



# Arkansas Clean Technology Primer

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*“A focus on **clean technology** can be an opportunity for Arkansas to create jobs, improve global competitiveness, keep energy dollars in the state and strengthen rural communities.”*



## Introduction

These are challenging economic times. Job losses over the last three years due to the Great Recession have driven states across the country to evaluate their strengths and assets in emerging industry sectors. One growing opportunity is in the clean technology sector.

Between 2008 and 2010, the United States lost 7 million jobs, or 5.1 percent of all jobs.<sup>1</sup> Nearly 2 million of these jobs were in the manufacturing sector and 1.2 million in construction. In Arkansas, nearly 40,000 jobs, 3.3 percent of all jobs, disappeared between 2008 and 2010.<sup>2</sup> The majority of these job losses also came from the manufacturing (23,600) and construction (7,700) sectors.

Rural communities across the country have been particularly hard hit, struggling to offset job losses in both the manufacturing and agricultural sectors. In 2010, rural communities in Arkansas had a poverty rate of 21 percent compared to 17 percent in urban areas.<sup>3</sup> This poverty rate is nearly five percentage points higher than the national rate of 16.5 percent.<sup>4</sup>

In board rooms, living rooms and government committee offices, people are looking for opportunities. There are no quick solutions or easy answers to the most obvious question, “Where will the new jobs come from?”

States need to identify opportunities where competitive advantages exist and where jobs

can be created. No one cluster can provide economic security to any state, and today’s dynamic economic transition requires new thinking around what is commonly referred to as a “new economic normal.” A comprehensive economic development approach that recognizes strengths, anticipates future opportunities and uses every means available to nurture jobs is the best strategy in uncertain times.

For this primer, the clean technology economy is defined as the creation, implementation and distribution of technologies related to diversifying energy sources, mitigating pollution and reducing greenhouse gas emissions. This is a diverse industry, ranging from scientists who develop better biofuels to manufacturers producing wind turbines to technicians installing energy efficient heating and cooling equipment.

A focus on clean technology can be an opportunity for Arkansas to create jobs, improve global competitiveness, keep energy dollars in the state and strengthen rural communities. This conclusion is based on four facts: 1) global energy demand is rising; 2) business leaders cite energy availability and costs as a core competitive factor; 3) Arkansas is a net energy importer; and 4) clean tech investments can and do occur in rural locations.

While the Great Recession brought a systemic dip in global energy demand, the U.S. Energy

Information Administration (EIA) estimates that global energy demand will increase by nearly 50 percent between 2007 and 2035, increasing demand for resources such as coal and oil.<sup>5</sup> For example, China's demand for coal is expected to increase by 2.4 percent annually over the next 25 years.<sup>6</sup> This increase in demand, as well as increased capital investments to mine hard-to-reach reserves, is likely to increase the price of energy for Arkansans.

A survey of global manufacturing leaders identified energy costs and policies as one of the three foundations of global manufacturing competitiveness.<sup>7</sup> According to the Council on Competitiveness, "As energy becomes scarce and countries compete to attain energy security and independence, the cost competitiveness of energy, and particularly country-specific clean and sustainable energy leadership, will be a prominent component of country manufacturing competitiveness." For Arkansas's manufacturers to stay competitive they will need to find ways of continuing to reduce their energy costs through energy efficient technologies.

**Table 1**  
Flow of Arkansas Energy Dollars (in Millions)

Natural Gas	+1,500
Coal	-418
Gasoline	-2,100
<b>Net Gain/Loss</b>	<b>-1,018</b>

Each year, more than \$1 billion leaves Arkansas's economy to purchase energy resources (Table 1). While the state is a net exporter of natural gas, Arkansas is a net importer of coal and gasoline. Developing and implementing new technologies that allow commercial and residential consumers to use

less energy or to consume energy from local resources keeps energy dollars from leaving the Arkansas economy.

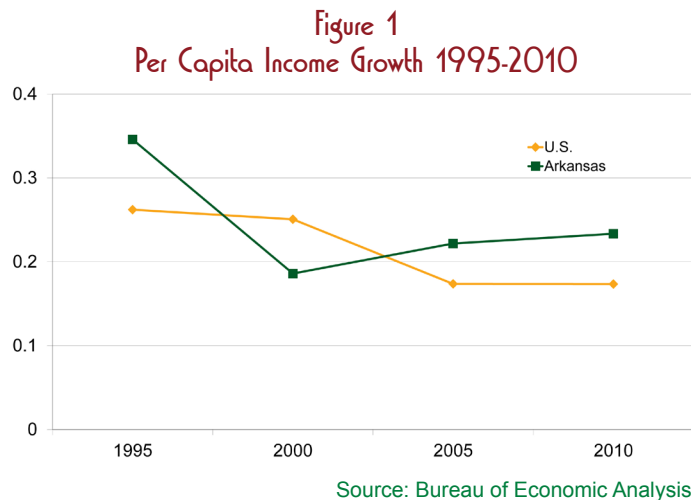
The clean technology economy has the potential to strengthen rural communities through jobs and wealth creation. This comes in the form of new markets for agricultural and forest resources, such as producing feedstocks for biopower and biofuel facilities. Rural areas can benefit from manufacturing these new products in biorefineries, where being near the biomass feedstock is important. In addition, new manufacturing opportunities in other clean technology sectors, such as wind and solar, may also bring jobs to rural communities.

The *Arkansas Clean Technology Primer* provides an overview of the current economic conditions in Arkansas and an overview of the clean technology activity in the areas of companies, research, workforce development and investment. This primer focuses on the clean technology assets already in place and how to build and support those assets to grow an industry that creates jobs and wealth for the state.

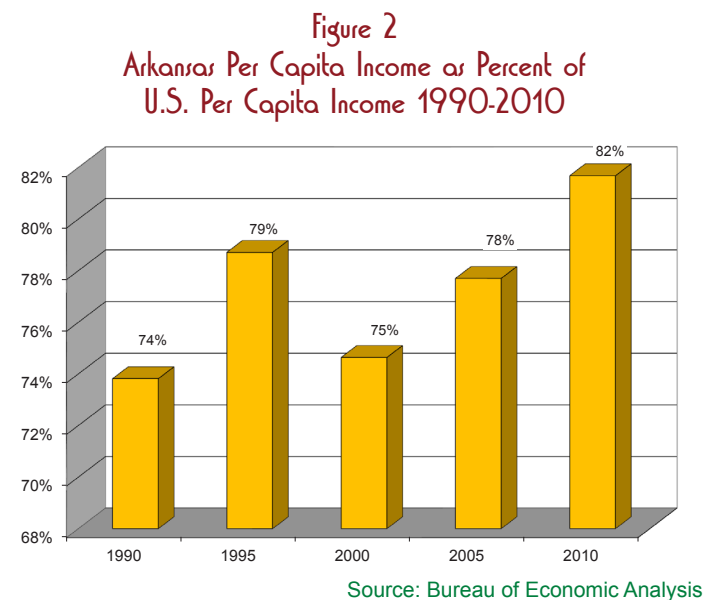
## Economic Overview

To understand why developing the clean technology economy to create jobs and wealth is important for Arkansas, this section provides an overview of recent economic trends. In 2009, Governor Mike Beebe made a goal for Arkansas to "increase the incomes of Arkansans at a growth pace greater than the national average."<sup>8</sup> This goal continues a trend for Arkansas. From 2005 to 2010, Arkansas's total per capita income increased by 23 percent, compared to the 17 percent increase that

occurred nationally (Figure 1).<sup>9</sup> Even during the difficult economic environment of 2009-2010, Arkansas's per capita income increased faster than the nation's, with a 3.5 percent increase compared to the nation's 3 percent increase.



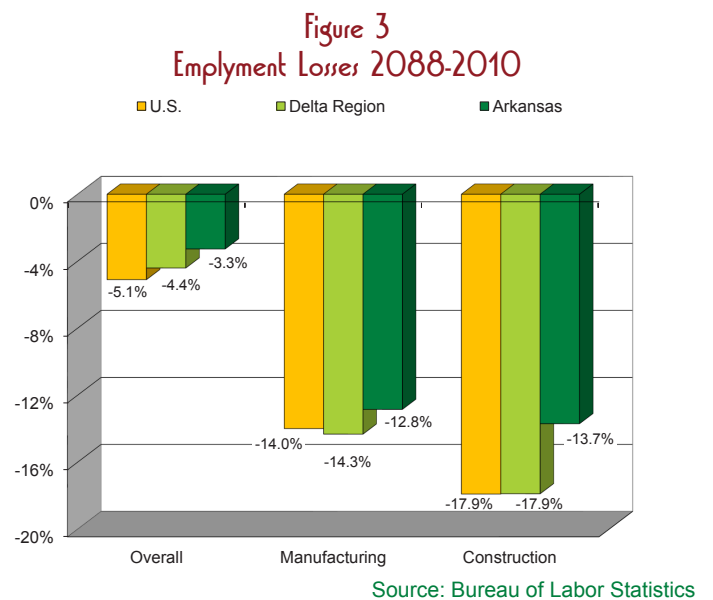
Given the fast rate of per capita income growth, Arkansas has gained ground in attaining 100 percent of the U.S. per capita income (Figure 2). Between 2006 and 2010, Arkansas went from 48th in per capita income in the country to



46th.<sup>10</sup> In 2010, Arkansas's per capita income was \$31,350, 82 percent of the U.S per capita income.

While Arkansas has seen gains in per capita income, between 2008 and 2011 Arkansas lost 39,300, or 3.3 percent, of total jobs.<sup>11</sup> Of the jobs lost, 23,600, or 60 percent, came from the manufacturing sector and 7,700, or 20 percent, came from the construction sector.

