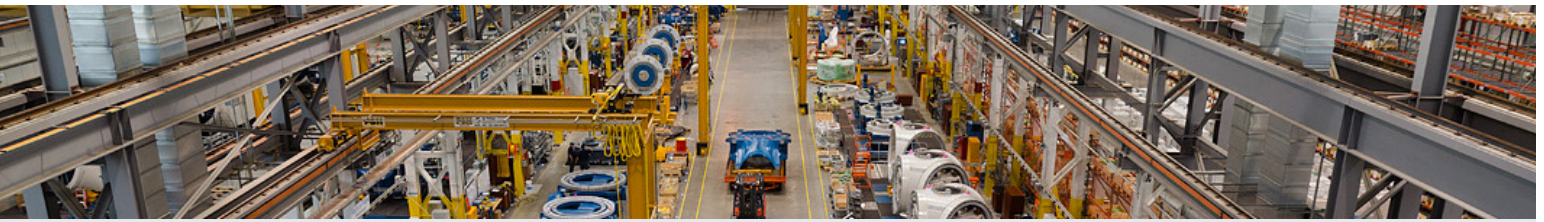


EMPLOYMENT IN THE ARKANSAS ADVANCED ENERGY INDUSTRY





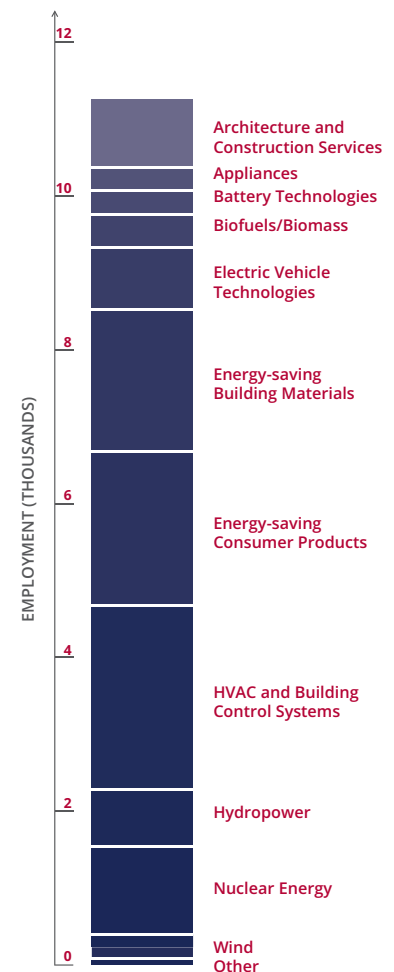
Arkansas has cultivated a substantial and growing advanced energy (AE) industry, building upon the foundation of the state’s historic economic assets, innovative business professionals, and forward-thinking private and public leaders.

On the basis of a conservative assessment prepared for Arkansas Advanced Energy Association (AAEA) by Advanced Energy Economy Institute (AEEI), the state is home to over 90 advanced energy companies across 22 advanced energy industry segments that collectively employ 11,337 Arkansans as of 2010. This is nearly equal to current Arkansas employment in the accommodation services segment (i.e., hotels and motels) of the hospitality and leisure industry. The largest number of jobs, nearly 2,500, is found in heating, ventilation, and air-conditioning (HVAC) and building controls – firms that improve performance of the largest drivers of energy use in buildings. The next largest number of jobs, nearly 2,100, is found in energy-saving consumer products – companies that make a wide variety of consumer products that meet higher performance standards, such as office products, computers, glass, and shades.

The methodology ensures that each of these counted jobs is associated with a verifiable company. Importantly, it also guarantees that 11,337 is a conservative count of employment in Arkansas’s advanced energy industry. It focuses only the “known universe” of advanced energy companies – those that are readily identified as part of the industry – and leaves out the “unknown universe” of firms that provide value to the industry, but may not be identified as members of it. As a company-by-company assessment, this analysis ensures the association between jobs and verifiable companies. It avoids survey-based methodologies that are used in some other studies to infer wider industry employment. In the process, this analysis leaves out some of the smaller, less visible firms in the industry. Finally, there are segments of the advanced energy industry that are not included in the estimate, such as natural gas truck fleets and fueling stations, because they were not part of the available datasets.

The chart (Figure 1) at right shows employment by industry segment. The same data are shown as a table in Figure 5 in the Results section.

