stated earlier, generate abundant economic development opportunities, mitigate the need for foreign oil from unreliable and/or unstable nations, create positive externalities related to the environment by lowering reliance on fossil fuels and facilitate a range of positive American foreign policy objectives on account of the diminishing reliance on fossil fuels from volatile areas of the world.

Part 2

The Environmental and Energy Efficiency Case for Focusing on the Renewable Energy Sector

The United States is the single largest consumer of energy in the world, using twice as much energy as it produces.²⁵ In 2006, President George W. Bush maintained that the United States relied too heavily on foreign sources of energy and emphasized the need to develop greater energy efficiency and a more diversified energy portfolio, primarily through technology and innovation.²⁶ Recently, in response to rising gasoline prices, President Barack Obama touted the benefits of energy diversity, including job creation and controlling the escalating cost of energy. “Instead of subsidizing yesterday’s energy sources, we need to invest in tomorrow’s,” President Obama said, emphasizing the imperative of long-term planning for the energy needs of the United States.

Moving in the direction of more renewable energy production can yield a variety of environmental and public health benefits for states and communities, including cleaner air by reducing greenhouse gas emissions. Although cap and trade legislation currently is off the table in the U.S. Congress, other efforts are under way to control the level of emissions produced in the United States, including the Emergency Economic Stabilization Act of 2008 (EESA) and the American Recovery and Reinvestment Act of 2009 (ARRA), which created a more favorable policy environment for renewable energy.²⁷ Studies suggest that, apart from theories regarding global warming and other potentially catastrophic events, greenhouse gases—particularly CO₂—have the potential to cause serious health risks, especially in children and the elderly, and exposure has been associated with shortness of breath and coughing to more serious ailments like heart attacks and lung cancer.²⁸

Renewable energy is almost always domestic and, generally, local. Reliance on foreign oil has been of grave concern to U.S. officials for some time. Replacing reliance on transportation fuels produced under foreign governments, some of which are run by unstable regimes, would be advantageous from an economic and

a public safety perspective. In addition, many environmental benefits can be derived from using renewable energy, such as water resources protection.

States are becoming increasingly interested in the sheer potential for greater energy security and reliability that renewable energy production holds. In 2009, crude oil prices, which are increasingly susceptible to demand expectations, steadily rose from \$41.68 per barrel at the beginning of the year to \$74.47 per barrel by December. In April 2011, the price per barrel of oil hovered above \$100.

Given the myriad factors associated with reliance on foreign energy resources, there is a renewed interest in alternative forms of energy for other environmental and public health reasons. In addition to benefiting the environment and public health, the movement toward the use of more renewable fuels has the potential to produce lower electricity rates for consumers. According to the Center for American Progress and Energy Resource Management Corporation, in addition to creating more than 625,000 full-time, sustainable construction and construction-related jobs during the next decade, the United States could save electric ratepayers as much as \$64 billion a year by expanding the use of renewable fuels. A report released by the

Center in 2010 emphasizes that state policies promoting energy efficiency projects could yield more than \$500 billion in new investments from private companies. Two SLC states—Texas and North Carolina—are among the top 10 states in the nation in terms of developing such policies, which encourage everything from attracting large-scale wind projects, to retrofitting homes and commercial businesses to meet higher efficiency standards.²⁹

There are a variety of policies that can be particularly advantageous to states wishing to actualize greater energy efficiency potential. First, states can include energy efficiency measures in their renewable portfolio standard (RPS), a state policy that requires electricity providers to generate a minimum percentage of their power from renewable energy resources by a certain date. Currently, there are 24 states, plus the District of Columbia, that have implemented RPS policies. Together, these states account for more than half of the electricity production in the United States. Of these 24 states, four are SLC member states (Missouri, North Carolina, Texas, Virginia* and West Virginia).

There are numerous strategies that states can deploy to encourage energy efficiency and clean energy production. These may include:

- » Defining energy efficiency as a form of clean energy;
- » Establishing renewable energy credits and markets in which these credits can be traded;
- » Requiring utilities to meet energy demand through energy efficiency, rather than by simply increasing energy supply; and
- » Examining the benefits of unbundling utility structures, in which utilities that work in energy transmission and distribution are characterized separately from power generation companies.

Similarly, states can implement decoupled utility rate structures, whereby utility profits are disassociated from the sales of a particular energy commodity. This removes both the incentive to increase electric-

* Virginia technically does not have an RPS, but rather a nonbinding goal for the adoption of renewable energy.

Missouri requires that 15 percent of its electricity production be from renewable sources by 2021. North Carolina requires 12.5 percent by the same year. Texas' demand is for 5,880 MW of renewable energy capacity by 2015. Virginia's goal is to reach 12 percent of energy usage generated from renewable resources by 2022. West Virginia will be enforcing a requirement for 25 percent of all electricity production to be from renewable energy resources by 2025.³⁰

ity sales and the disincentive to run effective energy efficiency programs or invest in other activities that may reduce load. Therefore, utilities are encouraged to make least-cost investments to deliver reliable energy services to customers even when such investments reduce throughput. Rates are then adjusted to compensate utilities for changes in the volume of energy sold, removing the structural disincentive to conserve energy. In addition, many policymakers and state utility commissions are examining the benefits of attracting renewable energy through the use of “feed-in tariffs,” which require retail utilities to purchase electricity from renewable energy sellers at specified prices and for a specific duration and, correspondingly, requires the renewable energy provider to sell to the utility for the same determined price and length of time. This standardization of the process offers the certainty of revenue for companies generating renewable energy, while reducing the cost of project financing.

A major challenge associated with renewable energy development and production is cost and, correspondingly, an increase in energy prices for consumers. Much of the cost often is associated with start-up. For instance, approximately 75 percent of the installed cost of a wind plant is associated with purchasing wind turbines, and as much as 64 percent of the cost of solar photovoltaics is related to the cost of the modules and inverter.³¹ However, new innovations are helping change the competitiveness of renewable energy. Locating manufacturing jobs in the United States may prove essential to this process. As the costs of renewable energy components continue to decline, so will the cost of energy produced from these resources.

Large-scale renewable energy projects often get the most attention, but the growing momentum of the numerous smaller projects in states is gaining recognition as well. For instance, small businesses, homeowners, farmers and others are installing solar panels and wind turbines. Often, whenever states encourage renewable energy production and use through policy, companies either start up or get involved in things like manufacturing and research. For instance, Ohio, which implemented an RPS in 2008, which requires 25 percent of the state's energy to come from renewable sources by 2025 (an ambitious goal for a state that currently relies on coal for 90 percent of its power), and makes available a variety of grants through the Ohio Advanced Energy Fund, has initiated substantial growth in renewable energy jobs. In addition to several large-scale renewable projects in the state, including plans to install a wind farm in Lake Erie, the state has seen the creation of hundreds of companies and growth in jobs related to the renewable energy sector. In addition, the city of Toledo has become a center for

thin-film solar cell research and manufacturing and is expected to become a hub for energy efficiency research and innovation in years to come.³² States can play an integral role in attracting researchers currently developing the next generation of LEDs, solar panels, wind turbine designs, and other innovations that will make renewable energy competitive and a potential source of cheaper energy for consumers.

Sources of Renewable Energy

There are various types of renewable energy used in the United States. These include, but are not limited to, wind, solar, biofuels, hydropower, geothermal and other sources.

WIND ENERGY

According to EIA, the United States has over 33,000 megawatts (MW) of installed wind energy capacity.³³ In recent years, approximately 96 percent of renewable energy capacity increases in the United States came from new wind capacity.³⁴ Texas has been at the forefront of wind energy development, with the support of Governor Rick Perry, who opposed federal cap and trade legislation but who has touted wind as a viable contributor to Texas' growing energy needs. Last year, he announced an \$8.4 million investment by the Texas Emerging Technology Fund (TETF) in a collaborative wind energy project facilitated by the Texas Tech University System. According to a press release from the governor's office, TETF has contributed \$154 million in funds to early stage companies since its inception in 2005, leading to the creation of more than 100 enterprises that are contributing to research and development, as well as manufacturing of products used in renewable energy production.³⁵ As a result, Texas now leads the nation in wind capacity and generation. In 2008, the state increased its wind capacity by 65 percent, reaching 7,427 MW of power.³⁶

Montana is another state that has seen a surge in wind energy production and reaped millions of dollars in economic benefits since passing its renewable energy standard in 2005 and cutting property taxes on wind energy development. Today, the state produces nearly 400 MW of wind energy, up from zero just a decade ago, and is anticipating more farms to come online in the near future. In addition to direct skilled labor jobs associated with wind production, the state is seeing a growing need for additional infrastructure in order to properly deliver the energy produced to the marketplace.³⁷

A major difficulty with wind energy is its unreliability; peak wind and peak demand do not necessarily coincide. Whenever there is no demand for power, companies often dump excess power or reduce production altogether. However, energy storage for intermittent energy sources is a major area of exploration for electricity providers. The obvious advantage to battery storage is that production does not need to coincide with use, but it has an added benefit of allowing "arbitrage," or the buying of power at a low price during low demand times of the day, and then reselling during times of higher demand. Xtreme Power, a company based in Austin, Texas, is working on a project to develop storage batteries for electricity produced from wind. The system will be able to hold approximately 10 megawatt-hours (MWh), which is the amount a 30 MW wind farm can produce in 20 minutes if it is running at full capacity. The round trip efficiency of the battery system, or the amount of electricity it is capable of delivering per MWh of stored energy, is touted at more than 90 percent. Currently the highest efficiency seen in energy storage in general use is approximately 70 percent to 85 percent from pumped hydropower.³⁸ Such innovations will help wind energy remain a major source of renewable power in the United States.

SOLAR ENERGY

Solar energy projects capture sunlight with panels of photovoltaic cells and convert it directly into electricity or use it for heating. There are some limitations to solar energy production. Similar to wind energy, solar projects can only produce electricity when the sun is shining, and most projects require a large amount of space in order to produce a substantial amount of electricity. Although the generation of solar energy is most practical in the sunny Western and Midwestern states, new developments are making it a more viable source of renewable energy throughout the nation. The National Renewable Energy Laboratories (NREL) currently is conducting research in a variety of fields, including finding ways to improve performance and reliability, best practices for siting solar energy systems, and accelerating manufacturing capacity in the United States. In 2009, the United States maintained approximately 603 MW of solar electricity generation capacity and, according to a recent report by Solarbuzz, a leading global market research firm specializing in solar energy supply, the U.S. solar market, which doubled in size in 2010, is poised to do so again in 2011. According to the report, nonresidential projects are driving this increase and 29 states have utility-scale solar projects in development. This trend reflects the declining cost of installing large projects, due to innovation as well as government incentives.³⁹



An example of hydroelectric generators, from the Dalles Dam on the Columbia River Gorge, Oregon. Photo courtesy of flickr user Sam Churchill via Creative Commons License.

BIOFUELS

Biomass energy includes the use of wood, agricultural crops and residues, municipal refuse, wood and paper products, manufacturing waste, and livestock manure to produce electricity, heat homes, or create transportation fuels. Ethanol is the most widely produced biofuel and is used predominantly as a transportation fuel. Nearly all ethanol in the United States is made from corn, although it can be produced from other sources such as sugarcane. Advances in cellulosic ethanol, which can use woodchips or other forest waste, have gained much attention in recent years, particularly since the process does not rely on food products, a drawback of ethanol production from corn. The ethanol industry produces approximately 5 billion gallons annually.⁴⁰ There also is a small but expanding industry that produces biodiesel, which typically uses grain oils or animals fats. According to EIA, the largest increase in renewable energy consumption in 2009 came from biofuels.⁴¹

GEOHERMAL ENERGY

Geothermal energy is the capture of heat produced by the earth but trapped below the surface. Resources include hot water or rock, typically found between three to five miles below the ground, as well as extremely high temperatures of molten rock, or magma, deep below the surface. The process of capturing geothermal energy involves injecting cold water into a well, circulating it through hot fractured rock, and then capturing the heated water produced in the well. The

United States uses geothermal energy to heat buildings and greenhouses, as well as in steam power plants. Most geothermal projects are located in Western states, but ARRA provides significant funding, loan guarantees and tax credits for purchasing and installing geothermal operations, increasing the likelihood that such projects will expand throughout the nation. According to EIA, the United States maintained approximately 2,351 MW of geothermal electricity generation capacity in 2009. In addition, EIA anticipates geothermal energy generating capacity to increase by almost 2,500 MW by 2026. There currently are more than 100 new geothermal projects underway in the United States.⁴²

HYDROPOWER

Hydropower is produced from flowing water passing through hydroelectric turbines. Most hydropower is produced at large dams, where water is trapped and routed through tunnels that contain turbines, which turn and generate electricity. The Hoover Dam, near Las Vegas, is perhaps one of the best known sites for hydroelectric power generation. For many years, the project was able to supply a large portion of the city's energy needs. Hydroelectric dams are expensive to build and require a great deal of planning, development and preparation, which can make siting very difficult. However, once built, power stations can produce a great deal of power and do so very cheaply. Another advantage is that hydropower is much more reliable than other alternative energy sources, such as wind and solar, providing a mechanism for constant energy generation. In addition, the water collected by the dam can be used for other needs, such as irrigation. According to EIA, the United States maintained approximately 77,951 MW of hydropower electricity generation capacity in 2009.⁴³

OTHER RENEWABLE ENERGY SOURCES

Other renewable energy sources are being developed as well. For instance, landfill gas capture and use has become a fairly significant industry in recent years, particularly since the sites produce methane, a far more heat-potent and environmentally dangerous gas than carbon dioxide.* According to the U.S. Environmental Protection Agency (EPA), there are more than 425 landfill gas recovery projects operating in 43 states, supplying at least 74 billion cubic feet of fuel to end users and generating approximately 10 million MWh of electricity every year.⁴⁴ The United States maintained approximately 4,405 MW of waste electricity

* For more information regarding landfill gas capture projects in the Southern region, see the 2008 SLC report, *Landfill Gas to Fuel*, available at www.slcatlanta.org/publications.shtml.

generation capacity, including landfill gas capture and use, in 2009.⁴⁵

Tidal energy and energy derived from river currents have garnered a great deal of attention in recent years as well. Although there are only a few operating wave and tidal power plants in the world, the source is touted as one of the greatest untapped energy resources in existence. Additionally, new technology allows the conversion of river and ocean currents into electricity by capturing vibrations produced when water flows around cylindrical objects, known as vortex-induced vibrations. While hydroelectric plants harness power from falling water, these devices rely on river currents to generate electricity, expanding the potential to charge batteries on anchored ships or even supply power to nearby communities.

Energy Consumption

During the last few years, U.S. energy markets have reflected the impacts of the economic downturn that began in late 2007. Total electricity generation fell by about 1 percent in 2008, and by another 3 percent in 2009, the first time in at least 60 years that electricity use fell in two consecutive years. Moderate growth in energy consumption is expected for 2010, along with further increased use of renewable fuels and a decline in reliance on imported liquid fuels. In addition, U.S. energy consumption is expected to increase by 14 percent from 2008 to 2035, representing an average annual growth rate of 0.5 percent.⁴⁶

The growth in consumption of renewable fuels largely is the result of federal and state initiatives to encourage use, including the federal renewable fuels standard (RFS), various state RPS initiatives, as well as funds in ARRA. Although fossil fuels continue to provide most of the energy consumed in the United States, rising fuel costs have spurred growth in a movement toward renewable fuels. Over the next 25 years, it is projected that the share of overall energy from fossil sources will fall from 84 percent in 2008 to approximately 78 percent in 2035.⁴⁷

The role of renewable fuels could grow more than expected if current policies that promote the use of such fuels are renewed and expanded. For instance, ARRA, which extended production tax credits (PTC) and investment tax credits (ITC) for renewable energy, as well as offered incentive grants designed to promote the growth of renewable fuels, allows companies that generate wind, solar, geothermal and biofuels to offset many of the costs associated with production. PTC, for instance, provides a 2.1-cent per kWh benefit for the first 10 years of the renew-

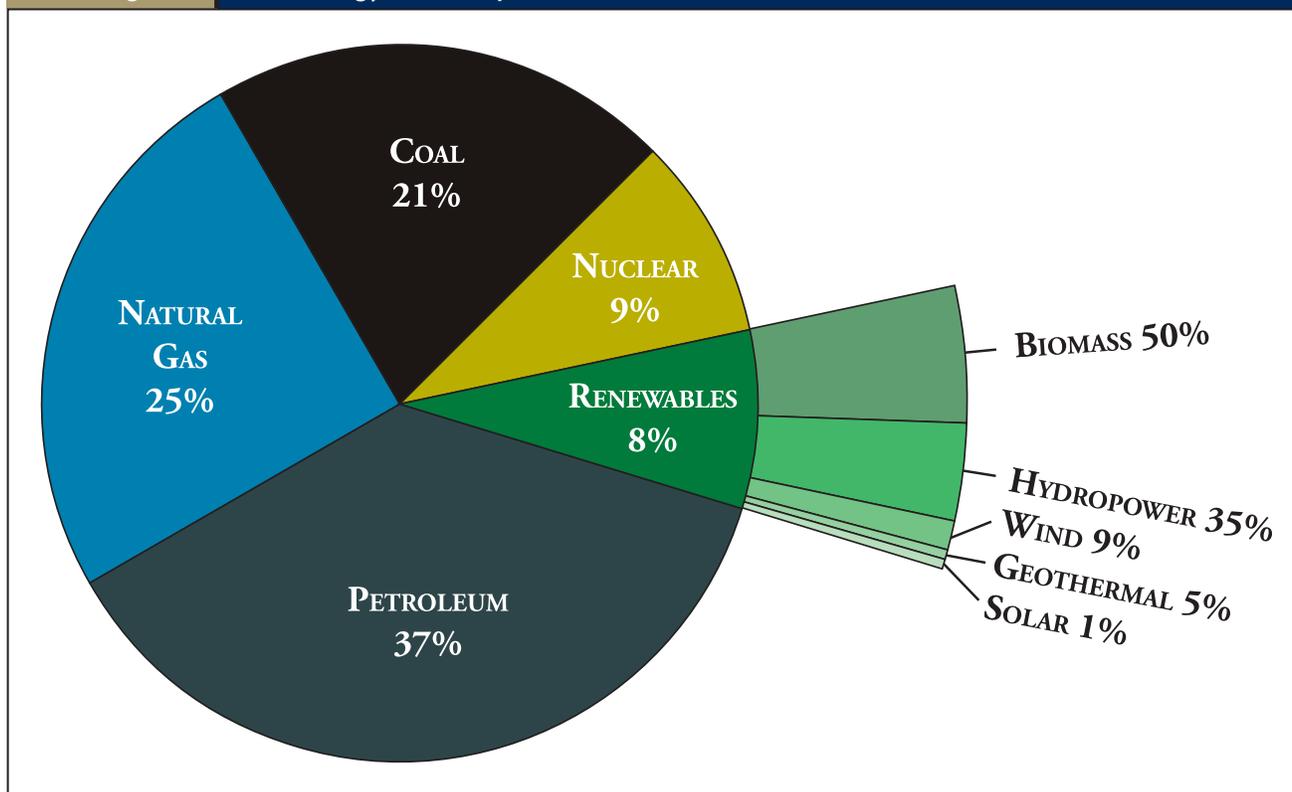
Table 8 Renewable Electricity Generation and Capacity 2008		
State	Total Renewable Net Generation (thousand MW)	Total Net Renewable Capacity (MW)
Texas	18,679	8,380
Alabama	9,493	3,865
Tennessee	6,611	2,842
Oklahoma	6,362	1,637
Arkansas	6,173	1,643
North Carolina	4,956	2,294
Georgia	4,927	2,642
Florida	4,509	1,046
Louisiana	3,774	586
Virginia	3,709	1,368
South Carolina	3,140	1,592
Kentucky	2,377	886
Missouri	2,293	734
West Virginia	1,640	594
Mississippi	1,391	229

Source: U.S. Energy Information Administration

able energy facility's operation. Other endeavors, such as "open-loop" biomass production, which uses farm or forest waste rather than dedicated energy crops, as well as incremental hydropower, small irrigation systems, landfill gas programs and municipal solid waste operations, may receive a tax credit of 1.0 cent per kWh. The ITC for businesses and individuals who buy solar energy systems is set at 30 percent. However, many of these incentives will end in the next few years. The PTC for wind, for instance, will expire at the end of 2012, and the PTC for biofuels will expire at the end of 2013.⁴⁸ Although EIA estimates that renewable generation will account for about 45 percent of the increase in total energy generation between 2008 and 2035, if PTC, ITC and other economic incentives are extended for the next 25 years, then the share of growth in total generation accounted for by renewable energy resources could be as high as 65 percent.⁴⁹

According to EIA, renewable capacity in the United States increased by 8,469 MW in 2008, a 7.8 percent leap from 2007. According to the Southeast Energy

Figure 5 Total Energy Consumption in the United States 2009



Source: Annual Energy Outlook 2010, Energy Information Administration, April 2010

Efficiency Alliance, between 2010 and 2030, energy consumption is expected to increase in the Southern region by 16 percent.⁵⁰ In addition, actual renewable energy generation increased by approximately 8 percent from 2007 to 2008.⁵¹ Total energy consumption in the United States decreased in 2009 by nearly 3 percent from 2008, while renewable energy consumption rose by about 5 percent.⁵²

Although the consumption of liquid fuels is projected to continue growing for the next 25 years, reliance on petroleum imports is projected to decrease. Rising oil prices, along with government subsidies for renewable fuels, means biofuels most likely will account for almost all growth in liquid fuel consumption in the United States, while the consumption of petroleum-based liquids is essentially fixed, according to EIA. The total consumption for all liquid fuels, including fossil-based ones and biofuels, will rise from about 20 million barrels per day in 2008 to approximately 22 million barrels per day in 2035. The role of petroleum-based liquids could further be diminished if electric and natural gas fueled vehicles begin to enter the market in greater quantities.⁵³

The environmental benefits from a greater shift to renewable energy could be substantial. Due largely to increasing reliance on renewable fuels, as well as the slowing of energy consumption growth, EIA projects a slowing in the growth of CO₂ emissions in the next 25 years. On average, although energy growth is expected to increase approximately 0.5 percent every year between now and 2035, CO₂ emissions, stemming mainly from the electric power generation and transportation sectors, are expected to grow on average by 0.3 percent every year, or a total of 9 percent, during the same period. Additionally, although the total energy-related CO₂ emissions would increase from 5,814 million metric tons in 2008 to 6,320 million metric tons in 2035, emissions per capita are predicted to fall by 0.6 percent every year.⁵⁴

State, local, and federal governments; utilities; businesses; and individuals all have a role to play in actualizing the movement toward more reliance on renewable energy. Although there are a variety of challenges facing the further development of renewable energy, the prospect for long-term energy safety and reliability is worth examining.