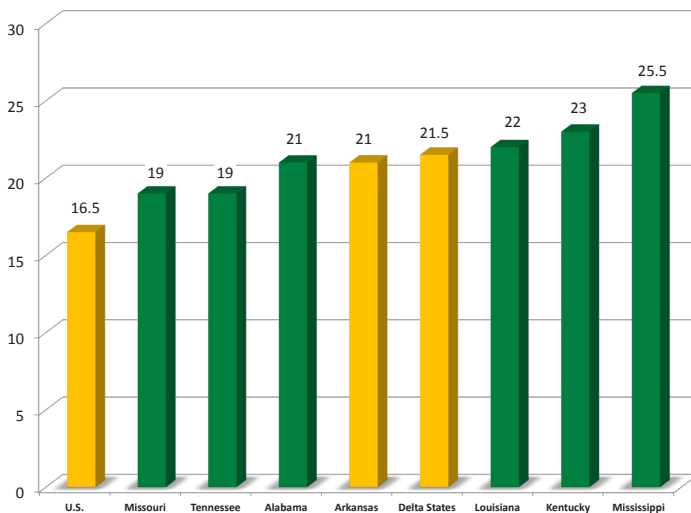
Arkansas fared better than both the nation and the Delta region,<sup>12</sup> which lost 5.1 and 4.4 percent of total jobs, respectively (Figure 3). Arkansas's better-than-average performance through the Great Recession and into the recovery has been attributed largely to the state's relatively low foreclosure rates in both the prime and subprime markets.<sup>13</sup> As of August 2010, the state had the 8th lowest prime mortgage foreclosure rate (1.3 percent) and the 3rd lowest subprime mortgage foreclosure rate (5.4 percent) in the country. The U.S. prime foreclosure rate was 2.9 percent and its subprime foreclosure rate was 12.8 percent.<sup>14</sup>



A lot of this is good news: increasing per capita incomes, relatively fewer job losses than many states and relatively low home foreclosure rates. Yet, there is still work to be done. Arkansas's June 2011 unemployment rate of 8.2 percent was the highest it's been in the last four years.<sup>15</sup> While per capita incomes are growing, they are still 20 percent lower than the national average.

In addition, poverty levels in Arkansas's rural areas are particularly high. In 2010, Arkansas's rural poverty rate was 21 percent.<sup>16</sup> This is four points higher than the urban poverty rate of 17 percent. Arkansas's rural poverty rate is also higher than the rest of the nation (16.5 percent) and half of the other Delta states (Figure 4).<sup>17</sup>

**Figure 4**  
Rural Poverty Rates 2010



Source: U.S. Department of Agriculture

Without the drag of the housing crisis, Arkansas is poised to make real economic gains as the economy recovers. However, this transition will occur as new pressures mount for businesses to limit environmental degradation and greenhouse gas emissions. Further, they will occur as emerging economies expand and compete

for the natural resources that have provided American businesses with inexpensive power and raw materials to produce value added goods. These dynamics make it especially important that Arkansas consider how it can position itself to be an economic leader given these changing conditions and growing environmental constraints. The next section analyzes the state's production, consumption and costs of energy to further explore the role energy plays in Arkansas's economy.

## Energy Overview

Energy is the lifeblood of any thriving economy. It fuels manufacturing, technology, communications and transportation. Clean technology plays two roles in the Arkansas economy. First, by creating and implementing measures that reduce or more efficiently use energy, manufacturers become more competitive in national and global markets with reductions in energy expenditures. Second, by creating, producing and implementing new technologies that produce energy, replace fossil fuels and improve other natural resources, such as air and water, Arkansas's businesses create new products and services that result in jobs in both urban and rural communities and keep more energy dollars in the state.

This section provides an overview of energy production, consumption, and expenditures in Arkansas.

### Electricity

In 2009, Arkansas generated more than 57 million MWh of electricity.<sup>18</sup> This is 23 percent more electricity than the 46.5 million MWh produced in 1999 (Figure 5). Of this 11 million MWh increase, 61 percent was generated by

natural gas, 21 percent by nuclear and 14 percent by hydroelectric sources. Overall, 44 percent of the state's electricity is produced by coal, 26 percent by nuclear, 20 percent by natural gas and 7 percent by hydroelectric.

### Renewable Electricity

Arkansas generates 5.8 million MWh, or 10 percent, of its electricity from renewable resources, while the United States produces 11 percent as a whole.<sup>19</sup> Compared to other Delta states, Arkansas is third in renewable energy production behind Tennessee (14 percent) and Alabama (11 percent).

Hydroelectric constitutes 73 percent of Arkansas's renewable generation and biomass 27 percent. The primary generation of biomass-fueled electricity comes from industrial combined heat and power (CHP) operations that

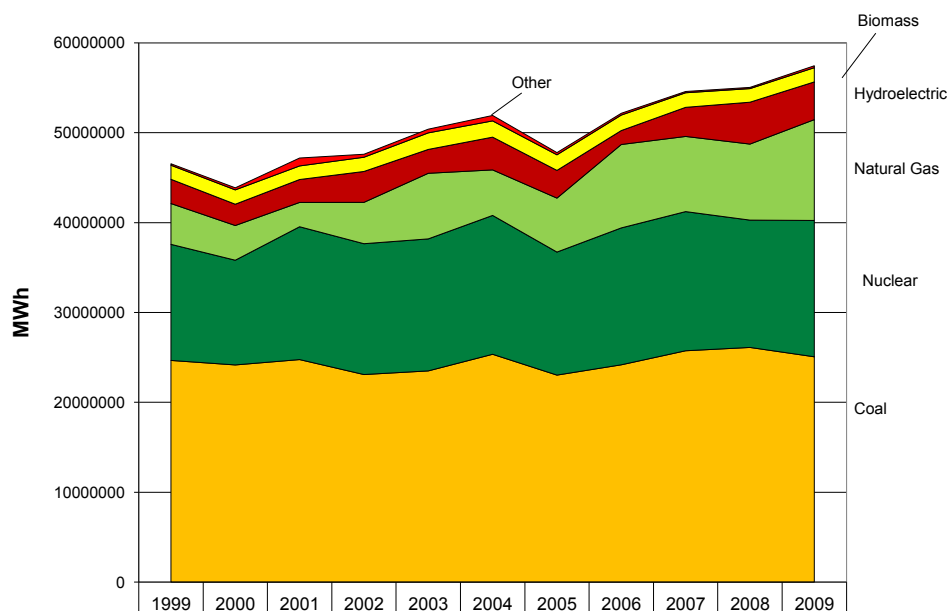
use woody biomass as the fuel source.

### Transportation Fuel

Arkansans consumed 34.8 million barrels of gasoline in 2009.<sup>20</sup> This is approximately 11.9 barrels per capita, which is slightly less than the Delta's 12.3 barrels per capita and more than the U.S. average of 10.5. Between 1999 and 2009, Arkansas increased its consumption of gasoline by three percent. This three percent is relatively low compared to the seven percent increase in consumption by the United States as a whole during the same time period.

Arkansans also went from consuming zero barrels of fuel ethanol in 1999 to consuming 1.7 million barrels in 2009.<sup>21</sup> This increase coincided with the implementation of the Federal Renewable Fuels Standard (RFS) and bans on methyl tert-butyl ether (MTBE) in 21 states. The

Figure 5: Arkansas Electricity Growth by Source 1999-2009



Source: Energy Information Administration

RFS legislation that passed in 2005 required 7.5 billion gallons of renewable fuel to be blended into gasoline by 2012. Lawmakers increased the RFS in 2007 to 36 billion gallons by 2022. At the same time, states were banning the use of MTBE, an additive to gasoline, to improve air quality found to pollute water supplies, leading oil companies to use ethanol instead.

Arkansas did not consume fuel ethanol between 1999 and 2004. It consumed a modest 28,000 barrels in 2005 when the RFS passed. Then, in 2008, the first full year that the RFS went into effect, the state consumed 664,000 barrels.

### Energy Expenditures

In 2009, Arkansans spent \$8.3 billion on energy, including electricity and transportation fuel.<sup>22</sup> This translates into \$2,837 per capita and 8 percent of gross state product, more than the average for U.S. states. Nationally, energy expenditures equal \$2,542 per capita and 6 percent of gross domestic product.

Arkansans spent \$3.2 billion for gasoline in 2009. Of the \$2,837 total energy per capita, \$1,084 (38 percent) was spent on gasoline. The nation averaged \$1,013 per capita, while the Delta region averaged \$1,134 (Figure 6).

### Flow of Energy Dollars

Just as important as the amount of dollars spent on energy is whether those dollars stay within Arkansas or leave for other states or countries. When analyzing the inflows and outflows of natural gas, coal and motor gasoline, \$1 billion leaves the state's economy each year to purchase energy resources.

Arkansas uses coal for 44 percent of its electricity production. All of this coal is imported

from the state of Wyoming, totaling \$418 million in exported energy dollars.

Arkansas is also a net importer of motor gasoline. Refineries in North Louisiana and Arkansas combined produce 11.9 thousand barrels a year of motor gasoline, while the state of Arkansas consumes 34.8 thousand barrels a year. This means that at least 66 percent (\$2.1 billion) of the state's motor gasoline expenditures leave the state.

Arkansas is a natural gas net exporter. The state exports 65 percent of the natural gas produced, totaling \$1.5 billion dollars of revenue for the state.

Currently, Arkansas does not produce any of the 1.7 million barrels of ethanol consumed each year.<sup>23</sup>

### Traditional Energy Jobs

In 2010, there were 7,297 jobs in the utility sector, representing less than one percent of all Arkansas jobs.<sup>24</sup> Of these jobs, 70 percent were related to power generation and supply and 19 percent to natural gas distribution. Though power generation and supply jobs actually decreased between 2001 and 2010, utility sector jobs overall increased by 6.6 percent due to the growing natural gas industry. Natural gas distribution jobs increased by 79 percent for a total of 1,371 jobs. In addition, oil and gas extraction jobs nearly tripled between 2001 and 2010, from 399 to 964 jobs.

As explored in the next section, the estimated number of renewable energy jobs is 1,350 and the estimated number of energy and resource efficiency jobs is 9,163.

## Clean Technology Economy

The clean technology economy includes the creation, implementation and distribution of technologies related to diversifying energy sources, pollution mitigation and reducing greenhouse gas emissions. This is a diverse industry ranging from scientists who develop better biofuels to manufacturers producing wind turbines to technicians installing energy efficient heating and cooling equipment. This section outlines the clean technology economy assets of the state, including jobs and companies.

### Clean Technology Jobs

Clean technology jobs are inherently difficult to count. First, there is no one universally accepted definition of what constitutes a clean technology job. Second, clean technology jobs are present across existing industries and supply chains. And third, there is no central data source to obtain clean technology job information. Given these limitations, there are a number of studies that can be used to estimate the number of clean technology jobs in Arkansas. Table 2 gives an overview of three different studies and their results for clean technology jobs in Arkansas.

**Table 2**  
*Clean Technology Job Estimates for Arkansas*

Study	Jobs	Data Date
Brookings Institution- All Sectors	32,450	2010
Brookings Institution- Renewable Energy & Energy Efficiency Sectors	10,513	2010
Pew Center on the States	4,597	2007
U.S. Conference of Mayors	3,738	2006

While these studies employed differing definitions and methodologies, there are a number of observations that can be made:

- The number of jobs in Arkansas's clean technology economy is growing faster than all jobs combined. The Brookings Institution data indicates that the clean technology economy grew by 16 percent between 2003 and 2010, while the Pew Center on the States found it grew by 7.8 percent between 1998 and 2007. Arkansas had an overall decline in jobs of two percent between 2001 and 2010.
- Manufacturing and bio-based products are two of the fastest-growing clean technology segments in Arkansas. According to Brookings, Arkansas ranked third in the growth of Green Consumer Products from 2003 to 2010, with a growth rate of 20 percent and accounting for more than 4,000 jobs. Brookings also ranked Arkansas seventh in the country for growth in the Sustainable Forestry Products segment and ninth in the country for growth in the Biofuels/Biomass segment. The Sustainable Forestry Products segment grew by six percent (937 jobs) and Biofuels/Biomass grew by 23 percent (329 jobs) between 2003 and 2010.
- Currently, a large number of clean technology jobs in Arkansas reside in areas related to waste management and recycling. In the Brookings and Pew reports, the categories consisting of waste management and recycling consisted of 30-60 percent of the clean technology jobs. Due to this segment's maturity, it is true in most states that the largest number of jobs falls in this category.

