The Economic Impact of Advanced Energy in Arkansas:

A Survey of Business Activity in 2014

Prepared for:

Arkansas Advanced Energy Foundation

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1. Introduction

The development of innovative techniques and technologies to help meet America's energy demands has created a wave of new economic activity in many regions of the country. As a companion study with the recent survey of the state's energy-efficiency (EE) contractors for the Arkansas Advanced Energy Foundation,[1] an economic study of advanced energy (AE) jobs in Arkansas produced some impressive findings. Before an analysis by HISTECON Associates, Inc. could identify the important factors, several research steps were accomplished to project a reasonably accurate picture of the full effect of advanced energy on the state's job growth in the near future.

First, building on national studies from information agencies like ACEEE and AEEI – whose data have been regionalized to include Arkansas estimates – the present study adapted existing methodologies and made their basic tables current by using recent data sources. Second, using a limited number of "key informant" surveys, we corroborated the shares of employment counted by earlier studies and determine possible trends in local AE industries. Related to this, the data from our companion study of EE contractors provided insights into some of the AE sectors, and helped complete the record of employment by small (with less than five workers) companies across the board, which are frequently left out of national studies.

Lastly, these data became inputs for our efforts to model the overall job effect of the AE businesses. Working with UALR's Institute of Economic Advancement and using the IMPLAN multiplier model, the collected data helped create an economic model of the direct and indirect impacts of AE spending on the overall Arkansas economy.

The survey data was used to project the total size of the AE sector for Arkansas in 2014, which had a direct impact of $1.7 billion in output and accounted for about 16,000 jobs. The IMPLAN model was utilized to follow the effects of this level of spending on the overall economy, through its state-level data on the multiplier properties of various types of spending – e.g., new residential or commercial upgrades.

[1] HISTECON Associates, Inc., "The Economic Impact of Energy Efficiency Programs in Arkansas: A Survey of Contractor Activity in 2013," AAEF, August 2014.

Based on these inputs, the model projected that another 9,300 jobs were created in related sectors and additional output of $1.1 billion was generated. Thus, the total effect of AE spending in the current Arkansas economy is quite substantial: about $2.8 billion in total output and employment of more than 25,000 workers on a full-time basis.

2. A Knotty Problem: Identifying Advanced Energy Firms and Industries

At the outset, the study team benefitted from previous research efforts to identify what properly constitutes this new industrial category. The problem of defining what business activity should be included in the advanced economy is not unique to AE studies, and many different approaches have been tried. Related problems also plague studies of "clean" or "green" economy, as a recent Brookings report made clear.

> Yet, the clean economy remains an enigma: hard to assess. Not only do "green" or "clean" activities and jobs related to environmental aims pervade all sectors of the U.S. economy; they also remain tricky to define and isolate—and count. The clean economy has remained elusive in part because, in the absence of standard definitions and data, strikingly little is known about its nature, size, and growth at the critical regional level. Currently no comprehensive national database exists on the spatial geography of the clean economy and its sub-industries…[2]

Substitute AE economy for the clean-economy references in the above paragraph and one can see the same difficulties emerging for the present study. While the present report includes many of the job sectors that are included in any "green" or "clean" energy study, it differs in its focus on activities that drive the economy away from traditional fossil-fuel energy sources toward innovations that make the state's energy supply more secure, clean and affordable. This is a more conservative approach, and defines the study universe by focusing more narrowly on activities that are clearly included in the AE economy. These activities include an expanded utilization of advanced energy technologies, including energy efficiency, demand response, natural gas electric generation, solar, wind, hydro, nuclear, electric vehicles, alternative fuels, and smart grid.

California, always a leader in the energy and environmental fields, has produced several studies on the economic impact of green energy companies. The studies have also used an expansive version of what constitutes green vs. clean energy, as noted in the following section.

> The green economy is not just about the ability to produce clean energy, but also the growing market for products which consume less energy, from fluorescent light bulbs to organic and locally produced food. It also

[2] Mark Muro et al, "Sizing the Clean Economy: A National and Regional Green Jobs Assessment," The Brookings Institution, 2011.

> encompasses economic sectors that improve the environment, for instance through remediation of toxic sites or design of more compact cities. With an emerging consensus about the impacts of global climate change, there is new enthusiasm among governments, industries, nonprofits, and individual consumers for green processes and products.[3]

Notably, the Berkeley study includes recycling, waste processing, and many environmental industries that would not fit normally in the concept of an advanced energy study.

Thus, any analysis of green energy activity in Arkansas is likely to produce larger estimates of the economic impact when compared to advanced energy. For example, a Brookings Institution profile of green-energy employment in the state in 2010 totaled 32,450 jobs in the industry.[4] These included about 2,900 in conservation and about 2,500 in HVAC and related services – clearly part of the AE economy as well – but also 5,700 jobs in consumer products like cosmetics and about 2,700 in forestry products, which are difficult to defend in a count of AE firms. All together, these jobs represent 2.6 percent of total employment in the state, which is much higher than any available estimates of AE employment in Arkansas.

Nevertheless, some instructive background can be learned from the clean-energy studies. The Brookings study labeled both renewable energy services and biofuels/biomass as among the fastest growing sectors in the state's green economy, each growing at annual rates of more than 23 percent during the 2003-2010 period. Also, average annual income from the clean-energy sector was pegged at $32,116 (median), and a large percentage of these jobs (73.7 percent) were available to workers with a "modest education."[5] Each of these estimates is well above the averages for the general Arkansas economy, for reasons that will be described later in this report.

[3] "Innovating the Green Economy in California Regions," The Center for Community Innovation, University of California, Berkeley, 2010.

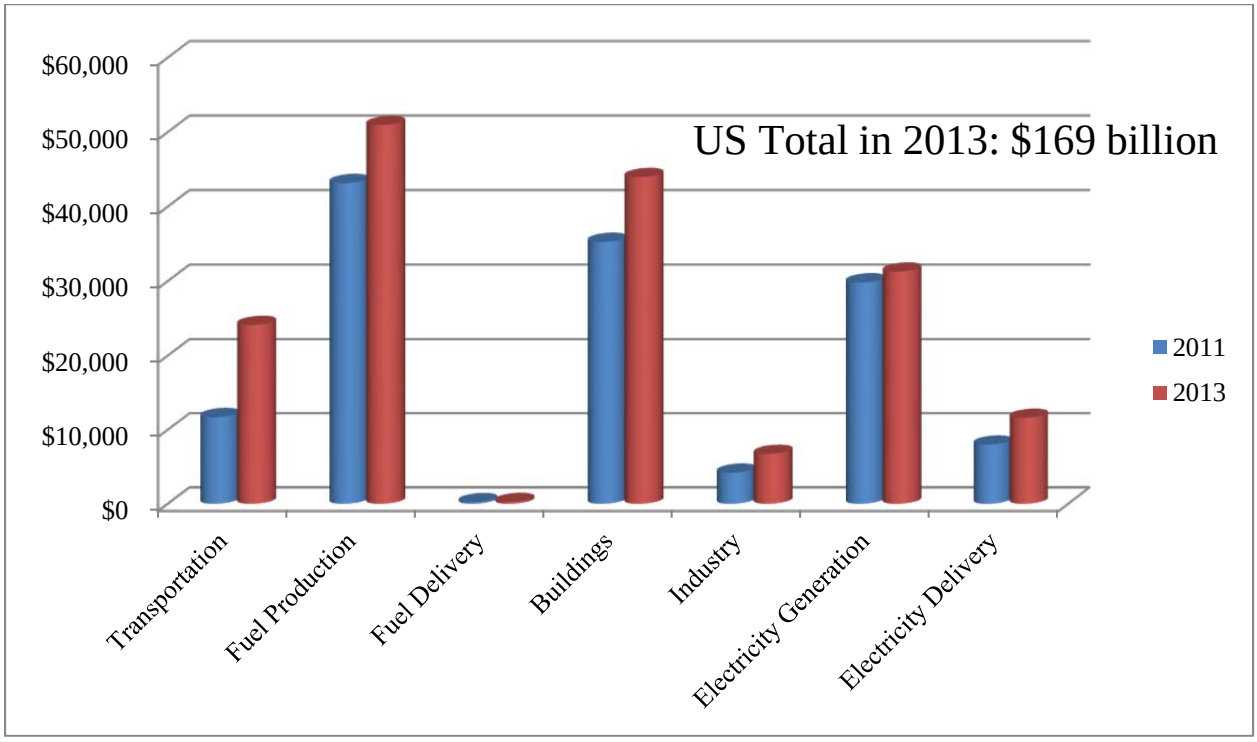
[4] "Sizing the Clean Economy: The Clean Economy in the State of Arkansas," Metropolitan Policy Program, The Brookings Institution, 2011.

[5] Ibid.

3. The Arkansas AE Study in a National Context

The AE sector in Arkansas is reflective in many ways of a rapidly growing set of industries nationally. A recent report from Navigant Research indicates that $169 billion in revenue was generated by these firms in 2013, a 28 percent increase from 2011. As shown in the next chart, leading sectors in the U.S. were electricity generation and delivery, fuel production, transportation, and building design and conservation.[6] However, no estimate was offered about the employment level that was supported by these industries in 2013.

AE Revenue Growth in the US Market, 2011-2013 ($ millions)



[6] Navigant Research, *ADVANCED ENERGY NOW- 2014 MARKET REPORT*, Advanced Energy Economy, February 2014.

In the southern region, most utilities have lagged behind other regions in promoting energy efficiency and energy alternatives. Marilyn Brown of Georgia Institute of Technology has noted that "even though per-kilowatt-hour prices in Southern states are four to six cents less than the national average, energy bills are higher 'because the South uses energy so wastefully. We have 35 percent of the country's population but use 43 percent of the electricity.'"[7] Arkansas has completed two new coal-fired power plants in the past five years, for example, while elsewhere utilities have been retiring these carbon-intensive facilities.

Globally, the emphasis on renewable energy has produced remarkable additions to the capacity of power generation. According to the International Energy Agency, in 2013 the share of renewables rose to about 22 percent of worldwide capacity, up from about 18 percent in 2005. The agency projects that trend will continue at least until 2020 when renewables should account for 25 percent of the world's electricity.[8]

The continued growth derives from both the lower costs for photovoltaic technologies and the advance of onshore wind developments. Many countries are promoting and subsidizing renewable energy projects in order to become less reliant on traditional fossil-fuel sources of electricity. Among developed nations, Germany leads the "green way" and is close to reaching its current target of 30 percent of its electricity from renewable energy sources – more than twice the share of the U.S.[9]

Previous Research on the AE Economy in Arkansas

One benchmark for the current analysis of AE jobs is the report on 2010 employment by the Advanced Energy Economy Institute (AEEI.) Although the research methodology used by that study was completely different than the present study – no survey was engaged there and broad, national databases were partitioned to analyze the Arkansas component using a "top-down" approach – its findings on employment are instructive.

For example, the AEEI report found that about 11,000 workers were employed in AE activity full-time in 2010.[10] Like the present study, major sectors included energy-saving building and consumer products, HVAC and building control systems, and architecture

[7] J.L. Mernit, "A Cleaner South," *Sierra*, November-December 2014.
[8] D.J. Unger, "Clean energy: How the world is cleaning up its act," *The Christian Science Monitor*, Sept. 14, 2014.
[9] Justin Gillis, "Germany leads push to go 'green'," *The New York Times*, Sept. 14, 2014.
[10] "Employment in the Arkansas Advanced Energy Industry," Advanced Energy Economy Institute, 2010.

and construction services. Notably missing from its industry list were natural gas production and electricity generation from natural gas.