Part 3

Survey Responses from SLC States

A critical component of most SLC publications involves information provided directly by the appropriate state agencies in response to our survey questionnaire. This report relied on responses from 14 of the 15 SLC states on five broad renewable energy topics: general; legislative initiatives; economic impact; corporate profiles; and other relevant information. Part 3 presents the information provided by the states along with related information gleaned from additional research. For the one SLC state (Florida) that did not provide an official response, details gathered by SLC staff research are presented. As mentioned in the Methodology section, it is important to note that the survey responses received from the states are not presented verbatim, as the SLC took editorial license to maintain content uniformity. However, the individual state sections were forwarded to the relevant state department officials for review, commentary and updates prior to publication.



Alabama

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Alabama has focused on a variety of renewable energy sources over the last few decades. These include hydroelectric, solar, wind, biomass, and geothermal projects. The state also has funded several renewable energy projects using funds from the ARRA.

One of the state's most successful renewable energy programs is its Biomass Program, which began in 1984. It provides financial assistance in the form of an interest subsidy of up to \$75,000 in loans toward the purchase and installation of qualifying biomass energy systems. In 2010, the Biomass Program had four active projects, and more than 40 have been implemented since the program began.*

The Alabama Department of Revenue also offers a Capital Credit program which provides a credit of 5 percent of the capital costs of a qualifying project, to be applied to the Alabama income tax liability or financial institution excise tax generated by the project income, each year, for a period of 20 years. A project must be initiated at a new site in the state or, if at an existing facility, must involve a new investment that will expand the capacity and the number of employees. All renewable energy facilities and utility projects that produce electricity from alternative energy sources or hydropower production are eligible for the credit.

In addition, two methane capture and use, one solar thermal, and three solar photovoltaic projects currently are being funded through the Energy Efficiency and Conservation Block Grant (EECBG)

Program. A methane capture and use project is being utilized to fire a bio-gas boiler utilizing methane produced by an anaerobic digester at a cheese plant in the state. A landfill gas project is being developed to generate electricity for the distribution lines at a local electrical co-op, and a solar thermal hot water system has been installed in a county correctional facility to offset water heating costs. In addition, several photovoltaic projects are being implemented for a city hall, a museum, and an environmental center in the state. Each project in this program is evaluated for its individual energy savings potential and actual results are reported upon completion. Environmental assessment evaluations are completed for all U.S. Department of Energy (DOE) funded projects.

Currently, no workforce training programs pertaining to renewable energy are administered through the State Energy Office. However, the Governor's Office of Workforce Development recently received funding and selected projects for energy efficiency and renewable energy workforce training in the state. The State Energy Sector Partnership recently awarded a grant to the Alabama Technology Network to develop and provide green jobs training as a component of the Alabama E3 project. (The Alabama E3—Economy, Energy, and Environment—project is a coordinated federal and local technical assistance initiative that helps communities work with their manufacturing base to adapt and thrive in a new business era focused on energy sustainability, the first of its kind in Alabama).

Alabama also has launched a new revolving loan fund (RLF) that provides low-cost financing for energy efficiency and renewable energy projects at existing industries in the state. The *Alabama SAVES*[™] RLF

* For details on the historical impact of the Biomass Program, see <http://uahcmer.com/wp-content/uploads/2010/09/Alabamas-Biomass-Energy-Program.pdf>

provides loans up to \$4 million, at a 2 percent interest rate, to cover up to 100 percent of the cost of energy efficiency retrofits and/or the installation of renewable energy systems for existing companies in the large commercial and industrial sectors in Alabama.

Alabama is working to raise awareness and promote the increased usage of economically available renewable energy options and to provide opportunities for implementation on a limited basis within funding constraints.

Although the state does not currently assist corporations in securing grants, loans and other financing mechanism for renewable energy projects, it is examining the advantages of pursuing a U.S. DOE grant award to develop a residential energy retrofit program in partnership with several other states. Project development and implementation are pending and will take place over a three-year period.

COMPANY PROFILE

In January 2011, media reports in Alabama touted a plan unveiled last year by **HK Motors**, a Pasadena, California-based subsidiary of Hybrid Kinetic Group Ltd. of Hong Kong, indicating that the company intended to start a \$1.5 billion automobile produc-

tion plant in Baldwin County in 2013. According to these reports, the hybrid cars built at the Alabama facility would run mainly on compressed natural gas, backed up by electric batteries and a small gasoline tank. While HK Motors forecasted that it would build 300,000 vehicles each year at the outset, with production increasing to 1 million by 2018, the firm also estimated that production would facilitate the creation of at least 5,000 jobs. In a radical departure from the usual approach to financing a project of this nature, the company announced a unique funding plan for the facility: raising money from hundreds of individual investors in China by offering immigration to the United States as an additional incentive. They were able to do so because under current U.S. immigration rules, specifically, the EB-5 visa program launched in 1990, foreign investors who invest \$500,000 or more in an American business in a rural or high-unemployment zone that creates at least 10 jobs is eligible for permanent residency in the United States. As a result, state leaders in former Governor Bob Reilly's administration last year indicated that "much work needs to be done, particularly fundraising by HK Motors, before the hybrid car plant can be built, and it is far from certain that the project will be completed."



Arkansas

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

There are three facets to the Arkansas renewable energy program: equipment manufacturing, workforce training and renewable energy production. The state has targeted renewable industries through its “Clean, Green and Sustainable” program, which includes alternative fuels, wind power, as well as green and sustainable building materials. As a result, Arkansas has successfully recruited three wind component manufacturers over the last few years. In addition to the workforce being employed directly by renewable energy equipment manufacturers, an effort has been made in the state to train its workforce for more specific occupations related to the renewable industry, including system installation and maintenance, as well as trainers and inspectors for the industry.

In an effort to complement these developments, Arkansas is working to encourage the development and use of renewable energy in the state through programs like the Tall Towers Wind Measurement Study (to determine the state’s wind resources), Arkansas Anemometer Loan Program (to allow landowners to measure their wind energy potential) and the Renewable Technology Rebate Fund (to provide incentives for the installation of small renewable energy systems).

Arkansas has been focusing on developing renewable energy since 1981, at which time the Arkansas Energy Office became a part of the Arkansas Economic Development Commission. The state has attempted to expand hydroelectricity, solar, wind, biomass and geothermal energy development and production. These efforts dramatically increased in 2007, with the addition of alternative fuels and wind power specifically targeted in the state, when special incentives were added for the manufacture of wind energy blades and components.

The Arkansas General Assembly passed “net metering” legislation in 2001, which directed the Arkansas Public Service Commission to establish rules for certain renewable energy systems. In 2007, the General Assembly increased the availability of net metering by improving the law’s provision to carry over net excess generation and by clarifying the ownership of renew-

able energy credits. Currently, residential renewable energy systems up to 25 kW in capacity and nonresidential systems up to 300 kW in capacity are eligible for net metering. Eligible technologies include solar, wind, hydroelectric, geothermal and biomass systems, as well as fuel cells and microturbines that use renewable fuels. There is no limit on the aggregate capacity of all net metered systems. The General Assembly established the Arkansas Alternative Energy Commission in 2009, with the purpose of studying the needs and impacts of various forms of alternative energy on the economic future of the state.

The major areas of renewable energy production in the state have been biofuels and wind, although solar energy also is being assessed for its potentially feasible benefits. Additionally, there has been a continued effort to encourage the use of renewable energy through a solar training program, as well as wind measurement studies for both small- and commercial-scale wind, and a rebate program for small solar and wind system installation. The state has developed hydroelectricity, where feasible, but the state’s capacity in this energy form has been utilized to its fullest potential, according to the most recent information.

Arkansas continues to develop renewable energy in the state and has three major goals in this regard:

- » Increase the incomes of Arkansans at a growth pace greater than the national average;
- » Expand entrepreneurship, focusing on knowledge-based enterprises; and
- » Compete more effectively in the global marketplace for new business and jobs while simultaneously creating a business retention strategy to reduce closures.

The Arkansas General Assembly has passed myriad bills promoting the use of renewable energy in the state, including financial incentives. These include:

- » Act 736 (2009): provides incentives for windmill blade and component manufacturers;
- » Act 737 (2009): exempts biomass grown for biofuel production from the severance tax;
- » Act 977 (2009): amended the Alternative Fuels Development Program, which provides grants

to biofuels producers, distributors, and feedstock processors; and

- » Green Technology Grant Program: funded by the ARRA of 2009; makes grants available to companies that make or sell products that contribute to renewable energy production or storage.

Arkansas has an array of incentives designed to assist a wide selection of qualifying businesses in various stages of growth. Some of these incentives include:

- » Advantage Arkansas (income tax credit);
- » Tax Back (sales and use tax refund);
- » InvestArk (sales and use tax credit);
- » Create Rebate Program (payroll rebate);
- » ArkPlus (income tax credit based on total investment); and
- » Targeted Businesses (transferable income tax credit based on payroll and research and development).

In addition, when a business locates in the state, it can take advantage of the following benefits:

- » A favorable unemployment insurance and workers' compensation rates;
- » A reduced sales tax rate on manufacturing utilities;
- » A sales/use tax exemption on manufacturing machinery and equipment;
- » A right-to-work state, as guaranteed by the Arkansas Constitution; and
- » Favorable individual and corporate income tax rates.

Arkansas also provides assistance through two revolving loan funds, which are available for commercial or industrial buildings and state-owned buildings.⁷ The state has attracted three original equipment manufacturers (OEM) of wind turbine components; three suppliers for these wind turbine component manufacturers; four biodiesel production facilities; and 21 companies that install solar and/or wind systems. The state projects that 2,100 direct jobs were created from the wind turbine component manufacturers' operations. In addition, 300 more direct jobs are expected

⁷In terms of commercial buildings, the Arkansas Industrial Energy Technology Loan (IETL) Program finances energy efficiency retrofits and green energy implementation for industries in Arkansas. The IETL Program encourages Arkansas' industries to make investments in clean technologies and improvements in the energy efficiency of industrial processes and systems. In terms of state-owned buildings, the Sustainable Building Design Revolving Loan Fund, created with \$12 million in funding received under ARRA, serves as a revolving loan fund to make energy efficient improvements in state buildings and provides a grant to the Arkansas Building Authority to administer the fund in consultation with the Arkansas Energy Office.

to be created from suppliers of wind turbine components to OEMs. Finally, the state indicated that since 2005, at least three photovoltaic and two biodiesel patents originated in the state.

COMPANY PROFILES

In October 2008, Denmark-based **LM Wind Power** opened a production facility in southwest Little Rock turning out wind turbine blades. The facility, which had a total investment of \$150 million, is expected to employ 1,000 people within five years when its operation is fully up to speed.

In October 2010, the groundbreaking ceremony for **Mitsubishi Power Systems Americas Inc.**, a division of Mitsubishi Heavy Industries, a \$100 million wind turbine project, took place near Fort Smith, Arkansas, in the northwest corner of the state. The 200,000 square foot factory is expected to be completed in September 2011, with production expected to begin in January 2012 and employing a projected work force of about 400. While the new plant will be the company's first nacelle production plant located outside of Japan, its location is a part of the former Fort Chaffee which was closed following the 1995 recommendations of the Defense Base Closure and Realignment Commission.

German firm **Nordex** had the largest wind equipment startup in Arkansas in 2009 with its \$100-million wind turbine, nacelle and blade facility in Jonesboro. While the operation eventually will employ about 700, a number of suppliers have begun setting up operations nearby. For instance, **Beckmann Volmer**, the German company that manufactures steel components for wind turbines, announced plans in May 2010 for a new manufacturing facility in Osceola, Arkansas, as a direct supplier to Nordex and to other wind energy companies. Beckmann Volmer investments will reach \$10 million at the new facility, where approximately 300 people will be employed at an average hourly wage of \$18. Given that steel components manufactured by the company have a wide variety of applications in a wind turbine, the Osceola facility will manufacture the largest component, the turbine's main frames, i.e., the structural backbone of the turbine. Company officials at Beckmann Volmer also intimated the possibility of an additional \$7.5 million investment with 200 more potential employees.

Silicon Solar Solutions, a startup, student-run business from the University of Arkansas, recently took first place and \$25,000 in the Global Venture Challenge, a competition funding market-satisfying technology products. Their product results in lower manufacturing costs for silicon-based photovoltaic producers. The team competed against 22 semifinalists from five countries.



Florida

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Florida adopted a series of clean energy policies during the last few legislative sessions, including a dramatic reduction in greenhouse gas emissions and a renewable portfolio standard that requires 20 percent renewable electricity generation by 2020, as well as the motor vehicle emission standards previously passed in California. According to the American Council for an Energy-Efficient Economy (ACEEE), Florida could save as much as \$28 billion through energy efficiency standards, and offset the state's entire future growth in electric demand by 2023. Such initiatives have the potential to create as many as 14,000 jobs.⁵⁵

COMPANY PROFILE

Solar Source, a company located in Largo, Florida, in the Tampa Bay Area, secured a military contract in March 2011 to build a solar farm at Guantanamo Bay Naval Base in Cuba. The \$1.5 million contract will involve the company installing 1,200 solar panels at the base. "What I've seen in the past 12 to 24 months, specifically from the U.S. military, is a lot of interest and/or construction going on with solar technology. Just about every base that I know has a solar initiative starting or one already in place," said Rick Gilbert of Solar Source. While the contract has nothing to do with the prison at Guantanamo Bay, it will be used to power a workout facility for military personnel. Solar Source has recently hired 10 people for this project and indicates that they will continue to expand.



Solar photovoltaic rooftop system installed by Solar Source at the Orange County Convention Center in Orlando, Florida. Photo courtesy of U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy



Georgia

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Georgia's renewable energy program contains a combination of industry-specific incentives as well as general business incentives designed to help companies successfully locate and grow in the state. In 2004, former Governor Sonny Perdue's Commission for a New Georgia made a recommendation to focus economic development in six strategic industry clusters, one of which was energy and environment. Governor Perdue then issued a series of executive orders over the next few years to create the Center of Innovation for Energy, the Governor's Energy Challenge and the State Energy Strategy, all of which work in conjunction to comprise Georgia's renewable energy program.

Based on Georgia's available natural resources, the primary focus has been solar and biomass development in the state, which is why the state is home to leading solar companies such as Suniva, Enfinity and Mage Solar. According to *Forbes* magazine, in 2010, Georgia ranked third nationally for biofuel potential, a demonstration of the considerable development the sector has enjoyed in Georgia in recent years. By fall 2010, 12 biomass-to-electricity projects had been announced in the state, providing 689 MW of renewable energy and more than 570 direct and 1,700 indirect jobs in the state. In addition, in conjunction with research institutions and the federal government, the state is studying the potential for wind power generation off the Georgia coast.

Overall, Georgia has a broad range of state initiatives targeting energy conservation and efficiency, renewable energy, distributed generation, advanced research and development, vehicle fleet conservation, green technology and green jobs, all of which are designed to promote greater development and use of renewable energy. The major economic objective of the state's renewable energy policy package is to exceed this goal and make Georgia a national leader in renewable energy research, businesses and jobs. Currently, Georgia has over \$2 billion worth of renewable energy-related projects active in the state, and this strategic industry is projected to pump nearly \$5 billion into the state's economy during the next 10 years.

Georgia first passed solar easement legislation in 1978. However, over the last decade, the General Assembly has passed a variety of renewable energy policies. In 2005, the state created the Centers of Innovation (COI), which provides unique, technology-oriented support to existing businesses and entrepreneurs in the areas of aerospace, agribusiness, energy, life sciences, logistics and advanced manufacturing. Georgia's COI for energy supports the expansion, production and use of renewable energy and biofuels with a business-oriented focus. In 2006, Georgia passed a biofuels sales and use tax exemption. The Clean Energy Property Tax Credit was passed in 2008, which established personal and corporate tax credits for renewable energy equipment. The state currently is looking at further expanding its menu of industry-specific incentives to promote even more investment and job creation.

The Governor's Energy Challenge combines a variety of elements from the State Energy Strategy into a comprehensive program to advance energy efficiency, conservation and clean energy development in the state. Both of these initiatives were created by executive order. A main component of the Governor's Energy Challenge is a commitment by state government to reduce energy use per square foot by 15 percent in state facilities by 2020. In conjunction with the state's energy goals, Governor Perdue challenged individuals, businesses, local governments and others to reduce their energy consumption by 15 percent by 2020 as well.

Georgia enacted legislation in April 2006 creating an exemption for biomass materials from the state's sales and use taxes. The term 'biomass material' comprises a variety of materials; it is defined as organic matter, excluding fossil fuels, including agricultural crops, plants, trees, wood, wood wastes and residues, sawmill waste, sawdust, wood chips, bark chips, and forest thinning, harvesting, or clearing residues; wood waste from pallets or other wood demolition debris; peanut shells; pecan shells; cotton plants; corn stalks; and plant matter, including aquatic plants, grasses, stalks, vegetation, and residues, including hulls, shells, or cellulose-containing fibers. To qualify for the exemption,

the biomass material must be utilized in the production of energy, including the production of electricity, steam, or both electricity and steam. Pellets and fuels derived from biomass generally are eligible.

In May 2008, Georgia enacted legislation establishing personal and corporate tax credits for renewable energy equipment and certain energy efficient equipment installed and placed into service. For renewable energy property used for any purpose other than single-family residential purposes, the tax credit is equal to 35 percent of the cost of the system (including installation), \$0.60 per square foot for lighting retrofit projects, and \$1.80 per square foot for energy efficient products installed during construction. The credit is subject to various ceilings depending on the type of renewable energy system or project. The maximum credit amount is the lesser of 35 percent of the system cost or the maximum dollar cap specified for the technology. The following credit limits for various technologies apply:

- » A maximum of \$100,000 per installation for domestic solar water heating;
- » A maximum of \$500,000 per installation for photovoltaics, solar thermal electric applications, active space heating, biomass equipment and wind energy systems;
- » A maximum of \$100,000 per installation for Energy Star™-certified geothermal heat pumps;
- » A maximum of \$100,000 for lighting retrofit projects; and
- » A maximum of \$100,000 for energy efficient products installed during construction.

Leased systems are eligible for the credit. In the case of a leased system, the cost is considered to be eight times the net annual rental rate, which is the annual rental rate paid by the taxpayer less any annual rental rate received by the taxpayer from sub-rentals.

For clean energy property installed for single-family residential purposes, the tax credit is equal to 35 percent of the cost of the system (including installation). The credit is subject to various ceilings depending on the type of system. The following credit limits for various technologies and sectors apply:

- » A maximum of \$2,500 per residence for domestic solar water heating;
- » A maximum of \$10,500 per residence for photovoltaics, active space heating and wind energy systems; and
- » A maximum of \$2,000 per installation of Energy Star™-certified geothermal heat pumps.

As of February 12, 2010, Georgia's Residential Energy-Efficient Appliance Rebate Program offered rebates for select Energy Star™ appliances installed in households in Georgia. This program is administered

by the Georgia Environmental Finance Authority. Rebates are available for Energy Star™ refrigerators, freezers, washers, dishwashers, heating and cooling equipment and various types of water heaters, including solar water heaters. These appliances must replace an existing appliance. After purchasing the eligible Energy Star™ appliances, individuals must apply for the rebate online or via phone and then submit supporting documentation within 30 days of application. The corporate version of the Clean Energy Tax Credit applies to commercial, industrial, multi-family residential and agricultural businesses.

Georgia estimates that approximately \$371 million worth of venture capital funds have flowed into the state in the last five years to support industrial, energy-related firms. Some of these companies include Mage Solar, GE Energy, BMC Biomass and Suniva.

COMPANY PROFILES

While Georgia does not offer specific assistance to corporations in the form of grants, loans or other financial mechanisms for renewable energy projects, the state does possess a strong package of incentives that is available to all businesses that locate and expand in Georgia. Renewable energy companies have taken advantage of these incentives.*

In June 2008, **Suniva Inc.**, a manufacturer of high value crystalline silicon solar cells, publicized the opening of its first solar cell factory in Gwinnett County, Georgia. The new facility was constructed with an initial financing round of \$50 million, a development that led to the creation of 100 high paying, permanent green jobs at the manufacturing facility in the first year. Less than six months later, Suniva completed installation of its first production line at this new facility and began shipping its proprietary ARTisun™ solar cells to solar module manufacturers around the world. These contracts were estimated to be worth over \$1 billion. Additionally, in November 2010, Suniva announced the completion of the state's largest single solar installation, a 365 kW rooftop solar array at USFloors in Dalton, Georgia. The complete USFloors solar installation, a total of three arrays, is expected to produce 560,000 kWh per year.

In April 2011, **Metropolitan Atlanta Rapid Transit Authority (MARTA)** announced a new energy efficient solar canopy project. The \$10.8 million project, which currently is under construction, is funded by a federal grant and will be the largest solar canopy in Georgia and second largest structure of its kind at a U.S. transit system. The solar panels will cover the 220

*The Georgia response also included the comment that the state's Georgia Environmental Finance Authority (GEFA) might be contacted for additional details.

bus parking stalls at MARTA's primary bus maintenance facility in Decatur, Georgia, a suburb of Atlanta. They will be equipped with LED light fixtures that will provide enough lighting for safety and maintenance activities at night.

In January 2010, **RWE Innogy** of Germany and **BMC** of Sweden pronounced the siting of a bioenergy production plant in Waycross in Ware County, Georgia, creating approximately 75 direct jobs with an initial investment of nearly \$150 million. The facility will operate as a wood pellet production plant and is expected to produce 750,000 tons of wood products annually. RWE will serve as an investor in this project, while BMC will carry out the development of the new facility.

In April 2010, **GE Energy**, a world leading supplier of power generation and energy delivery technologies, publicized the opening of its Smart Grid Technology Center of Excellence near the company's existing Marietta headquarters in Cobb County, Georgia. This project represents a \$15 million investment and is forecasted to create 400 jobs over the next three years. The Center will be responsible for developing smart grid technology to markets around the world, and will manage the research and development of new technology for power plant automation and monitoring electrical grids and full integration of an "energy internet." The solutions developed at the Center will create efficiencies to optimize the resources of power plants, conserve natural resources and, ultimately, reduce electricity rates for the industry and consumers. In order to carry out this project, GE Energy formed a partnership with the Georgia Institute of Technology—pledging \$1.5 million—to develop its workforce as well as conduct research and development related to smart grid technology.

In May 2010, **Mage Solar GMBH**, a Ravensburg, Germany-based manufacturer of solar energy products, announced that it will locate its North American headquarters in Dublin, Georgia. A division of par-

ent company Mage Group, the company markets high grade photovoltaic modules, high performance branded inverters and mounting systems used in the solar energy industry. This project represents a \$30 million investment and is expected to create 350 jobs over five years.

In October 2010, **Georgia Power** received the state Public Service Commission's permission to nearly double its purchases of solar energy. Under a new solar tariff, the utility will buy an additional 1.5 MW of solar capacity from relatively small generators—100 kilowatts (kW) or less—for 17 cents per kWh. (1 MW can power one Super Wal-Mart.) The providers, which include commercial buildings and homes with solar arrays, must give the company all cost and operational information so that the company can learn more about solar generation. The company also will solicit proposals for power from larger solar generation sources, with no limit on the size of a given project. Georgia Power will buy up to one MW of power for 15 cents per kWh under that program. The power will go to the company's premium green energy program, which allows customers to buy 100 kWh blocks of green energy—50 percent of it solar—for \$5 extra per month.