## Clean Technology Reports – Further Data

This section dives further into three clean technology jobs reports to learn more about Arkansas's clean technology sector. These reports are:

- *Sizing the Clean Economy*, The Brookings Institution
- *The Clean Energy Economy*, Pew Center on the States
- *U.S. Metro Economies: Current & Potential Green Jobs in the U.S. Economy*, U.S. Conference of Mayors

***Sizing the Clean Economy, The Brookings Institution.***<sup>25</sup> Of the three reports listed above, Brookings' *Sizing the Clean Economy* has the broadest definition of a clean technology job. The report defines a clean economy job as "the sector of the economy that produces goods and services with an environmental benefit."

Brookings estimates that there were 32,450 clean economy jobs in 2010 in Arkansas, which would account for 2.6 percent of all Arkansas jobs. This is the 11th highest concentration of clean technology jobs in the country. In addition, between 2003 and 2010, the number

of clean jobs increased by 4,530, or 2.2 percent annually.

As seen in Table 3, Brookings estimates that 43.3 percent of jobs in Arkansas's clean technology economy occur in the Greenhouse Gas Reduction, Environmental Management, and Recycling category. Within this category, the Green Consumer Products segment has the most jobs, at 5,719. These jobs can be found largely at L'Oreal USA in Little Rock. Other large segments in this category include Waste Management and Treatment (2,992), Recycled-Content Products (1,451), Nuclear Energy (1,186) and Green Building Materials (1,169).

The second largest clean technology category is Energy and Resource Efficiency, with 9,163 jobs. The segments with the most jobs in this category are HVAC and Building Control Systems (2,403), Energy-saving Consumer Products (2,033), and Energy-saving Building Materials (1,858).

The third largest clean technology category is Agricultural and Natural Resources Conservation, with 6,319 jobs. The subsectors in this category are Conservation (2,883), Sustainable Forestry Products (2,743), and

**Table 3: Brookings Jobs Estimates by Category**

Category	Number of Jobs	% of AR Clean Tech Industry	Degree of Specialization <sup>26</sup>
Greenhouse Gas Reduction, Environmental Management, and Recycling	14,048	43.3%	1.4
Energy and Resource Efficiency	9,163	28.2%	1.2
Agricultural and Natural Resources Conservation	6,319	19.5%	1.4
Education and Compliance	1,570	4.8%	1.2
Renewable Energy	1,350	4.2%	1.1
<b>All Categories/Total</b>	<b>32,450</b>	<b>100%</b>	<b>1.3</b>

Organic Food and Farming (693). Table 4 shows the fast-growing subsectors in all categories.

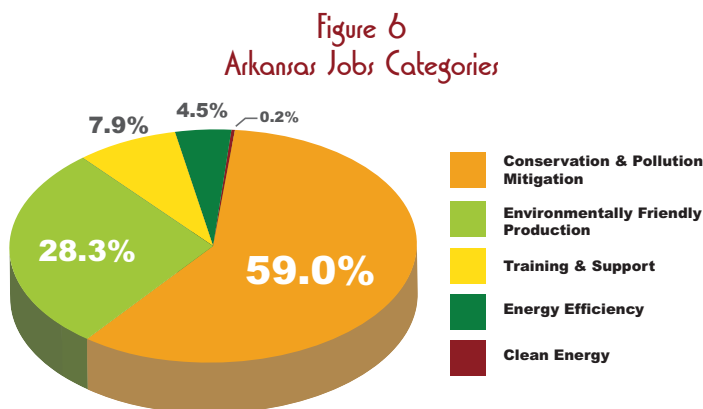
Other findings from the Brookings report include:

- Each clean economy job in Arkansas produces \$42,450 worth of exports on average. This is the 4th highest average export produced in the United States.
- The median wage for Arkansas’s clean economy jobs is \$32,116 compared to \$30,376 for all jobs.
- 73.7 percent of Arkansas’s clean economy jobs are “green collar,” meaning they fall within 20 percent of the national median wage of \$33,190 (\$26,552 to \$39,828).

*The Clean Energy Economy, Pew Center on the States.*<sup>27</sup> The Pew Center on the States study, *The Clean Energy Economy*, defined the clean technology economy as jobs, businesses and investments focused on “clean energy production, increasing energy efficiency, reducing greenhouse gas emissions, waste and pollution, and conserving water and other natural resources.” Information was gathered using venture capital data, the National

Establishment Time Series Database (NETS) and web searches.

Pew’s research identified 448 clean technology businesses and 4,597 jobs in Arkansas in 2007. Of these jobs, the majority were found in conservation and pollution mitigation (59 percent). This category includes natural resource management, pollution control and recycling operations. The second-largest category is environmentally friendly production (28.3 percent), which includes clean technology jobs that develop products in the areas of transportation, manufacturing, construction, agriculture, energy production and materials (Figure 6).



**Table 4: Fastest Growing Subsectors of Arkansas’ Clean Economy 2003-2010**

Segment	Jobs, 2010	Job Change 2003-2010	Annual Average Job Change 2003-2010 (%)
Wind	125	+125	N/A
Renewable Energy Services	35	+33	+50.5%
Regulation & Compliance	1,570	+1,215	+23.7%
Biofuels/Biomass	433	+329	+22.6%
Green Consumer Products	5,719	+4,113	+19.9%
Professional Environmental Services	369	+159	+8.4%

Table 5 illustrates how Arkansas fared in the Pew study relative to surrounding states. Compared to surrounding states, Arkansas's per capita jobs rate is relatively low. Tennessee, the top ranked state for jobs per capita in the region, had 50 percent more jobs per capita than Arkansas.

**Table 5**  
**Pew Clean Jobs Data - Jobs Per Capita**

	Clean Jobs 2007	Jobs Per Capita	Jobs Per Capita Rank
Tennessee	15,507	0.0024	1
Louisiana	10,641	0.0023	2
Kentucky	9,308	0.0021	3
Missouri	11,714	0.0020	4
Arkansas	4,597	0.0016	5
Oklahoma	5,465	0.0015	6
Mississippi	3,200	0.0011	7
U.S. Total	770,385	0.0025	

In terms of venture capital awarded to clean technology businesses, Arkansas has fared well compared to surrounding states. Arkansas received the second highest per capita venture capital dollars of the surrounding states, coming in second only to Mississippi (Table 6).

**Table 6**  
**Pew Clean Jobs Data - Venture Capital Per Capita**

	Venture Capital 2006-2008 (thousands)	VC Per Capita	VC Per Capita Rank
Mississippi	30,384	0.0102	1
Arkansas	22,845	0.0078	2
Missouri	24,480	0.0041	3
Tennessee	16,329	0.0026	4
Oklahoma	5,192	0.0014	5
Kentucky	0	0	6
Louisiana	0	0	6
U.S. Total	12,570,110	0.0402	

*U.S. Metro Economies: Current & Potential Green Jobs in the U.S. Economy, U.S. Conference of Mayors.*<sup>28</sup> The U.S. Conference of Mayors study, *U.S. Metro Economies: Current & Potential Green Jobs in the U.S. Economy*, defined clean technology as “any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuel, manufacturing jobs producing goods used in renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research, and consulting fields.” Data was gathered from the NETS database.

This report found that Arkansas had 3,738 jobs in eight metropolitan areas. The report also projected that, by 2038, the state would have nearly 30,000 clean technology jobs (Table 7).

**Table 7**  
**U.S. Conferences of Mayors**

Arkansas	2006	Projected to 2038
Fayetteville-Springdale-Rogers, AR-MO	247	1,956
Fort Smith, AR-OK	183	1,450
Hot Springs, AR	263	2,085
Jonesboro, AR	54	424
Little Rock-North Little Rock, AR	1,319	10,438
Memphis, TN-MS-AR	1,075	8,507
Pine Bluff, AR	37	291
Texarkana, TX-Texarkana, AR	560	4,430
Total	3,738	29,581