The largest employment category in 2010 was about 2,400 jobs in HVAC-related firms, followed by about 2,000 jobs in energy-saving consumer products. Almost 1,900 jobs were found in energy-saving building materials, and about 1,200 jobs were counted in nuclear energy.

Next, the recent survey of the state's EE contractors – the EERS report that is a companion study for the AAEF – provided several important findings about related economic activity. It documents that AE work, especially but not limited to energy efficiency work, is having tangible results on energy demand in communities throughout the state, meaning that households and businesses are spending less on energy costs than before (assuming stable prices, of course). This means that family and firm budgets will have more to spend on other goods and services, and these expenditures will help local economies grow faster than before.

A recent ACEEE white paper makes this point clearly.

> Both the initial investment and the re-spending of energy savings produce direct, indirect, and induced jobs. … Generally, an initial investment in energy efficiency drives direct, indirect, and induced jobs in labor-intensive industries such as construction, engineering, maintenance, and contracting. Direct jobs are created as workers are deployed to develop and install the efficiency measures. Indirect jobs are subsequently created in the supply chain in facilities such as lumber yards and with manufacturers such as plumbing suppliers.
>
> … The second round of job creation occurs as individuals and businesses re-spend the money that they saved through lower energy bills, and this wave of job creation reverberates throughout the economy over the long-term. In fact, this is where the bulk of energy efficiency job creation resides. Dollars once spent on energy bills are put back into the general economy (which is, on average, more labor intensive than energy production and distribution), and ongoing job creation is stimulated.[11]

[11] Casey Bell, "Energy Efficiency Job Creation: Real World Experiences," Washington, DC: American Council for an Energy-Efficient Economy (ACEEE), 2012.

In theory, energy savings opens another benefit stream for the overall economy and in particular for the construction industry. Work in the AE sector employs carpenters, turbine-blade fabricators, plumbers, HVAC technicians, insulation workers, etc., and this creates new and often larger work projects as customers request more efficient equipment and energy techniques for both new and retrofitted installations. The Arkansas survey of AE firms tests the theory in a number of fundamental ways, and helps answer questions about the types of economic growth that may arise from the resulting energy savings.

It is also noteworthy that the shift of jobs from the traditional energy-production sector – a capital-intensive area of the economy – to construction trades and the general economy actually creates more jobs per dollar spent. This is because of the labor intensity of the other areas, as shown in Figure 1. Note that while the energy sector produces about 10 jobs for every $1 million invested, on average the construction sector creates about twice that amount of employment for the same dollar investment: 20 jobs for every $1 million invested.[12]

This observed pattern is not intended to recommend the need for any wholesale move away from lower to higher labor-quotient areas of the economy. Rather, the pattern merely suggests that marginal employment changes that occur from energy savings are not "one-for-one" changes because the type of work involves different skill sets and skill requirements. This is true whether the new employment involves direct jobs (e.g., green-building design, geothermal installations, or a tank-less water heater installed by a plumber), indirect jobs (e.g., a hardware or supply house salesperson or stocker), or an induced job (e.g., a clerk at a local store whose sales have increased from the new incomes of local workers).

Furthermore, some opposition remains to an increasing reliance on AE and energy conservation to reduce energy demand in the state. For example, Arkansas's Attorney General appealed recently to the U.S. EPA to alter its carbon reduction plans and not include EE improvements (an important part of AE in the state) as a major component to the Clean Power Plan (aka the 111 (d) rule). From his viewpoint,

> Energy efficiency programs tend to drive up rates even when weighed against avoided generation and fuel cost savings. Although program participants' bills may decrease, the fixed cost of paying for existing assets is spread over a smaller pool of purchases, and some customers may never have a meaningful opportunity to participate. This includes some of our

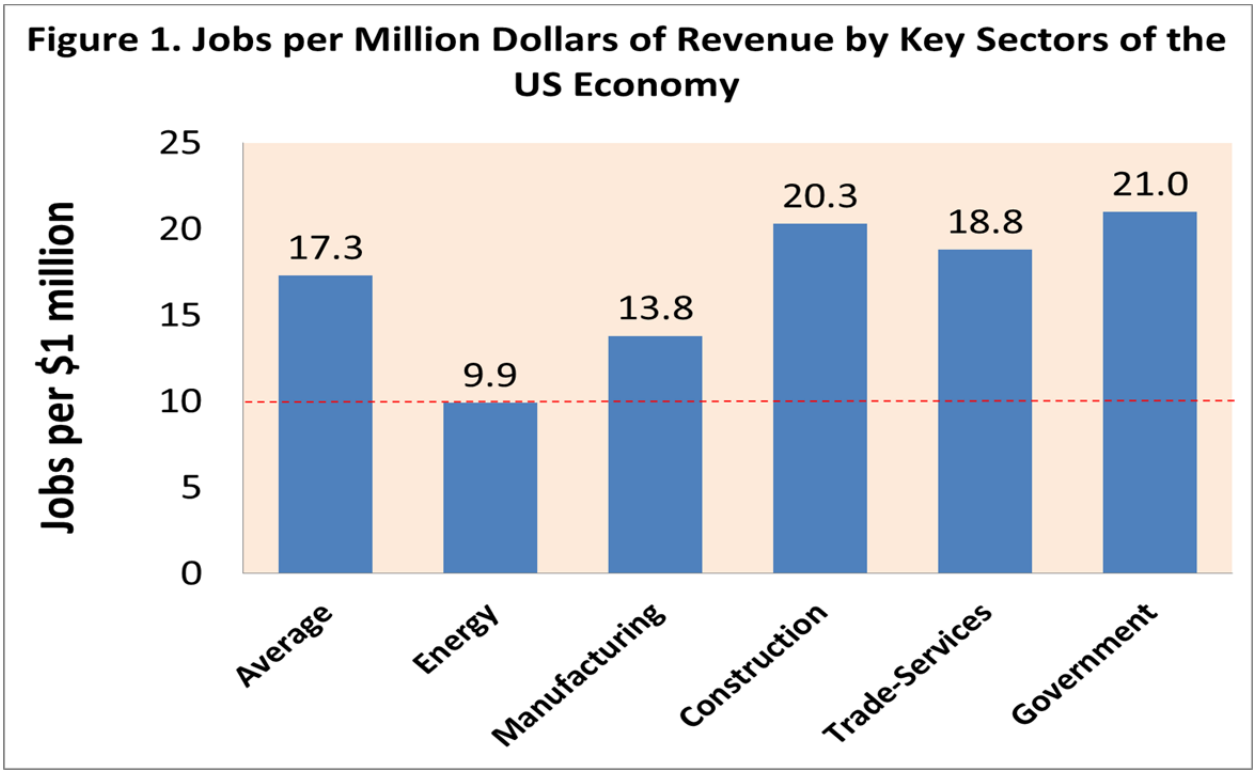
[12] C.J. Bell, "Understanding the True Benefits of Both Energy Efficiency and Job Creation," Community Development INVESTMENT REVIEW, Federal Reserve Bank of San Francisco, Vol. 10, Issue 1, 2014.

> poorest citizens who cannot afford energy efficiency investments, and industries and other consumers that may be doing all they can to save electricity.[13]

Thus, understanding the size and nature of the AE workforce becomes more important as Arkansas considers increasing its reliance on energy savings as a strategy for combatting environmental damage and the higher cost of new, large-scale production facilities. This picture not only will clarify the geographic breadth of the economic activity of the AE sector in the state, but also will demonstrate that the types of jobs created include skilled and unskilled workers and opportunities for Arkansans of all income levels and training stages to take advantage of employment openings in their own communities.

In the next two chapters, this report provides an extensive picture of the economic footprint of the AE sector and of the positive indirect effects the sector has on the state's economy and its workforce.

Figure 1. Jobs per Million Dollars of Revenue by Key Sectors of the US Economy



Source: Bell, "Understanding the True Benefits of Both Energy Efficiency and Job Creation," and presentation by Skip Laitner, ACEEE.

[13] Dustin McDaniel, Arkansas Attorney General, Letter to A.S. Garbow, General Counsel, U.S. EPA, Washington D.C., Aug. 4, 2014.

4. An Analysis of AE Jobs in Arkansas

To resolve the dilemma of properly identifying AE firms, this study adopted a two-pronged approach. First, working with Census data from the County Business Patterns (CBP) reports for Arkansas from 2011, the study team reviewed the company counts and employment totals for a set of related industries listed at the six-digit level of description. Many of these codes were referenced from the earlier study by UC-Berkeley,[14] and the study team augmented the list by adding new industry codes from other, related studies.[15] From this review the study team totaled 1,954 companies for Arkansas that have involvement in this energy sector.

Unfortunately, CBP data does not list individual names and addresses that could be used in a survey mailing. Using available listings of potential AE firms in the state, the study team created a mailing list of potential respondents based on the CBP categories. These included members of the Arkansas Advanced Energy Association, companies that have related businesses to these members, EE contractors from the companion study, and some firms from the green energy categories that were recognized from the California study. Care was taken to exclude businesses that, while fitting a description of "clean" energy, did not meet the definition of AE as any service or technology that makes the energy supply more secure, clean, and affordable.

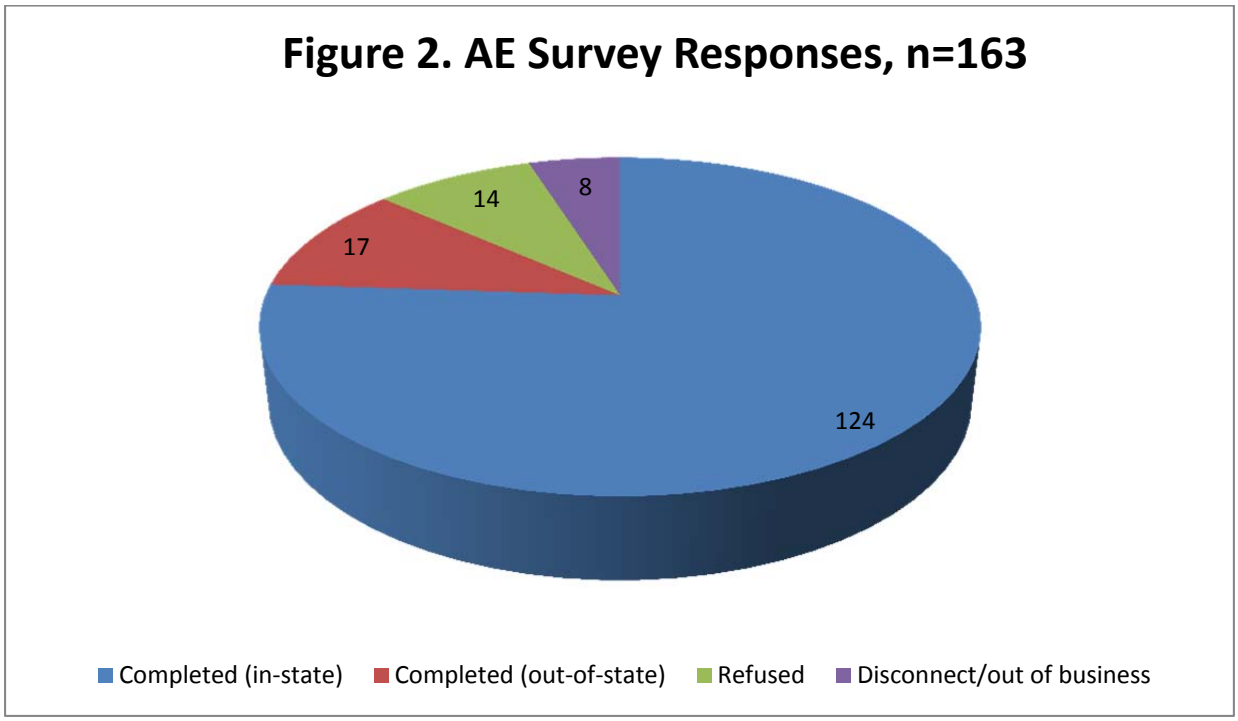
Although the combined list originally contained 782 firms and included in-state and out-of-state companies operating in Arkansas, the initial survey mailing identified about 12 addresses where the businesses had closed. Working with the list of 770 firm addresses that we believe are active, a survey form was mailed in August 2014 to each company. (See Appendix A for a copy of the survey and introductory letter.) In September after the mailing responses were finished, a series of random samples were drawn from the master list and each member of the samples was contacted by telephone for an interview. The combined result of these efforts was a data set of 141 respondents, for a response rate of 18 percent.[16] (See Figure 2 for the disposition of the contractors that were contacted; note that this compilation does not include businesses without a forwarding address.)