In July 2010, Atlanta scored a renewable energy coup when **HydroPhi Technology Inc.**, a little-known hydrogen energy company with huge potential, publicized that it will establish its headquarters, research and development center and factory in the city, eventually creating 300 jobs. Hydrogen—the most abundant element in the universe—remains largely a commercially unproven commodity, and HydroPhi is betting it can reduce U.S. dependence on imported oil and gas, improve the environment and create jobs. Toward this goal, HydroPhi leased 8,000 square feet in Doraville, Georgia, a suburb of Atlanta, where its hydrogen technology will be developed further. Within three years, company officials indicate that it will employ 300 people. While 200 are slotted as factory workers, 50 will operate as designers and engineers and another 50 as salespeople, marketers and administrative staff.



Kentucky

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Kentucky generates approximately 2 percent to 4 percent of its electricity from hydroelectric facilities. A smaller percentage is generated from landfill gas and wood. The commonwealth is utilizing a portion of federal ARRA funds to spur development of renewable energy sources. For example, two new schools have been awarded funds to install solar arrays in an effort to achieve net zero or near net zero energy use. Additionally, funds have been awarded to the Governor's Office for Agricultural Policy to provide grants to farmers for installations of renewable energy systems and energy efficiency improvements.

The commonwealth's goals related to renewable energy are articulated in its strategy for energy independence, *Intelligent Energy Choices for Kentucky's Future*. The strategy calls for Kentucky to triple its renewable energy production by 2025 to generate the equivalent of 1,000 MW of clean energy while continuing to provide safe, abundant and affordable food, feed and fiber. Renewable energy-related work of the Department for Energy Development and Independence, the commonwealth's energy office, primarily focuses on policy analysis, policy development, education and outreach and project development and support.

Kentucky is focusing on expanding its bioenergy potential both as a means of meeting a percentage of electricity demand and biofuel targets established by the Renewable Fuels Standard II. Governor Steven L. Beshear convened the Executive Task Force on Biofuels and Biomass Development in Kentucky in 2009. The Task Force identified that Kentucky has significant potential to increase energy output by utilizing existing biomass resources, including wood waste, crop residue and bio-gas from landfills and anaerobic digestion of animal waste. The commonwealth also has the ability to increase the contribution of hydroelectric energy to its electricity portfolio. A study by Idaho National Laboratory puts Kentucky's potential for additional

hydroelectric power at approximately 850 MW, utilizing resources that already have been dammed. Three new hydroelectric plants currently are under construction in the commonwealth.

Although Kentucky has limited wind resources—according to wind resource maps produced by the National Renewable Energy Lab, Kentucky only has 60 MW of wind potential at a 30 percent capacity factor—two companies have set up towers in the commonwealth and are looking at Kentucky as a possible development site in the future. Similarly, even though Kentucky does not have geothermal resources strong enough to produce electricity, the commonwealth has installed systems to tap the constant temperature of the earth and use thermal energy and cool furnaces in more than 200 schools and public buildings to reduce the cost of heating and cooling buildings and heating water. Geothermal systems are an important component in the net zero schools. Solar energy systems are being developed in Kentucky as well. The largest is approximately 400 kW and is being funded through an ARRA grant as part of a net zero school project. Solar is the most expensive renewable energy option for the commonwealth, and its development in Kentucky is limited by cost.

The Kentucky General Assembly has passed myriad bills to promote the development and use of renewable energy in the commonwealth. These include:

- » Incentives for Energy Independence Act: A renewable energy facility that meets the minimum output of 1 MW (50 kW for solar) and the investment of \$1 million qualifies for tax credits up to 100 percent of tax paid on corporate income or limited liability entity tax arising from the project; wage assessment incentives up to 4 percent of gross wages of each employee; and sales and use tax credits up to 100 percent of tax paid on tangible personal property made to construct, retrofit or upgrade a facility. Credits are capped at 50 percent of capital invest-

ment and available for up to 25 years. This legislation was passed in 2007. To be eligible, a company must construct, retrofit, or upgrade a facility to increase the production and sale of alternative transportation fuels; increase the production and sale of synthetic natural gas, chemicals, chemical feed stocks, or liquid fuels; coal, biomass resources, or waste coal through a gasification process; or generate electricity for sale through alternative methods such as solar power, wind power, biomass resources, landfill methane gas, hydropower or other renewable resources. For an alternative fuel facility or gasification facility using coal as the primary feedstock to qualify, it must be carbon capture ready and have a minimum capital investment of \$100 million. For an alternative fuel facility or gasification facility using biomass resources as the primary feedstock to qualify, it must be carbon capture ready and have a minimum capital investment of \$25 million. Renewable energy facilities that meet the minimum electrical output requirement of at least 1 MW of power for wind, hydro, biomass, landfill methane, or generation of 50 kW for solar, also qualify. The minimum capital investment for these projects is \$1 million.

- » Tax credits for renewable energy systems for residential and commercial applications: This legislation, passed in 2008, provided tax credits equivalent to 30 percent of eligible costs not to exceed \$500 for residential properties and single-family residential rental units; and \$1,000 for commercial properties and multi-family residential rental units. The personal and corporate tax credits for renewable energy were available for the first time during tax year 2009. Additionally there is a Biodiesel Fuel Tax Credit, for instance, that allows producers or blenders of biodiesel fuel or blended biodiesel fuel (with a blend of at least 2 percent fuel from renewable sources), to receive a \$1 credit per gallon of fuel produced or blended.
- » Recycling Equipment Credit: This income tax credit is eligible for 50 percent of the installed costs of equipment used exclusively to recycle or compost postconsumer waste (excluding secondary and demolition wastes) and for machinery used exclusively to manufacture products composed substantially of postconsumer waste materials. For the year the equipment is purchased, the credit is limited to 10 percent of total credit allowed and 25 percent of the taxpayer's income tax liability. The unused por-

tion of the total allowable recycling credits can be carried forward to succeeding tax years, with the credit claimed during any tax year limited to 25 percent of the taxpayer's income tax liability. For equipment sold, transferred or otherwise disposed, there is a formula for calculating an allowable tax credit for equipment with a useful life of five or more years or for equipment with a useful life of five or less years. For equipment with a useful life of five or more years the formula is: 1) Less than one year, no credit; 2) Between one and two years, 20 percent of the allowable credit; 3) Between two and three years, 40 percent of the allowable credit; 4) Between three and four years, 60 percent of the allowable credit; 5) Between four and five years, 80 percent of the allowable credit; and 6) Over five years is 100 percent of the allowable credit. For equipment with a useful life of less than five years the formula is as follows: 1) Less than one year, no credit; 2) Between one and two years, 33 percent of the allowable credit; 3) Between two and three years, 66 percent of the allowable credit; and 4) Over three years is 100 percent of the allowable credit.

- » Major Recycling Project Tax Credit: A Major Recycling Project is one where the taxpayer: 1) invests more than \$10 million in recycling or composting equipment; 2) has 750 or more full-time employees and pays more than 300 percent of the federal minimum wage; and 3) has plant and equipment with a total cost of over \$500 million. A taxpayer with a "major recycling project" is entitled to an income tax credit for up to 10 years and up to 50 percent of the installed costs of the equipment. In each taxable year, the amount of credits claimed for all major recycling projects is limited to 1) 50 percent of the excess of the total of each tax liability over the baseline tax liability of the taxpayer; or 2) \$2.5 million, whichever is less. Taxpayers with one or more projects will be entitled to a tax credit equal to the total for each major recycling project, but they may not take the standard recycling credit and the major project credit on the same equipment.
- » Kentucky Environmental Stewardship Act: The Kentucky Environmental Stewardship Act provides for an income tax credit for up to 10 years for manufacturers of unique products with substantial positive impact on the environment. The credit must be approved by the Kentucky Economic Development Finance Authority and meet specific criteria: 1) the

COMPANY HIGHLIGHT

With global headquarters in Munich, Germany, and several American facilities, including one in Louisville, **Süd-Chemie** is a specialty chemicals company. Süd-Chemie's products ensure sparing use of energy and water as natural resources and the company's catalysts are essential for efficient chemical and petrochemical processes and offer optimal solutions in the areas of hydrogen production and emission control. The company's Kentucky operations include administration, production and distribution features.

product must have qualified for eligible costs of at least \$5 million. This includes 100 percent of the costs of providing the necessary skills training needed to produce the product and 25 percent of the equipment costs; 2) the costs must go toward the construction, rehabilitation or improvement of facilities necessary to produce the "Environmental Stewardship Product," which is defined as any new or improved product that has a reduced adverse effect on human health and the environment when compared to a current product; 3) wages and benefits must meet statutory requirements; 4) the maximum claimed for any one year is 25 percent of the total authorized inducement; and 5) an approved company under this agreement is not entitled to take a recycling tax credit. The Kentucky Science and Technology Corporation administers these funds under contract with the Cabinet for Economic Development's Department for Commercialization and Innovation.

- » Establishment of the Center for Renewable Energy Research and Environmental Stewardship: Passed in 2007, this measure authorized the governor to appoint a board to promote energy efficiency, renewable energy and environmental stewardship.
- » Net Metering and Interconnection Standards: Passed in 2008, this legislation establishes net metering guidelines for renewable energy systems rated at 30 kW or less.
- » Kentucky Clean Coal Incentive: The Kentucky Clean Coal Incentive Act provides for an income tax credit or public service corporation property tax credit for new clean coal facilities constructed at a cost exceeding \$150 million and used for generating electricity. Before the credit is given, the Environmental and Public Protection Cabinet must certify that a facility is

reducing emissions of pollutants released during electric generation through the use of clean coal equipment and technologies. The amount of credit is \$2.00 per ton of coal mined in Kentucky and used in the facility and not already receiving tax credit. Unused portions of this credit cannot be carried forward.

In addition to these measures, the Kentucky New Energy Ventures Fund (KNEV) provides seed stage capital to support the development and commercialization of alternative fuel and renewable energy products, processes and services in Kentucky. The funds exist to stimulate private investment in Kentucky-based technology companies with high growth potential. KNEV awards grants of \$30,000 and investments ranging from \$250,000 to more than \$750,000. Qualified companies must be Kentucky-based and funds are designated for business development activities.

There are six landfill gas-to-energy projects operated by East Kentucky Power Cooperative. There are two large solar arrays ranging from 350 to 400 kW in size that have been installed or will be installed on schools. There also are three hydroelectric facilities that are under construction or planned and a wood-to-energy facility (50 MW) that is expected to be built in Hazard, Kentucky.

In total, there currently are approximately 796 renewable energy-related jobs in Kentucky. Some of the companies that have been identified as directly or indirectly involved in the renewable and alternative energy fields in the commonwealth include General Electric (GE) Consumer and Industrial; Commonwealth Agri-Energy LLC; Parallel Environmental Services Corporations; Bluegrass Biodiesel LLC; Griffin Industries Inc.; Owensboro Grain Company LLC; and Southland Renewable Fuels LLC.

Focusing on GE's Consumer and Industrial division remains particularly relevant given the company's announcement that it will manufacture highly energy efficient hybrid electric water heaters in Louisville, Kentucky, at the Company's Appliance Park facility, creating about 400 jobs. The new hybrid patented technology will make GE the first manufacturer to introduce a water heater that will meet the new 2009 Energy Star™ standards for heat pump hot water heaters. The new industry-exclusive GE hybrid electric water heater is designed to provide hot water in the quantities homeowners demand but uses only about half the energy of conventional water heaters to produce it. Based on the standard 50-gallon tank water heater that uses approximately 4,800 kWh per year, the new GE hybrid electric water heater is designed to:

- » Use about 2,300 kWh per year, a savings of approximately 2,500 kWh per year;
- » Save approximately \$250 per year—that’s \$2,500 savings in energy costs over a 10-year period based on 10 cents per kWh.

According to the DOE, if just 10 percent of the nation’s 4.8 million electric water heater shipments were heat pump water heaters with an energy factor of 2.0 instead of conventional models with an energy factor at the federal standard, the aggregate energy savings would amount to nearly 1.3 billion kWh per year. The GE hybrid electric water heater combines energy-saving heat-pump technology with traditional electric heating systems used in most conventional water heaters on the market today, without sacrificing the amount of hot water it can deliver. This hybrid technology is designed to absorb heat in ambient air and transfer it into the water. Since this requires much less energy than the energy used to generate radiant heat—as used in a conventional electric water heater—the GE hybrid electric water heater is more economical to operate. Such innovation will continue to help the commonwealth move toward cleaner energy sources and greater energy independence.

According to the PricewaterhouseCoopers/National Venture Capital Association MoneyTree Report, venture capital in renewable energy into Kentucky for the period 2005 to 2010 amounted to approximately \$58 million. According to the Clean Energy Economy report, published by the Pew Charitable Trust, between 1999 and 2008, there were 17 patents related to renewable energy registered in Kentucky.

COMPANY PROFILES

In Perry County, in the state’s southeastern corner, **ecoPower Generation, LLC**, was established in 2009 to build and operate a wood-powered bioenergy plant. The company aims to develop homegrown renewable energy sources and, given its vast forest resources, Kentucky remains one of the most fertile states for producing bioenergy in the country. ecoPower intends to use low quality logs, wood chips, sawdust and bark left over from sawmills to convert this organic matter into electricity at its plant. As a result of purchasing thousands of tons of these materials each year, ecoPower will provide an economic boost to the state’s logging, timber and transportation industries as well. When operating at capacity, ecoPower’s 50 MW power plant—producing enough energy to power 30,000 homes—will be the first of its kind in Kentucky.

Toyota Motor Manufacturing of Kentucky (TMMK) in Georgetown builds the hybrid Camry and is a model facility for energy efficiency and stewardship. The Georgetown Toyota plant’s search for the

PROJECT HIGHLIGHT

A joint research project between **Kentucky Renewable Energy, University of Kentucky Center of Applied Energy Research and Kentucky Power Plants** seeks to use algae to capture CO₂ from power plant flue gas to reduce greenhouse gas emissions. Along with the long-term goal of developing this process into a commercially viable system, the algae product also will be researched by the University of Kentucky to determine the viability to use it as a biodiesel feedstock.

ultimate eco-car has a lengthy history dating as far back as December 2002, when it launched limited sales of the Toyota FCHV, a Fuel Cell Hybrid Vehicle that runs on high pressure hydrogen. For this Kentucky plant, hybrid technology’s potential is becoming clearer by the day and the plant envisions hybrid technology as the core that will become dominant in the eco car market and eventually evolve to form the basis of what is referred to as the “ultimate eco car.”

In Hopkinsville, Kentucky, the 100 percent farmer-owned **Commonwealth Agri-Energy’s** ethanol production facility will use 12 million bushels of corn to produce 33 million gallons of ethanol; 107,000 tons of distilled dried grains; 110,000 tons of CO₂ and 3,000 tons of animal feed grade corn oil. The company includes two groups of farmer investors: the 650 members of the Kentucky Corn Growers’ Association and the 2,300 members of the Hopkinsville Elevator CO-OP.

Owensboro Grain Company, at its plant locations on the Ohio River in western Kentucky, produces mainly biodiesel along with additional products from soybeans. The company’s soy products include protein meal and hull pellets for animal feeds, crude and degummed oil, lecithin, various blends of refined vegetable oil for human consumption, biodiesel and glycerin. Its location on the Ohio River enables the company to respond quickly to market demands by being able to ship by truck, rail or river.

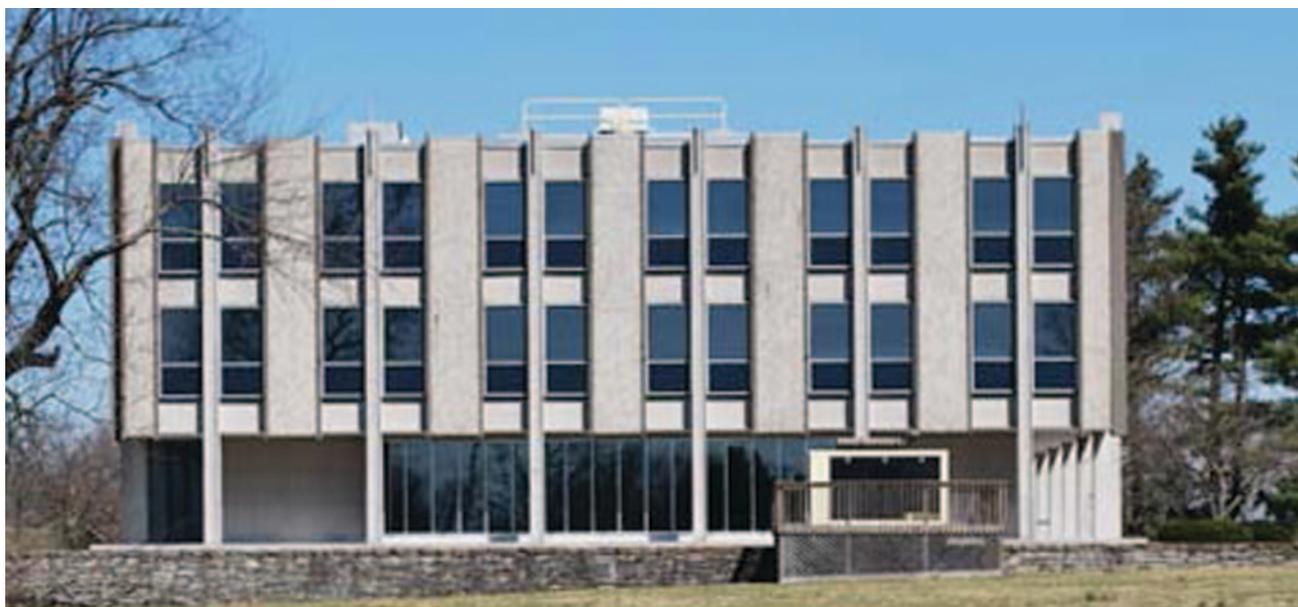
Madisonville, Kentucky-based **LEI Products** manufactures the Bio-Burner, a multi-fuel, multi-day burner/boiler with a universal feed system. The heat energy for the unit is created by burning “untraditional” biomass fuels (dirty fuels, fine dust products, crop stover such as the leaves and stalks of maize) along with traditional fuels (corn, wood chips and wood pellets) in the same unit.

Headquartered in Louisville, **Parallel Products** is a leader in unsaleable beverage destruction and recycling. The company also operates a regional recycling facility in Louisville, which involves a liquid recycling program. At this facility, the company converts bev-

erage wastes (soda, juice, beer, wine and spirits) into waste-derived fuel grade ethanol. This ethanol is utilized by major oil companies as a clean air additive in their gasoline blends. Materials that would otherwise be unusable wastes now contribute to the production of 51 million gallons of gasoline without the negative effects of food offsets and increased groundwater contamination.

In April 2009, Governor Steve Beshear announced the formation of the **Kentucky-Argonne National**

Battery Manufacturing Research and Development Center, a partnership among the federal government's lead laboratory for applied advanced battery research and development, Argonne National Laboratory, Kentucky, University of Louisville and University of Kentucky. The Center will help develop and deploy a domestic supply of advanced battery technologies for vehicle applications that will aid in securing U.S. energy independence, reduce greenhouse gas emissions and strengthen the economy.



The Kentucky-Argonne National Battery Manufacturing Research and Development Center's administrative offices are located in the Spindletop Building in Lexington, Kentucky.



The University of Kentucky's Center for Applied Energy Research's new renewable laboratory (due for completion in December 2011) will house the lab facilities of the Kentucky-Argonne National Battery Manufacturing Research and Development Center. The building will contain an advanced research and development laboratory with a state-of-the-art prismatic (flat) cell assembly processing capability to evaluate new cathode, anode and electrolyte materials produced at universities, national laboratories and industry locations.



Louisiana

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The Louisiana Department of Economic Development (LED) is implementing a “Blue Ocean” target industry strategy “to attract and retain industry sectors which are compatible with Louisiana’s existing strengths and assets.” LED expects this approach to lead to “significant job growth over the next two decades.” Renewable energy and energy efficiency are two of the Blue Ocean high growth target industry sectors. LED is pursuing job creation opportunities across the entire spectrum of renewable sources of energy and has identified biomass and small hydroelectric projects as promising initial areas of focus for the state.

The Department began implementation of the Blue Ocean strategy in 2010, with the ultimate goal of generating sustained job creation in Louisiana. In order to cultivate the renewable energy and energy efficiency sectors, LED is engaging in aggressive business development and marketing activities as well as identifying and implementing policy solutions to make Louisiana a more competitive place for these sectors. LED administers a variety of statutory incentive programs targeted at new and expanding businesses.

Also, the Louisiana Public Service Commission is implementing a Renewable Energy Pilot (REP) Implementation Plan, which began in June 2010 with a 90-day implementation process. The plan includes a research component with two options utilities may select: build three small (less than 300 kW) renewable energy projects for research purposes or offer a standard tariff for as-available renewable energy for up to 5 MW per contract, with a minimum of 25 kW output. The maximum a utility can acquire is 30 MW under this second option. The projects are expected to be operational by the end of 2013. The REP also includes a “request for proposal” component for larger renewable resources, allocating 350 MW to the four jurisdictional investor-owned utilities and to jurisdictional cooperations that have expiring contracts prior to 2014. The term is up to 20 years and a certification is required in accordance with the Commission’s 2008 “market-based mechanism” orders.

Louisiana’s promotion of the renewable energy sector was spurred by legislative statute and other efforts.

A few major areas where incentives have been offered include:

- » Solar rights;
- » Net metering;
- » Tax credit for solar and wind energy systems on residential property;
- » Property tax exemption for solar energy systems;
- » Tax credit for conversion of vehicles to alternative fuel usage;
- » Alternative fuel vehicle revolving loan fund;
- » Energy standards for state buildings; and
- » Sustainable energy financing districts.*

Louisiana offers a host of statutory incentives targeted at a broad section of industry, including firms focused on renewable energy projects. Selected examples include:

- » Modernization Tax Credit, which provides a 5 percent refundable credit for manufacturers modernizing or upgrading (including energy efficiency improvements) existing facilities in Louisiana;
- » Quality Jobs, which provides a 5 percent to 6 percent payroll rebate on net new jobs created over a 10-year period;
- » Research and Development Tax Credit, which provides up to a 40 percent refundable credit on research expenses; and

*Louisiana’s responses provided additional details on the incentives and policies promoting the renewable energy sector. These additional details follow:

Solar rights: <http://legis.state.la.us/billdata/streamdocument.asp?did=720429>

Net metering: <http://www.legis.state.la.us/lss/lss.asp?doc=208140>

Tax credit for solar and wind energy systems on residential property: <http://www.legis.state.la.us/lss/lss.asp?doc=453218>

Property tax exemption for solar energy systems: <http://www.legis.state.la.us/lss/lss.asp?doc=101337>

Tax credit for conversion of vehicles to alternative fuel usage: <http://www.legis.state.la.us/lss/lss.asp?doc=672160>

Alternative fuel vehicle revolving loan fund: <http://www.legis.state.la.us/lss/lss.asp?doc=727493>

Energy standards for state buildings: <http://ssl.csg.org/dockets/2010cycle/30B/30Bbills/0330b06laenergypublicfacilities.pdf> and <http://www.gov.state.la.us/assets/docs/OfficialDocuments/2008EOGreenGovernment.pdf>

Sustainable energy financing districts: <http://www.legis.state.la.us/lss/lss.asp?doc=670836>



Blade Dynamics assembly facility in New Orleans, Louisiana. Photo courtesy of Blade Dynamics.