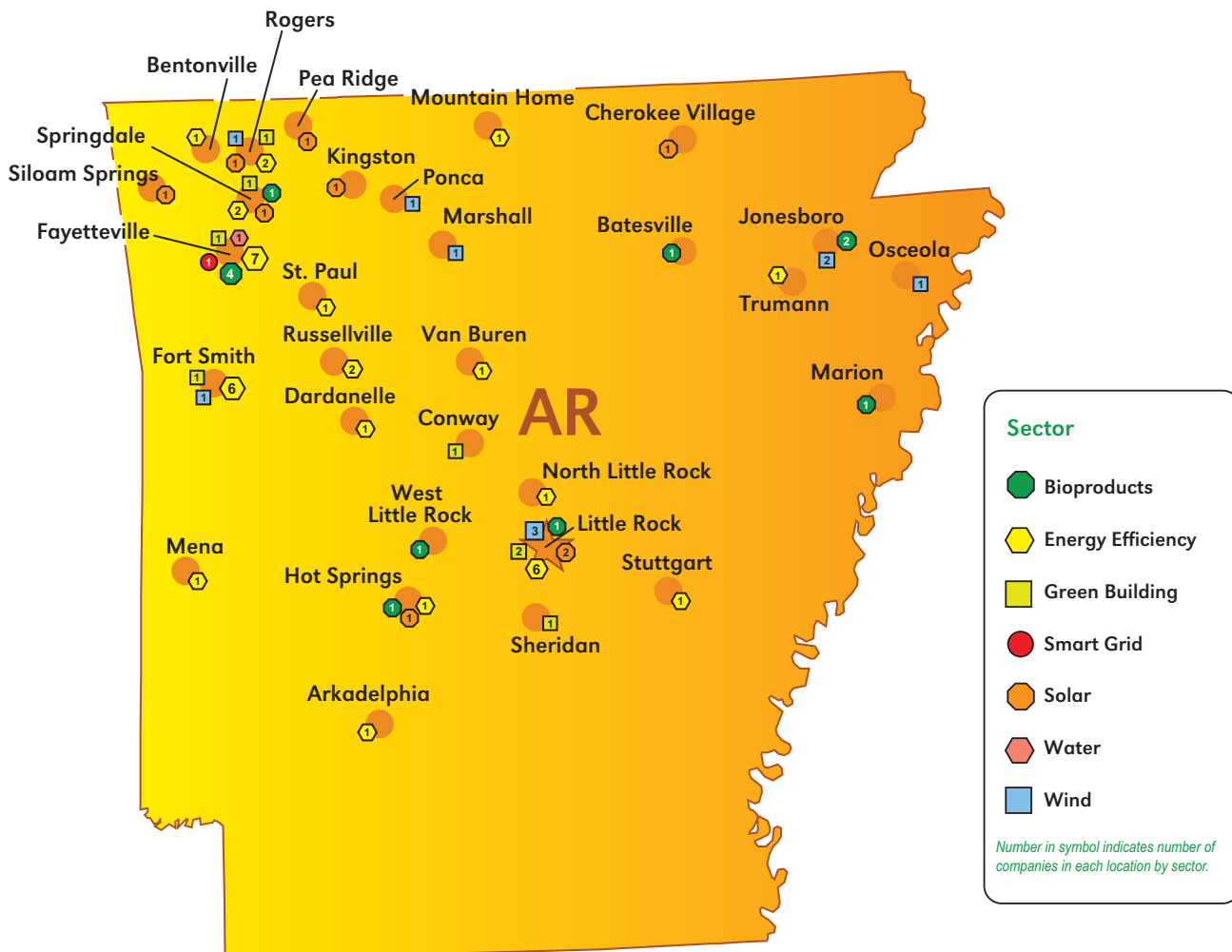
### Clean Technology Companies

In addition to jobs estimates, mapping employers is also important for identifying where, in which sectors and to what extent Arkansas is active in the clean technology economy. Figure 7 provides a snapshot of clean technology companies in Arkansas. It identifies where, which sector and how many companies are in each location. This is an

extensive, though not comprehensive, list of clean technology companies. Arkansas’s clean technology companies primarily fall under the categories of:

- Bioproducts
- Energy Efficiency
- Green Building
- Solar
- Wind

Figure 7: Clean Technology Companies in Arkansas 2010



Source: Arkansas Advanced Energy Association, Internet Searches

City	Company Name	Sector
Arkadelphia	Danfoss	Energy Efficiency
Batesville	FutureFuel	Bioproducts
Bentonville	Sun Coast Energy Systems	Energy Efficiency
Cherokee Village	Solargy Services LLC	Solar
Conway	Nabholz Construction	Green Building
Dardanelle	IntenCity Lighting	Energy Efficiency
Fayetteville	Arkansas Power Electronics International	Smart Grid
	BioEnergy Systems	Bioproducts
	BlueInGreen	Water
	CaseStack	Energy Efficiency
	CGP Cogeneration Custom Construction Co.	Green Building
	Coenco	Energy Efficiency
	E3Regenesis	Energy Efficiency
	Fibrowatt	Bioproducts
	Home Energy Consultants	Energy Efficiency
	Ineos Bio	Bioproducts
	LGW Inc.	Energy Efficiency
	NextGen Illumination	Energy Efficiency
	Powers Energy of America	Bioproducts
	Swiftwater Development	Green Building
	Trem/Wel Energy	Energy Efficiency
Fort Smith	Baldor Electric Co.	Energy Efficiency
	Cobblestone Homes	Green Building
	EnviroGuard Technologies	Energy Efficiency
	Mitsubishi Power Systems America	Wind
	Rheem Manufacturing Co.	Energy Efficiency
	Solar Shield Inc	Energy Efficiency
	Weather-barr	Energy Efficiency
Hot Springs	GTS Inc.	Energy Efficiency
	Liberty Solar Solutions LLC	Solar
	PRM Energy Systems Inc.	Bioproducts
Jonesboro	Greenway Wind	Wind
	Infinite Enzymes	Bioproducts
	Nice-Pak	Bioproducts
	Nordex USA Inc.	Wind
Kingston	Rocky Grove Sun Co.	Solar
Little Rock	Blanz Engineering & Environmental Solutions	Energy Efficiency
	CLEARresult	Energy Efficiency
	Curtis H. Stout Inc.	Energy Efficiency
	Energy Systems Group	Energy Efficiency
	HERS Inc. (Home Energy Raters)	Energy Efficiency
	Histecon Associates	Energy Efficiency
	LM Wind Power	Wind
	L'Oreal USA	Bioproducts
	MESA Landscape Architects	Green Building

City	Company Name	Sector
	Polymer Composites (owned by ETW International)	Wind
	Rooftop Wind Power	Wind
	Solar Source Consulting	Solar
	Stellar Sun Shop	Solar
	Viridian (Eco Intergration)	Green Building
Marion	Southern Soy Scents	Bioproducts
Marshall	Tradewind Energy	Wind
Mena	Nidec-Motor Corp. (previously Emerson Motor Co.)	Energy Efficiency
Mountain Home	BPSi Foam Insulators	Energy Efficiency
North Little Rock	Energy Master Home	Energy Efficiency
Osceola	Beckmann-Volmer	Wind
Pea Ridge	O Y Not Solar	Solar
Ponca	Green Energy Products	Wind
Rogers	Derry Berrigan Lighting Design	Energy Efficiency
	Luma Vue	Energy Efficiency
	Silicon Solar Solutions	Solar
	Stitt Energy Systems Inc.	Green Building
	Winds of Change	Wind
Russellville	Dow Chemical	Energy Efficiency
	H5 Energy (previously Energy Design Systems)	Energy Efficiency
Sheridan	CENTRIA	Green Building
Siloam Springs	Appro-Tec Renewable Energy	Solar
Springdale	BioBased Technologies	Bioproducts
	EcoPotential	Green Building
	Paschal Heat, Air, and Geothermal	Energy Efficiency
	Sun City Solar Commercial Energy	Solar
	Trane Arkansas	Energy Efficiency
St. Paul	Programming & Design Associates LLC	Energy Efficiency
Stuttgart	Lennox International	Energy Efficiency
Trumann	Ashley Lighting Inc.	Energy Efficiency
Van Buren	Arkansas Lamp Manufacturing	Energy Efficiency
West Little Rock	BioFoam Insulation of Arkansas	Bioproducts

**Bioproducts.** The bioproducts category includes companies that are involved in the creation and deployment of power, transportation fuel and consumer products made from biomass (plant and organic materials). The development of bioproducts companies offers a unique opportunity for development in rural communities. These companies offer new markets for forest and agricultural resources. Also, bioproducts companies often need to

be near their feedstock sources to be cost-competitive, providing more opportunities for rural job creation than perhaps other clean technology sectors. For example, FutureFuel in Batesville (population 9,500) is producing biodiesel. And PRM Energy Systems in Hot Springs (population 40,000) designs and implements systems that use biomass to produce heat and electricity.

Figure 8: Bioproducts Companies in Arkansas 2010

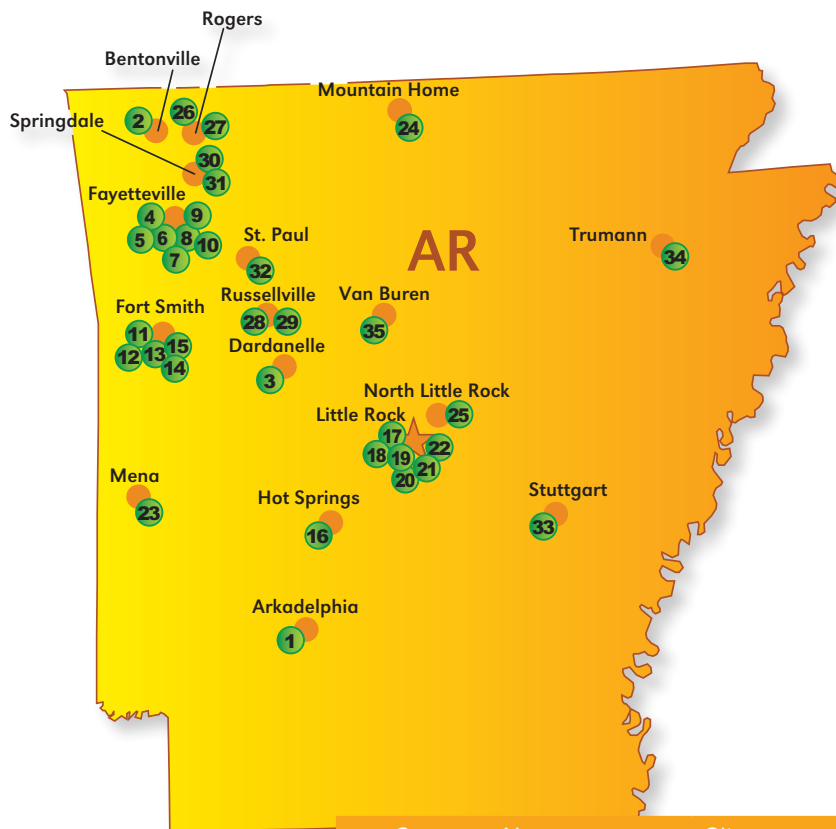


Source: Arkansas Advanced Energy Association, Internet Searches

**Energy Efficiency.** Companies in the energy efficiency category are involved in the creation and deployment of products that reduce energy consumption. For Example, NextGen Illumination in Fayetteville develops LED

products and provides lighting solutions to reduce energy consumption while improving lighting options. Lennox International is another company in this category that manufactures energy efficient HVAC systems in Stuttgart.

Figure 9: Energy Efficiency Companies in Arkansas 2010



Company Name	City
1 Danfoss	Arkadelphia
2 Sun Coast Energy Systems	Bentonville
3 IntenCity Lighting	Dardanelle
4 Coenco	Fayetteville
5 E3Regenesis	Fayetteville
6 Home Energy Consultants	Fayetteville
7 LGW Inc.	Fayetteville
8 NextGen Illumination	Fayetteville
9 Trem/Wel Energy	Fayetteville
10 CaseStack	Fayetteville
11 Baldor Electric Co.	Fort Smith

Company Name	City
12 Rheem Manufacturing Co.	Fort Smith
13 Solar Shield Inc.	Fort Smith
14 EnviroGuard Technologies	Fort Smith
15 Weather-barr	Fort Smith
16 GTS Inc.	Hot Springs
17 Blanz Engineering & Environmental Solutions	Little Rock
18 CLEAResult	Little Rock
19 Curtis H. Stout Inc.	Little Rock
20 Energy Systems Group	Little Rock
21 Histecon Associates	Little Rock
22 HERS Inc. (Home Energy Raters)	Little Rock
23 Nidec-Motor Corp. (previously Emerson Motor Co.)	Mena
24 BPSi Foam Insulators	Mountain Home
25 Energy Master Home	N. Little Rock
26 Derry Berrigan Lighting Design	Rogers
27 Luma Vue	Rogers
28 Dow Chemical	Russellville
29 H5 Energy (previously Energy Design Systems)	Russellville
30 Paschal Heat, Air, and Geothermal	Springdale
31 Trane Arkansas	Springdale
32 Programming & Design Associates LLC	St. Paul
33 Lennox International	Stuttgart
34 Ashley Lighting Inc.	Trumann
35 Arkansas Lamp Manufacturing	Van Buren

Source: Arkansas Advanced Energy Association, Internet Searches

**Green Building.** Companies that design and construct buildings that use energy more efficiently and are built with renewable resources are in the green building category. MESA Landscape Architects, a member of the U.S. Green Building Council, develops

sustainability options for clients, such as the best options to use water and light efficiently in landscape projects. Viridian is a consulting firm that has expertise in the design and development of LEED buildings, energy efficiency plans and energy modeling services.