[14] "Innovating the Green Economy in California Regions," 2010.

[15] See, for example, "Green Jobs: Key Issues with Analyzing an Emerging Field," Florida Agency for Workforce Innovation, Labor Market Statistics Center, April 2009.

[16] For comparison, response rates for mailed surveys average in the 20-25 percent range. The few state studies that used surveys reported rates from 5 percent to 40 percent. See Holbrook et al., "The Causes and Consequences of Response Rates in Surveys by the News Media and Government Contractor Survey Research Firms," 2007, available on-line at https://pprg.stanford.edu/wp-content/uploads/2007-TSMII-chapter-proof.pdf.

Map 1 illustrates the distribution of the contractors that responded. Because of the highly differentiated character of the AE companies, care must be used in drawing estimates from the completed surveys. While many of the businesses are small and owner-operated – a frequent type of interview consisted of talking with an owner while he or she was on-site working on a customer call – other respondents were large firms with layers of sales staff and annual budgets of $10 million or more. Recognizing these differences, the study team divided the contractor list into three categories by employee size and annual revenue.[17]



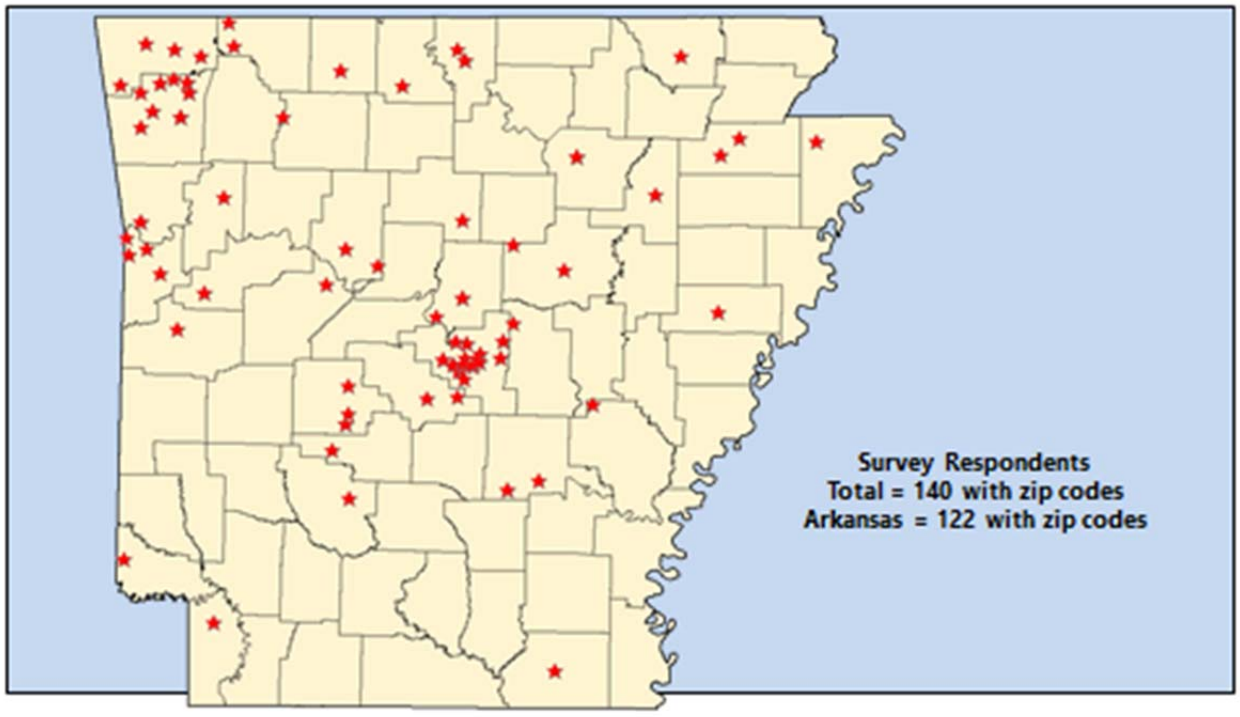
Group A	1-10 employees	Less than $1 million in annual revenue
Group B	11-100 employees	$1.01 to $10 million in annual revenue
Group C	More than 100 employees	More than $10 million in annual revenue

[17] Arkansas Economic Development Commission uses a similar letter grouping for its manufacturers based on employee size. See, for example, "Industry Lists" available on-line at http://www.arkansasedc.com/data-center/reports.

Besides the large number of firms that were identified as AE companies, another point of overall interest is the widespread distribution of these companies throughout the state. As Map 1 illustrates, practically every populous county has some representation. Many areas have multiple contractors in the areas of electrical, plumbing, lighting, and HVAC. Of course, the primary population centers like Little Rock and Ft. Smith are the most active areas, but also notable are places like Rogers and Fayetteville.

Map 2 illustrates the distribution of the original list of known business addresses of AE firms. By comparing the two maps, one can note that the location of the survey respondents reflects generally the pattern of where AE companies are located throughout the state, and follows a decidedly urban trend.

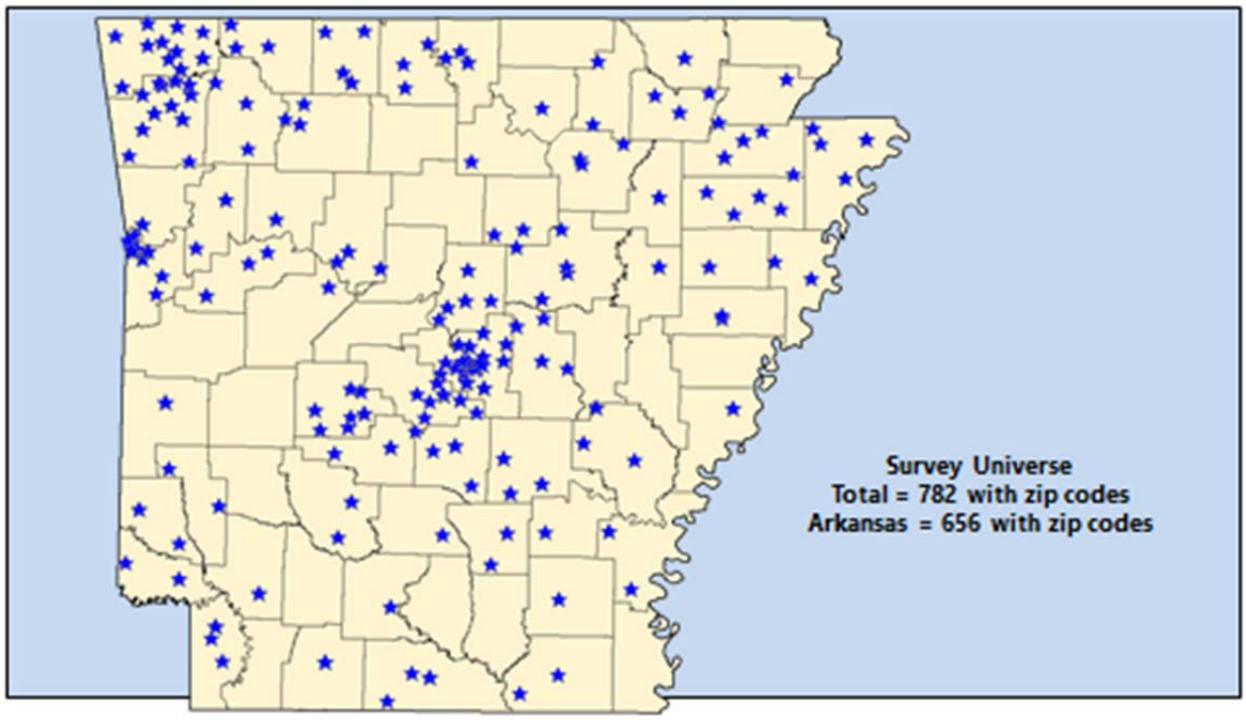
Map 1. Location of Advanced Energy Firms
Arkansas Counties 2014



Source: HISTECON Associates, Inc.; Pitney Bowes Software, Inc.

Based on the survey data from the AE firms and using detailed analysis of the three size groupings, we estimate that AE work in Arkansas accounts for about 16,000 jobs and produces total sales of more than $1.7 billion for the state's economy. This is the direct impact of AE business in 2014 and does not include the indirect or secondary effects of these sales for other businesses. The indirect impact of this AE work is another 9,300 jobs in related sectors and output of almost $1.1 billion. (These effects will be described in the next chapter.)

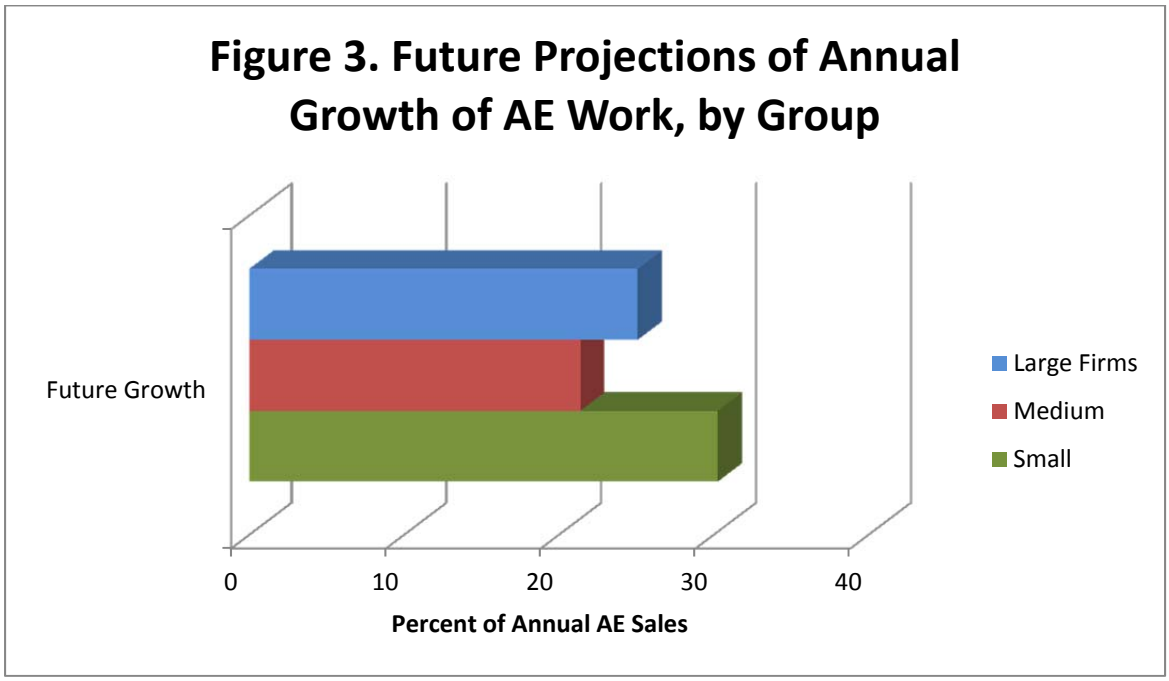
Map 2. Location of Survey Universe
Arkansas Counties 2014