- » Home Energy Loan Program, which offers homeowners 5-year loans to improve the energy efficiency of an existing home.

An LED impact study on renewable energy estimates that the state could create as many as 30,000 new direct and indirect jobs in the renewable energy sector alone over the next two decades. A number of renewable energy companies already operate in the state.

COMPANY PROFILES

In August 2010, **Blade Dynamics** announced that it would manufacture advanced wind turbine blades and wind turbine components at its Michoud assembly facility in New Orleans. Blade Dynamics has committed to create 600 new, direct jobs by 2015 at an average annual salary of about \$48,000 plus benefits, as well as a capital investment of approximately \$13 million. LED estimates these jobs will result in the creation of more than 970 new, indirect jobs, for a total of more than 1,570 new jobs in Louisiana. In addition, LED estimates the Blade Dynamics project will result in \$35.8 million in additional state tax revenue and \$23.9 million in additional local tax revenue over the next 10 years. Blade Dynamics has developed wind turbine blade technologies designed to increase the efficiency and performance of high power (multimegawatt) wind turbines, while also reducing costs.

New Orleans-based **Free Flow Power (FFP)** aims to harness the current of the Mississippi River to generate hydrokinetic power. The flow of the Mississippi River is extremely strong and reliable – an attractive setting for the conversion of hydrokinetic power to electricity. The Federal Energy Regulatory Commission granted FFP permits for 80 sites along the Mississippi River and 17 sites along one of its branches, the Atchafalaya River, in which to place turbines. Because Louisiana maintains rights over its riverbeds, companies can take advantage of an easier negotiation process for turbine site establishment. The turbines potentially could create enough electricity to power the entire city of New

Orleans. This would be the first time in-stream hydrokinetic technology has been used on a commercial scale.

Point Bio Energy is locating a new manufacturing facility at the Port of Greater Baton Rouge. The new facility will produce wood pellets for fuel generation, creating up to 100 new, direct jobs and 273 new, indirect jobs, and representing more than \$100 million in capital investment. Point Bio Energy estimates the plant will produce 450,000 metric tons of wood pellets per year. The wood pellet industry has experienced significant growth recently due to a push to reduce greenhouse gas emissions. According to Point Bio Energy, the lumber-based fuel is a more environmentally friendly alternative to coal and has both industrial and residential applications. The Port of Greater Baton Rouge was selected due to its strategic advantages. The Port has the unique position of being located within a sustainable forest management area with an ample amount of suitable timber acreage, providing Point Bio Energy an opportunity to transport wood supplies to its facility at a lower price-point than its competitors.

Dynamic Fuels produces renewable diesel with the lowest emission levels of any transportation fuel on the market. Animal fats, greases and vegetable oils are converted into next generation renewable, synthetic fuels which power a wide array of vehicles from city buses to fighter jets. The fuel is sold in the United States within the existing diesel fuel distribution network. Its substantial performance and environmental advantages are expected to make it a strong competitor in the market. Dynamic Fuels has invested \$138 million in North America's first renewable, synthetic fuels plant, with a capacity of 75 million gallons per year. Located in Geismar, Louisiana, the plant will create 250 temporary construction jobs and 45 permanent, high-skill jobs.

In Norco, Louisiana, **Diamond Green Diesel** is developing a renewable diesel facility that will produce 137 million gallons of fuel per year, primarily from

animal fats used in cooking oil and other waste grease streams.

Louisiana Geothermal, LLC is developing a new geothermal energy source which utilizes high pressure hot brines beneath the Sweet Lake area in Cameron Parish to produce electricity. This project will involve the drilling of a geothermal well and construction of a power plant. The U.S. Department of Energy has awarded Louisiana Geothermal, LLC a grant of \$5 million for its innovative technique. The project will generate 5 MW to 10 MW of electricity for the first well drilled and provide the capability to expand in the future. Power from the geothermal power plant will generate only a fraction of the carbon dioxide emissions that would be produced by a conventional power plant of equivalent capacity. Geothermal energy is a sustainable and clean energy source harnessing heat generated by the earth and is considered virtually inexhaustible. The Louisiana Geothermal project will result in a total economic impact of \$45 million to the state. In total, the project is anticipated to create 221 jobs when the construction and operations of the projects are combined. Louisiana Geothermal, LLC is committed to utilizing Louisiana-owned service companies during the course of well drilling and power plant construction.

In Lake Providence, Louisiana, **Myriant Technologies** is establishing the world's largest bio-based succinic acid plant, which will provide a renewable bio-based industrial chemical building block, reduce U.S. dependence on imported oil and reduce greenhouse gas emissions.

The Shaw Modular Solutions project, developed by **The Shaw Group Inc.**, the Baton Rouge-based Fortune 500 company, is the nation's first manufacturing facility that will build modular components for new and modified nuclear reactors. As the premier structural steel fabricator and the largest pipe fabricator in the United States, Shaw's new module fabrication facility will primarily produce structural, piping and equipment modules for new nuclear power plants utilizing the Westinghouse AP1000™ technology, the world's safest and most economical commercial nuclear power technology. The Shaw project will result in \$17.8 billion in new sales, \$4.5 billion in new earnings and 9,205 total new Louisiana jobs, including indirect jobs, over 15 years. In addition to constructing components for nuclear reactors, the facility at the Port of Lake Charles will have the capability to manufacture modules for chemical sites and petrochemical plants around the world. In May 2009, the 'Shaw Modular Solutions' project was selected as one of Site Selection

COMPANY HIGHLIGHT

Verenium Biofuels has pioneered the development of high-performance enzymes for use in processes related to the biofuels, industrial, and animal markets. It is a leader in the development and commercialization of cellulosic ethanol, an environmentally friendly and renewable transportation fuel. A pilot plant has been established in Jennings, Louisiana, to advance the production of ethanol from a wide array of non-food feedstocks, including dedicated energy crops, agricultural waste and wood products. In addition to the vast potential for biofuels, a multitude of large-scale industrial opportunities exist for products derived from the production of low-cost biomass-derived sugars.

magazine's top deals in North America for 2008. Top deals are determined by level of capital investment, degree of high-value jobs, creativity in negotiations and incentives, regional economic impact, competition for the project and speed to market.

Next Autoworks, a new American car company headquartered in San Diego, selected the former Guide plant in Monroe, Louisiana, for its new automobile assembly facility. Pending a U.S. DOE loan decision, the project will result in 1,400 new direct jobs with an average salary of \$40,000 plus benefits and an estimated 1,800 new indirect jobs.

Headquartered in Pineville, Louisiana, **Cleco Power** announced the completion of its 600 MW clean coal power generator, Madison 3, in April 2010. Using the byproduct petroleum coke as fuel, Madison 3 employs circulating fluidized-bed technology, which is capable of using renewable products such as biomass, to generate electricity. Madison 3 is one of the cleanest solid-fuel generating plants in the nation and one of the largest petroleum coke-fired facilities in the world. This project will create over 70 new jobs and is a \$1 billion capital investment.

ADA Environmental Solutions broke ground in October 2008 in Red River Parish, Louisiana, on what is expected to be North America's largest activated carbon production facility. The production line will be capable of producing 125 million to 175 million pounds of activated carbon per year. Red River Environmental Products LLC is building the activated carbon production facility to address the pressing need for clean coal technologies. The project is expected to create 50 new direct jobs and 230 new indirect jobs and is a \$350 million capital investment.



Mississippi

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The Mississippi Development Authority (MDA) is the state's lead economic and community development agency. The Energy Division of the MDA primarily is responsible for providing programs and services designed to increase the production of environmentally safe, renewable energy and improving the energy efficiency of buildings, utility, industrial and transportation systems in the state. The Authority's Existing Industry and Business Division provides services that result in the creation of new businesses and the retention and expansion of existing in-state industries, including those involved in the manufacturing of renewable energy systems or products. The Global Business Division specializes in business attraction and recruitment to create new jobs that boost Mississippi's economy.

All MDA renewable energy initiatives are designed to develop a robust, clean, advanced energy sector that presents tremendous economic growth, high tech jobs and investment opportunities for Mississippi. MDA recognizes that capitalizing on renewable and alternative energy such as solar; biomass; distributed electric and thermal; geothermal ground source systems, and bio-based products, promotes energy reliability and self-sufficiency for many industrial and agricultural applications.

As early as the mid-1980s, MDA spearheaded research and development of innovative and progressive alternative, renewable energy projects. These included the study of biomass (aviteva grass) to control erosion control and ethanol applications, as well as the development of artificial marshland treatment systems for Mississippi cities to provide energy efficient and environmentally friendly alternative wastewater treat-

ment systems. The state has expanded the use of whole building systems that utilize house plants to break down and deploy human waste as fertilizer, along with air filtration systems, state-of-the-art low wattage lighting systems and photovoltaic thermal storage, heating, ventilating, and air conditioning (HVAC) systems.

In the 1990s, following the passage of the Energy Policy Act of 1992, MDA nurtured the development of bio-based production plants in Mississippi. This task continues to be a priority in the state today. During this time, Mississippi witnessed the first installations of anaerobic digester technology that utilized animal waste to capture methane gas. Billed as the Delta Sustainable Energy Agriculture Conference, the Energy Division sponsored the first biomass production conference, which focused on economic, ecological and equity issues as related to biomass production of feedstock and solid waste. Biomass from trees, agricultural food and feed crops, crop wastes and residues, wood wastes and residues, aquatic plants, animal wastes and municipal wastes offers tremendous opportunity to use domestic and sustainable resources to provide fuel, power and chemical needs from plants and plant-derived materials. Biomass energy is estimated to contribute 7.1 percent of Mississippi's total energy consumption, which is double the national average.

Solar energy production has been a focus of the state as well. The Energy Division continues to advance the development of new technologies to capture the sun's energy including photovoltaic cells, concentrating solar power technologies and low temperature solar collectors.

Combined Heating, Cooling and Power (HCP) is a promising technology for increased energy efficiency through the use of distributed electric and thermal

energy delivery systems at or near end-user sites. CHP systems promote energy reliability and self-sufficiency for many industrial and agricultural applications. The state also is examining the expansion of geothermal ground source systems.

Mississippi has expressed a variety of economic, energy and environmental goals and objectives pertaining to the state's renewable energy program. The state is seeking to enhance recruiting opportunities and promote company expansion through proven and emerging energy efficiency technologies; stimulate the development of energy systems that assure adequate energy sources and supply during peak loads, natural disasters and threats to national security; provide affordable fuel options through advanced technology; attract and maintain business and industry; facilitate environmentally acceptable practices in energy production, transfer, and storage; and promote energy efficiency and management in all public and private sectors as the first source of renewable energy.

Mississippi laws and regulations governing renewable energy include the following:

- » The Bureau of Fleet Management was established within the Department of Finance and Administration to coordinate and promote efficiency and economy in the purchase, lease, rental, acquisition, use, maintenance and disposal of vehicles by state agencies. The Bureau encourages the use of fuel efficient or hybrid vehicles appropriate for the state agency's intended purpose and, when feasible, the use of alternative fuels, including, but not limited to, ethanol and biodiesel.
- » A study committee on the potential use of biodiesel fuel was created in 2006 to study the need for mandated use of biodiesel and the agricultural and environmental benefits of biodiesel use.
- » The State Liquefied Compressed Gas Board, operated through the state Department of Insurance, enforces laws and regulations regarding the distribution of liquefied compressed gases within the state. The Board also has grant money available for Mississippi-based entities for the purpose of promoting and researching the development of more cost-effective uses of propane. Educational, safety and market development programs also may qualify for this grant money.
- » All liquefied petroleum or natural gas carburetion systems installed on vehicles, including school buses, used in public transportation must be inspected by a field inspector. The State Liquefied Compressed Gas Board may require

inspection of any installations of liquefied petroleum gas or natural gas carburetion systems on any other vehicle types as deemed necessary. All installations must comply with the rules and regulations of the Board. Any installer of a liquefied compressed gas or compressed natural gas system who collects an installation service fee must hold an installer's license from the Board and must notify the Board of any applicable installation.

- » The fuel tax levied on distributors of compressed natural gas and liquefied natural gas is imposed per 100 cubic feet rather than on a gallon equivalent basis. An annual privilege tax is imposed on operators of motor vehicles capable of using compressed gas according to the gross vehicle weight rating.
- » Compressed natural gas is deregulated and may be sold to consumers as a motor vehicle fuel and for related purposes.

The state offers a variety of economic incentives for residents and businesses that employ energy efficient practices and/or promote the use of renewable fuels. Some of these include:

- » Mississippi Clean Energy Initiative: This program provides tax incentives for companies that manufacture systems or components used to generate renewable energy, including biomass, solar, wind and hydroelectric generation. Alternative energy manufacturers, including manufacturers of components used in nuclear power plants, also are eligible for this incentive. This program allows the Mississippi Development Authority to certify these manufacturers for a tax exemption.
- » Energy Investment Loan Program: This program provides loans to individuals, partnerships or corporations for capital improvements or in the design and development of innovative energy conservation processes. Funding for the program comes from the oil overcharge restitution funds from the U.S. Department of Energy.
- » Energy Performance Contracting Program: This program is available to universities, public hospitals, public non-profits, state agencies, and local government authorities. The participating entity works with a private energy services company to identify and evaluate energy savings opportunities, and/or renewable energy opportunities for their facilities which can be paid over a 15-year period from the projected saving with no upfront capital cost.
- » Energy Efficiency Lease Program: This program provides public entities access to prearranged

COMPANY HIGHLIGHT

Twin Creeks Technologies broke ground in 2010 for its new solar panel manufacturing facility in Senatobia, Mississippi. Construction of Twin Creeks' 100 MW solar manufacturing site is rapidly ramping up. From its new facility, Twin Creeks will use its proprietary technology to produce photovoltaic solar panels. The project will create 512 jobs in two phases, and represents a company investment of more than \$175 million. Initially, the facility will be 80,000 square feet, with plans to expand quickly to 250,000 square feet. Founded in 2008 and headquartered in San Jose, California, the company today has engineering and manufacturing locations in Boston and San Jose and a portfolio of over 50 patents. Twin Creeks' innovative manufacturing processes are changing the economics of crystalline silicon photovoltaic technology.

tax-exempt lease purchase financing and reduces high origination fees associated with individual project financing. It also streamlines lengthy funding processes, meets all federal and state laws and provides access to a team of technical, legal and financial professionals.

- » Biofuels Production Incentive: Mississippi's commissioner of Agriculture and Commerce is authorized to make direct payments to ethanol and biodiesel producers located in Mississippi. The amount of payment for each producer's annual production is \$0.20 per gallon, up to 30 million gallons per year per producer, for a period of up to 10 years following the start date of production. The maximum total annual payment to a single producer per fiscal year is \$6 million.

In addition, the Mississippi Development Authority's Financial Resources Division administers a variety of incentive programs designed to assist businesses in obtaining grants and loans for development and expansion and to posture the state as an aggressive competitor in the global market. For major projects that require substantial financing, Mississippi works with companies to tailor packages of financial programs to make expansion or location simple and cost-effective.⁵⁷

MDA does not annually provide financial assistance for energy efficiency projects at the residential level. However, ARRA allocated approximately \$2.8 million for the State Energy Efficient Appliance Rebate Program, administered by MDA. The program provided thousands of rebates to qualified purchasers of eligible Energy Star™ rated appliances. The Energy

Division of MDA provides consumer workshops and demonstrations designed to train residents on Energy Star™ homes and appliances, energy efficient design, home performance and remodeling that can reduce energy bills by 30 percent, or even greater reductions with renewable energy.

Various studies on the statewide economic impact of the renewable energy investments have been conducted by the MDA. These include:

- » Biodiesel Feasibility Study: Providing grants to the Mississippi Biomass Council, Mississippi State University, Alcorn State University, and Frazier/Barnes Consulting Firm, the Energy Division identified Mississippi feedstock to determine the amount of feedstock available along with the location of feedstock for the production of biodiesel fuels. The study also identified the location of highway infrastructure, railroad lines and waterways. The study provided prospective biodiesel companies with the best locations in Mississippi for production plants. By locating biodiesel plants in Mississippi, the study concluded, farmers will have another market for their crops.
- » Regional Strategy for Biobased Products in the Mississippi Delta: The MDA's Energy Division was a primary funder in the regional partnership for the study conducted by the Battelle Technology Partnership Practice. The Mid-South Mississippi Delta encompasses 98 counties, distributed across parts of five states (Arkansas, Kentucky, Mississippi, Missouri and Tennessee). The core mission of the project is to develop an analysis and make recommendations for maximizing the economic value of the Mid-South Mississippi Delta's biomass assets.
- » Final Report: Distributed Generation in the Southern States: This study documents the issues affecting distributed generation development in Mississippi and other Southern states. It identifies barriers as well as possible actions to reduce them.

COMPANY PROFILES

KiOR, a biofuels company headquartered in Pasadena, Texas, is locating five biofuel production facilities in Mississippi. In total, KiOR will be investing more than \$500 million in its Mississippi facilities and has committed to create at least 1,000 direct and indirect jobs in the state. KiOR will use Mississippi's abundant, renewable natural resources to create a high quality crude oil substitute that will help meet the nation's energy needs and reduce dependence on foreign oil. KiOR's revolutionary catalytic conversion

process allows the company to convert biomass, from a variety of feedstock, including wood products and agricultural waste, into a high quality renewable crude oil, known as Re-Crude, that can be used as a direct replacement for imported crude oil. The company's low-cost, feedstock flexible technology reduces nature's process of creating oil from a period of millions of years down to a matter of seconds. Using existing refinery infrastructure, KiOR's crude oil substitute can be refined into transportation fuels and can be produced inexpensively in an easily scalable and environmentally friendly manner. KiOR has selected Columbus and Newton, Mississippi, for its first facilities and determined that another facility will be located in southwest Mississippi.

Soladigm, a supplier of next-generation green building solutions, is locating manufacturing operations in Olive Branch, Mississippi. The project represents a capital investment of more than \$130 million by the company and will create more than 300 new jobs. From its plant in Olive Branch, Soladigm will produce highly energy efficient dynamic insulated glass units. With the use of its proprietary manufacturing process, Soladigm's glass can change from clear to tint on demand, allowing unprecedented control over the amount of light and heat that enters a building. The company's dynamic glass offers substantial reduction in energy consumption, resulting in reduced energy and maintenance costs, while creating an improved user experience in buildings by controlling glare and heat without obstructing the view. To help facilitate this project, Mississippi provided a \$40 million loan through the Mississippi Industry Incentive Financing Revolving Fund, in addition to \$4 million in Momentum Mississippi^{*} incentives for project improvements at the company's new facility.

Sanderson Farms was awarded \$709,200 of ARRA funds from the Mississippi Development Authority Energy Division (MDA-ED) Renewable Energy grant program for the implementation of a biogas recovery system. The system is designed to extract methane from the processing facility's anaerobic lagoon while conveying the gas to an existing boiler. This project is estimated to reduce approximately 39,000 MMBTU^{**} of natural gas consumption. Founded in 1947, Sanderson Farms Inc. is a poultry processing company that engages in the production, processing, marketing and distribution of fresh and frozen poultry products

^{*} The Momentum Mississippi Incentive legislation has two components—first, enhancing existing tax credits and incentives to include high-tech non-manufacturing industries and provide investment incentives to existing Mississippi businesses and second

^{**} MMBTU = 1 Million British Thermal Units (BTUs). to fund incentive programs through issuance of bonds.



An example of wood pellets, such as those produced by Piney Woods Pellets. Photo courtesy of flickr user Mark Atwood via Creative Commons License.

in the United States. The company currently operates nine poultry plants, with another facility under development in Kinston, North Carolina. Sanderson Farms currently employs over 10,000 workers and over 576 independent growers.

Crown Cork and Seal USA Inc. is a leading manufacturer of packing products, making a wide range of metal packaging for food, beverage, household and personal care products. Today, Crown Cork and Seal currently manufactures packaging products from 139 plants located in 41 countries. Crown currently employs 222 full-time workers at the Batesville, Mississippi facility, its U.S. headquarters. Crown Cork and Seal received \$214,500 of ARRA funds from the MDA-ED Renewable Energy grant program to incorporate a regenerative thermal oxidizer waste heat recovery system in the Batesville facility. The waste heat recovery system will use a hot thermal oxidation unit to recover and heat water used in the plant's beverage can washing operation. This project is estimated to save 24,000 MMBTU of natural gas consumption annually.

Piney Woods Pellets is a leading renewable energy company specializing in raw materials that produce wood pellets to both protect the environment and generate economical heating fuel for customers. Piney

Woods Pellets utilizes recycled forestry waste material that is processed into pellet fuel, which is a carbon neutral biofuel with one of the lowest carbon consumption rates of any energy source. Piney Woods Pellets was awarded \$125,625 of ARRA funds from the MDA-ED Renewable Energy grant program to install a 15 kW solar panel system on the roof top of its offices, which will reduce utility consumption and provide an estimated 85 percent in energy savings costs. With the installation of the solar panel system, Piney Woods Pellets also estimates a reduction of 36,000 pounds of carbon dioxide per year. The company also plans to install one Hardy heater and three Quadra-Fire pellet stoves to provide heat within the facility. The company estimates that the heater system will reduce electrical cost by at least 74 percent during the winters.

Aqua Green LLC is an aquaculture facility specializing in producing fresh and saltwater fish. Aqua Green currently specializes in producing Tilapia, Florida Pompano, Cobia and Red Drum. The company has production facilities located in Perkinston, Mississippi, and Canon City, Colorado. The Perkinston facility soon will grow to include a new commercial hatchery for conditional brood stock along with facilities for spawning and larviculture. The new commercial hatchery is unique because it has dedicated resources for research and development that will include a well-equipped water quality laboratory. Aqua Green LLC was awarded \$400,000 of ARRA funds from MDA-ED Renewable Energy grant program for the installation of biomass heaters and a solar evaporator system at the Perkinston facility. The solar evaporator will be used to reclaim salt from waste water and will prevent high

concentrations of salt water from being lost through the use of marine sludge for land applications or composting, which are the two most common methods for sludge disposal from fresh water and aquaculture systems. Aqua Green also plans to use multiple biomass units that are capable of providing 3 billion BTUs of heat for the facility's aquaculture tanks. The biomass units are estimated to save approximately 133,700 BTUs of energy per year.