Figure 10: Green Building Companies in Arkansas 2010



Source: Arkansas Advanced Energy Association, Internet Searches

**Solar.** Most of the solar companies in Arkansas are involved in the installation and maintenance of solar energy systems, such as Liberty Solar Solutions in Hot Springs and Rocky Grove Sun

Company in Kingston. One exception is Silicon Solar Solutions in Fayetteville. This startup firm is focused on using less silicon while at the same time producing more power.

Figure 11: Solar Companies in Arkansas 2010

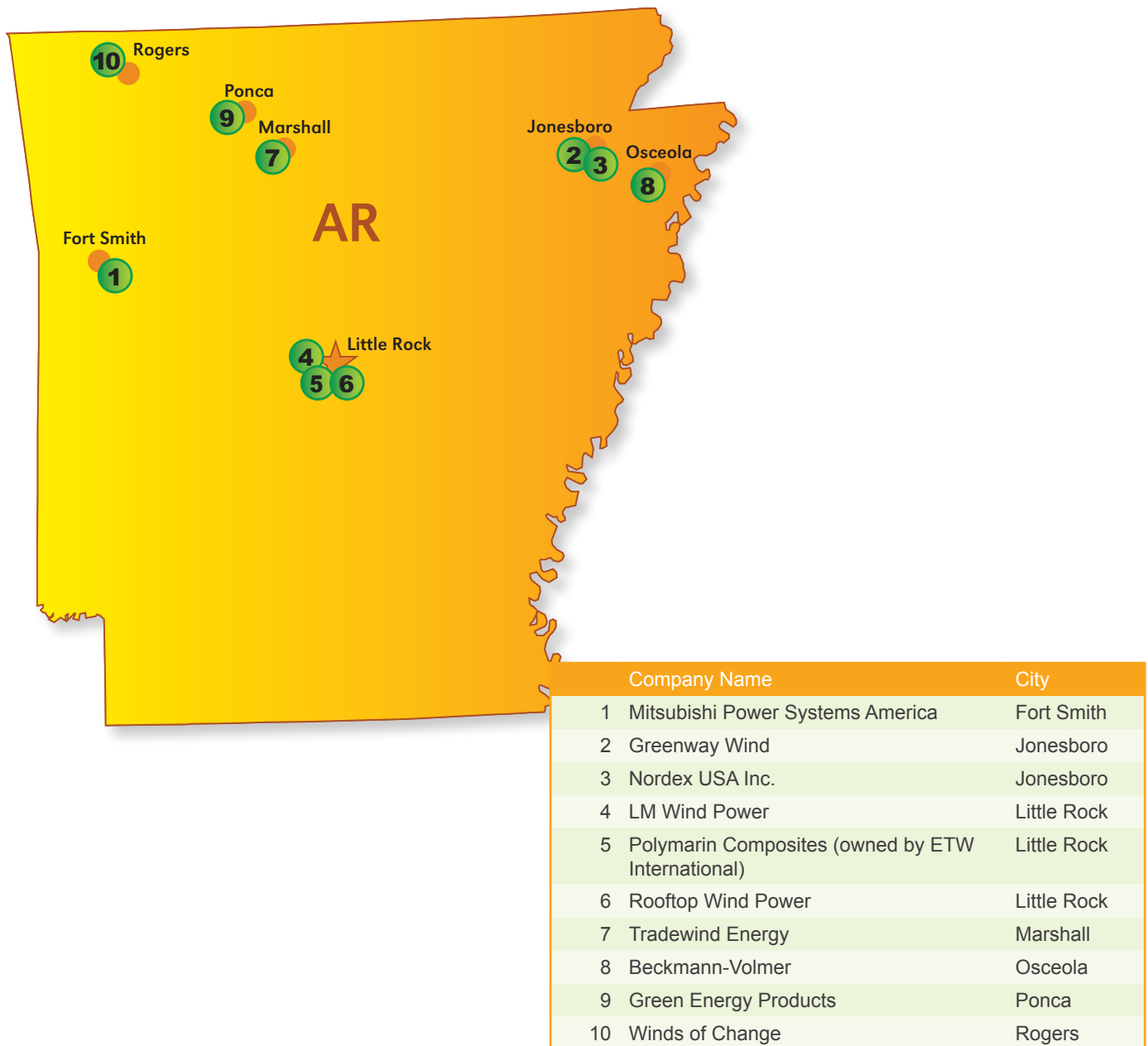


Source: Arkansas Advanced Energy Association, Internet Searches

**Wind.** While there are no large-scale wind installations in Arkansas, the wind manufacturing sector has continued to grow over the last five years. Key companies in this sector include international companies, such as

Nordex and Mitsubishi in Jonesboro and Fort Smith, that build wind turbines. In addition, the state is home to local companies such as Jonesboro-based Greenway Wind, a full-service small wind company.

Figure 12: Wind Companies in Arkansas 2010



Source: Arkansas Advanced Energy Association, Internet Searches

# Clean Technology Innovation Economy

Innovation assets are another key feature of the clean technology economy. These assets encourage innovation through funding, research, commercialization and workforce development.

## Clean Technology Research Centers

Research is often where innovation begins. Arkansas is home to a number of research centers with expertise in the clean technology economy (Figure 13, Appendix B). Two well-established areas of research are biomass and electric power transmission/battery technologies. In addition, new research capacity is being built in solar technology research.

Figure 13: Arkansas Clean Technology Research Centers 2010



Source: Arkansas Advanced Energy Association, Internet Searches

**Biomass & Bioproducts Research.** A number of research efforts in Arkansas occur in the biomass field. A primary hub of activity occurs at the Arkansas Center for Plant-Powered Production (P3). The Center draws from researchers at Arkansas State University, University of Arkansas at Little Rock and University of Arkansas at Fayetteville to build on the state's strength in the agricultural and food industry. Recent research investments focus on the interface of agriculture, the environment and medicine. The center also links research competitiveness with outreach and entrepreneurship to ensure knowledge-based economic development.

In addition to P3, other research projects include work being done at Arkansas State University in the area of plant cell walls and biomass conversion and at the Arkansas Forest Resources Center on the sustainability of forest-based natural resources.

**Electric Power Transmission/Battery Technology.** Research investments surrounding electric power transmission and battery technology are growing in Arkansas. The National Center for Reliable Electric Power Transmission (NCREPT) is located at the University of Arkansas at Fayetteville. The center's work includes research on smart grid technologies and chargers for hybrid electric vehicles. The center won a \$4 million grant, along with Arkansas Power Electronics International, to develop chargers that deliver high levels of power to batteries for plug-in hybrid electric cars.

**Solar Technology Research.** In 2010, a \$20 million grant from the National Science Foundation and the Arkansas Science & Technology Authority helped create two solar technology research centers in Arkansas:

the Generating Renewable Energy Efficient Nanoplasmonic Solar Cells Center (GREEN) and the Vertically Integrated Center for Transformative Energy Research (VICTER). The GREEN Center is focused on producing photovoltaic panels that use less silicon by increasing efficiency and creating new photovoltaic materials. VICTER's focus is to "develop new photovoltaic materials which can be used to build electronic devices." Research will also be done on the packaging of solar cells, creating cost-effective and durable solar panels, and developing efficient transmission to the grid.

### **Clean Technology Research Support Organizations**

In addition to research institutions, Arkansas also invests in organizations to promote and develop clean technology research in the state. These organizations include:

- Arkansas Research Alliance
- Arkansas Research & Technology Park
- Arkansas Science & Technology Authority

**Arkansas Research Alliance.** The alliance is dedicated to maximizing Arkansas's ability to participate in the 21st-century economy by recruiting university scholars with a track record of incubating and commercializing businesses – increasing the number of competitive knowledge-based jobs for Arkansans. Of the alliance's nine focus areas, two are particularly relevant to clean technology. The first is nano-related materials and application, which has significant impacts on the creation of lighter and stronger materials valuable to many clean technology sectors. Second is the focus on sustainable agriculture and bioenergy management, addressing "agriculture and bioenergy as an integrated system of growing,

transporting, and processing feedstock and developing co-products.”<sup>29</sup>

In addition, the alliance’s Scholars Program recruits research scholars with a history of entrepreneurship to the state. Launched in July 2010, the program has two scholars, one focused on sustainable bioenergy.

#### **Arkansas Research & Technology Park.**

The technology park six research centers: Engineering Research Center, GENESIS Technology Incubator, High Density Electronics Center, Innovation Center, National Center for Reliable Electric Power Transmission and Enterprise Center. Silicon Solar Solutions, a commercial spin-off from the University of Arkansas now housed at the GENESIS Technology Incubator, provides an example of how the park has helped clean technology companies.

#### **Arkansas Science & Technology Authority.**

ASTA addresses strategies to promote scientific research, technology development, business innovation, and math, science and engineering education. Of particular interest to researchers is the Arkansas ASSET II Initiative. ASSET II is part of the National Science Foundation’s EPSCoR program. The initiative is a multi-institutional, interdisciplinary, statewide program designed to strengthen the three specialty areas of plant-based production, solar cell technology and new power electronics. An integral component of the program is entrepreneurial training, support for commercialization of new technologies and an educational outreach program that targets the STEM pipeline needed to support the advanced technologies workforce.

### **Clean Technology Venture Capital Funds**

Venture capital is an important part of

developing any emerging industry, including clean technology. Arkansas has limited in-state venture capital funds, though there are both public and private options for firms seeking investment:

**Arkansas Risk Capital Matching Fund.** ARCMF works to strengthen and advance the financial infrastructure that supports and accelerates the growth of technology-based enterprises in Arkansas. It targets fund investments in technology-based enterprises that are in the early stages of development and not yet able to attract adequate private sources of traditional financing, venture or investor-backed capital for their growth and development.