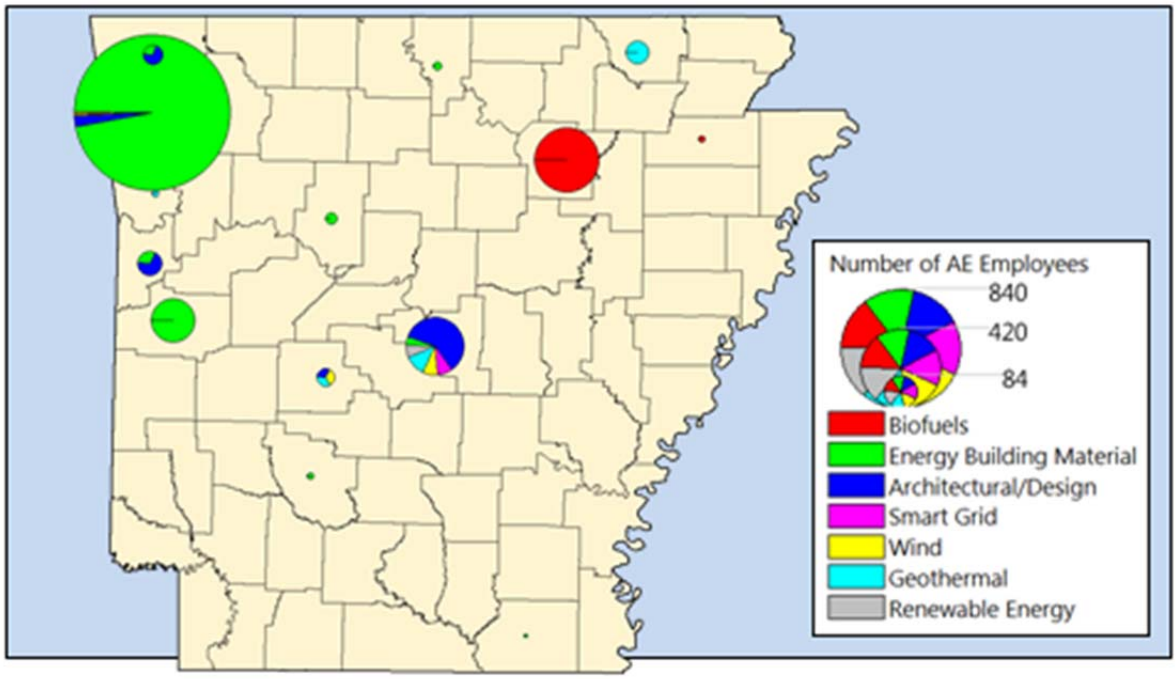
Source: HISTECON Associates, Inc.; Pitney Bowes Software, Inc.

As indicated above, the majority of the firms (56 percent) are smaller in size and number of employees (Group A). They tend to concentrate on residential and HVAC work, and AE projects comprise about 72 percent of their total sales. About 90 percent of Group A expects AE work to continue to grow as part of their sales. As Figure 3 shows, of those that report expected growth, they anticipate sales to grow about 30 percent on average during the next three years.

Group B firms account for 29 percent of the total number of AE firms, and operate slightly more in the commercial and new construction areas. AE projects comprise about 52 percent of their total sales (see Figure 4), and about 95 percent of Group B expects AE projects to continue to grow as part of their sales. Of those that report expected growth, they see sales growth of 21 percent during the next three years (see Figure 3).



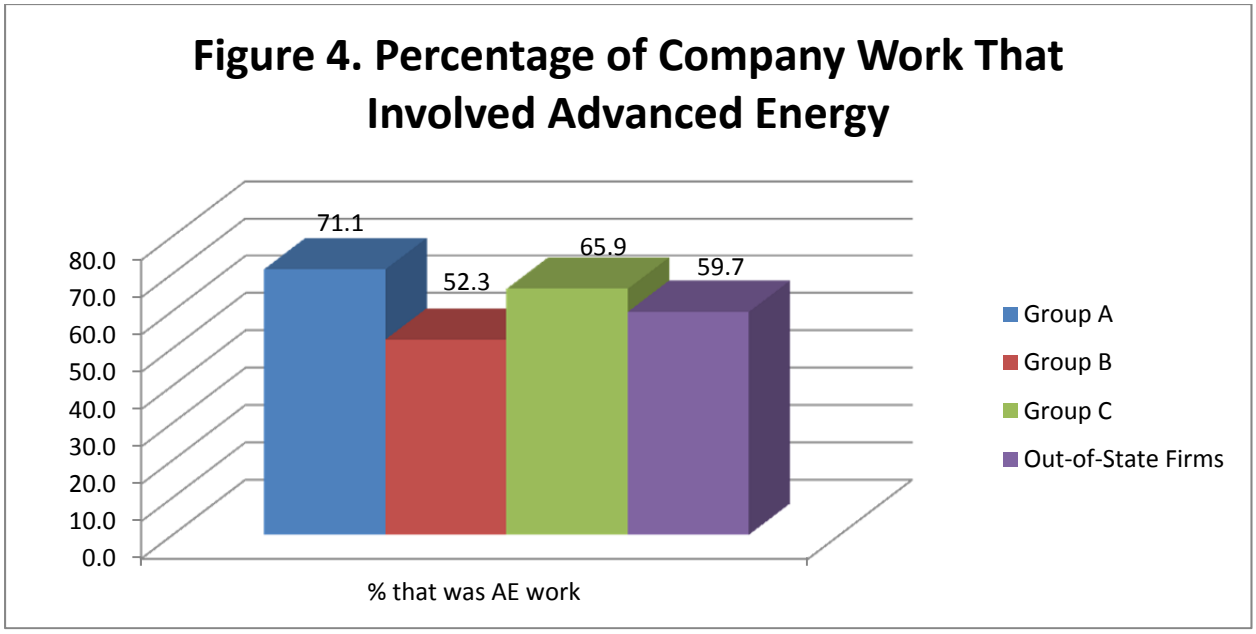
Map 3. Employees per Advanced Energy Category
Arkansas Counties 2014



Source: HISTECON Associates, Inc.; Pitney Bowes Software, Inc.

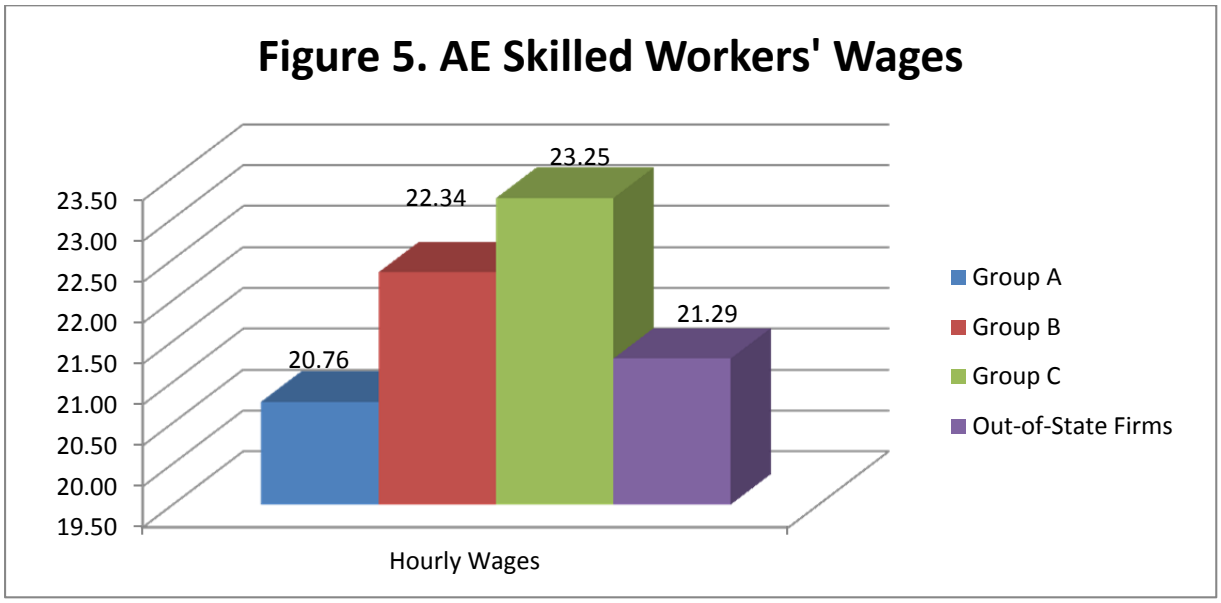
Hardest to analyze is Group C, consisting of about 15 percent of the respondents. Many of these firms are large, long-established companies that operate throughout the U.S. and other countries also: e.g., Johnson Controls or Air Works. Each has hundreds of employees, a large revenue base, and often a main office in another state, so only a few workers may be assigned to Arkansas for AE projects. For this reason, the survey counted only those employees who worked in Arkansas or were assigned to projects in the state. Nevertheless, on average these firms employ almost ten times as many workers on AE contracts as the average company in Group A (85 full-time versus 9 full-time employees for small companies). Taken together, of the approximately 15,000 workers estimated to work on AE projects in the state, Group C accounts for eight percent of the employees. As shown in Figure 4, about two-thirds of their total work in Arkansas is described as AE activity.

In Map 3, the primary type of activity for the AE firms is shown in the pie symbols at various locations. The respondents with the largest number of employees were from biofuels, energy building materials, wind, geothermal, and the architectural and design sectors. While out-of-state firms are not shown on these maps, some information on their business in Arkansas in included in the following charts. Also, many in-state and out-of-state respondents offered general comments about the status of AE in the state, and these observations are reported in Appendix B.