Burrows Paper Corporation is a leading global manufacturer of paper and packaging solutions and manufactures numerous products used in various applications including medical, food packaging and many other industrial grade papers. The company operates four mills in New York and Mississippi, offering a wide variety of capabilities and flexibility. Burrows Paper Corporation received \$183,645 of ARRA funds from the MDA-ED Renewable Energy grant program for the incorporation of a geothermal system in its paper mill facility in Pickens, Mississippi. The proposed system will heat the paper mill facility without consuming any fossil fuels. The geothermal system is estimated to show a potential reduction in gas energy up to 11.7 BTUs per year.

In January 2011, a Silicon Valley-based solar panel manufacturing company announced its plans to locate in Mississippi. **Stion**, based in San Jose, California, will occupy the Sunbeam building in Hattiesburg, where the company will produce its high-efficiency, low-cost thin film solar panels. Stion's new plant will create 1,000 jobs over the next six years, and the company has committed to invest \$500 million in the state.



Missouri

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

In 2008, Missouri voters approved a renewable portfolio standard of 2 percent by 2011 and 15 percent by 2021. The program is coordinated by the Missouri Public Service Commission. The state's Clean Air Interstate Rule (CAIR) Energy Efficiency and Renewable Energy Set-Aside Program was established to provide financial incentives for energy efficiency or renewable generation projects that will improve air quality, stimulate local economic activity, diversify energy production in Missouri and provide greater power system reliability. In 2007, in response to the U.S. EPA CAIR requirements for reducing statewide annual emissions of mono-nitrogen oxides (NO_x), Missouri established a NO_x allowance cap and trade program. As part of this program, Missouri set aside 300 NO_x allowances awarded annually to energy efficiency and renewable energy projects located in Missouri. Awards also may be made to Missouri electric utilities that sponsor renewable generation projects located outside the state. Eligible in-state projects may qualify to receive awards for up to seven years, and eligible projects located outside the state may qualify for up to five years. The awards are in the form of NO_x allowances that can be sold to the highest bidder.

In June 2009, the U.S. DOE approved Missouri's application to its State Energy Program and awarded the state more than \$57 million in ARRA funding for energy efficiency and renewable energy programs. Along with meeting several of the ARRA's primary goals, i.e., stimulating the economy and creating and retaining jobs, the energy-related ARRA funds also will help increase energy efficiency, reduce reliance on imported energy, improve the reliability of energy resources and services, and reduce the impacts of energy production and use on the environment. In order to accomplish these extended goals, the state's Department of Natural Resources makes the ARRA funding available through various grants, loans or rebates for homes, agriculture, industry and bioenergy. Two program areas related to renewable energy included:

- » Energize Missouri Renewable Energy Biogas Grants: The state DNR offered grants for shovel-ready agricultural or industrial projects that use anaerobic digestion systems and landfill

gas recovery projects to produce energy. Eligible projects also may produce biopower, bioheat or other forms of bioenergy.

- » Energize Missouri Renewable Energy Study Subgrants: The Department offered grants for renewable energy resource assessments and project feasibility studies by Missouri residents, businesses, corporations, not-for-profit organizations, universities and research institutions, and county or city governments.

A report released by the Missouri Economic Research and Information Center on the state's Green Economy identified the following:

- » Missouri boasts 131,103 total green jobs—both primary and support positions—among employers. There are 28,720 primary green jobs and 102,383 green supporting jobs;
- » A majority (71 percent) of employers surveyed stated that current economic conditions were the largest barrier toward hiring additional green workers. This finding highlights the potential for growth in Missouri's green economy as, in the next few years, national recovery efforts help to mitigate the more recent downward spiral of employment numbers;
- » Almost 80 percent of employers in the survey stated that they utilize in-house classrooms or on-the-job training to train workers in green jobs. Surveyed employers also indicated that the top three skill sets needed for future green workers are waste minimization, pollution reduction control and principles of energy conservation;
- » The survey estimated green employment for 160 detailed occupations. Occupations that represented the largest share of primary green employment include: refuse and recyclable material collectors, chemical technicians, plumbers, refrigeration mechanics and installers, and architects;
- » Primary green occupations with the most opportunity for growth through 2016 include construction managers, environmental engineering technicians, operating engineers, electricians, environmental engineers and pipe lay-

ers. The occupations cited span a variety of education and skill levels.

COMPANY PROFILES

In September 2010, the **Wind Capital Group** completed construction of the 150 MW Lost Creek Wind Farm, south of King City in DeKalb County, Missouri. This \$340 million investment remains the largest wind project in Missouri. When combined with the Bluegrass Ridge project, the state's first utility scale wind farm that started operating in 2007, the presence of the Lost Creek Wind Farm transforms King City into the wind energy capital of Missouri. The group had been awarded a \$107 million federal grant for renewable energy generation in July 2010. While General Electric supplied 100 of its 1.5 MW wind turbines for the project, the ABB (the global leader in power and automation technologies headquartered in Zurich, Switzerland) operation in Jefferson City, Missouri, manufactured the transformers. Of note, Wind Capital Group is leasing the property from local farmers who will receive annual lease payments to supplement the lost income they would have earned from corn, soybeans and pasture land. The Lost Creek Wind Farm will cover 32,000 acres and generate enough energy to power 50,000 homes in northwest Missouri through Northwest Electric Cooperative transmission lines. According to experts, Associated Electric Cooperative—which supplies power to electric co-ops in Missouri and parts of Iowa and Oklahoma—has a 20-year contract to buy all the electricity generated from the Bluegrass Ridge and Lost Creek Wind Farms. Missouri officials also noted that the Wind Capital Group has built these additional wind farms in Missouri:

- » Loess Hills (Rockport - 5 MW);
- » Cow Branch (50.4 MW); and
- » Conception (50.4 MW).

In December 2010, **Vest-Fiber**, a Danish company that produces fiberglass products for wind turbine manufacturers, decided to establish a new factory in Moberly, Missouri. The new manufacturing facility involves an initial investment of \$2 million and will create 50 new jobs. Vest-Fiber produces fiberglass and materials for the composite industry, products that are mainly used to produce wind turbine blades. Company officials indicate that the new Missouri production site will provide good access to the U.S.-based wind turbine manufacturing industry. A \$128,318 incentive package from the Missouri Quality Jobs program helped attract the company to the location in north central Missouri.

In March 2011, **3M** announced securing a \$4.4 million U.S. DOE grant for testing, research and production of its patented Ultra Barrier Solar Film. The company's solar film product is a flexible film for solar panels that would replace the standard glass used for most solar energy systems, reducing the weight and, eventually, the cost. The grant, which will be paid over three years, is aimed at reducing the cost of solar energy systems by about 75 percent. The company stated that the new product, and additional products brought into the Columbia, Missouri plant, could lead to 120 new jobs, revitalizing a factory that has shed jobs for years. While full scale production is scheduled to begin in early 2012, 3M already has been selling limited amounts of the product to end users from a facility in Minnesota, where the company's headquarters is based. Several leading companies in the solar panel industry already have expressed interest in the film product, a development that bodes well for the Missouri operation.



North Carolina

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

In 2007, state lawmakers established a renewable portfolio standard that the North Carolina Utilities Commission tracks by making power suppliers file compliance reports. The legislation maintains that an RPS of 10 percent by 2018 for cooperatives and municipalities must be achieved and that by 2021, 12.5 percent of the energy that investor-owned utilities, such as Duke Energy, supply must be generated from renewable sources. Solar, wind, biomass, tidal energy, landfill gas, swine and poultry waste all qualify, and consumers must pay for part of the costs. North Carolina is one of 32 states with such standards, according to information collected by the U.S. Department of Energy. In 2010, the state enacted a 25 percent tax credit for renewable energy manufacturing, including major component manufacturers. The North Carolina Sustainable Energy Association estimated that, in 2010, about 12,500 jobs in the state were “green” or linked to the renewable energy sector.

For several years, the state also has offered a 35 percent renewable energy investment tax credit as an incentive to install solar, wind, geothermal and other renewable energy technology. Geothermal systems also have been added in recent years to the Renewable Energy Property Tax Credit, which has a maximum level of \$2.5 million for commercial installations and varying levels—depending on the technology—for individuals. (Solar electric systems, for instance, have a maximum credit of \$10,500.) In 2010, the General Assembly added a tax credit for businesses and homeowners who install combined heat-and-power (CHP) systems. CHP systems are up to twice as efficient when compared with traditional heating and cooling systems. In fact, the DOE estimates that if 20 percent of U.S. households installed CHP systems by 2030, the amount of energy consumed by these households would be slashed in half. Observers contend that the “carrot-and-stick” approach has boosted the number of solar water heating installations and photovol-

taic installations in North Carolina, ranking the state ninth nationwide, with 31 MW installed in 2010. In that year, more than 100 solar energy companies operated in the state, employing more than 1,500 workers, according to a report by the North Carolina Solar Center.

North Carolina has the greatest offshore wind resources of any state on the Atlantic Coast. After exclusions for military and environmental factors, there are approximately 50 gigawatts of potential wind power that could be developed. The state has an active federal offshore renewable energy task force, operated by the U.S. Department of Interior’s Bureau of Ocean Energy Management, that will issue a “Call for Information” later in 2011 for selected designated areas to ascertain interest by developers. This is the first step toward the later issuance of leases for development.

Another alternative energy project taking place in North Carolina involves growing canola and sunflower crops along the wasted edges of highways and other marginal areas. These powerhouse plants, whose seeds contain 50 percent oil, are excellent for biodiesel production. Once harvested, cleaned and crushed, they are put through a chemical process known as “transesterification” to obtain the fuel. This national program, entitled *Free Ways to Fuel*, which began in Utah and has spread across the United States, originally used municipal zones to plant crops for biofuels. Utah’s first harvests are now being used to power state Department of Transportation vehicles in Salt Lake County. North Carolina State University is the lead research organization on this project, and the goal is to produce 550 pounds of sunflower seeds and 40 gallons of biodiesel per acre, sufficient fuel to power the state’s Department of Transportation vehicles.

COMPANY PROFILES

In April 2011, a Chapel Hill, North Carolina, solar energy developer, **Strata Solar**, filed an application to build a major solar farm (4.5 MW) in Kings Mountain

in Western North Carolina. Building the project, about 200 miles west of Raleigh, will cost nearly \$22 million and require nearly 22,000 solar panels. Recently approved by the state's utilities commission, it is the second largest solar farm in the state.

In October 2010, **Saertex USA**, a German-based maker of lightweight, high strength composite materials, announced that it would expand its Huntersville, North Carolina site, creating 178 new energy-related jobs and investing \$6.5 million over three years. The company makes materials for the wind energy, aerospace, civil engineering, car and shipbuilding industries. According to the company, the expansion is the result of growing demand for lighter, energy-saving alternatives to materials such as steel and aluminum.

Also in October 2010, **SAS**, the renowned Cary, North Carolina-based company that makes business intelligence and analytics software allowing companies to analyze their work and predict trends, announced a major expansion of the solar energy farm at SAS's sprawling campus, a move that propels solar power to new levels in the state. The declining cost of solar technology made the price of Solar Farm 2 less than the original project, even as it generates 20 percent more electricity. The company invested \$5.5 million for the expansion and, when combined, the two SAS installations will feature more than 10,000 solar panels fanned across 12 acres. Their combined 2.2 MW capacity will generate enough electricity to power 325 average homes. While SAS' solar effort is one of about a dozen commercial-scale projects in the state, it is one of the larger ones.

In May 2011, the North Carolina Utilities Commission approved plans for the U.S. subsidiary of the Spanish company **Iberdrola Renewables** to build one of the largest wind farms in the United States. Plans call for up to 150 turbines, each about 400 feet tall, at this wind farm project near Elizabeth City in the northeastern corner of the state. If the \$600 million project gets the necessary federal, state and local permits, it will be another large source of renewable energy produced in North Carolina. The wind farm will encompass about 20,000 acres and is projected to produce up to 300 MW, or enough to supply 60,000 homes per year. Officials indicate that operations at the wind farm could start as soon as January 2013.

A second onshore wind project has been identified for northeastern North Carolina. Developed by **Invenergy**, it also will be a 300 MW project, operating in Camden and Currituck Counties.

Also, at a site near High Point, construction of the final phase of **SunEdison's** \$173 million solar farm with 63,000 photovoltaic panels is under way on about 200 acres. Duke Energy has a 20-year contract to buy all the power generated by the solar farm—about 17 MW, or enough to supply 2,600 homes per year. In fact, the twin Iberdrola Renewables and SunEdison projects are expected to generate sufficient electricity to provide power to about 62,000 homes per year, and experts note that it would become an important component of the energy blend that residential, commercial and industrial consumers in the state already receive from the power grid.



Oklahoma

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Oklahoma harnesses its abundant renewable energy sources through a variety of means. The state is home to several operational commercial wind projects, multiple biofuel centers, numerous small wind and solar installations and an expanding fleet of alternative fuel vehicles. The state offers a variety of means of support to renewable programs through incentives and a friendly business environment. The state saw its first commercial wind farms come online in 2003, following approximately five years of development and research. Home to Bergey Windpower, a leading manufacturer of small wind turbines since the early 1970s, Oklahoma has recognized renewable energy's potential in the state, but true focus on harnessing the state's renewable resources began in earnest in the early 2000s.

Oklahoma has focused efforts on building the manufacturing sector of the renewable energy industry as well as building transmission infrastructure to meet the ongoing and future needs of the power generation groups. The Oklahoma Department of Commerce has placed particular focus and dedicated resources to growing and attracting the wind and solar industries to the state. Efforts include attending national and international trade shows and conferences, such as those arranged by the American Wind Energy Association, European Wind Energy Association, Solar Power International and others. At each of these events, over 50 specific meetings are scheduled with various industry representatives that include the participation of at least five economic development and business partners from around Oklahoma. Efforts also are made on an international front with multiple trips annually to Europe to meet and interact with wind and solar companies in order to engage business and policy groups regarding renewable energy in Oklahoma. The Department of Commerce is dedicated to providing resources to in-state partners by hosting multiple events, including conferences and workshops, dedicated to ensuring that in-state partners have the assets for the expansion of the renewable energy industry. Specific emphasis has been placed on building and expanding supply chain efforts for the renewable industry in Oklahoma. The Department of Commerce's Business Solutions team is

dedicating resources to identify companies and services that have the ability to serve the wind and solar industries and provide resources to enable their growth and development into this new sector.

Biofuels has been a focus of renewable energy development for Oklahoma. The state has taken a lead in establishing Smart Grid technologies across the state. Two of the three major utilities in Oklahoma are deploying large scale Smart Grid projects throughout their territories. Energy efficiency has been at the forefront of energy policy in the state as well.

Oklahoma also is focusing on the development of "green" training to include numerous programs across the state. This includes the establishment of a demonstration site, the Center of Energy Excellence and Innovation, at Tulsa Community College. The Oklahoma Green program will expand training capacity; increase the number of workers certified in energy efficiency and renewable energy occupations; and assist employers within targeted industries in becoming more energy efficient and utilizing related technologies. In addition, the program will provide an infrastructure for building a sustainable green jobs workforce pipeline for the future.

Major renewable initiatives identified by Oklahoma include:

- » Developing the full potential of Oklahoma's green energy industries, particularly wind, biofuels, and solar, while simultaneously continuing to explore ways to use natural gas as a complementary fuel to these green, renewable resources;
- » Realizing the importance of petroleum production to the state and the nation while working with industry and its workers to make the production, refining and transport of petroleum products more environmentally friendly;
- » Developing an entrepreneurial culture in the state among business, government and citizens for energy efficiency and development of renewable energy resources;
- » Working with industry sectors to incorporate green methods and innovations into everyday business operations; and

- » Training Oklahoma's workforce, throughout all industry sectors, to "think green" and bring energy efficiency practices to the workplace.

Oklahoma aims to be a "full energy state," harnessing all sources of domestic energy. As such, Oklahoma is attempting to utilize domestic resources for wind power, solar, biofuels and natural gas. It is the goal of the Department of Commerce to increase the quantity and quality of jobs across Oklahoma. In that vein, the renewable energy industry is one area that is being primed to increase job creation.

These efforts have been backed and/or initiated through legislative action. Some of the major measures supporting renewable energy development include:

- » SB 1212 (2004) - Oklahoma Wind Power Assessment Committee: The Oklahoma Wind Power Assessment Committee was created to review and analyze the potential for renewable energy in Oklahoma. The Committee held meetings and received information and presentations from various governmental and industry groups in an effort to formulate goals and recommendations. The Committee issued an interim report in April 2005 outlining recommendations in areas of policy, education and encouragement of project development.
- » HB 3028 (2010) - Renewable Energy Goal: Established in 2010, the Renewable Energy Standard calls for 15 percent of the total installed generation capacity in Oklahoma to be derived from renewable sources by 2015. There are no interim targets and the goal does not extend past 2015. Eligible renewable energy resources include wind, solar, hydropower, hydrogen, geothermal, biomass and other renewable energy resources approved by the Oklahoma Corporation Commission (OCC). Energy efficiency may be used to meet up to 25 percent of the goal. The law does not require utilities to purchase and retire Renewable Energy Certificates. Instead, each utility that owns or operates electricity generation facilities must file a report with the OCC each year by March 1. The report must document the total installed capacity of all generation facilities, the number of kilowatt hours generated by each facility and the energy source for each facility. The law also requires utilities to file a report with the OCC each year by March 1 detailing and quantifying the energy efficiency programs they have administered.

Financial incentives have played a major role in developing Oklahoma's renewable energy capacity. Major actions include:

- » Zero-Emission Facilities Production Tax Credit (68 Okl. St. § 2357.32A): For tax years beginning on or after January 1, 2003, a state income tax credit is available to producers of electric power using renewable energy resources from a zero-emission facility located in Oklahoma. The zero-emission facility must have a rated production capacity of 1 MW or greater. The facility must be placed in operation after June 4, 2001, and the electricity must be sold to an unrelated party. The amount of the credit varies depending on when the electricity is generated and may be claimed for electricity generated on or after January 1, 2003, during a 10-year period following the date that the facility is placed in operation (after June 4, 2001). Eligible renewable energy resources include wind, moving water, sun, and geothermal energy. The construction and operation of the zero-emission facility must result in no pollution or emissions that are or may be harmful to the environment, as determined by the state Department of Environmental Quality.
 - Facilities placed in operation on or after January 1, 2003, and before January 1, 2007: For electricity generated on or after January 1, 2003, but prior to January 1, 2004, the amount of the credit is seventy-five one hundredths of one cent (\$0.0075) for each kWh of electricity generated. For electricity generated after January 1, 2004, but prior to January 1, 2007, the amount of the credit is \$0.0050/kWh. For electricity generated after January 1, 2007, but prior to January 1, 2012, the amount of the credit is \$0.0025/kWh. Facilities placed in service on or after January 1, 2007, and before January 1, 2016, are eligible for a tax credit of \$0.0050/kWh. The tax credit is freely transferable at any time during the 10 years following the year of qualification. This includes transfers or sales from non-taxable entities to taxable entities and transfers or sales from one taxable entity to another.

The Department of Commerce is able to assist various customers apply for funding mechanisms as appropriate by funding source and regulations. This assistance is done in accordance with the rules associated with the specific funding available.

By fall 2010, the state had created approximately 615 direct, 68 indirect and 109 induced jobs related to the renewable energy sector through these initiatives. There has been \$1.5 billion in venture capital invested in the state related to wind projects alone. There have

been over 30 patents filed in the state during the last five years and approximately 25 renewable energy companies are operating in the state at this time.

COMPANY PROFILES

Oklahoma Gas & Electric (OG&E) is an Oklahoma-based electric power utility that serves approximately 779,000 customers in a service territory spanning 30,000 square miles in Oklahoma and western Arkansas. Upon completion of its third wind farm, a \$451 million, 227.5 MW project in northwest Oklahoma, OG&E wind capability will reach 780 MW in 2011, which amounts to approximately 10 percent of the company's total generating capacity. OG&E also is involved in smart metering and smart grid projects and allows customers to specify the amount of wind power purchased for their needs.

Public Service Company of Oklahoma (PSO) is an electric utility company that serves more than 514,000 residential, industrial and commercial clients in Oklahoma. The company portfolio includes coal and natural gas generation, as well as power purchase agreements from Oklahoma wind farms that will total 689.6 MW by 2012. This will make their wind power about 14 percent of their total electric generation capacity in Oklahoma. Public Service Company of Oklahoma is a subsidiary of American Electric Power, which is one of the largest electric utilities in the United States. With the Oklahoma Corporation Commission's recent approval of PSO's wind and solar manufacturers' tariff, producers of wind and solar power equipment can receive a discount on their electric bill. The tariff offers a three-year, 30 percent discount on demand charges to manufacturers who locate in PSO's service area and are primarily engaged in the production of wind and solar equipment, including wind turbines, solar cells and related components. Conditions of service of the wind and solar manufacturers' tariff require that new, eligible customers have a demand greater than 100 kW, or that existing customers add at least 100 kW of demand.

ClimateMaster Inc. is an Oklahoma City-based company that is the world's largest and most progressive manufacturer and marketer of ultra-high efficiency water source and geothermal heat pumps for residential and commercial use. Its systems are sold, installed and serviced by a network of independent distributors throughout the world. ClimateMaster is a wholly owned subsidiary of Oklahoma City-based LSB Industries, which is a manufacturing, marketing and engineering company.

In April 2011, **Google** announced an investment in clean energy in the form of a 20-year power purchase



Siemens also collaborated with Wanzek Construction, a Maztec company, headquartered in Coral Gables, Florida, and Duke Energy, based in North Carolina, on the Top of the World Windpower Project near Casper, Wyoming. Forty-four Siemens wind turbines and 66 General Electric turbines will produce up to 200 MW of electricity—enough to power approximately 60,000 homes. Photo courtesy of flickr user Duke Energy via Creative Commons License.

agreement for one of its data centers in Oklahoma. The Oklahoma deal will help support the building of **NextEra Energy Resources'** second wind farm near Minco, Oklahoma. Specifically, the 100.8 MW Minco II Wind Energy Center is expected to include 63 GE 1.6 MW wind turbines and should be up and running by the end of 2011. Google's efforts in Oklahoma mirror the company's wind energy projects in Iowa and North Dakota. At the time of the announcement, Google had invested around \$350 million in renewable energy.

In late May 2011, the German-based **Siemens Energy** announced plans for a new wind service warehousing operations in Woodward, in the northwestern region of the state. While Siemens already had been utilizing a 12,000 square foot warehouse in Woodward's industrial park by the airport, the May announcement indicated an expansion to utilize another 52,000 square feet of space. The combined 64,000 square footage will be Siemens' largest wind power service distribution center to date in the United States and will include tooling and spare parts capabilities. The expansion is propelled by Siemens' efforts to centralize their service operations for more than 250 of their wind turbines, which already are in service or in the process of being installed in the area.