**Arkansas Science and Technology Authority.** ASTA administers Seed Capital Investments, an investment fund that provides seed capital for new and developing technology companies. Nine out of the 26 companies (35 percent) in which the fund has invested since 2006 are identified as clean technology companies.<sup>30</sup> Of the \$4 million that Seed Capital Investments has invested, nearly \$1.5 million (37 percent) went to the nine clean technology companies.

**Diamond State Ventures.** DSV is a private equity and venture capital firm with \$125 million under management in two funds. DSV I invests in small and lower middle-market companies located in Arkansas and across the Midwest and Southeast United States. Diamond State Ventures II is a federally licensed Small Business Investment Company that, along with co-investment partners, focuses on transactions up to \$25 million. Its market interest includes energy services.

**Fund for Arkansas’s Future.** This fund is an angel investor fund for the purpose of capitalizing early-stage, Arkansas-based

companies. A primary motivation behind this fund is to bolster the state's economy through high-growth ventures. Companies with an emphasis on technology or biotechnology are targeted, but other companies with significant growth potential are also considered. Thus far, the fund has invested in one clean technology company.

### **Clean Technology Economic Development Organizations**

Arkansas's economic development and business organizations also encourage and support innovation and the clean technology economy.

**Accelerate Arkansas.** Accelerate Arkansas is focused on the development of the knowledge economy. Its members include representatives from education and business that are focused on job creation through increasing innovative research, risk capital, entrepreneurship, STEM education and existing companies' competitiveness. Accelerate Arkansas's successes include the creation of Innovate Arkansas, the Arkansas Risk Capital Matching Fund and the Arkansas Research Alliance.

**Arkansas Economic Development Commission.** The mission of the Arkansas Economic Development Commission (AEDC) is to lead statewide economic development, create targeted strategies that produce better-paying jobs, promote communities and support the training and growth of a 21st century skilled workforce. The commission's clean technology focus areas include wind power equipment, bioproducts and sustainable building products. AEDC is the leading state agency for recruitment, incentives and export promotion for the clean technology economy. An example of AEDC's success includes Arkansas's fast-growing wind component manufacturing industry

with the recruitment of blade manufacturer LM Wind Power, turbine manufacturers Nordex USA and Mitsubishi Power Systems, and supplier Beckmann Volmer.

**Fayetteville Forward Economic Accountability Council.** In 2009, Fayetteville Forward was created by the City of Fayetteville to engage the entire community in economic development efforts in Fayetteville, Arkansas. The FFEAC has 16 seats: one each for the City of Fayetteville, Chamber of Commerce, University of Arkansas and each of 13 key action areas, including the Green Economy. The purpose of the Green Economy group is to promote best practices in resource management through meetings with public officials, community forums and newspaper articles.

**GreenWAY Initiative.** The Fayetteville Chamber of Commerce, the City of Fayetteville, the UA Sam Walton School of Business, University of Arkansas Applied Sustainability Center and the University of Arkansas Students In Free Enterprise (SIFE) have been working in conjunction with community leaders and non-governmental entities on the GreenWAY program. The program's purpose is to assist chamber member organizations to implement best practices for green and sustainable business. There are currently 25 Fayetteville businesses, including a beauty salon and a large manufacturer, that are certified through the program.

**Green Valley.** Located in Northwest Arkansas, Green Valley's mission is to "connect the world's best sustainability innovators, grow local companies, recruit new companies and technologies; then coordinate just-in-time delivery of the capital, resources, and services needed for a Green Valley company to excel in the world market." Green Valley comprises two

components: the Green Valley Network and Green Valley Development. The Green Valley Network is a nonprofit organization focused on education and networking of sustainability leaders. Green Valley Development is a 501(c)(6) organization focused on recruitment of sustainable businesses.

**Innovate Arkansas.** A program of the Arkansas Economic Development Commission and Winrock International, the primary goals of Innovate Arkansas are to encourage technology-based innovations and create jobs in Arkansas. Innovate Arkansas provides the necessary due diligence required to identify potential new technology products and services, assist the founders or inventors of the products with their business starts and financial support needs, and provide mentoring to move them to commercial enterprises. Clean technology clients include Arkansas Power Electronics, NextGen Illumination, BlueInGreen and Silicon Solar Solutions.

**Sustainable Business Network of Central Arkansas.** SBNCA is a membership-based organization that serves the sustainable and green business community in Central Arkansas through activities, such as networking events, training workshops and a sustainable business certification program.

**Winrock International.** This nonprofit works with people in the United States and around the world to empower the disadvantaged, increase economic opportunity and sustain natural resources. Winrock's activities focus on the topics of clean energy and climate change for economic development. Focus areas include carbon markets, forestry and municipal renewable energy. Winrock was a founding partner of Arkansas Clean Cities, Innovate Arkansas and the American Carbon Registry.

## Workforce Development

Clean technology companies need highly skilled and well-trained employees to grow. Arkansas has a number of programs to train workers for the clean technology industry. These programs generally focus on training workers in the fields of clean technology manufacturing, energy efficiency, green building and bioenergy. The Arkansas Association of Two-Year Colleges (AATYC) is the primary workforce development hub for the clean technology industry. AATYC is a private, nonprofit higher education membership organization that represents all 22 public two-year colleges in Arkansas. The association facilitates the sharing of ideas, resources and opportunities among its members and advocates on behalf of members' students. AATYC's programs include:

- **Heart of Arkansas Regional Training (HART) Consortium** – In 2009, central Arkansas's two-year colleges with manufacturing technology skills training organized to provide new "green" industry training and to inject green methods/ concepts into existing technical programs. The consortium includes Pulaski Technical College, Arkansas State University-Beebe, Ouachita Technical College, UA Community College at Morrilton, National Park Community College and Southeast Arkansas College.
- **Arkansas Energy Sector Partnership** – Started in 2010, the AESP provides funding to enable Arkansas workers statewide to be trained in the skills required to succeed in the areas of energy efficient buildings, construction, retrofitting, renewable electric power and energy efficiency assessment. AESP enables the development and deployment of materials and programs that will be used by Arkansas's 22 two-

year colleges and seven apprenticeship programs to prepare participants for careers in the targeted industries.

- **Building Science Centers of Excellence** – Two Centers – Northwest Arkansas Community College and Pulaski Technical College were selected in 2009 to become Building Science Centers of Excellence through the Arkansas Economic Development Commission’s competitive grant application process. These two colleges will develop and/or customize curriculum and deliver training for new energy auditors and various support technicians across Arkansas based out of their schools as well as the other two-year colleges.
- **Center of Excellence for Renewable Energy Technology Education** – The Arkansas Delta Workforce Innovations in Regional Economic Development (with funding from the U.S. Department of Labor Employment and Training Administration) funded the Center of Excellence for Renewable Energy Technology Education at Phillips Community College. The center is developing training materials and courses focused on biodiesel and ethanol production. Students will be able to earn a technical certificate and an associate of applied science degree. The center is also supported through a community-based job training grant from the U.S. Department of Labor to bring its training materials and courses to partner colleges of the Arkansas Delta Training & Education Consortium.

Other workforce development programs in Arkansas include:

- **Arkansas State University** – Bachelor of Applied Science with Emphasis in Renewable Energy Technology – Arkansas

State University, in partnership with Arkansas Delta Training and Education Consortium (ADTEC), has developed a four-year degree program in Renewable Energy Technology for students interested in careers in renewable energy-related industries. Emphasis areas include: Advanced Bioenergy, Wind Energy Technology, Advanced Renewable Energy Systems, and Energy Conservation and Efficiency.

- **Mid-South Community College - Mid-South Renewable Energy Center** – The \$9 million center is expected to open in January 2012 and serve as a singular resource to the entire Delta region. It will include advanced technological classrooms, a conference center, multiple workforce training facilities and a biofuel training center. This will include a biofuel production laboratory (ethanol, biodiesel, jet fuel), a biofuel analysis laboratory and a state-of-the-art engine testing facility that provides the capacity to evaluate the effects of biofuels and biolubricants on engine performance and durability. This will support not only workforce training but also entrepreneurs, research scientists and an education pathway in diesel/biodiesel technology for high school, community college and a bachelor’s degree.

### **Key Public Policy Tools for the Clean Technology Economy**

Public policy plays an important role in the development of a state’s clean technology economy, as do market-based transformations that encourage further adoption of clean tech products or services. Policy tools, such as economic development incentives and targeted loan and grant programs, can be used to support this emerging industry.

### Arkansas Alternative Fuels Development Fund.

This is a statutory grant program that supports the development of alternative fuels produced from feedstock processed in Arkansas. Grants are available to alternative fuel producers, feedstock processors, feedstock producers, and distributors.

### Energy Efficiency & Renewable Energy

**Revolving Loan Funds.** Arkansas's industries and businesses can take advantage of low-interest loans through the state's revolving loan programs for energy efficiency and renewable energy projects.

**Targeted Business Incentives.** In addition to investment and job creation tax incentives that are available to any type of business, Arkansas also targets certain industries for further incentives. Targeted industries within the clean technology economy include nanotechnology, advanced materials, electronics manufacturing, energy reduction and bio-based products. These incentives are managed by the Arkansas Economic Development Commission and awarded at the discretion of the AEDC director. The goal of these incentives is to support young (less than five years old) knowledge-based businesses.

**Wind Energy Manufacturing Incentive.** In April 2009, the Arkansas Legislature expanded a tax incentive for manufacturers of windmill blades or components. A full-income tax exemption is available for businesses that meet certain criteria, including locating in the state before Dec. 31, 2007. Businesses that locate in the state after Jan. 1, 2008 are eligible for partial income tax abatement. Businesses taking advantage of these tax incentives must demonstrate significant investment and job creation in order to receive the tax incentive.

## Conclusion

The clean technology economy is an opportunity for Arkansas to:

- Improve global competitiveness.
- Create jobs.
- Keep energy dollars in the state.
- Strengthen rural communities.

This primer has laid out the assets of the clean technology economy that already exist, from research to companies to support organizations. While there are numerous assets across all clean technology segments, there are three areas where Arkansas has significant activity: manufacturing, bio-based products and energy efficiency/green building.

First, **clean technology manufacturing** is growing in Arkansas. New wind power manufacturers and bio-based product manufacturers have emerged, building off of Arkansas's existing manufacturing sector strengths.

The state has attracted wind turbine manufacturers, such as Mitsubishi Power Systems (\$100 million project, 400 jobs projected), Nordex (\$100 million project, currently 100 jobs) and wind blade manufacturer LM Wind Power USA (\$150 million, currently 350 jobs). In addition, Arkansas is looking to build out the complete wind turbine supply chain. For instance, Beckmann Volmer, a German company that manufactures steel components for wind turbines, is a direct supplier to Nordex and is building a \$10 million manufacturing facility in Osceola, Ark. The facility will be less than one hour away from the Nordex plant in Jonesboro and create 300 jobs.