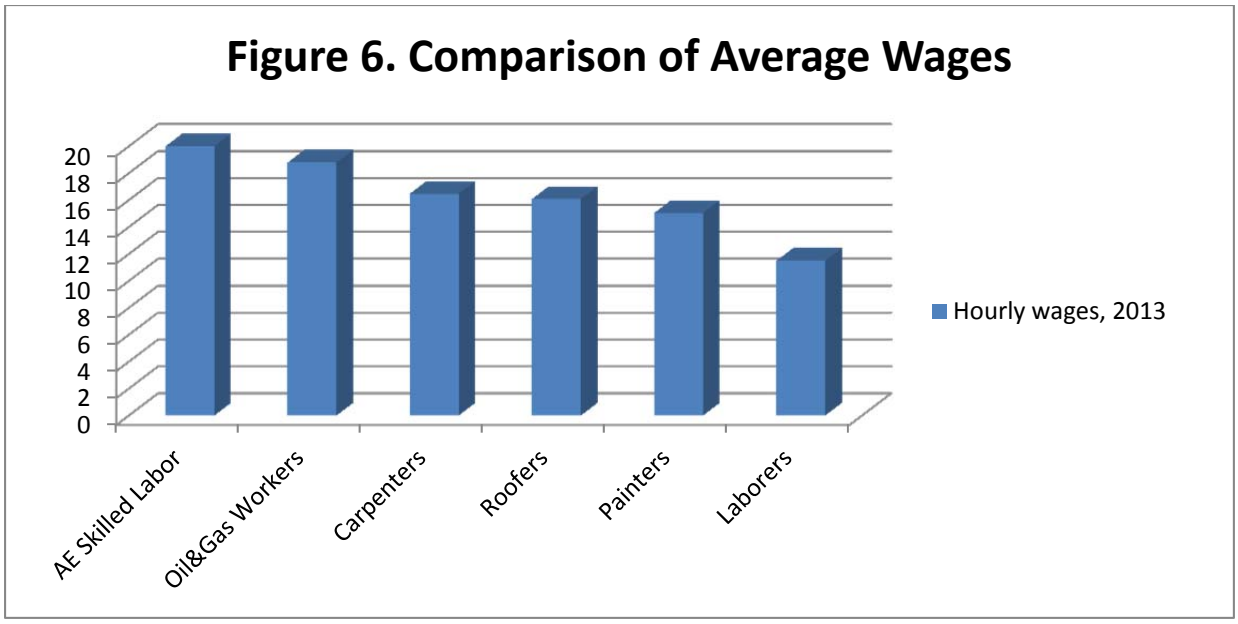


The study collected a variety of information on wages and salaries paid by AE firms. The pattern can best be seen by focusing on skilled workers and their hourly rates, which are reflected in the other types of wage data. Figure 5 shows a trend of rising wage rates as we move from smaller to larger firms (from about $20 to about $23 per hour), which is expected because many smaller firms are located in rural areas and larger firms tend to locate in urban areas where wages are more competitive for skilled labor in Arkansas. The out-of-state companies, however, operate where a larger pool of skilled labor exists, and this supply factor may explain why their average wage is slightly lower at under $22 per hour.

AE work pays well in Arkansas as it does elsewhere. As shown in Figure 5, hourly wages for skilled labor averaged $20 per hour and above for the respondent groups. This equates to a yearly income of more than $40,000, which is well above the median income for Arkansans during 2013. The difference is even more pronounced when one considers the typical wages for skilled and semi-skilled employment in the state, as demonstrated in Figure 6.

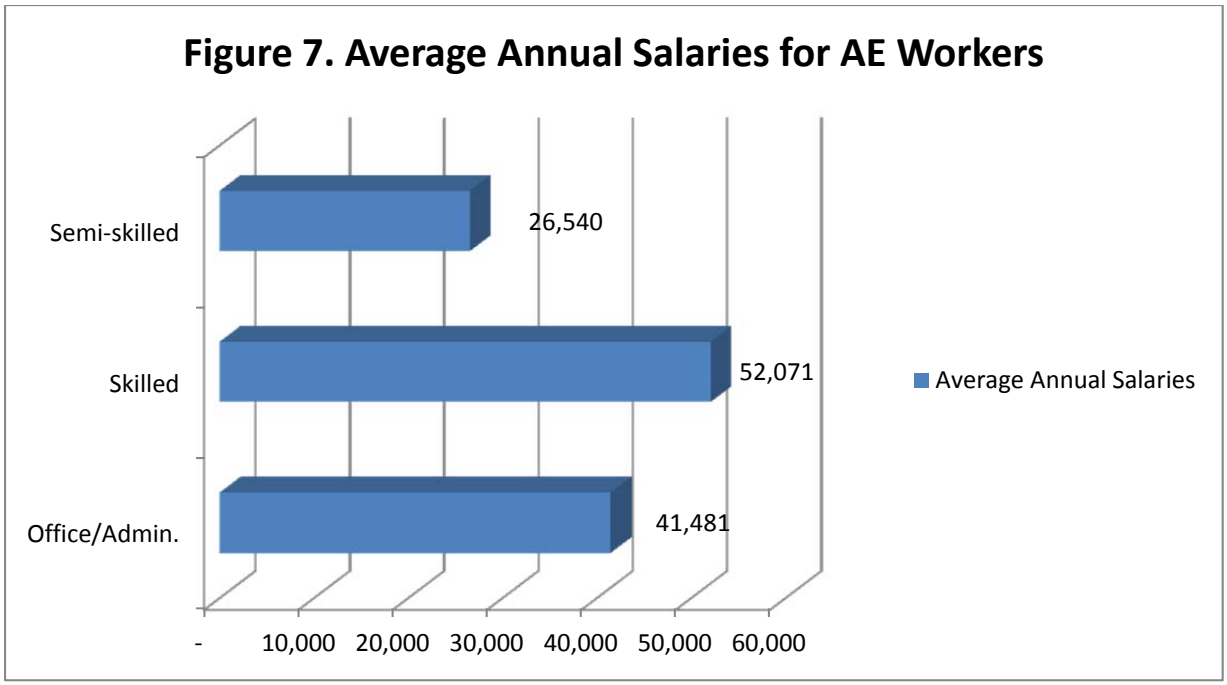


Interestingly, a large number of AE companies hesitated to provide average hourly wages for their workers and often indicated that seasonality and periods of overtime work meant that annual salaries were more meaningful information. Based on those responses, Figure 7 shows that average annual pay in the AE sector reflects the pattern shown earlier for skilled labor. A comparison of pay for skilled labor shows an annual average greater than $52,000; for semi-skilled workers the annual wage is more than $26,500; and for the combined category of office staff and professional/administrative jobs the average is almost $41,500. By any measure, in Arkansas these are good paying jobs and they compare well with other industries and other, similar employment in the state, as the next chart confirms.



Source: Arkansas Department of Workforce Services, "Arkansas Occupational Employment and Wage Survey," July 2013, available on-line at http://www.discoverarkansas.net/admin/uploadedpublications/537_oespub.pdf.

Overall wages in the AE industries are higher than most of the employment categories open to many Arkansans. For example, Figure 6 offers a comparison of average hourly wages among some skilled trades and related jobs in the state in 2013. Although they vary in the amount of training required and in the general working conditions, none of these examples provide the relatively high average wage that was reported from this survey of AE companies for their skilled workers.



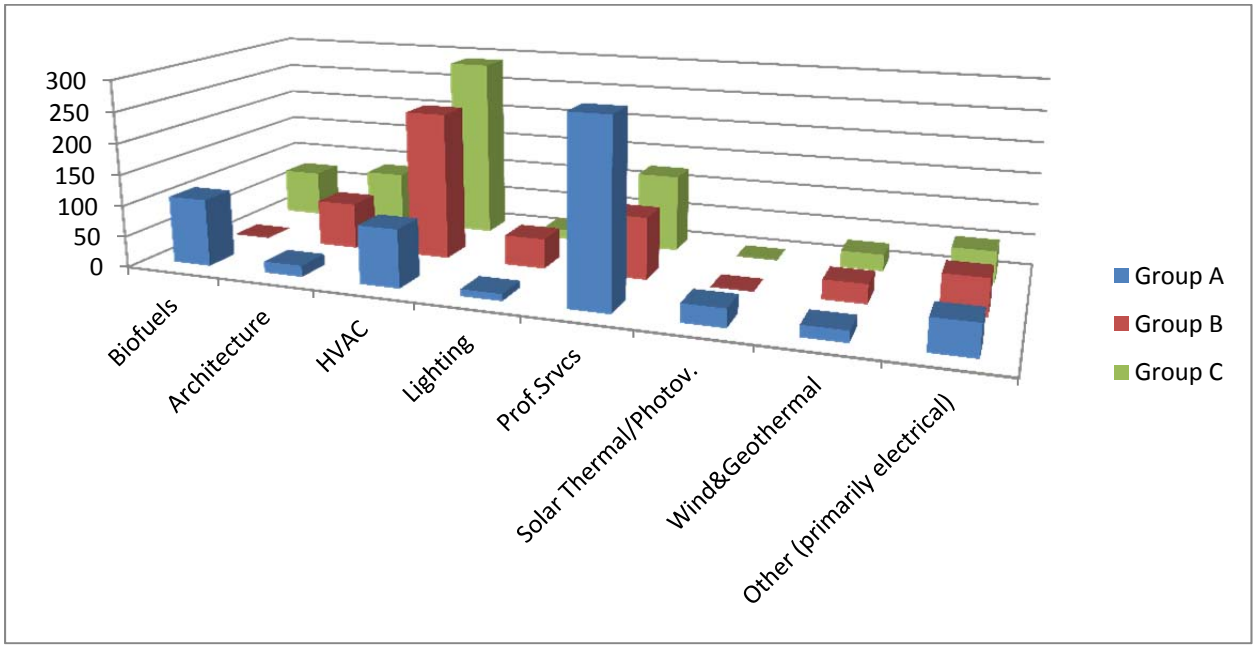
As discussed in Chapter 2, AE firms are operating in a wide variety of industries, and in Arkansas this pattern includes many construction and building related fields. Table 1 helps demonstrate that the employment profile of survey respondents is largely reflective of the total advanced energy employment in the state. Energy efficiency is by far the largest sector with the combined employment of energy building materials, architecture, HVAC, lighting, and professional services making up 61 percent of the total advanced energy employment reported by survey respondents. (Table 1 does not list all forms of AE employment, such as batteries and electric vehicles, where the counts represent a small portion (less than two percent) of total AE jobs.)

Table 1. Major AE Industries and Employment Totals by Respondents Only, 2014

AE Industry	Employees
Biofuels	183
Energy Building Materials	960
Architecture	178
HVAC	619
Lighting	75
Nuclear	1,100
Professional Services	513
Wind and Geothermal	76
Other (primarily electrical companies)	159

Figure 8 provides an illustration of the wide swath of industries that are included in the state's AE activity. (Two sectors – Energy Building Materials and Nuclear – are not part of the chart for scaling purposes, but their employment numbers are footnoted.)

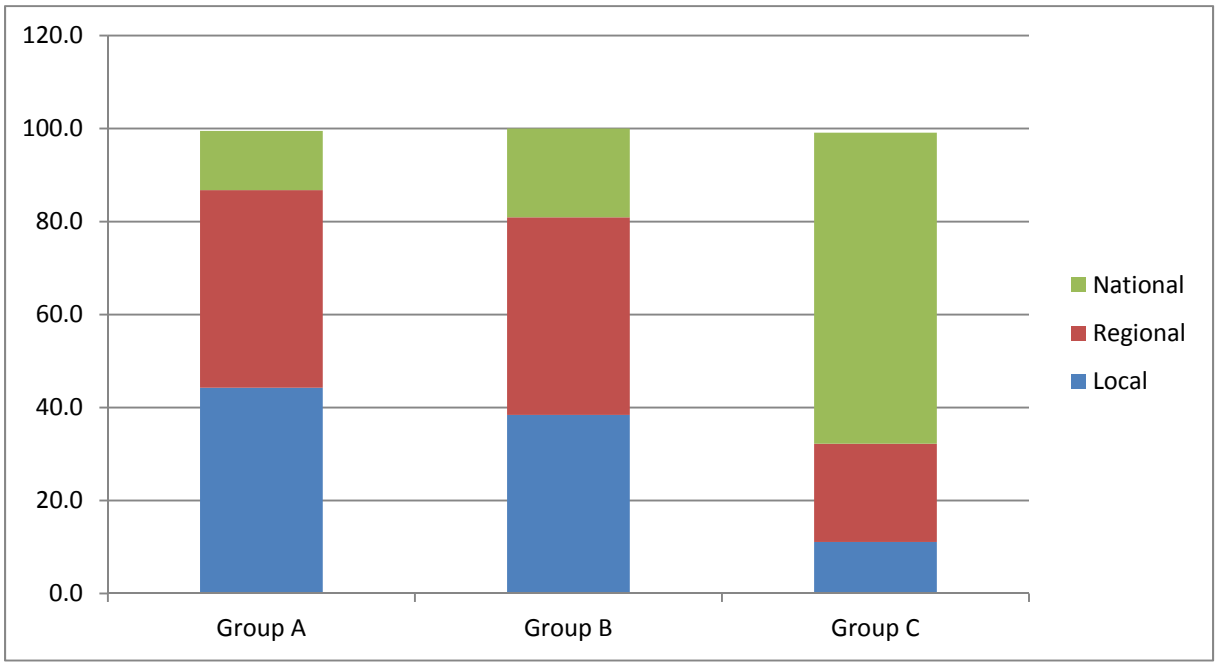
Figure 8. AE Employment Reported by Respondents, by Group (n=141)*



* Not included for scaling purposes: Energy Building Materials reported 960 employees; Nuclear reported about 1,100 employees, mostly in Group C.