South Carolina

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» Economic Impact

» Company Profiles

South Carolina has promoted renewable energy through a multitude of initiatives that encompass the government, private and academic sectors. The overarching goal of these programs is to make certain that energy-related decisions promote the economic and environmental well-being of the state. South Carolina first officially encouraged the use of renewable energy resources in its 1992 Energy Policy Plan, with the accompanying directive to maximize environmental quality and minimize the cost of energy throughout the state. South Carolina also has focused its efforts on encouraging the growth of alternative energy component manufacturers in the state. It has specific programs to address the development of solar, wind, biomass, ethanol, biodiesel, hybrid vehicles and hydrogen fuel cells. As a result, *Business Facilities* magazine recently ranked South Carolina as the ninth best state for alternative energy and second for wind energy manufacturing.

South Carolina has promoted renewable energy through tax incentives. One of the most significant pieces of legislation was Act No. 261 of 2008, the Energy Freedom and Rural Development Act, which passed the General Assembly in June 2008. Some highlights of the legislation include:

- » Incentive payments beginning in 2009 for retailers of alternative fuel such as biodiesel and E85 ethanol ranging from 5 cents to 25 cents per gallon;
- » Incentive payments beginning in 2008 for biomass energy users ranging from 1 cent per kWh or 30 cents per thermal unit;
- » Income tax credit of up to \$2,000 for plug-in hybrid vehicles purchases;
- » Income tax credits of up to \$100,000 for research and development of renewable fuel feedstocks best suited for South Carolina, such as cellulosic ethanol and algae-based biodiesel;
- » A 20 cent to 30 cent per gallon tax credit for biodiesel and ethanol production;
- » Income tax credit worth up to 25 percent of the cost of the equipment and installation for the construction of a building and equipment used in the intermediate steps of renewable fuel production such as milling, crushing, distillation and handling of feedstocks; and

- » Income tax credit worth up to 25 percent for the purchase and installation of biomass energy equipment used to create power from a biomass resource, including wood and wood waste, agricultural and animal waste, sewage, landfill gas and other organic materials.

There also is a tax credit for hybrid, fuel cell, alternative fuel or lean burn motor vehicles that is worth 20 percent of the federal income tax credit for those vehicles, along with a solar and hydropower tax credit worth 25 percent of the cost of the installation and equipment, up to \$3,500 per year for up to 10 years.

The most recent renewable energy tax credit was passed with Act 351 (2010). This created the Renewable Energy Tax Incentive Program targeted at renewable energy manufacturers investing over \$500 million. It encourages business investment and employment opportunities by providing tax incentives to companies in the solar, wind and other renewable energy industries that are expanding or locating in South Carolina. Beginning in 2010, a taxpayer is allowed a nonrefundable tax credit of 10 percent of the total qualifying investments in plant and equipment for renewable energy manufacturing. The taxpayer must meet the following conditions:

- » Manufacture renewable energy systems and components in South Carolina for solar, wind or other renewable energy uses;
- » Invest at least \$500 million in the year the tax credit is claimed;
- » Create at least one and one-half full-time jobs for every \$500,000 of capital investment that pays at least 125 percent of the state annual median wage; and
- » Add renewable energy manufacturing to the accelerated depreciation schedule for property tax purposes.

In some instances, South Carolina has provided financial assistance to obtain federal grants. For example, the state pledged more than \$10 million for the Clemson University Drivetrain Testing Facility grant application as part of a large U.S. Department of Energy solicitation, which has since been awarded to Clemson. State funding sources included a legislative appropriation and a state Department of Commerce grant, among other sources.

The South Carolina Energy Office also provides renewable energy grants when funds are available through its program and facilitates the submission of grants for South Carolina stakeholders to outside entities such as the U.S. Department of Energy, U.S. Department of Agriculture and U.S. Environmental Protection Agency, for a broad range of projects. The South Carolina Energy Office has had a more limited role in helping stakeholders secure loans, although the office currently is facilitating the implementation of the Conservation Energy Bonds program, which were bond appropriations given to cities and counties throughout South Carolina as part of funding received under ARRA.

South Carolina also has an ARRA funded demonstration project that is providing energy efficiency upgrades to over 600 residents of manufactured housing units served by the state’s electric cooperatives. The purpose of the demonstration project is to determine which of several measures will provide the greatest savings to manufactured housing residents. Measures include roof retrofits, replacement of electric strip heating with high efficiency heat pumps and replacement of inefficient appliances with Energy Star™ appliances. Power meters also are being tested in some homes.

South Carolina does not have an ongoing statewide residential assistance program at this time. However, the General Assembly has passed legislation allowing utilities to provide on-bill financing for energy efficiency projects for both residential and commercial customers. The loans would be paid back through utility bills and the loan would remain “with the meter,” so that homeowners who move before the loan is repaid simply pass the loan on to the next resident. The loan program will begin with the state’s electric cooperatives, once funding is identified to capitalize it. In addition, the city of Charleston is one of a group of cities across the southeast participating in a DOE funded effort to establish financing programs for residential energy efficiency.

The on-bill financing program will be available to commercial applicants as well. The South Carolina Energy Office also offers assistance to commercial entities in the form of free energy assessments, supported through ARRA funds. The program is open to commercial and small industrial users with energy bills of \$2 million or less per year.

The South Carolina Department of Commerce is conducting a survey of green businesses to measure green employment and develop an economic impact analysis of green industry in the state. This work is funded by the ARRA Labor Market Information Improvement Grant. The economic impact analysis

Table 9 Alternative Energy Supply Chain in South Carolina	
Supply Chain	Number of Companies
Wind, Solar, & Biomass	14
Biomass & Geothermal	71
Biomass	97
Wind	258
Solar	175
Total	615

will be conducted by Clemson University, using the REDYN Economic Impact Model, in early 2011, based on survey responses.

Since 2008, the South Carolina Department of Commerce actively has participated in attracting over \$800 million in alternative energy investments, creating approximately 1,000 new, direct jobs in the state. The majority of these projects have been in the biomass fuel and fuel cell technology areas. Based on industry classifications of companies in South Carolina and the potential alternative energy supply chain study by the DOE’s Renewable Energy Policy Project, 615 companies are potential suppliers to the green energy industrial economy.

COMPANY PROFILES

Starting operations in 1968 with 340,000 square feet of manufacturing space and 250 employees, the **GE Energy Greenville** site has grown into the world’s largest and most technologically advanced turbine design and production site. The Greenville plant employs more than 3,000 employees in various disciplines, including manufacturing, product design, development, and testing. GE Energy’s Greenville site is dedicated to high efficiency and high reliability design, state-of-the-art manufacturing and innovative advances in power generation for heavy duty gas and wind turbines. Greenville also is the headquarters of Energy’s Engineering Division as well as Renewable Systems Engineering. The site encompasses 413 acres with 1.5 million square feet of manufacturing space, comprising the world’s largest gas turbine plant.

In December of 2009, **Trulite** announced its plans to relocate manufacturing and headquarter operations to Columbia. Trulite builds hydrogen fuel cell generators and hydrogen fuel canisters for commercial uses.

Itron’s manufacturing, sales and support facility in Oconee is a global leader in the development of Smart



Oconee Manufacturing and Research and Development Facility (Itron). Photo courtesy of South Carolina Department of Commerce.

Grid technology. Itron is a leading technology provider to the global energy and water industries. The company is the world's leading provider of intelligent metering, data collection and utility software solutions, with nearly 8,000 utilities worldwide relying on their technology to optimize the delivery and use of energy and water. The OpenWay CENTRON smart meters produced at the Oconee manufacturing facility will meet the growing worldwide demand for measurement systems in Smart Grid advanced metering infrastructure systems. Itron's Oconee manufacturing facility is the third largest employer in Oconee County with approximately 600 full- and part-time employees. Oconee houses the research and development, engineering, product marketing and production of several lines of electricity meters. In readiness for future demand, the Oconee facility encompasses 317,000 square feet of highly automated, flexible and scalable manufacturing and office space.

In April of 2009, **Peregrine Energy** announced plans to develop a new woody biomass-fueled cogeneration plant at Sonoco's Manufacturing complex in Hartsville, South Carolina. The \$135 million project will create a 50 MW facility to replace Sonoco's existing coal-fired boilers. The project benefits the regions' forestry industry by using pre-commercial thinning and waste logging residual as biomass fuel for the plant. A privately held company with its corporate office in Greenville, Peregrine Energy has been building and operating independent power and other energy-related projects for over 15 years. The company has a broad range of expertise and experience in owning and operating hydroelectric projects, coal-fired cogeneration projects, natural gas-fired boilers, electric boilers, and renewable energy plants that use woody biomass as their fuel.

Early in 2010, Golden, Colorado-based **Proterra Inc.**, a leading innovator of zero-emission commercial

vehicle solutions in the country, announced plans to build a full-scale, state-of-the-art research and development center and manufacturing plant on the campus of Clemson University's International Center for Automotive Research in Greenville, South Carolina. The company is rated as one of the major outfits manufacturing hybrid and battery powered buses for mass transit. Proterra's move was designed to give the company access to tremendous research and development resources in building EcoRide™ BE-35, the company's next generation zero-emission vehicle and FastFill™ Charging Stations. Proterra's objective is to construct more than 1,500 buses per year (with room to expand to more than double output) and to expand to 1,300 employees over the next five years. In order to accomplish this goal, Proterra has already moved its manufacturing operation from Colorado to Greenville. In January 2011, U.S. Secretary of Transportation Ray LaHood visited the Proterra's South Carolina facility and rode one of the company's recently completed buses. Proterra also received a \$6.5 million research grant from the U.S. Department of Transportation.

AQT Solar, a Sunnyvale, California-based solar company, announced plans in January 2011 to invest more than \$300 million in a Blythewood, South Carolina, manufacturing facility that could employ 1,000 people by 2014. Most solar cells are made of silicon, but AQT makes its solar cells from copper-indium-gallium-diselenide, a much cheaper, but less efficient, energy-producing material. AQT's business model is built around lowering the cost of solar panels to make the technology more widely available. According to AQT Solar officials, the company has \$100 million worth of purchase orders with another \$150 million under negotiation. State and local incentives were deployed to attract AQT Solar's move to South Carolina.

The **South Carolina Hydrogen and Fuel Cell Alliance**, a public-private collaboration for the cooperative and coordinated utilization of resources in the state, seeks to advance the commercialization of hydrogen and fuel cell technologies. The Alliance is a non-profit partnership of government, business, academia and citizens working together to grow economies of local communities, the state and the nation, to enable energy security and to limit their environmental footprint with the use of hydrogen and fuel cell technologies that are cost-effective, convenient and produced with local resources. The Alliance works toward developing an economic development strategy for the South Carolina hydrogen and fuel cell cluster to include the mapping of hydrogen and the fuel cell supply chain.



Tennessee

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Tennessee is moving aggressively to grow the clean energy economy in the state. In 2009, the Pew Charitable Trust released a report that highlighted Tennessee as one of the top three states (with Oregon and Colorado) in the country for the number and rate of growth of clean energy jobs. Tennessee is taking a comprehensive approach to renewable energy that includes developing policy drivers, creating a targeted clean energy economic recruitment strategy and investing state resources to support deployment and spur investment in the clean energy value chain. Tennessee is focused on supporting the clean energy technology sector as defined by the 2009 Clean Energy Future Act, including solar, wind, biomass, biofuels, hydro, geothermal and nuclear.

Tennessee has a legacy of clean energy innovation that dates back to the New Deal and the creation of the Tennessee Valley Authority. The state was one of the sites where the Manhattan Project developed the science to enable carbon free production of electricity through nuclear energy. In addition, the Tennessee Valley Authority boasts a generation portfolio of over 30 percent nuclear energy and has plans to increase this percentage in the coming years. Part of the state Jobs Cabinet's approach to the development of the clean energy sector is leveraging strategic partners like the Tennessee Valley Authority, University of Tennessee and Oak Ridge National Laboratory (ORNL).

During the tenure of former Governor Phil Bredesen, Tennessee defined the clean energy sector in state statute; developed a targeted economic recruitment strategy; created efficient, flexible and innovative incentives; developed and implemented successful policy drivers; and made strategic investments in the key growth areas of sustainable mobility, biofuels and solar. Billions of dollars of investment have flowed into Tennessee during the last eight years across the clean energy value chain. The state sees this sector as one of the most important strategic growth sectors for the future of the state's economy. Tennessee has four primary clean energy goals as defined by the Governor's Task Force on Energy Policy: lead by example; improve energy efficiency; expand the availability and use of renewable energy and biofuels; and grow the clean energy sector of the state's economy.

Tennessee is emerging as a national leader in the development of solar energy. Hemlock Semiconductor and Wacker Chemie, the world's top two producers of polycrystalline silicon, have made a combined investment of \$2.2 billion and created 1,000 new jobs in the state. Tennessee also has seen successful investments from other solar companies, such as Confluence Solar, Shoals Technologies, AGC Flat Glass and Sharp Solar.

In 2010, with funding received from ARRA, Governor Bredesen established the Volunteer State Solar Initiative, a comprehensive solar energy and economic development program focusing on job creation, education, renewable power production and technology commercialization. The Initiative comprises two goals: creating the Tennessee Solar Institute at the University of Tennessee (UT) and ORNL, which will focus on industry partnerships to improve the affordability and efficiency of solar products; and establishing the West Tennessee Solar Farm, a 5 MW 20-acre power generation facility in Haywood County that will be one of the largest installations in the Southeast and serve as a demonstration tool for education and economic development. Tennessee's Department of Economic and Community Development will be contracting with UT for both projects. According to the U.S. Department of Energy, the net result of the Volunteer State Solar Initiative will be to advance solar technology, promote the use of renewable energy statewide, lower fossil fuel emissions, decrease the state's dependence on foreign oil, and create green jobs across Tennessee.

In biofuels, spurred by more than \$70 million in investments in the 2007 state budget, Tennessee has become a national leader in second-generation cellulosic ethanol technology and production. The University of Tennessee, working through the UT Research Foundation, created Genera Energy. Genera Energy, in partnership with Dupont Danisco Cellulosic Ethanol, has developed and built the first commercial-scale cellulosic bio-refinery in the country.

Tennessee also has a burgeoning sustainable automobile industry. Since 2008, Volkswagen and Nissan have announced more than \$1 billion in investments into Tennessee to produce new fuel efficient and electric vehicles. Nissan is spending \$1.7 billion to build a new plant in Smyrna to produce lithium-ion batteries

and also is upgrading its current auto plant to produce the all-electric Leading, Environmentally friendly, Affordable, Family car (LEAF). Tennessee and Nissan also are partnering with ECOTality North America in the largest deployment of electric vehicles and charging infrastructure in U.S. history.

Several legislative initiatives have contributed to the state's progress in developing renewable energy. Some landmarks include:

- » The 2009 Clean Energy Future Act and the 2010 Appropriations Act were the result the Governor's Task Force on Energy Policy. Called the "cornerstone of all future" energy policy activities in Tennessee, key components of the legislation include:
 - Requiring state government to "lead by example" with improved energy management of its buildings and passenger motor vehicle fleet;
 - Encouraging job creation in the clean energy technology sector by making qualified existing businesses eligible for Tennessee's emerging industry tax credit; and
 - Promoting energy efficiency in newly constructed homes with a limited statewide residential building code and expanding eligibility for federal funds used to weatherize existing homes in low-income areas.
- » The fiscal year 2010 Appropriations Act incorporated the funding for the Volunteer State Solar Initiative, support of the Electric Vehicle Project and the creation of a public-private energy efficiency revolving loan program; and
- » In 2008, the Tennessee General Assembly established the Energy Efficient Schools Initiative with \$90 million of excess proceeds from the Tennessee Education Lottery. This program provides grant and loan funding to school districts to make energy efficient improvements to their facilities.

In addition, Tennessee has developed a "Green Tool Kit" containing details on a number of the state's clean energy incentives. Some of these specific programs include the Green Energy Tax Credit; Carbon Charge Tax Credit; Pollution Control Equipment Tax Credit; Incentives for Clean Energy Technology; Emerging Industry Tax Credit; Green Island Biofuel Corridor Infrastructure Grant; Tennessee Energy Loan Program; and Reduced Tax on Electricity. Additionally, the Tennessee Valley Authority offers a variety of programs, including the Generation Partners Program, to spur adoption of renewable energy technologies. Tennessee also has helped to establish an innovative

public-private energy efficiency and renewable energy financing program administered by Pathway Lending.

Analysis of aggregate economic impact of the recent clean energy investment in Tennessee continues. Over the last four years, Tennessee has been successful in recruiting more than \$4 billion in clean energy economic development projects. In addition to these large investments, Tennessee has experienced high levels of growth across the clean energy spectrum, as highlighted by the 2009 Pew Charitable Trusts Report.

COMPANY PROFILES

In December 2008, **Hemlock Semiconductor** and its parent company, Dow Corning, announced Hemlock's plan to locate a polycrystalline silicon manufacturing operation at the Commerce Park megasite in Clarksville, Tennessee. The facility, which will produce a primary component used in the manufacture of solar panels and other energy equipment, will be built with an investment of \$1.2 to \$2.5 billion dollars by the company and will create 500 jobs, with the potential of employing up to 900 people within five to seven years. If plans are fully implemented, the project would become the largest announced corporate capital investment in Tennessee history.

In February 2009, **Wacker Chemie AG** of Munich, Germany, announced the company's plans to build a \$1 billion dollar facility for the manufacture of hyperpure polycrystalline silicon in Bradley County, Tennessee. The project is expected to create more than 500 jobs for this region of the country.

In January 2010, Missouri-based **Confluence Solar** announced that it had selected Clinton, Tennessee, as the home of its new manufacturing, warehousing and distribution facility. The facility will produce premium quality monocrystal silicon ingots for photovoltaic solar power generation. The company's HiCz™ brand products increase the efficiency of solar cells by 15 percent or more, helping manufacturers of solar panels generate electricity more efficiently at a cost equivalent to or better than that of multi-crystal silicon ingot.

In January 2010, leaders from **DuPont Danisco Cellulosic Ethanol, UT** and **Genera Energy** cut the ribbon on one of the world's first cellulosic ethanol demonstration facilities, located in Vonore, Tennessee. The 74,000 square foot plant has started producing ethanol and will deliver low cost, fully integrated technology for commercial production of ethanol from agricultural residue and bio-energy crops, including corncobs and switchgrass. It is estimated that Tennessee farmers could produce 1 billion gallons of ethanol feedstock on 1 million acres of land by 2025 with no disruption to food and fiber production. The biorefinery also has opened the Biomass Innovation



Solar panel system of the Natural Energy Group in Knoxville, Tennessee. The photovoltaic system, the largest in Tennessee, uses 4,608 Sharp modules manufactured in the state and is capable of producing 1 MW of electricity. Photo courtesy of flickr user Harvey Abouelata via Creative Commons License.

Park on a one-of-a-kind campus to integrate and optimize the biomass supply chain. Additionally, DOE funded the creation of the \$135 million Bioenergy Science Center at ORNL. The Center's purpose is to develop cost-effective and sustainable means of producing biofuels from plants and aims to revolutionize bioenergy processing within five years. As mentioned earlier, the University of Tennessee, working through the UT Research Foundation, created Genera Energy.

In June 2010, **Alstom** inaugurated a new production facility for steam turbines, gas turbines, large turbo generators and related equipment for the North American fossil fuel and nuclear power generation market. It also will retrofit existing steam turbines with leading-edge technology. The new facility, located in Chattanooga, Tennessee, springs from an initial investment of approximately \$300 million and eventually will create approximately 350 jobs.

In May 2010, **Nissan** broke ground on the project that brings Nissan LEAF production to the United States. The groundbreaking ceremony marks the start of construction on a manufacturing facility in Smyrna, Tennessee, that will produce the lithium-ion batteries that power the Nissan LEAF zero emission vehicle. The all-electric Nissan LEAF will be produced at Nissan's vehicle assembly facility in Smyrna beginning in 2012. Nissan LEAF and battery production will create up to 1,300 jobs when the plants are operating at full capacity. The battery plant, one of the largest vehicle battery manufacturing plants in North America at 1.3 million square feet at full capacity, will be capable of producing 200,000 advanced technology batteries annually. It

will be located adjacent to the vehicle assembly plant, which will be retooled to accommodate production of the Nissan LEAF and capable of producing 150,000 electric cars annually.

In June 2010, **Sharp Electronics Corporation**, the U.S. subsidiary of Sharp Corporation, one of the world's leading manufacturers of solar cells, highlighted the production of its 2 millionth solar panel at its assembly operation in Memphis. Since coming online in 2003, the facility's production capacity has increased tremendously and its manufacturing staff has tripled. A year later in June 2011, Sharp switched on a 1,174-panel solar array at its Memphis facility that doubled the company's on campus solar power production, sufficient power to run 53 homes. The facility can now produce about 460 kW, the carbon equivalent of taking 80 cars off the road. The Memphis solar manufacturing facility assembles a variety of panels for residential and commercial installations. Sharp has grown its presence in the United States, supplying the solar modules that power thousands of residential, governmental, commercial and utility scale solar electricity systems throughout the country. Among Sharp's roster of notable commercial solar installations are the FedEx's hub in Oakland, California; Google's corporate campus in Mountain View, California; Patagonia's headquarters in Ventura, California; and the San Francisco Giants' AT&T Park. Over the years, Sharp's Memphis facility has produced enough solar modules to fully power more than 65,000 total average-sized homes, with clean, renewable solar energy, saving nearly 12 million metric tons of CO₂ per year.



Texas

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

Although Texas does not have an official renewable energy program or strategic plan, several legislative initiatives have been implemented over the years to promote renewable energy. In this connection, the most important initiative was the RPS, which was established in 1999. In August 2005, the Legislature implemented recommendations from the Governor's Texas Energy Planning Council to continue and expand the state's RPS program. This legislation extended the RPS to expand the state's generating capacity from renewable energy sources to 5,880 MW by 2015, and 10,000 MW by 2025. The program is run out of the Public Utility Commission of Texas, and has an additional target of 500 MW of non-wind alternative energy capacity by 2015.

Wind is one sector that has benefited significantly from the RPS, and Texas is now the top producer of wind energy in the nation. The state has been at the forefront of wind energy development with the support of Governor Rick Perry who, in 2010, announced an \$8.4 million investment by the Texas Emerging Technology Fund (TETF) in a collaborative wind energy project facilitated by the Texas Tech University System. According to a press release from the governor's office, TETF has contributed \$154 million in funds since its creation by the Legislature in 2005, leading to the establishment of more than 100 companies that are contributing to research and development, as well as manufacturing of products used in renewable energy production.⁵⁸ In 2008, the state increased its wind capacity by 65 percent, reaching 7,427 MW of power, according to the U.S. Energy Information Administration.⁵⁹

A notable project in Texas is the creation of Competitive Renewable Energy Zones, designed to move electricity generated by renewable energy sources (primarily wind) from the remote parts of Texas (West Texas and the Texas Panhandle) to the more heavily populated areas of Texas, such as Austin, Dallas, Fort Worth and San Antonio.