Second, Arkansas's natural resources, research efforts, and agriculture and forestry history give a good foundation for a strong **bio-based products** industry. The bioeconomy provides a broad range of job creation and economic activity - from feedstock development to product distribution. Research efforts at the Arkansas Center for Plant-Powered Production (P3) and Arkansas State University (ASU) provide opportunities for new companies to form from new innovations. For example, Infinite Enzymes is developing new enzymes for the conversion of biomass into new products such as cellulosic ethanol. The company is a spin-off of the research being done at ASU.

Companies that focus on manufacturing bio-based products, including biofuels, biopower and other consumer products, are also doing business in Arkansas. For example, L'Oreal USA uses plant ingredients in the manufacturing of cosmetics. The company employs 4,000 Arkansans.

Third, from workforce development programs that train energy efficiency auditors to landscape architects, there is significant activity in Arkansas surrounding **energy efficiency and green building**. Energy efficiency not only creates jobs for those who are installing and maintaining energy efficient products, but it also reduces the bottom line for Arkansas companies and households.

While the three areas of clean technology manufacturing, bio-based products and energy efficiency are where most of the clean technology activity is occurring, there are other areas where new opportunities are emerging. This includes the growing capacity in research and commercialization of solar and electricity transmission technologies.

## Next Steps

With the state's strong support for research, entrepreneurs and existing businesses, Arkansas has the potential to become a leader in the clean technology economy. Southern Growth Policies Board and the Arkansas Advanced Energy Association (AAEA) will be convening a set of strategic planning sessions for development of the clean technology economy in the upcoming months to identify specific recommendations of how Arkansas can further take advantage of this opportunity. These sessions will gather input from public, private, and nonprofit leaders to create a set of recommendations for strategies to support the clean technology economy in Arkansas.

## Appendix A - Clean Technology Companies by Sector

City	Company Name	Clean Tech Sector
Batesville	FutureFuel	Bioproducts
Fayetteville	BioEnergy Systems	Bioproducts
Fayetteville	Fibrowatt	Bioproducts
Fayetteville	Ineos Bio	Bioproducts
Fayetteville	Powers Energy of America	Bioproducts
Hot Springs	PRM Energy Systems Inc	Bioproducts
Jonesboro	Infinite Enzymes	Bioproducts
Jonesboro	Nice-Pak	Bioproducts
Little Rock	L'Oreal USA	Bioproducts
Marion	Southern Soy Scents	Bioproducts
Springdale	BioBased Technologies	Bioproducts
West Little Rock	BioFoam Insulation of Arkansas	Bioproducts
Arkadelphia	Danfoss	Energy Efficiency
Bentonville	Sun Coast Energy Systems	Energy Efficiency
Dardanelle	IntenCity Lighting	Energy Efficiency
Fayetteville	Coenco	Energy Efficiency
Fayetteville	E3Regenesis	Energy Efficiency
Fayetteville	Home Energy Consultants	Energy Efficiency
Fayetteville	LGW, Inc	Energy Efficiency
Fayetteville	NextGen Illumination	Energy Efficiency
Fayetteville	Trem Wel Energy	Energy Efficiency
Fayetteville	CaseStack	Energy Efficiency
Fort Smith	Baldor Electric Company	Energy Efficiency
Fort Smith	Rheem Manufacturing Co	Energy Efficiency
Fort Smith	Solar Shield Inc	Energy Efficiency
Fort Smith	EnviroGuard Technologies	Energy Efficiency
Fort Smith	Weather-barr	Energy Efficiency
Hot Springs	GTS Inc	Energy Efficiency
Little Rock	Blanz Engineering & Environmental Solutions	Energy Efficiency
Little Rock	CLEAResult	Energy Efficiency
Little Rock	Curtis H. Stout, Inc.	Energy Efficiency
Little Rock	Energy Systems Group	Energy Efficiency
Little Rock	Histecon Associates	Energy Efficiency
Little Rock	HERS, Inc (Home Energy Raters)	Energy Efficiency
Mena	Nidec-Motor Corporation (Prev. Emerson Motor Company)	Energy Efficiency
Mountain Home	BPSi Foam Insulators	Energy Efficiency
North Little Rock	Energy Master Home	Energy Efficiency
Rogers	Derry Berrigan Lighting Design	Energy Efficiency
Rogers	Luma Vue	Energy Efficiency

## Appendix A (continued) - Clean Technology Companies by Sector

City	Company Name	Clean Tech Sector
Russellville	Dow Chemical	Energy Efficiency
Russellville	H5 Energy (Prev. Energy Design Systems)	Energy Efficiency
Springdale	Paschal Heat, Air, and Geothermal	Energy Efficiency
Springdale	Trane Arkansas	Energy Efficiency
St. Paul	Programming & Design Associates, LLC	Energy Efficiency
Stuttgart	Lennox International	Energy Efficiency
Trumann	Ashley Lighting Inc	Energy Efficiency
Van Buren	Arkansas Lamp Manufacturing	Energy Efficiency
Conway	Nabholz Construction	Green Building
Fayetteville	CGP Cogger Custom Construction Company	Green Building
Fayetteville	Swiftwater Development	Green Building
Fort Smith	Cobblestone Homes	Green Building
Little Rock	MESA Landscape Architects	Green Building
Little Rock	Viridian (Eco Intergration)	Green Building
Rogers	Stitt Energy Systems Inc	Green Building
Sheridan	CENTRIA	Green Building
Springdale	EcoPotential	Green Building
Fayetteville	Arkansas Power Electronics International	Smart Grid
Cherokee Village	Solargy Services LLC	Solar
Hot Springs	Liberty Solar Solutions LLC	Solar
Kingston	Rocky Grove Sun Company	Solar
Little Rock	Solar Source Consulting	Solar
Little Rock	Stellar Sun Shop	Solar
Pea Ridge	O Y Not Solar	Solar
Rogers	Silicon Solar Solutions	Solar
Siloam Springs	Appro-Tec Renewable Energy	Solar
Springdale	Sun City Solar Commercial Energy	Solar
Fayetteville	BlueInGreen	Water
Fort Smith	Mitsubishi Power Systems America	Wind
Jonesboro	Greenway Wind	Wind
Jonesboro	Nordex USA, Inc.	Wind
Little Rock	LM Wind Power	Wind
Little Rock	Polymarin Composites (owned by ETW International)	Wind
Little Rock	Rooftop Wind Power	Wind
Marshall	Tradewind Energy	Wind
Osceola	Beckmann-Volmer	Wind
Ponca	Green Energy Products	Wind
Rogers	Winds of Change	Wind

## Appendix B - Arkansas Clean Technology Research Centers

Description	Website	Contact	E-mail	
Arkansas Center for Plant-Powered Production (P3)	The center draws from a variety of institutions and builds on the state's strengths in agriculture and the food industry, and recent investments in research at the interface of agriculture, the environment and medicine. It links research competitiveness with outreach and entrepreneurship to ensure knowledge-based economic development. It has a focus on new sources for enzymes, biofuels, health-promoting phytochemicals and other industrial compounds and new ag-derived products to meet diverse markets.	<a href="http://www.arkp3center.org/index.html">http://www.arkp3center.org/index.html</a>	Dr. Carole Cramer, Arkansas State University	ccramer@astate.edu
Arkansas Power Electronics International	APEI is a small business dedicated to developing and marketing state-of-the-art technology in power electronics systems, electronic motor drives and power electronics packaging. In 2010, it received a \$4 million research grant to develop chargers that deliver high levels of power to batteries for plug-in hybrid electric cars, ensuring that these batteries can be charged more quickly and efficiently. Partners in this grant include the National Center for Reliable Electric Power Transmission in Fayetteville and Oak Ridge National Laboratory.	<a href="http://www.apei.net/default.aspx">http://www.apei.net/default.aspx</a>	Dr. Alexander Lostetter, President & CEO	(479) 443-5759
Arkansas Research & Technology Park @ University of Arkansas-Fayetteville	The Arkansas Research & Technology Park hosts six centers of research. The park is a hub for commercialization of new technologies, including clean technologies.	<a href="http://www.uark.edu/ua/artp/">http://www.uark.edu/ua/artp/</a>		

## Appendix B (continued) - Arkansas Clean Technology Research Centers

	Description	Website	Contact	E-mail
Engineering Research Center	The center houses several interdisciplinary laboratories through which much of the research of the individual departments of the college is handled. Laboratories include: Computational Biology & Biomedical Engineering Laboratory; Nano Mechanics & Tribology Laboratory; Arkansas Micro & Nano Systems Laboratory; Mechanical Properties Research Laboratory; Multiscale Mechanics of Materials Laboratory; Combustion Research Laboratory; Nanomaterials Research Laboratory; and Bio/Nano Technology Laboratory.	<a href="http://www.uark.edu/ua/artp/facilities/enrc.html">http://www.uark.edu/ua/artp/facilities/enrc.html</a>	Mike Brosius, Facility Manager	<a href="mailto:brosius@uark.edu">brosius@uark.edu</a>
GENESIS Technology Incubator	GENESIS offers a variety of services to qualifying technology-intensive entrepreneurs who desire to base their operations there during the critical early stages of company development. The incubator plays an important role as the entry point to the ARTP for startup companies working to develop emerging technologies in a variety of fields.	<a href="http://www.uark.edu/ua/artp/facilities/genesis.html">http://www.uark.edu/ua/artp/facilities/genesis.html</a>	David Whitmire, Director of Finance	<a href="mailto:drwhitm@uark.edu">drwhitm@uark.edu</a>
High Density Electronics Center (HiDEC)	The HiDEC facilities include nearly 6,000 square feet of clean room space that houses conventional MCM processing on five-inch wafers, deposition and photolithographic definition of thin film materials and package assembly. HiDEC research includes all aspects of advanced electronic packaging, including, but not limited to, such areas as materials synthesis, low-cost MCM design techniques, flip chip die attachment, flexible substrates, integrated passive components, low temperature cofired ceramic, wideband electrical characterization, and analytical and lifetime testing.	<a href="http://www.hidec.uark.edu/">http://www.hidec.uark.edu/</a>	Errol Porter, Research Associate	<a href="mailto:evporte@uark.edu">evporte@uark.edu</a>

## Appendix B (continued) - Arkansas Clean Technology Research Centers

	Description	Website	Contact	E-mail
Innovation Center	The University of Arkansas Innovation Center provides an environment that promotes specialized skill-training, education, research and technical support. It also provides office and laboratory space for technology-intensive companies. Core competencies include: next-generation electronic and photonic devices; biotechnology and related chemical, biological and food sciences; transportation and logistics; materials and advanced manufacturing; database, software and telecommunications; and environmental and ecosystem analysis.	<a href="http://www.uark.edu/ua/artp/facilities/innovation-center.html">http://www.uark.edu/ua/artp/facilities/innovation-center.html</a>	Phillip Stafford, UATDF President	psstaff@uark.edu
National Center for Reliable Electric Power Transmission,	The center is involved in five areas of research that impact the realization of power electronics solutions: power electronic design and modeling; control algorithms for power electronics; power electronics packaging; power electronics test; and mixed-signal integrated circuit design for the drive and control of power electronic interfaces. It is a partner in a \$4 million grant with Arkansas Power Electronics International working on batteries for plug-in hybrid electric vehicles.	<a href="http://ncrept.eleg.uark.edu/">http://ncrept.eleg.uark.edu/</a>	Dr. Alan Mantooth, Director	mantooth@uark.edu
<b>Arkansas State University, Jonesboro</b>				
Applications in Plant Biotechnology Laboratory	This laboratory is engaged in research related to cell wall structure and biotechnology of foreign gene expression in maize. The lab has a strategic focus on plant cell walls and biomass conversion and control of gene expression.	<a href="http://clt.astate.edu/ehood/">http://clt.astate.edu/ehood/</a>	Dr. Elizabeth Hood, Professor	ehood@astate.edu.
Various Academic Departments - Agriculture, Biology & Engineering	These departments have activities related to the clean technology economy.	<a href="http://www.astate.edu">http://www.astate.edu</a>	Dr. Elizabeth Hood, Professor	ehood@astate.edu.