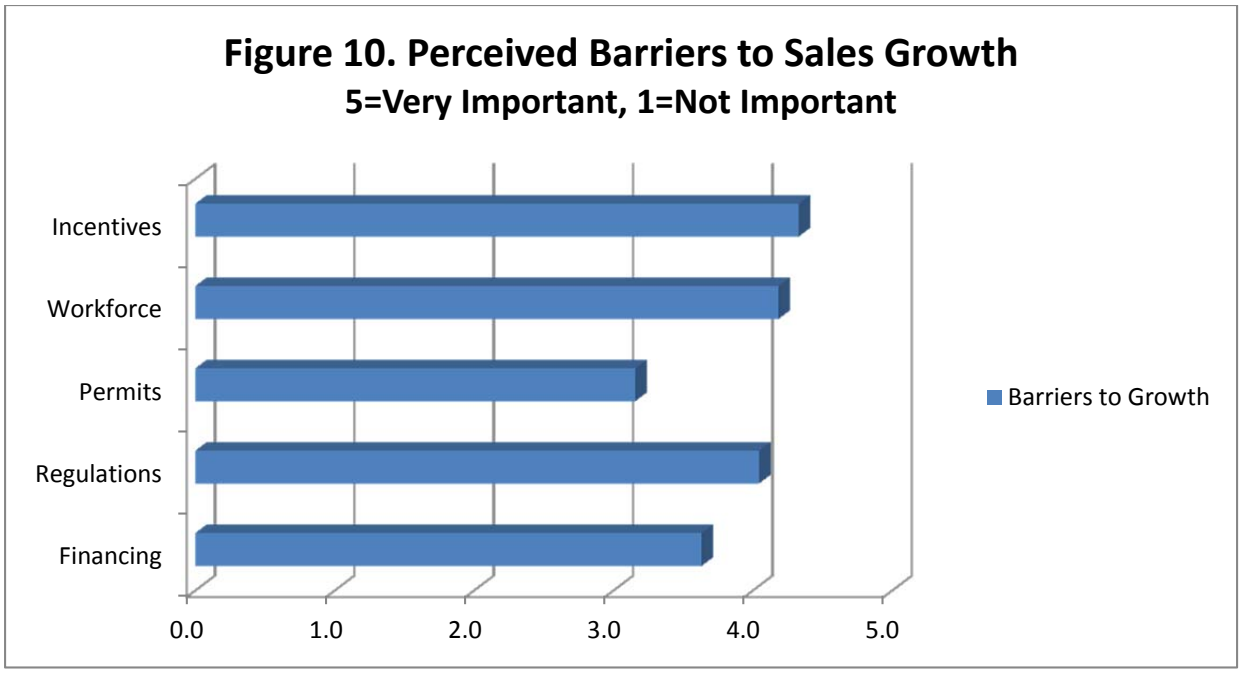
As shown in Figure 8, the largest employment occurs in HVAC and professional services, followed by nuclear power and energy building materials. For the smaller firms, HVAC, professional services, and biofuels production are the dominant areas. For the largest firms, wind and nuclear power join these three fields as the most important providers of AE jobs.

Figure 9. Location of Sales by AE Firms with Jobs in Arkansas*

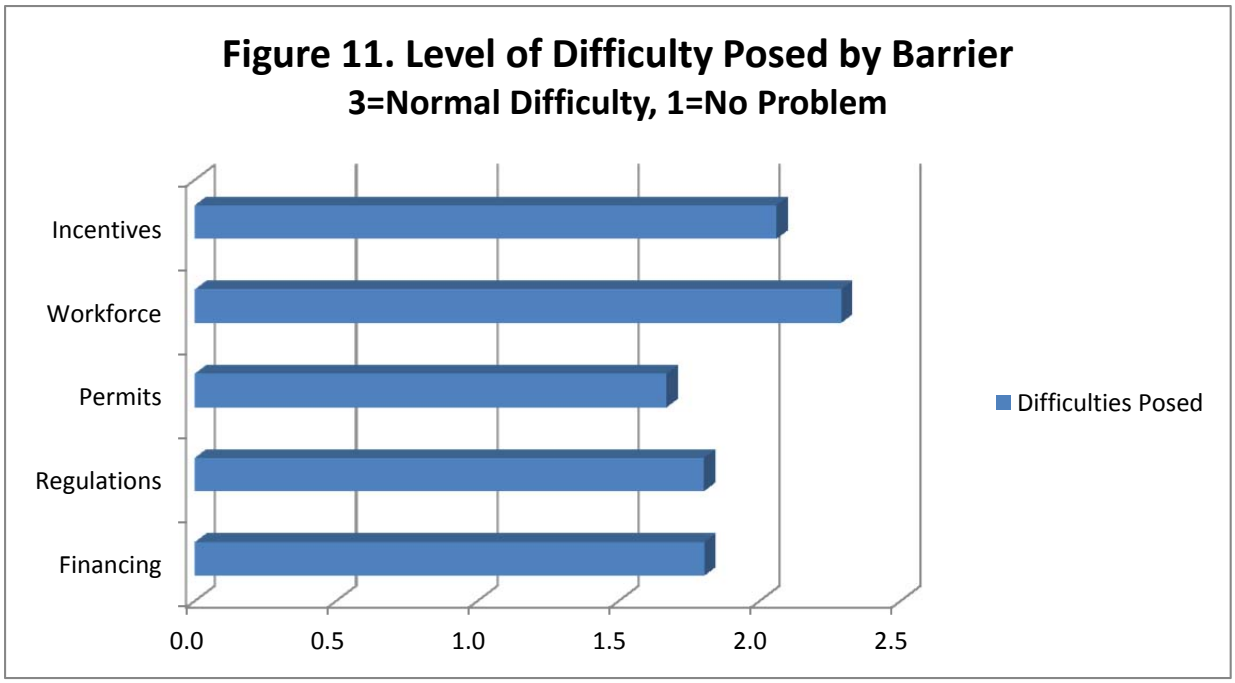


*Minor percentages of Group A and Group C companies reported some international sales.

For the small and medium firms, local and regional sales dominate their business. Respondents reported that more than 80 percent of revenue came from local and regional markets. In contrast, as indicated in Figure 9 the largest firms have about two-thirds of their revenue coming from national markets, and not surprisingly about one-tenth of their sales occur locally.



Looking forward to future AE activity, three areas of concern arose from the respondents regarding barriers to growth – business incentives, workforce preparation, and governmental regulations. Each of these areas registered an average "score" that these are important to their business planning, and that future changes in one of these areas could seriously impair or improve their ability to grow. Rebate programs and other energy-savings incentives was the greatest concern, as shown in Figure 10.



Interestingly, when respondents were asked how much difficulty these same factors were causing them at present, workforce preparation stood alone as the most important barrier to future growth. Education and training were cited by many contacts as the cause of the concern, and whereas many respondents reported "no problem" with areas like permits, regulations, and financing. Figure 11 shows the stronger concern about barriers like workforce skills and business incentives.

Regardless of these concerns about barriers to growth, AE firms reported that they plan to increase employment during the next year. This is especially true at the small firms, which expect to expand AE activity about 30 percent on average. The two larger groups of firms also plan to grow their AE business next year by about 20 percent, a slower pace that is consistent with their more established organizations.

These sections painted a detailed picture of the types and economic size of AE activity in the state recently, but it has not told the full story. Recall that our estimate that AE work in Arkansas accounts for 16,000 jobs and produces total sales of more than $1.7 billion for the state's economy is only the direct impact in 2014. As such, the estimate does not include the indirect or secondary effects of these sales for other businesses and the way that these jobs affect the rest of the economy. That description requires an economic model of the state's economy like IMPLAN, which is explained in the next chapter by incorporating the effects of AE spending on the overall picture.

5. The AE Economy and Overall Impact on the Region

For several technical reasons, the study team used a well-known regional economic model to project the state-level impact of AE spending. IMPLAN, an acronym for IMpact analysis for PLANning, has a national-level technology matrix and estimates of sectorial activity for final demand, final payments, industry output, and employment for each county in the U.S. IMPLAN uses these social accounts to calculate the commodities flow from industry to producers and consumers. In addition, IMPLAN shows the consumption, factors of production, capital ownership, and commodities imports from outside of the region. Once IMPLAN estimates the social accounts for an area, these social accounts are then converted into Leontief multipliers.[18]

The concept of the multiplier depends on the difference between the initial effect of change in final demand and the total effect of the initial change. The total effect of final demand change is classified as direct, indirect, and induced effects. Direct effects are changes in the initial production or expenditure made by affected industries. Indirect effects are the local inter-industry spending by the industries. Induced effects are the local household spending patterns caused by "changes in household income generated from the direct and indirect effects."[19]

Table 2. IMPLAN Multipliers

Type	Definition
Type I	Type I multiplier is the direct effect, produced by a change in final demand, plus the indirect effect divided by the direct effect.
Type II Multiplier	Type II multiplier incorporate "induced" effects resulting from new labor income.
SAM Multiplier	Type SAM multipliers are the direct, indirect, and induced effects where the induced effect is based on the information in the social account matrix.