Several Texas policymakers have expressed interest in creating incentives to build up the state's solar energy sector, which has not grown at the same pace as wind, but has significant potential. A 2010 U.S.

Department of Energy study ranked Texas among the seven states with the best solar resources in the United States.

Various financial incentives exist for renewable energy projects in the state. According to the Texas Comptroller of Public Accounts' State Energy Conservation Office (SECO), Texas does not currently offer programs that provide funding of renewable energy equipment on an individual basis. However, there are tax exemptions available in certain instances, such as (1) franchise tax deductions and/or exemptions for businesses that use, manufacture or install wind energy generators and (2) property tax exemptions involving wind energy generation for business installation or for the construction of such systems. SECO also provides low interest loans to assist selected public entities in financing their energy-related cost-reduction efforts utilizing the LoanSTAR revolving loan program.*

The state offers a state tax exemption for biofuel and pollution reduction incentives. Texas also offers rebates for the purchases of certain energy efficient appliances. According to the Database of State Incentives for Renewable Energy, the state allows a corporation or other entity subject to the state franchise tax to deduct the cost of a solar energy device from the franchise tax (Texas' corporate tax). Entities are permitted to deduct 10 percent of the amortized cost of the system from their apportioned margin. For the purposes of this deduction, a solar energy device means a system or series of mechanisms designed primarily to provide heating or cooling or to produce electrical or mechanical power by collecting and transferring solar-generated energy. The term includes a mechanical or chemical device that has the ability to store solar-generated energy for use in heating or cooling or in the production of power. Under this definition wind energy also is included as an eligible technology. Texas also offers a franchise tax exemption for manufacturers, sellers or installers of solar energy systems which includes wind energy as an eligible technology.

* The Texas LoanSTAR—Loans to Save Taxes and Resources—program began in 1988 as a \$98.6 million retrofit program for energy efficiency in buildings. The loans are targeted toward public buildings: state agencies, local governments, and school districts.

The Texas Enterprise Fund and TETF are potential sources of grant funding for corporations or researchers engaged in renewable energy. According to the governor's office, as of August 2010, TETF has awarded nearly \$5.3 million to renewable energy-related projects which have resulted in the announcement of more than 900 new jobs in the state. A total of five companies have received grants. The governor's office also reports that TETF has awarded nearly \$27.5 million to renewable energy-related projects, spanning technologies such as solar cells, algae biofuels and advanced batteries. A total of 17 companies involved in renewable energy have received TETF grants.

The governor's office published the Texas Renewable Energy Industry Report in August 2010. According to this report, Texas has over 4,800 companies employing more than 55,600 Texans in clean energy fields.

COMPANY PROFILES

Xtreme Power, a company based in Austin, is working on a project to develop storage batteries for electricity produced from wind. The system will be able to hold approximately 10 MWh, which is the amount a 30 MW wind farm can produce in 20 minutes, if it is running at full capacity. The round trip efficiency of the battery system, or the amount of electricity it is capable of delivering per MWh of stored energy, is touted at more than 90 percent. Currently the highest efficiency seen in energy storage in general use is approximately 70 percent to 85 percent from pumped hydropower, whereby off-peak electricity is used to pump water from a reservoir to a higher elevation; at peak demand, the water is allowed to flow back down through a turbine, producing electricity.

In Abilene, **Broadwind Energy** invested \$7 million to renovate and expand a former Lockheed Martin manufacturing facility for its new drivetrain service center at this location. Broadwind Energy Inc.'s new, 300,000 square foot wind turbine drivetrain

service center will employ 60 people at full capacity. "Demand for wind turbine gearbox services is growing in this region—Texas is the number one state in the nation for installed MW, and Oklahoma is not far behind," said Peter C. Duprey, Broadwind's president and CEO. "The Abilene Broadwind facility is the only facility with the gearing expertise and service capability to meet this emerging demand." Texas is by far the leading wind power state, with more than 10,000 MW of wind installations—more than twice its nearest competitor, Iowa. "At the rate Texas is installing wind power, Broadwind's new wind turbine drivetrain service center couldn't have come sooner," said American Wind Energy Association (AWEA) CEO Denise Bode. "There's a reason why Broadwind is adding more jobs in Texas—because the Lone Star State knows energy, and it has embraced wind power. Through its new center, Broadwind Energy is providing an integral service within the dynamic wind energy value chain, right here in America. This facility is another example of the many jobs and economic benefits the wind industry is bringing to this country."

In October 2009, **E.ON Climate & Renewables (EC&R)** announced that one of the world's largest wind farms began operating in the area surrounding Roscoe, Texas. The series of 627 wind turbines providing a 781.5 MW capacity covers about 100,000 acres and four counties. The wind complex is a collaborative wind project with the community that included negotiations with more than 300 landowners, and a mix of different turbines made by several companies including Mitsubishi, General Electric, and Siemens. While the project took approximately 500 workers and an investment of over \$1 billion dollars, at 781.5 MW, the Roscoe wind complex has the capacity to power 230,000 residences. As Governor Rick Perry noted in a statement, "Texas continues to lead the nation in the development of renewable energy and has more wind generation capacity than any other state and all but four countries."



Virginia

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

The 2010 Virginia Energy Plan (VEP) recommends actions to meet the following goals: focus on transforming Virginia into the energy capital of the East Coast by increasing the use of conservation and efficiency alongside expanding both traditional and alternative energy production, jobs and investment.⁶⁰ In support of the recommendations and goals of VEP, the Department of Mines, Minerals and Energy (DMME) collaborates with public and non-profit stakeholders to enable the growth of renewable energy technologies and to attract renewable and alternate energy manufacturing and technology deployment to the commonwealth. For example, DMME provides financial support to Virginia Clean Cities, a government-industry partnership which strives to reduce petroleum consumption in the transportation sector by advancing the use of alternative fuels and vehicles, idle reduction technologies, hybrid electric vehicles, fuel blends and fuel economy. DMME also supports the Virginia Biomass Energy Group, a collaboration of farmers, government officials, university researchers, businesses and other stakeholders working to characterize the commonwealth's biomass resources and develop strategies for attracting capital investment and creating jobs associated with renewable energy production from biomass resources. Additionally, Virginia universities undertake considerable research on a wide variety of renewable energy sources such as biomass, wind, algae, geothermal and solar.

VEP has three goals, all of which are focused on economic growth and job creation:

- » Make Virginia the energy capital of the East Coast;
 - Grow both traditional and alternative energy production, jobs and investment;
 - Increase the use of conservation and efficiency;
- » Expand public education about Virginia's energy production and consumption, its effect on the economy, and how Virginians can use energy more efficiently; and
- » Maximize the investment in clean energy research and development through the work

of the Universities Clean Energy Development and Economic Stimulus Foundation.

Wind energy is a major part of Virginia's renewable energy portfolio. The Virginia Offshore Wind Development Authority (VOWDA) was created to facilitate and support the development of wind-powered electric energy facilities off the coast and beyond the commonwealth's three-mile jurisdictional limit.⁶¹ VOWDA is charged with, among other tasks: (1) collecting ocean data, (2) identifying existing regulatory or administrative barriers to the development of the offshore wind industry, (3) upgrading port facilities to accommodate the manufacturing and assembly of these project components and vessels that will support the construction and operations of offshore wind energy projects, (4) securing federal loan guarantees, and (5) developing, constructing and operating interconnection facilities on the Virginia shoreline to connect offshore wind energy projects to the electric grid.

Virginia also is working diligently to cultivate solar energy in the commonwealth. The Solar Photovoltaic Manufacturing Incentive Grant program (SMIG) is designed to encourage the full value added product development and manufacture of solar photovoltaic panels and to promote the development of a high technology, renewable energy industry in Virginia.⁶² It was first passed into law in 1993. Any manufacturer selling photovoltaic panels manufactured in Virginia is eligible for an annual incentive grant of up to 75 cents per watt of the rated capacity of the panels sold.

The Biofuels Production Incentive Grant Program encourages production of biofuels from traditional and advanced feedstock. A producer of more than 1 million gallons per year is eligible for an incentive grant of 10 cents per gallon for fuel made with traditional feedstocks and 12.5 cents per gallon for fuel made with advanced feedstocks. Virginia's Major Employment and Investment Project Approval Commission currently is considering the recommendation of a broader Clean Energy Manufacturing Incentive Grant, which could merge the SMIG program and the Virginia Biofuels Production Incentive Grant Program into a consolidated performance-based economic develop-

ment incentive for solar, biofuels and other renewable and alternative energy production.⁶³

Biomass and energy from waste are supported by a \$10 million grant program administered by DMME. This program is funded by ARRA, which also funds \$13 million for solar and wind energy systems for commonwealth facilities; \$3 million in solar and wind demonstrations for local government, schools and community colleges; a \$15 million solar and wind rebate program for residential, business and non-profit property owners; and \$10 million in economic development grants for businesses that manufacture renewable energy or energy efficiency products or services.

Key legislation has been implemented to encourage renewable energy deployment and associated manufacturing, including the following:

- » The Permit by Rule process designed to streamline permitting of small renewable energy projects up to 100 MW;
- » Virginia's voluntary renewable portfolio standard;
- » The Biofuel Producers Incentive of 10 or 12.5 cents per gallon, based on feedstock;
- » The Biofuel and Green Diesel tax credit for small producers;
- » The clean fuel vehicle and advanced cellulosic biofuels job creation tax credit of up to \$700 per employee;
- » The Green Job Creation Tax Credit up to \$500 for each annual salary that is \$50,000 or more, up to 350 jobs;
- » Virginia's Alternative Fuels Revolving Fund;⁶⁴
- » Virginia's Universities Clean Energy Development and Economic Stimulus Foundation: Legislation established the Foundation as a corporate body and a political subdivision of the commonwealth. The Foundation is directed to identify, obtain, disburse and administer funding for (1) research and development of alternative fuels, clean energy production and related technologies; (2) support of economic development projects in disadvantaged rural areas; and (3) the provision of assistance in the commercialization of alternative fuels and clean energy technologies. The Foundation also is directed to award grants to those proposed projects that best meet the established criteria and purposes of the legislation;⁶⁵
- » Virginia's renewable energy portfolio standard program ensures that an investor-owned electric utility will receive triple credit toward meeting the goals of the renewable energy portfolio stan-

⁶³ Virginia's renewable portfolio standard technically is a voluntary target the commonwealth hopes to meet; it is not a binding goal for utilities.

ard program for energy derived from offshore wind. This measure also provides that an electric utility that participates in the renewable energy portfolio standard program may sell renewable energy certificates produced at its own generation facilities located in the commonwealth or, if located outside the commonwealth, owned by the utility and in operation as of January 1, 2010, or renewable energy certificates acquired as part of a purchase power agreement to another entity and then purchase lower cost renewable energy certificates. The net difference in price between the renewable energy certificates is required to be credited to customers;⁶⁶

- » Virginia's clean energy financing program grants localities the authority to, in order to secure loans for the initial acquisition and installation of clean energy improvements, place liens equal in value to the loan against any property where such clean energy systems are being installed. It also allows the locality to bundle the loans for transfer to private lenders in such a manner that would allow the liens to remain in full force to secure the loans;⁶⁷ and
- » Virginia provides for a separate classification for renewable energy manufacturing tangible personal property and improvements to real property. This legislation adds tangible personal property and improvements to real property designed and used primarily for manufacturing a product from renewable energy as separate classifications of property for local property tax purposes.⁶⁸

Virginia has a goal of 12 percent of its electric sales coming from renewable energy sources by 2022. The commonwealth's effort to accomplish this goal is overseen by the DMME. At the request of Governor Bob McDonnell, the General Assembly enacted a Green Jobs Tax Credit for Virginia.⁶⁹ This \$500 per year, five-year tax credit makes the whole commonwealth of Virginia a green jobs zone. The credit can be doubled if the jobs are in an enterprise zone. In addition, grants available to, but not restricted exclusively to, the renewable energy sector are available from the Tobacco Indemnification and Community Revitalization Commission for research and development and energy business development in Southside and Southwest Virginia. The Governor's Opportunity Fund also offers discretionary funds to localities on a matching basis with the expectation that the grant will result in a favorable business location decision for the commonwealth. Also, various agencies, including DMME, Virginia Economic Development Partnership, Center for Innovative Technology, Virginia Universities

Clean Energy Development and Economic Stimulus Foundation and the Virginia Department of Business Assistance provide technical assistance to businesses seeking financing for renewable energy projects. Other specific financial incentives include:

- » Energy Efficiency Rebate Program for Residential Property Owners: Using federal funds awarded by ARRA, DMME allocated \$15 million for rebate incentives to stimulate implementation of energy efficiency improvements in homes and commercial properties. Residential consumers were eligible for a rebate for 20 percent of the cost of eligible energy efficiency improvements, up to \$2,000 per property address. Energy efficiency improvements included upgrading heating and air conditioning equipment, adding insulation, replacing leaky windows and other improvements to existing homes that reduce energy consumption and utility costs. Eligible products had to be purchased on or after June 26, 2009. The first round of funding for efficiency rebates totaling about \$10 million was expended in less than three weeks when the program opened in late October 2009. A second round of funding made available in late March 2010 for about \$5 million was exhausted in less than 24 hours. Applicants were able to reserve a rebate for a qualifying system, given 180 days to complete the work and redeem their reservation for a rebate check. Once reservations depleted available funds, over 3,000 applications were placed on a wait list. Wait-listed applicants are now being approved for rebate reservations as unclaimed or unredeemed rebate funds become available.
- » Energy Star™ Sales Tax Holiday: Virginia exempts Energy Star™ appliances for home or personal use from the state sales tax during a four-day period in October. During this period, purchases of certain Energy Star™ and WaterSense qualified products purchased for non-commercial use and costing \$2,500 or less are exempt from sales tax. The exempt Energy Star™ items include dishwashers, clothes washers, refrigerators, air conditioners, ceiling fans, compact fluorescent light bulbs and programmable thermostats that carry the Energy Star™ designation. The exempt WaterSense items include bathroom sink faucets, faucet accessories, showerheads and toilets. In 2011, in addition to the sales tax holiday, DMME is administering an appliance rebate program that will provide flat amount rebates for some of the appliances that are included in the sales tax holiday, in-

cluding clothes washers, refrigerators, room air conditioners and dishwashers.

- » Preferential Property Tax Rates on Energy Efficient Buildings: The Code of Virginia was amended in March 2009 to authorize preferential property tax rates on energy efficient buildings, not including the real estate or land on which they are located, which are now considered to be a separate class of property and constitute a classification for local taxation separate from other classifications of real property. The governing body of any county, city, or town may, by ordinance, levy a tax on the value of such buildings at a different rate from that of tax levied on other real property. The rate of tax imposed by those local government entities on such buildings shall not exceed that applicable to the general class of real property.
- » Financial Mechanisms for Energy Efficiency and Renewable Energy Improvements: The Code of Virginia was amended in March 2009 to authorize localities to create financing mechanisms for energy efficiency and renewable energy improvements. Any locality may, by ordinance, authorize contracts to provide loans for the initial acquisition and installation of clean energy improvements with free and willing property owners of both existing properties and new construction.
- » Water/Sewer Rate Incentive Program: The Code of Virginia was amended in March 2009 to allow localities to establish a water and sewer connective fee rate incentive program designed to encourage the use of green roofs in the construction and remodeling of residential and commercial buildings. If established, the incentives are to be based on the percentage of storm water runoff reduction the green roof provides.
- » Taxation of Electric Motor Vehicles: The Code of Virginia was amended in February 2009 to enable localities to give preferential treatment to electric motor vehicles when establishing rates of taxation on personal property.

Using the jobs created/retained cost of \$92,000 per job, the following number of jobs have been created and retained in the renewable energy-related programs during the 2009-2012 time period for which funds were received under ARRA:

- » 163 jobs from \$15 million in renewable energy rebates;
- » 92 jobs from \$10 million in biomass grants;
- » 92 jobs from \$10 million in renewable energy grants to local government facilities; and

- » 131 jobs from \$12.1 million in renewable energy grants to state facilities (Public-Private Educational Facilities Infrastructure Act).

Based on research studies undertaken by the Virginia Economic Development Partnership, Virginia's energy industry employs (direct employment only) more than 30,000 workers. Of these, roughly 5 percent, or more than 1,500, are in the renewable energy area in Virginia.

COMPANY PROFILES

Covanta's I-95 Energy Resource Recovery Facility, located in Fairfax, Virginia, and the largest of Virginia's many waste conversion and biomass energy plants, began operation in 1990. Under contract to Fairfax County, the Facility is located adjacent to the I-95 Landfill Complex. The Energy Resource Recovery Facility is one of the largest waste-to-energy facilities in the country. Municipal solid waste serves as the fuel for the Facility. Steam is produced that turns turbines that can generate over 80 MW of electricity. The Facility can process not only municipal solid waste, but also such waste items as confidential documents, infested nursery plant materials, old currency and other items that need assured destruction.

Osage Bio Energy currently is completing construction of its Appomattox Bio Energy facility in Hopewell, Virginia. This one-of-a-kind plant is designed to use winter barley as its raw material in making fuel ethanol and a number of value-added bio-related products, including high value proteins for animal feed; barley hulls for making biomass pellets; and a high quality carbon dioxide stream.

Planned biomass/waste facilities include the **585 MW Virginia City Hybrid Energy Center** proposed in Wise County, designed to co-fire as much as 20 percent from biomass.

In February 2011, **Gamesa Technology Corporation**, a global wind energy leader, and the shipbuilding operations of **Northrop Grumman Corp.**, America's largest shipbuilder, launched the Offshore Wind Technology Center in Chesapeake, Virginia, to jointly develop the next generation of offshore wind systems that will be deployed in the United States and around the world. As Governor Bob McDonnell noted, "Virginia is pleased to be the nexus where two industry leaders will join forces in the name of offshore wind innovation." Plans call for the development of North America's first offshore wind turbines by late 2012.

In February 2011, the federal government announced it will spend more than \$50.5 million over



An example of the wind turbines produced by Gamesa Technology Corporation. Photo courtesy of flickr user Scottish Government via Creative Commons License.

five years on wind energy projects off the coasts of Virginia, Maryland and New Jersey. While up to \$25 million will be used to develop wind turbine design tools and hardware, up to \$18 million will be used for reports and environmental research to identify environmental risk reduction, economic analysis and other studies. An important added benefit to Virginia would be additional traffic at the Port of Virginia. Port officials noted that once construction related to the wind energy projects begin 20 miles off the shore of Virginia Beach, much of the equipment needed for construction, such as turbines and blades, likely will pass through the Port.

Versar Inc., headquartered in Springfield, Virginia, announced in February 2011 that it had completed its solar energy project at the United States courthouse in Richmond. Versar provided the design and installation of a 115 kW DC photovoltaic roof system. The installed photovoltaic system, which converts solar energy into electricity, is a 500-solar panel system spanning 21,000 square feet and covering a substantial portion of the roof. The solar panel system will help the Courthouse reduce its fossil fuel energy consumption and carbon dioxide emissions.



West Virginia

» Renewable Energy Programs

» Legislative Initiatives

» Economic Impact

» Company Profiles

In 2007, the West Virginia Division of Energy (WVDOE) developed a plan to increase energy resources and advance economic development. In that vein, *West Virginia Energy Opportunities: A Blueprint for the Future* reviews resources and outlines goals relating to fossil energy, renewable energy and energy efficiency. The plan considers resources identified in 2006, when WVDOE commissioned Marshall University to conduct a study of West Virginia's innovative energy opportunities. That study identified the relevance of advancing renewable energy in tandem with fossil and energy efficiency initiatives.

An energy leader for the nation, West Virginia ranks behind only Pennsylvania as a net electricity provider for the grid. West Virginia consumes one-third of the electricity and less than one-half of the natural gas produced within its borders. The state provides 14,000 MW of coal-based electricity and has 1,000 MW of renewable and alternate energy production sources included in other states' electric portfolios. An established goal for WVDOE, via the state's performance-based budgeting, is diversification of the energy portfolio while expanding energy exports. WVDOE is committed to developing all of West Virginia's cost-competitive energy resources.

Highlights from a 2009 report from the National Renewable Energy Laboratory, *State of the States 2009: Renewable Energy Development and the Role of Policy* provided the following national rankings:

- » Growth in total renewable electricity generation, 2001-2007, ranked West Virginia 13th;
- » Growth in renewable electricity generation per capita, 2001-2007, ranked West Virginia 11th;
- » Growth in non-hydroelectric renewable electricity generation, 2001-2007, ranked West Virginia 9th;
- » Growth in hydroelectric generation, 2001-2007, ranked West Virginia 8th;
- » Growth in wind electricity generation, 2001-2007, ranked West Virginia 10th.

The state's initial entry into renewable energy development focused on biomass energy, which it has actively promoted for more than 20 years. West Virginia partnered with the Southeastern Regional Biomass Energy Program on numerous state initiatives. As the second most forested state in the contiguous 48 states, West

Virginia has many opportunities for wood fuel applications. Like several other Southern states, West Virginia also partnered with the Southern Solar Energy Center in Atlanta during the Carter Administration. That relationship provided the state's first opportunity to deploy and market solar thermal technologies.

West Virginia's current focus is on cost-competitive energy resources. The development status of the identified resources is as follows:

- » Hydro: West Virginia currently has 310 MW of hydroelectric generation in place with an additional 261 MW being sought through the Federal Energy Regulatory Commission permitting process. Long-term hydro opportunities such as Sutton Lake, Glen Ferris and Jennings Randolph Lake are being advanced as hydroelectric sites. Additionally, low-head sites in eastern West Virginia also are being developed.
- » Solar: West Virginia recently has funded five solar projects through the ARRA. These include a county courthouse (20 kW), two city halls (19 kW and 4 kW), a municipal water treatment facility (19 kW), a grade school in Marshall County and the state Department of Environmental Resources Headquarters. A sixth project involves the installation of solar panels on a school constructed on a surface-mined site.
- » Wind: National Renewable Energy Laboratory wind mapping identified 3,800 MW of wind capacity outside of state and federal parks in West Virginia. The state has 581 MW of wind in operation: 66 MW in Tucker County, 101 MW in Greenbrier County, 264 MW in Grant County and 150 MW in Randolph/Barbour Counties. An additional 345 MW are permitted but have not been constructed. Additional projects have yet to seek state approval. WVDOE administers the West Virginia Wind Working Group, meeting annually with wind developers to understand their development plans while ensuring the state permitting process as administered by the West Virginia Public Service Commission is understood. West Virginia has extended favorable treatment to wind developers on property and business and occupation taxes.