## Appendix B (continued) - Arkansas Clean Technology Research Centers

	Description	Website	Contact	E-mail
Generating Renewable Energy Efficient Nanoplasmonic Solar Cells Center (GREEN)	The center is focused on producing photovoltaic panels that use less silicon by increasing efficiency and creating new photovoltaic materials.	In Development (Related Article)	Dr. Vasundara Varadan, Principal Investigator	vvvesm@uark.edu
National Center for Appropriate Technology - Fayetteville Regional Office	NCAT projects have ranged from low-tech to high-tech, addressing complex issues of housing, economics and environmental quality. NCAT has a focus on sustainable agriculture, sustainable energy and sustainable communities. The Fayetteville office functions as a hub for NCAT's sustainable agriculture activities throughout the southeast.	<a href="http://www.ncat.org/index.php">http://www.ncat.org/index.php</a>		rural@ncat.org
<b>University of Arkansas, Fayetteville</b>				
Applied Sustainability Center	The center's vision is to create a sustainable global consumer goods economy. It leads organizations in the retail and consumer goods industries toward sustainable practices that support an economy built around people, planet and profit by solving complex problems, providing expert guidance, brokering problems and solutions and sponsoring research.	<a href="http://asc.uark.edu/">http://asc.uark.edu/</a>	Michele Halsell, Managing Director	mhalsell@walton.uark.edu
Arkansas Water Resources Center	The center's statewide mission is to: arrange for competent research that addresses water problems and enhances our understanding; aid the entry of new research scientists into water resources fields; train future water scientists and engineers; and transfer results of sponsored research to water managers and the public.	<a href="http://www.uark.edu/depts/awrc/">http://www.uark.edu/depts/awrc/</a>	Dr. Brian Haggard, Director	haggard@uark.edu
Community Design Center	The center's mission is to advance creative development in Arkansas through education, research and design solutions that enhance the physical environment. Areas of research focus include urban forestry, smart growth planning and transit-oriented development.	<a href="http://uacdc.uark.edu/">http://uacdc.uark.edu/</a>	Stephen Luoni, Director	sluoni@uark.edu

## Appendix B (continued) - Arkansas Clean Technology Research Centers

	Description	Website	Contact	E-mail
National Agricultural Law Center	The center is the only agricultural law research and information facility that is independent, national in scope and directly connected to the national agricultural information network. It is staffed by a team of law and research professors, lawyers, other specialists and graduate assistants from the University of Arkansas School of Law Graduate Program in Agricultural Law. The center hosts a "reading room" on Renewable Energy and Sustainable Agriculture.	<a href="http://www.nationala-glawcenter.org/">http://www.nationala-glawcenter.org/</a>	Harrison Pittman, Director	<a href="mailto:hmpittm@uark.edu">hmpittm@uark.edu</a>
Sam Walton Center for Business & Economic Research	The primary activities of the center include: conducting research and providing analysis that supports economic development efforts in Arkansas; compiling and disseminating economic and demographic data on Arkansas and its geographic subdivisions; and conducting applied economic research sponsored by Arkansas communities and institutions. Economic impacts oil and gas have been a focus of the Center.	<a href="http://cber.uark.edu/">http://cber.uark.edu/</a>	Katherine Deck, Director	<a href="mailto:kdeck@walton.uark.edu">kdeck@walton.uark.edu</a>
<b>University of Arkansas, Monticello</b>				
Arkansas Forest Resources Center	The mission of the center is to develop and deliver superior programs in education, research and extension that enhance and insure the sustainability of forest-based natural resources.	<a href="http://www.afrc.uamont.edu/">http://www.afrc.uamont.edu/</a>	Tamara Walkingstick, Associate Center Director	
<b>University of Arkansas, Pine Bluff</b>				
Graduate Program - Aquaculture & Fisheries	This research-based masters program prepares graduates for careers in aquaculture resource management, natural fisheries and allied industries. Areas of study include water quality, aquaculture engineering and aquaculture production systems.	<a href="http://grad.uapb.edu/aquaculture-fisheries-home.html">http://grad.uapb.edu/aquaculture-fisheries-home.html</a>	Dr. Peter Perschbacher, Graduate Coordinator	<a href="mailto:pperschbacher@uaex.edu">pperschbacher@uaex.edu</a>

Appendix B (continued) - Arkansas Clean Technology Research Centers

## End Notes

- <sup>1</sup> Bureau of Labor Statistics, “Employment, Hours, and Earnings – National,” 2010.
- <sup>2</sup> Bureau of Labor Statistics, “Employment, Hours, and Earnings – State and Metro Areas,” 2010.
- <sup>3</sup> Economic Research Service, “Arkansas State Fact Sheet,” United States Department of Agriculture, 2010.
- <sup>4</sup> Economic Research Service, “U.S. State Fact Sheet,” United States Department of Agriculture, 2010.
- <sup>5</sup> Energy Information Administration, *International Energy Outlook 2010*, Washington DC: U.S. Energy Information Administration, 2010.
- <sup>6</sup> Energy Information Administration, *International Energy Outlook 2011*, Washington DC: U.S. Department of Energy, Energy Administration, September 2011.
- <sup>7</sup> Council on Competitiveness and Deloitte, *2010 Global Manufacturing Competitiveness Index*, Atlanta, GA: Council on Competitiveness, June 2010.
- <sup>8</sup> Arkansas Economic Development Commission, *Governor Mike Beebe’s Strategic Plan for Economic Development*, Little Rock: Arkansas Economic Development Commission, 2009.
- <sup>9</sup> Bureau of Economic Analysis, “Per Capita Personal Income by State,” 2010.
- <sup>10</sup> Hughes, Anne, “AR per-capita income at historical high ranking,” Governor Mike Beebe’s Office, Web, September 21, 2010. <http://mikebeebe.com/2010/09/21/ar-per-capita-income-at-historical-high-ranking/>
- <sup>11</sup> Bureau of Labor Statistics, “Employment, Hours, and Earnings – State and Metro Areas,” 2010.
- <sup>12</sup> Arkansas, Kentucky, Louisiana, Mississippi, Missouri, Tennessee.
- <sup>13</sup> Pakko, Michael, Personal Interview, August 22, 2011.
- <sup>14</sup> Pakko, Michael, *Arkansas Economic Outlook*, Presentation at University of Arkansas-Little Rock’s Economic Forecast Conference, November 2010.
- <sup>15</sup> Pakko, Michael, “Arkansas Employment and Unemployment – June 2011,” Blog post at [www.arkansaseconomist.com](http://www.arkansaseconomist.com), June 22, 2011.
- <sup>16</sup> Economic Research Service, “Arkansas State Fact Sheet,” United States Department of Agriculture, 2010.
- <sup>17</sup> Economic Research Service, “U.S. State Fact Sheet,” United States Department of Agriculture, 2010.
- <sup>18</sup> Energy Information Administration, “Table 5. Electric Power Industry Generation by Primary Energy Source, 1990 Through 2009 (Megawatthours),” 2011.
- <sup>19</sup> Energy Information Administration, *State Renewable Electricity Profiles 2009*, Washington DC: U.S. Energy Information Administration, July 2011.
- <sup>20</sup> Energy Information Administration, “Table CT1. Energy Consumption Estimates for Major Energy Sources in Physical Units, 1960-2009,” 2010.
- <sup>21</sup> Energy Information Administration, “Table C4. Estimated Consumption of Alternative Fuels, by State and Fuel Type, 2009,” 2011.
- <sup>22</sup> Energy Information Administration, “Table. E8 Primary Energy, Electricity, and Total Energy Expenditure Estimates, 2009,” 2011.
- <sup>23</sup> The energy dollars leaving the state for fuel ethanol is included in the motor gasoline numbers.
- <sup>24</sup> Bureau of Labor Statistics, “Employment, Hours, and Earnings – State and Metro Areas,” 2010.
- <sup>25</sup> Muro, Mark Jonathan Rothwell, Devashree Saha, and Battelle Technology Partnership Practice, *Sizing the Clean Economy*, Washington, DC: Brookings Institution, 2011.
- <sup>26</sup> “Degree of Specialization” is defined as the share of all jobs in the state for the given category divided by the same share nationwide. Values greater than one indicate a relatively high concentration of jobs in the given category.
- <sup>27</sup> Pew Center on the States, *The Clean Energy Economy*, Washington DC: Pew Charitable Trusts, June 2009.
- <sup>28</sup> The United States Conference of Mayors and the Mayors Climate Protection Center, *U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy*, Lexington, MA: Global Insight, October 2008.
- <sup>29</sup> Arkansas Research Alliance, “Battelle study identifies statewide strengths of research universities,” <http://www.aralliance.org/research/battelle-study>.
- <sup>30</sup> Steve Stanley e-mail to Charity Pennock, Southern Growth Policies Board, September 7, 2011.



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Southern Growth Policies Board is a non-partisan public policy think tank based in The Research Triangle Park, North Carolina. Formed by the region's governors in 1971, Southern Growth Policies Board develops and advances visionary economic development policies by providing a forum for partnership and dialog among a diverse cross-section of the region's governors, legislators, business and academic leaders and the economic- and community-development sectors. This unique public-private partnership is devoted to strengthening the South's economy and creating the highest possible quality of life.

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