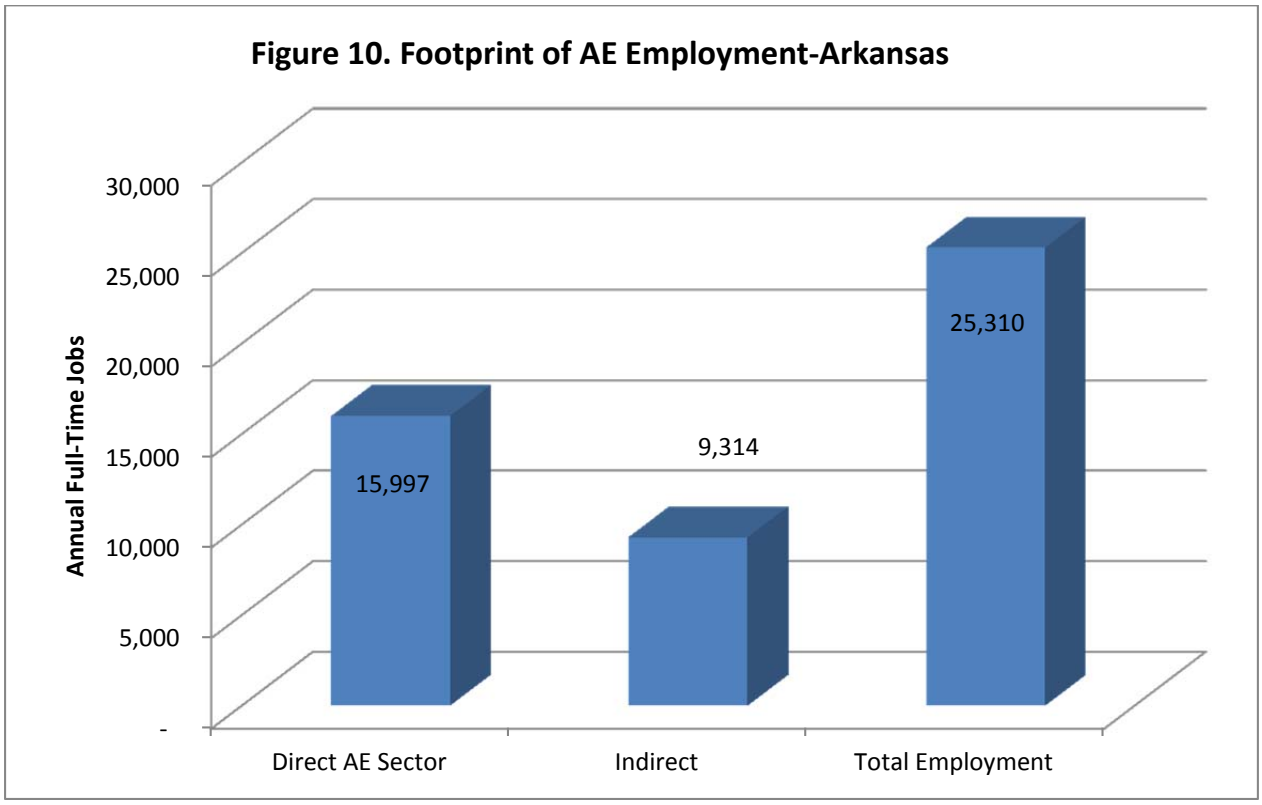
Sources: Day, Frances. (2012). *Principles of Impact Analysis & IMPLAN Applications*. Retrieved from http://implan.com and Lynch, Tim. (2000). *Analyzing the Economic Impact of Transportation Projects Using RIMS II, IMPLAN and REMI*. Retrieved from http://ntl.bts.gov/lib/18000/18800/18872/PB2002102503.pdf.

[18] Lindall, Scott A. & Douglas C. Olson. *The IMPLAN Input-Output System*, 1999. Retrieved from ftp://ftp-fc.sc.egov.usda.gov/Economics/NatImpact/implan_io_system_description.pdf.

[19] Ibid.

Since there are five measures of regional economic activity (total output, personal income, total income, value added, and employment), IMPLAN has five different sets of multipliers that correspond to the regional activity. Each set of multipliers generated four different types of multiplier. Table 2 lists the different types of multipliers generated in IMPLAN.

The IMPLAN methodology has been used extensively in regional economic impact analysis generally, as well as focused on the impact various energy programs. In a related example, the University of Minnesota found that an additional $1.09 in output was generated by each $1.00 of spending on weatherization programs in 2009. In addition, for every 100 direct jobs in weatherization work, another 77 indirect jobs were created in the state's economy.[20]

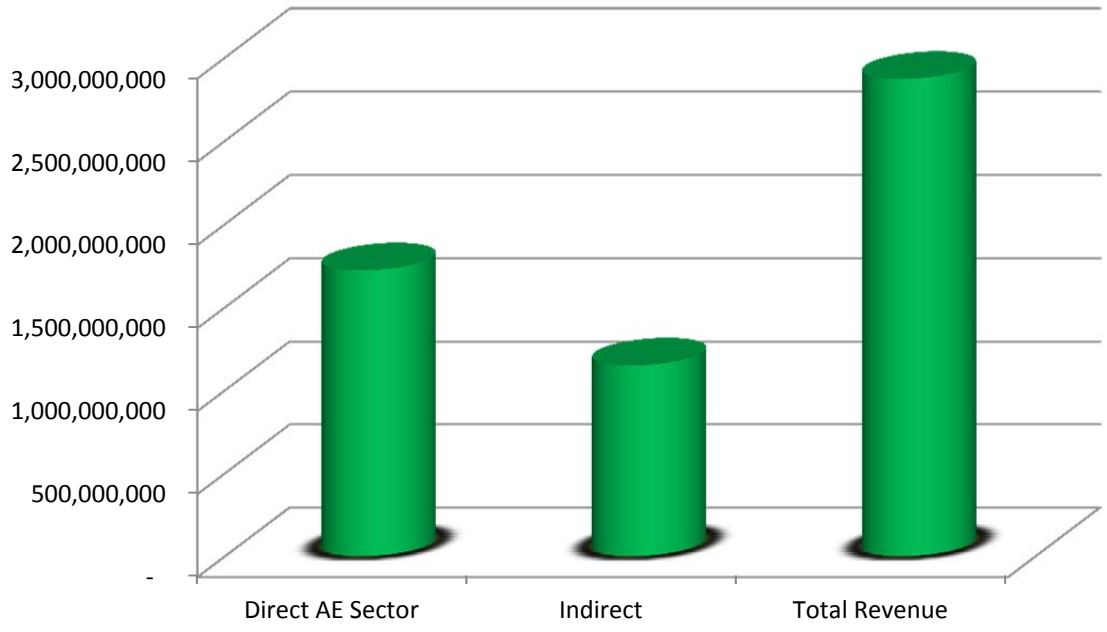


[20] Brigid Tuck and David Nelson, "The Economic Impact of Minnesota's Weatherization Programs: An Input-Output Analysis," University of Minnesota Extension office, June 2010.

The survey data was used to project the total size of the AE sector for Arkansas in 2014, which had a direct impact of $1.7 billion in revenue and accounted for about 16,000 jobs (see Figure 10). The IMPLAN model was utilized to follow the effects of this level of spending on the overall economy, through its state-level data on the multiplier properties of various types of spending – e.g., new residential or commercial upgrades. In addition, all reported employment, whether full-time or part-time, was converted to full-time equivalents to measure the income effects on other sectors.

Based on these inputs, the model projected that another 9,300 jobs were created in related sectors and additional output of $1.1 billion was generated. Thus, as shown in Figure 11, the total effect of AE spending in the current Arkansas economy is quite substantial: almost $2.8 billion in total sales and employment of more than 25,000 workers on a full-time basis.[21]

Figure 11. Estimated Company Revenue 2014



[21] This section of the report and the IMPLAN analysis were prepared by the Institute for Economic Advancement, University of Arkansas at Little Rock.

These indirect effects are important contributions to many of the small local economies in various regions of Arkansas. Value-added to these local economies, which consists of total output minus expenses for intermediate goods, totals more than $1.3 billion. Of that, labor income from the indirect spending accounts for almost $400 million. (See Appendix C for a detailed breakdown of the projections by type of AE activity.)

6. Summary and Conclusions

On a national scale, energy use has been declining recently and it appears that EE programs and AE technologies have played an important role in that decline. From the outset of these programs, it seemed clear that an exciting potential existed for these activities to have a strong positive effect on the overall economy that would offset the perceived yet uncertain cost of energy-savings and alternative energy policies.

With this report, AAEF is able to document in a comprehensive manner that the potential is already being realized, and that the roots of future growth and even more positive impacts have taken hold in Arkansas. The AE sector in Arkansas reflects in many ways the rapidly growing set of industries nationally. A recent report from Navigant Research indicates that $169 billion in revenue was generated by these firms in 2013, a 28 percent increase from 2011.

While this report includes many of the job sectors that are included in any "green" or "clean" energy study, it differs in its focus on activities that drive the economy away from traditional fossil-fuel energy sources toward innovations that make the state's energy supply more secure, clean and affordable. These activities include an expanded utilization of advanced energy technologies, including energy efficiency, demand response, natural gas electric generation, solar, wind, hydro, nuclear, electric vehicles, alternative fuels and smart grid.

The recent survey of the state's EE contractors – a companion study for the AAEF – provided several important findings about related economic activity. It documents that AE work, especially but not limited to energy efficiency work, is having tangible results on energy demand in communities throughout the state, meaning that households and businesses are spending less on energy costs. This means that family and firm budgets will have more to spend on other goods and services, and these expenditures will help local economies grow faster than before.

It is noteworthy that the shift of jobs from the traditional energy-production sector – a capital-intensive area of the economy – to construction trades and the general economy actually creates more jobs per dollar spent. This is because of the labor intensity of the other areas; while the energy sector produces about 10 jobs for every $1 million invested, on average the construction sector creates about twice that amount of employment for the same dollar investment: 20 jobs for every $1 million invested.

Because of the highly differentiated character of the AE companies, care must be used in drawing estimates from the completed surveys. While many of the businesses are small and owner-operated – a frequent type of interview consisted of talking with an owner while he or she was on-site working on a customer call – other respondents were large firms with layers of sales staff and annual budgets of $10 million or more.

The study collected a variety of information on wages and salaries paid by AE firms. Focusing on skilled workers and their hourly rates, the pattern shows a trend of rising wage rates as we move from smaller to larger firms (from about $20 to about $23 per hour). Out-of-state companies, however, operate where a larger pool of skilled labor exists, and this supply factor may explain why their average wage is slightly lower at under $22 per hour.

AE work pays well in Arkansas as it does elsewhere. Hourly wages for skilled labor of $20 per hour and above for the respondent groups equates to a yearly income of more than $40,000, which is well above the median income for Arkansans during 2013. The difference is even more pronounced when one considers the typical wages for skilled and semi-skilled employment in the state

AE firms are operating in a wide variety of industries, and in Arkansas this pattern includes many construction and building related fields. Principal AE industries in the state include the following: biofuels; energy building materials; architecture; HVAC; lighting; nuclear; professional services; wind and geothermal; and other related trades (primarily electrical companies). For the small and medium firms, local and regional sales dominate their business. Respondents reported that more than 80 percent of revenue came from local and regional markets.

Looking forward to future AE activity, three areas of concern arose from the respondents regarding barriers to growth – business incentives, workforce preparation, and governmental regulations. Each of these areas registered an average “score” that these are important to their business planning, and that future changes in one of these areas could seriously impair or improve their ability to grow.

Rebate programs and other energy-savings incentives was the greatest concern. When respondents were asked how much difficulty these same factors were causing them at present, workforce preparation stood alone as the most important barrier to future growth. Education and training were cited by many contacts as the cause of the concern. Regardless of these concerns about barriers to growth, AE firms reported that they plan to increase employment during the next year. This is especially true at the small firms, which expect to expand AE activity about 30 percent on average.

Finally, based on the survey data from the AE firms and using detailed analysis of the three size groupings, we estimate that AE work in Arkansas accounts for about 16,000 jobs and produces total sales of more than $1.7 billion for the state's economy. This is the direct impact of AE business in 2014 and does not include the indirect or secondary effects of these sales for other businesses.

The IMPLAN model was utilized to follow the effects of this level of spending on the overall economy, through its state-level data on the multiplier properties of various types of spending. Based on these inputs, the model projected that another 9,300 jobs were created in related sectors and additional output of $1.1 billion was generated. Thus the total effect of AE spending in the current Arkansas economy is quite substantial: about $2.8 billion in total output and employment of more than 25,000 workers on a full-time basis.