- » Biomass: West Virginia has advanced and supported several utility-scale coal/wood co-firing, wood-fired combined heat and power applications, wood residue use in kilns and grid-scale wood-to-electric projects. WVDOE supports an annual survey of wood residue: chip, sawdust and bark from wood processing operations and slash (limbs and tops) from wood harvesting operations. The survey reflects roughly 300,000 tons of residue and 3 million tons of slash available annually. WVDOE routinely provides, upon request, residue availability studies for 50- and 100-mile distances from proposed sites of wood-using facilities. For each MW of capacity, 10,000 tons of wood for wood-powered electric plants needs to be identified. A wood-fired power plant would require volumes consistent with the wood required to supply an oriented strand-board plant. In addition to residue, small round wood also is considered a wood energy input. WVDOE is partnering with the state's chemical industry to support a bio-based chemical feedstock. Two-acre test plots of *Arundo Donax* will be planted on a surface-mined site administered by the West Virginia Department of Environmental Protection. If the test proves successful, surface-mined properties could be used for growing this chemical sector input. WVDOE also established a West Virginia Wood Working Group representing industry and academic interests in advancing biomass as energy with their first meeting held in fall 2010. This group includes representatives from hard wood processors, the pulp and paper industry, land-owner groups, governmental entities, the environmental community and academia.
- » Hydrogen: Charleston, West Virginia, is the country's only state capital served by a hydrogen fueling station. The station at Charleston's Yeager Airport was installed in 2009 in partnership with the National Energy Technology Laboratory located in Morgantown, West Virginia. The project is demonstrating the cost-effectiveness of hydrogen produced by coal-based electricity as compared to gasoline. The project was successfully initiated through the support of the West Virginia Hydrogen Working Group. Actively participating in the group were the Kanawha County Commission, West Virginia Air National Guard, WVDOE, West Virginia Development Office, West Virginia University and local business interests.
- » Geothermal: In a nationwide study, West Virginia was identified as having the most sig-

nificant geothermal resources in the Eastern United States. WVDOE has initiated a geothermal resource identification study using the expertise of the West Virginia Geological and Economic Survey and Marshall University's Center for Business and Economic Research. Determining project criteria necessary for cost-effective geothermal investment and specific locations suitable for geothermal development are the goals of the study.

In 2009, then Governor Joe Manchin sponsored, and the Legislature adopted, an Alternative and Renewable Energy Portfolio bill. This legislation calls for state electric utilities to produce 25 percent of their electricity from alternative and renewable energy resources by 2025. Alternative resources include advanced and ultra-super critical coal plants, circulating fluidized bed power plants (waste coal) and carbon sequestration. Renewable energy resources include wind, hydro, solar, biomass and energy efficiency. The interim goals are 10 percent by 2015 and 20 percent by 2020. A credit is given for each MWh of qualified generation. If the generation comes from a renewable source, it receives two credits for every MWh. If the generation comes from a renewable source located on a surface-mined site, three credits are given for every MWh. In the bill, "alternative energy" is generally defined as clean coal technologies. Other states have included non-renewable sources in their renewable portfolio standards in the past, but typically categorize them in different tiers.

In 2001, West Virginia enacted a corporate exemption for utility-scale wind projects to reduce business and occupations tax from 40 percent to 12 percent of generating capacity. Also in 2001, West Virginia enacted a property tax incentive for utility-scale wind projects to reduce the property tax basis to about 25 percent of assessed value, and enacted a \$2,000 residential solar tax credit.

Additionally, capital investment in wind power facilities could qualify for the Industrial Expansion and Revitalization Tax Credit. Specifically, if the project results in the creation of new permanent jobs paying an annual adjusted minimum salary equal to the average statewide non-farm payroll wage (\$35,985 in 2010 and \$36,895 in 2011) with health insurance benefits, the Economic Opportunity Tax Credit of \$3,000 per qualified new job applies. However, no one project may qualify for both the Industrial Expansion and Revitalization Tax Credit and the Economic Opportunity Tax Credit at the same time.

The West Virginia Economic Development Authority (WVEDA) is charged with developing and advancing the business prosperity and economic wel-



An example of a do-it-yourself backyard solar panel system, such as those constructed by PIMBY. Photo courtesy of flickr user Scott Rivera via Creative Commons License.

fare of the state by providing financial assistance in the form of loans and direct financing and operating leases to industrial development agencies and enterprises for the promotion and retention of new and existing commercial and industrial development. WVEDA is empowered to borrow money and issue bonds, notes, commercial paper and other debt instruments and to furnish money, credit or credit enhancement for the promotion of business development projects. Credit enhancement is available through WVEDA's loan guarantee programs. These were created to ensure payment or repayment of bonds and notes issued by WVEDA and certain other public bodies, or other types of debt instruments entered into by an enterprise or state public body with a financial institution. WVEDA loans are secured by deeds of trust on property, security interests in equipment, promissory notes and, in certain cases, supplemental collateral comprising letters of credit, lease assignments and/or personal guarantees.

West Virginia has provided a sales tax exemption on Energy Star™ products during selected times in 2008, 2009 and 2010. West Virginia's State Energy Efficient Appliance Rebate Program began June 17, 2010, and was funded through ARRA. Residents must replace an existing, less-efficient appliance to be eligible for the rebate under this program and purchase the approved appliance from a participating retailer (online purchases did not qualify). Appliances replaced before the program start date are not eligible. The rebate comes in the form of a prepaid Visa card. West Virginia's pro-

gram covered dishwashers, refrigerators, freezers, room air conditioners and washers.

According to the 2009 Pew Charitable Trust report, West Virginia is one of the few states where growth in total jobs outpaced growth in the clean energy economy between 1998 and 2007. (Total jobs grew less than 1 percent during that period, however.) Specifically, in 2007, there were 3,065 jobs in 332 companies related to renewable energy production. The state attracted nearly \$6 million in clean technology venture capital and registered 14 patents between 2006 and 2008. Given West Virginia's long history as a coal mining state, it was notable that in May 2009 the state's Department of Environmental Protection granted its first carbon dioxide sequestration permit to Appalachian Power Company.

COMPANY PROFILES

West Virginia is home to four wind farms: a 66 MW **Wind Energy Center** in Tucker County, 64 MW **NedPower** project in Grant County, 100 MW **Beech Ridge** project in Greenbrier County and 150 MW project in Randolph/Barbour Counties. An additional 495 MW of wind electrical generation capacity has been permitted and is under development in West Virginia. A report by the American Wind Energy Association ranked West Virginia 19th in the country in terms of states with the highest capacity for wind energy.

Power In My Back Yard (PIMBY), a Tucker County-based business, offers site assessment as well as installation of wind turbines and solar power. "In addition to saving money, renewable energy creates job opportunities," says Matt Sherald, owner of PIMBY. PIMBY was inspired by the state's first large utility-scale wind farm that went up near the Sherald home in Thomas, West Virginia, a few years ago. "The wind farm had just gone in, and I was hearing a lot of people vocalize this desire to have a wind turbine like they were seeing out on the ridge, but a scaled-down model for their own houses," observed the new entrepreneur.

Wyoming County Schools has been recognized as an Energy Star™ Leaders Top Performer for achieving an average portfolio rating of 87. "We have eight out of 10 of the Energy Star™ schools in West Virginia", said Terry Tilley, Wyoming County Schools energy manager. "Five more schools in the county are awaiting audits".

Conclusion

Southern states are seeing a renewed interest in alternative forms of energy for a variety of reasons, including job creation, environmental concerns and public health factors. In addition to strengthening economies and preserving the environment, renewable fuels have the long-term potential to lead to greater energy independence for the United States, as well as produce lower utility rates for consumers.

The United States, the single largest consumer of energy in the world, relies heavily on foreign sources to meet its ever-increasing energy demands, using twice the amount of energy that it produces. Developing policies that promote the production and use of renewable energy sources can help alleviate dependence on foreign sources of energy, while stimulating economic growth and job creation. Since renewable energy is almost always domestic, and generally local, developing clean energy can play a significant role in jump-starting slouching economies. Promoting such policies also can help bring about substantial environmental and public health benefits for Southern states, including cleaner air through the reduction of greenhouse gas emissions that can cause serious health risks.

On the economic front, for Southern states to reap the potential benefits of a thriving commercial market in the renewable energy sector, this strategy must emerge as a driving priority in the future. As the nation, and particularly many parts of the South, struggles to emerge from the rigors of the Great Recession, the potential for rejuvenating the national, regional and state economies by focusing on the renewable energy sector continues to be a viable strategy pursued by every level of government. An added benefit of fostering the economic fortunes of the renewable energy sector involves promoting the nation's enfeebled manufacturing sector and catapulting this sector to become a vibrant part of the economy.

In fact, the presence of a number of impressive renewable energy projects has proven to be a major boost to the economic fortunes of several SLC states. For instance, Norcross, Georgia-based Suniva Inc., a manufacturer of high value crystalline silicon solar cells, announced contracts of over \$1 billion to ship its proprietary solar cells to solar module manufacturers around the world; in Kentucky, the Kentucky-Argonne National Battery Manufacturing Research

and Development Center will develop and adopt a domestic supply of advanced battery technologies for vehicle applications; in Mississippi, KiOR, a biofuels company, will be investing more than \$500 million and committing to create at least 1,000 direct and indirect jobs deploying Mississippi's abundant, renewable natural resources to create a high quality crude oil substitute; in South Carolina, GE Energy's Greenville facility has grown into the world's largest and most technologically advanced wind turbine design and production site, employing more than 3,000 workers in various disciplines, including manufacturing, product design, development, and testing; the South Carolina Hydrogen and Fuel Cell Alliance, a public-private collaboration for the cooperative and coordinated utilization of resources in the state, seeks to advance the commercialization of hydrogen and fuel cell technologies. Encouraged by this effort, Trulite, a company building hydrogen fuel cell generators and hydrogen fuel canisters for commercial uses, announced plans to locate its manufacturing and headquarter operations in Columbia; in Tennessee, which has quickly emerged as a hotbed for a number of solar-related operations, Hemlock Semiconductor, Wacker Chemie and Confluence Solar have made billions of dollars in investments and the promise of several thousand jobs; and, finally, in Texas, which remains the nation's leader in wind power generation, a fact reinforced by E.ON Climate & Renewables' (EC&R) announcement that one of the world's largest wind farms began operating in the area surrounding Roscoe, Texas, a project with an investment of over \$1 billion dollars, 500 workers and the capacity to power 230,000 residences.

Earlier sections of this report highlighted America's receding importance as a manufacturing powerhouse, a trend in progress for a number of decades now, and the fact that a true renaissance in the nation's economic fortunes have to involve a revival in this critical sector.

Examples from the renewable energy sector in a number of Southern states offer promise that this renaissance might be in place, though a clear American dominance in this sector in the global marketplace remains unlikely. Nevertheless, there are positive pieces of information documenting that this transformation may be in progress.⁷⁰ Given the Obama Administration's decision to work toward doubling America's exports by 2015, the news in June 2011 that Boeing's Long Beach, California, facility will manufacture \$4 billion worth of C-17 cargo planes for the Indian government is extremely positive.⁷¹ Similarly, the May 2011 report released by the Boston Consulting Group predicts that, within the next five years, the United States is expected to experience a manufacturing revival as the wage gap with China shrinks. In fact, this report documents that a number of U.S.-based companies (Caterpillar, NCR Corporation, Wham-O Inc.) already have begun rethinking their production locations and supply chains for goods destined to be sold in America.⁷²

The environmental benefits from a greater shift to renewable energy could produce healthier populations during a time when healthcare costs are exorbitant. Due largely to increasing reliance on renewable fuels, as well as the slowing of energy consumption growth, the U.S. Energy Information Administration projects a slowing in the growth of CO₂ emissions in the next 25 years. On average, although energy growth is expected to increase approximately 0.5 percent every year between now and 2035, CO₂ emissions, which emanate mainly from the electric power generation and transportation sectors, are expected to grow on average by 0.3 percent every year, or a total of 9 percent, during the same period, reflecting a significant impact of the renewable fuels on the environment in general, and air quality in particular.⁷³

During the last few years, U.S. energy markets have reflected the impacts of the economic downturn. Total electricity generation fell by about 1 percent in 2008, and by another 3 percent in 2009, the first time in at least 60 years that electricity use fell in two consecutive years. Correspondingly, energy consumption is expected to increase in the United States by as much as 14 percent from 2008 to 2035.⁷⁴ In addition, between 2010 and 2030, energy consumption is expected to increase in the Southern region by 16 percent.⁷⁵ Renewable fuels can play a vital role in expanding the available domestic energy resources needed to fulfill current and future demand.

There are a number of policies that states can employ to help expand renewable energy development and production, such as employing a renewable portfolio standard (RPS) or defining energy efficiency as a form of clean energy. Four Southern states already

have some form of an RPS, which is perhaps the most direct avenue for promoting renewable energy. Although expanded consumption of renewable fuels largely is the result of federal and state initiatives to encourage use, including the federal renewable fuels standard, state RPS initiatives have proven to expand renewable energy development.

Although fossil fuels continue to provide most of the energy consumed in the United States, rising fuel costs have spurred growth in a movement toward renewable fuels. Over the next 25 years, it is projected that the share of overall energy from fossil sources will fall from 84 percent in 2008, to approximately 78 percent in 2035.⁷⁶ Also, many states are examining the benefits of defining energy efficiency as a form of clean energy or establishing renewable energy credits and markets in which these credits can be traded.

Financial incentives are a major inducement for renewable energy development. Since perhaps the most limiting challenge associated with renewable energy development and production is cost, there is legitimate concern that renewable energy can lead to increased energy costs for ratepayers. However, much of the cost for renewable fuels often is associated with start-up. For instance, approximately 75 percent of the installed cost of a wind plant is in purchasing wind turbines and as much as 64 percent of the cost of solar photovoltaics is related to the cost of the modules and the inverter, according to the National Renewable Energy Laboratories.⁷⁷ Also, new innovations are making renewable energy more competitive. Locating manufacturing jobs in the United States is imperative to furthering this trend. Very basically, as the costs of renewable energy components continue to decline, so will the cost of energy produced from these resources. In addition, states can play a major role in attracting researchers currently developing the new and groundbreaking innovations that will make renewable energy competitive and a source of affordable energy for consumers.

Large scale renewable energy projects often get a great deal of attention, but the growing momentum of the numerous smaller projects in Southern states is receiving recognition as well. States continue to examine benefits, not simply for large renewable energy companies, but for small businesses, homeowners and others.

A collaborative effort by local, state and federal governments, utilities, businesses and individuals is imperative, as well as practical, in order to move the United States toward a greater reliance on renewable energy. Although there are a variety of challenges facing the increase of renewable energy, the prospect for long-term energy safety and reliability is an attainable goal, and one in which state lawmakers can play a major part.

Appendix A

Survey Questionnaire for Southern Legislative Conference Special Series Report – “Green Energy and the SLC States: Economic Development, Environmental Gains and Energy Security”

Name:

Title:

Agency Name:

State:

I. General

- a. Please describe your state’s renewable energy program.
- b. How long has your state focused on developing renewable energy as a mechanism to spur economic growth and create jobs?
- c. What specific areas within the renewable energy sector has your state focused on expanding? For instance, hydro, solar, wind, biomass, hydrogen, geothermal or other.
- d. How would you describe the economic goals and objectives of your state’s renewable energy program?

II. Legislative Initiatives

- a. Was your state’s effort to promote the renewable energy sector spurred by legislative statute?
- b. If so, please describe the key elements of this legislation, including the major bills involved.
- c. Please provide details on the financial incentives, if any, your state provides to either attract or retain corporations that focus on renewable energy projects.
- d. Does your state assist corporations in securing grants, loans and other financing mechanisms for renewable energy projects?
- e. Does your state offer financial assistance for energy efficiency projects at the residential level? What are some of the conditions or requirements for securing this assistance?
- f. Does your state offer financial assistance for energy efficiency projects at the commercial level? What are some of the conditions or requirements for securing this assistance?

III. Economic Impact

- a. Has your state carried out a statewide economic impact study of renewable energy investments? If yes, please provide us with a copy of this report.
- b. If your state has not carried out a statewide economic impact study, please provide us with the latest estimates of the following:
 - 1) Jobs, direct, indirect and induced (please include year) related to the renewable energy sector in your state;
 - 2) Estimate of the number of companies directly and indirectly involved in the renewable and alternate energy fields in your state;
 - 3) Estimate of the venture capital funds that have flowed to your state to finance and promote renewable energy projects in your state in the last five years; and
 - 4) The number of patents that have been registered from your state focusing on renewable energy activities in the last five years.

IV. Corporate Profiles

- a. Please provide a brief snapshot or profile of up to five corporations in your state that are prominent players in renewable energy projects that you would like us to highlight in this SLC report. Please feel free to include any images that you feel would best represent the work of this company in your state.

V. Other

- a. Please provide any other information you deem relevant and crucial in highlighting the importance of the renewable energy program or projects in your state.

Appendix B

Survey Questionnaire for Southern Legislative Conference Special Series Report – “Green Energy and the SLC States: Economic Development, Environmental Gains and Energy Security”

Name:
Title:
Agency Name:
State:

- I. General
 - a. Please describe your state’s renewable energy program(s).
 - b. When did your state begin focusing on developing renewable energy as a mechanism to encourage conservation and energy efficiency?
 - c. What specific areas within the renewable energy sector has your state focused on expanding (e.g., hydroelectricity, solar, wind, biomass, hydrogen, geothermal)?
 - d. How would you describe the energy and/or environmental goals and objectives of your state’s renewable energy program(s)?
- II. Legislative Initiatives
 - a. If your state’s effort to promote renewable energy was spurred by legislative statute, please describe the key elements of this legislation, including the major bills involved.
 - b. Please provide details on the financial incentives your state provides to either attract or retain commercial projects that focus on renewable energy.
 - c. Does your state offer financial assistance for energy efficiency projects at the residential level? What are some of the conditions or requirements for securing this assistance?
- III. Energy and Environmental Impacts
 - a. In what ways has your state assessed the impact of specific renewable energy projects? For instance, has your state carried out environmental impact studies or energy efficiency studies related to incentives for renewable energy projects? If so, please provide copies of these studies.
 - b. Please provide the following specific information:
 - 1) Approximate number of projects involved in renewable and alternative energy fields in your state.
 - 2) A brief snapshot or profile of major renewable projects in the state, along with the approximate energy efficiency and environmental impacts of these projects.
 - 3) Specific information regarding how these projects have contributed to environmental integrity in your state.
 - 4) Specific information regarding how these projects have contributed to energy savings and/or to what extent these projects have supplemented less clean energy sources in your state (i.e., percentage of electricity generated in the state the comes from renewable sources of energy)?
- IV. Training/Education
 - a. Please provide information regarding any workforce training programs for renewable energy projects (e.g., manufacturing photovoltaic cells; wind turbine maintenance; etc.), including vocational programs and degree programs offered at universities, colleges, or other institutes of higher learning in your state.
- V. Other
 - a. Please provide any other information you deem relevant and crucial in highlighting the importance of the renewable energy program or individual projects in your state.

Endnotes

1. 49 of the 50 states have at least a limited statutory or constitutional requirement of a balanced budget. See "State Balanced Budget Requirements: Provisions and Practice," Ronald K. Snell, 1996; updated 2004, National Conference of State Legislatures (NCSL), <http://www.ncsl.org/?TabId=1265>.
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16. "Solar Panel Maker Moves Work to China," *The New York Times*, January 14, 2011.
17. Full-time equivalent employees equal the number of employees on full-time schedules plus the number of employees on part-time schedules converted to a full-time basis. The number of full-time equivalent employees in each industry is the product of the total number of employees and the ratio of average weekly hours per employee for all employees to the average weekly hours per employee on full-time schedules. It is also important to note that FTE tables are an aggregate of data (four tables) based on four different classification systems used by the Bureau of Economic Analysis. The systems are:
1998-2009: 2002 North American Industry Classification System (NAICS)
1987-1997: 1987 Standard Industrial Classification (SIC)
1948-1986: 1972 Standard Industrial Classification (SIC)
1929-1947: 1942 Standard Industrial Classification (SIC)
18. <http://moneywatch.bnet.com/economic-news/blog/macro-view/manufacturing-surprise-the-us-still-leads-in-making-things/2134/>
19. Unfortunately, the declining importance of the goods or manufacturing sector has enormous negative implications for state finances since state sales taxes, devised over 70 years ago, rely disproportionately on the goods or manufacturing sector. States sales taxes were introduced at a time when the goods/manufacturing sector dominated the economy and economic activity. Given that this sector now is responsible for an increasingly smaller share of economic activity, states face the structural challenge of collecting sales tax revenues from a sector that has shrunk significantly. For more details on this development, see <http://www.slcatlanta.org/Publications/FAGO/FDIC2010.pdf>.
20. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/peri_report.pdf
21. Unless otherwise specified, this section of this report draws on *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America*, The Pew Charitable Trusts, June 2009, http://www.pewcenteronthestates.org/uploadedfiles/clean_economy_report_web.pdf
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23. Unless otherwise specified, this section of the report citing information from *Clean Tech Job Trends 2010* is extracted from Pernick, Ron, Wilder, Clint and Winnie, Trevor, *Clean Tech Job Trends 2010*, Clean Edge Inc. in partnership with SJF Institute, October 2010.
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 - Net metering: <http://www.legis.state.la.us/lss/lss.asp?doc=208140>
 - Tax credit for solar and wind energy systems on residential property: <http://www.legis.state.la.us/lss/lss.asp?doc=453218>
 - Property tax exemption for solar energy systems: <http://www.legis.state.la.us/lss/lss.asp?doc=101337>
 - Tax credit for conversion of vehicles to alternative fuel usage: <http://www.legis.state.la.us/lss/lss.asp?doc=672160>
 - Alternative fuel vehicle revolving loan fund: <http://www.legis.state.la.us/lss/lss.asp?doc=727493>
 - Energy standards for state buildings: <http://ssl.csg.org/dockets/2010cycle/30B/30Bbills/0330b06laenergypublicfacilities.pdf> and <http://www.gov.state.la.us/assets/docs/OfficialDocuments/2008EOGreenGovernment.pdf>
 - Sustainable energy financing districts: <http://www.legis.state.la.us/lss/lss.asp?doc=670836>
57. Mississippi's response to the SLC survey included further details on incentives packages available to companies moving to or expanding in the state but, given the length of the document, it is not included here. A copy of the financing programs offered may be viewed at www.mississippi.org or by emailing financial@mississippi.org.
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62. <http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+45.1-392>
63. <http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+30-312>
64. <http://leg1.state.va.us/cgi-bin/legp504.exe?101+ful+CHAP0134>
65. <http://leg1.state.va.us/cgi-bin/legp504.exe?101+ful+CHAP0846>
66. <http://leg1.state.va.us/cgi-bin/legp504.exe?101+ful+CHAP0850>
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Recognitions

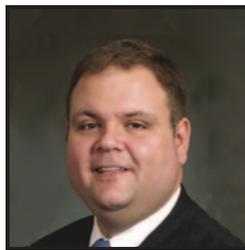
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