Appendix A. Cover Letter and Survey Instrument

August 10, 2014

XYZ Energy Company (EXAMPLE)
1000 West Main Street
Russellville, AR 72801-3518

Dear Sir or Madam:

The Arkansas Advanced Energy Foundation (AAEF) is conducting a study of the economic impact of advanced energy businesses in Arkansas. We are working with HISTECON Associates, Inc. to undertake the study of job creation, economic growth, and other economic benefits that are generated by companies like yours. The purpose of the AAEF study is to count every job that is associated with companies that provide goods or services in the advanced energy industry and better understand the size and scope of this growing energy sector in Arkansas.

HISTECON Associates has developed a brief survey to aid in this analysis. All advanced energy companies and organizations are being asked to participate in this study. In order to accommodate your schedule, we ask that you choose to respond in either of two ways:

1) Use the enclosed survey form for your answers, and return by mail using the self-addressed envelope also enclosed.
   OR
2) E-mail HISTECON representatives at jemetzger@aristotle.net and request a personal interview by telephone at a scheduled time.

ALL INFORMATION THAT YOU PROVIDE WILL BE HELD IN STRICT CONFIDENCE; the data will be shared with AAEF only in summary format without individual identifiers. All tabulations are completed using a double-blind methodology that protects the identity of the respondents. We plan to present the research findings to Arkansas policymakers and the general public as an overall measure of the importance of advanced energy to the state's economy.

Thank you for your assistance with this important study. Please feel free to contact our researcher Jim Metzger (jemetzger@aristotle.net) if you have questions.

Sincerely,

Steve Patterson,
Executive Director

Advanced Energy Survey Questionnaire

First and Last Name_____ Company Name_____
Company City _____ Company Zip _____

Advanced energy is defined as any service or technology that makes our energy supply more secure, clean and affordable. For this survey, we will just be asking about the advanced energy employees that work from or directly report to your Arkansas location(s).

SECTION 1 – Business information.

1. How many business locations do you have in Arkansas?
   Record # of locations in Arkansas _____

2. Including all full-time and part-time employees, how many **permanent** employees work at or from your Arkansas location(s)?
   Record # of employees _____

3. If you currently have full-time and part-time **permanent** employees in Arkansas, how many more or how many fewer permanent employees do you expect to have in Arkansas 12 months from now?

(Please enter the number more or the number fewer. For example, if you currently have 50 employees and expect to have 5 more 12 months from now, you would enter 5 next to more.)

1 More [record #_____]
2 Fewer [record #_____]
3 Same number
4 Don't know

4. Of your full-time and part-time **permanent** employees in Arkansas, how many workers support the advanced energy portion of your business? Please note that your response should include administrative staff supporting the advanced energy portion of your business.
   Record # of employees _____

5. Of the full-time and part-time **permanent** employees in Arkansas that support the advanced energy portion of your business, how many more or how many fewer permanent employees do you expect to have supporting the advanced energy portion of your business from your Arkansas location(s) 12 months from now?

(Please enter the number more or the number fewer. For example, if you currently have 20 employees supporting the advanced energy portion of your business and expect to have 3 more 12 months from now, you would enter 3 next to more.)

1 More [record #_____]
2 Fewer [record #_____]
3 Same number
4 Don't know

6. Of those working on advanced energy projects, about what percentage are the following?

Office/administration Skilled Labor Unskilled Labor
_____%_____%_____% = 100%

7. Of those working on advanced energy projects, what is the average pay for these workers? (You may choose to indicate an annual average salary or use an hourly rate.)

Office/administration Skilled Labor Unskilled Labor
$_____$_____$_____

8. Can you allocate your advanced energy employees to the following categories? Please count each employee only once and allocate them to the technology area in which they spend the most time.

Area	Number of Employees
1. Appliances	1. _____
2. Battery Technologies	2. _____
3. Biofuels/Biomass	3. _____
4. Electric Vehicles Technologies	4. _____
5. Energy Saving Building Materials	5. _____
6. Energy Saving Consumer Products	6. _____
7. Fuel Cells	7. _____
8. Green Architecture and Construction Services	8. _____
9. HVAC and Building Control Systems	9. _____
10. Lighting	10. _____
11. Nuclear Energy	11. _____
12. Professional Energy Services	12. _____
13. Smart Grid	13. _____
14. Solar Photovoltaic	14. _____
15. Solar Thermal	15. _____
16. Wind	16. _____
17. Geothermal	17. _____
18. Hydropower	18. _____
19. Renewable Energy Services	19. _____
20. Waste-to-Energy	20. _____
21. Wave/Ocean Power	21. _____
22. Carbon Storage and Management	22. _____
23. Other (Specify: _____)	23. _____
24. Don't know	24. _____

9. Approximately how much of your firm's work in Arkansas, in terms of total revenue, is related to advanced energy products or services?

_____1 All of it (100%)
_____2 Half to most of it (50% to 99%)
_____3 A quarter to almost half of it (25% to 49%)
_____4 Less than a quarter (1% to 24%)
_____5 Don't know

10. On an annual basis, what were your average total sales (include services and equipment) for the previous three (3) years? $_____average per year

11. In the past 12 months, what percent of your organization's advanced energy products and services were provided to customers in:

_____% Local markets within 100 miles of the office(s) _____% National markets

_____% Regional markets within 500 miles of the office(s) _____% International markets

12. This is sometimes difficult to do, but looking ahead: do you expect to see much growth in advanced energy business during the next three years?

Yes _____ No _____ Uncertain _____ Expect a decline in business _____

13. Again, looking ahead: If you answered "Yes," how much growth in advanced energy business do you expect to see during the next three years? (Approximate percent or a range of numbers is fine.)

_____ % per year OR between _____% and _____% per year

14. Let's talk about some potential barriers to future growth for your company. Please rate the following five categories by the importance to your business's growth.

	Very Important	Somewhat Important	Neutral	Hardly Important	Not At All Important
Access to financing					
State regulations					
Local permitting and siting					
Recruiting and workforce availability					
State financial incentives(tax credits)					

15. Now let's rate these same five categories by the difficulty that they pose for your business future growth prospects.

	No Difficulty	Moderate Difficulty	Regular Difficulty
Access to financing			
State regulations			
Local permitting and siting			
Recruiting and workforce availability			
State financial incentives(tax credits)			

16. Are you interested in receiving future information about the findings of this research?

_____1 Yes
_____2 No

SECTION 2 – Closing and Contact Info

17. Those are all our questions for today. Do you have any comments that you would like us to record about advanced energy policies in Arkansas?

_____

_____

_____

****

THANK YOU FOR YOUR TIME AND WILLINGNESS TO HELP WITH THIS IMPORTANT STUDY!

Appendix B. General Comments on AE Activity:

Comments Regarding Incentives and Rebates

1. Tax incentives and rebates would be a big boost. Getting the co-ops involved in rebates.

2. Legislation is very important to our business. The rebate programs are difficult to use.

3. Need incentives for renewables. Need to promote "performance contracting."

4. The program would be much easier to foresee what amount of time [though] many employees, materials, vehicles were needed yearly if the contractor had a clear incentive amount allotment from the beginning of each year.

5. Rebate program is now cost effective. "Magnetic ballast" is a winner. Why are Entergy-supplied energy providers (e.g., City of Benton) not eligible?

6. Arkansas is more aggressive on EE rebate. I'm in Texarkana and there [are] more rebates available in AR. Growth is in the foam insulation business.

7. The rebate programs are helping my business.

8. If state [government] will continue to offer rebates or subsidies, the market for EE would grow at a much faster rate.

9. The rebate programs are not promoted well by the utilities. Need to have T.V. Ads

10. The incentives are a good selling point and good for the customers.

Comments on Business Growth

1. Reprocessing needs more attention at the critical link needed to stimulate more material recovery and greater manufacturing competitiveness.

2. We do not have much work in AR. Sub-contractors hire their own people.

3. The growth of E.E. is dependent on bank or credit union financing. For existing homes, most families do not have 10k or 25k or 50k to spend – they need easy financing or leasing for solar or wind or geothermal equipment. Of people [that] can pay the [? lease] are out with the savings in energy, it will be an easy decision! Banks loan RVs, cars, boats, ATV's, pools, etc. that depreciate; EE improvements appreciate. Also, we need an energy code for the state IECC 2009. And the federal government must pass the S.A.V.A. (Sensible Accounting to Value Energy Efficiency).

Note: [words in brackets were approximated by transcriptionist]

4. There are a high percent of businesses and residential [customers] that don't know about the different types of “EE” programs out there that could benefit from. Most of “EE” advertisements are in mail/letter form. Most of those letters get thrown away. We need local T.V. Advertisement and maybe calling the customer would be a better way and would be more [personal]. Thanks hope I've helped!

5. Steadily increasing.

6. Federal Regulations play a bigger part in our success than local. EPA regulations and rulings play a major part in the future of Chem. Co. future.

Comments on Equipment

1. Solar needs to be higher on the priority list.

2. Our goal is to provide our customers with the most energy efficient equipment available and state of the art test equipment to prove it!

3. Blower door used regularly.

4. Splits are used in other countries. BRS systems are coming.

5. As tankless [water heater] price goes down, growth will increase.

6. LED lighting is a big money saver.

Comments on EE Programs

1. Get [metropolitan] involved with solar. Many cities don’t allow solar!

2. AAEF is doing a great job. We will support them in any way we can.

3. The PACE program has potential.

4. We appreciate the EE program thank you to everyone involved.

5. I am a big supporter of those programs. In fact, Nicholsons has re-vamped the way it does business because of these programs.

6. EE programs work for us.

7. We are asked regularly about programs such as Solar Entergy.

8. PACE program.

9. Cool saver only.

10. Make builders aware of program, they will sell it to customers.

11. The programs are saving people money.

12. We have been doing energy-efficiency work for 30 years. We use the Entergy EE programs.

13. Glad they're there – helps people afford a more efficient system with less money out of pocket.

Other Comments

1. I question the amount of money spent by Entergy – Is it taking away from the amount of incentives paid to Arkansas consumers?

2. I hope this is not too late to be included.

3. We are a new company and have not taken a salary. Partnership with [a solar company].

4. I would like to have face to face interview or phone interview to explain our beginning in the EE business. Also to detail some of the items that we were instrumental in applying and innovating the energy efficiency business.

Appendix C.

IMPLAN Stages to Project Indirect Effects of AE Direct Spending

Input					
Electric power generation and tramission and distribution					
Sector	Industry Sales	Employment	Employee Comp	Proprietor Income	Event Year
31 Electric power	$903,816,896.00	1,176	$145,798,913.78	$3,417,573.38	2014
Output					
	Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
	Direct Effect	1,176.00	$149,216,488	$582,118,751	$903,816,858
	Indirect Effect	977.1	$47,216,614	$67,545,673	$142,664,260
	Induced Effect	1,113.60	$42,220,984	$75,992,870	$129,556,993
	Total Effect	3,266.60	$238,654,085	$725,657,295	$1,176,038,111

Input					
Aggregate Construction					
Sector	Industry Sales	Employment	Employee Comp	Proprietor Income	Event Year
34 230 Construction	$1,645,876,992.00	13,721	$446,162,947.87	$198,557,270.78	2014
Output					
	Impact Type	**Employment**	**Labor Income**	**Value Added**	**Output**
	Direct Effect	13,721.00	$644,720,221	$656,313,168	$1,645,876,919
	Indirect Effect	4,205.40	$199,520,134	$309,941,749	$570,189,210
	Induced Effect	5,108.20	$195,972,450	$340,613,142	$578,958,083
	Total Effect	23,034.60	$1,040,212,805	$1,306,868,059	$2,795,024,212