Figure 1: Employment in Arkansas’s Advanced Energy Industry by Segment, 2010



Source: AEEI Analysis of Battelle-Brookings Database
 Note: Category “Other” includes Fuel Cells, Geothermal, Smart Grid, Solar Photovoltaic, Waste-to-Energy, Carbon Storage and Management, Wave/Ocean Power, Professional Energy Services, Solar Thermal, Renewable Energy Services, and Lighting

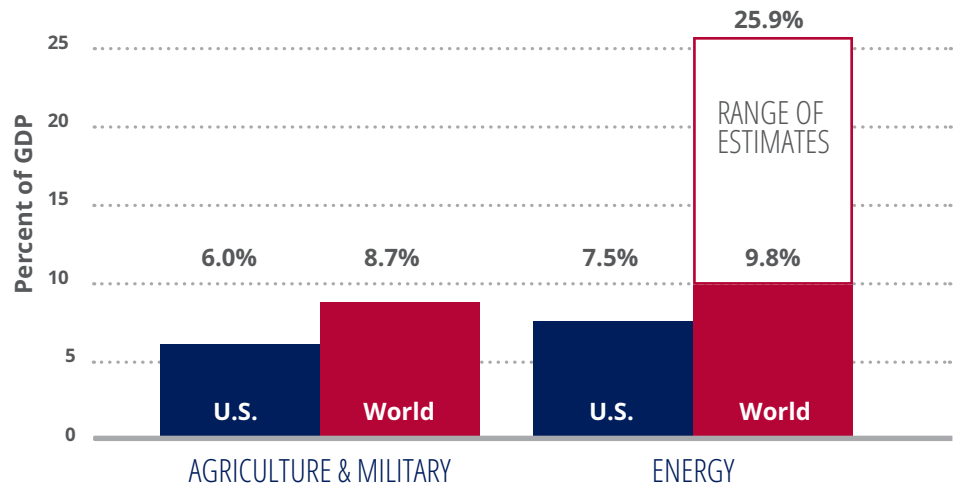
OVERVIEW

Energy is a fundamental resource fueling economies around the globe. In the United States, the energy sector constitutes roughly 8% of total economic output as measured by gross domestic product (GDP), while global estimates place the contribution at anywhere from 7% to 26% of GDP. That makes energy a \$1 trillion business in the United States and a \$6 trillion or larger industry globally. In both the U.S. and global economies, energy is larger than the military and agricultural sectors combined as shown in Figure 2.

The world economy is rebounding slowly from the global financial crisis of 2008,

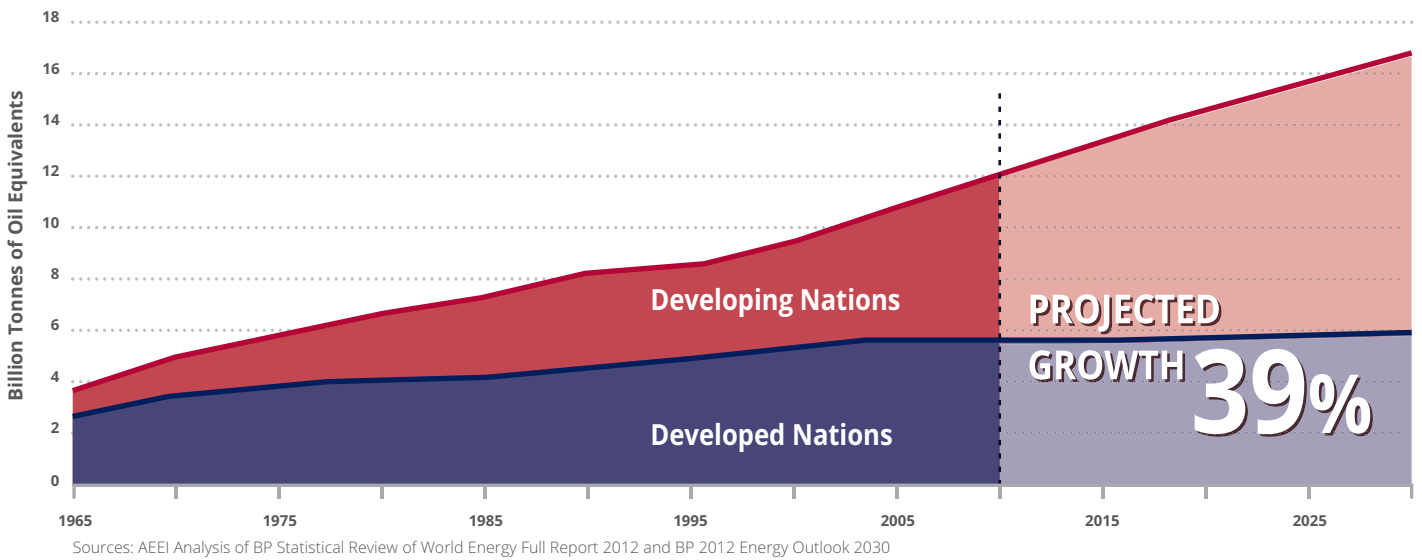
driven in large part by the rapid growth of big developing economies like China and India. As global economic expansion resumes and the world's population continues to rise, the energy industry will necessarily expand further to support that growth. BP's 2012 Energy Outlook projects energy demand growth of 39% between 2010 and 2030, as shown in Figure 3.

Figure 2: Portion of U.S. and Global GDP Contributed by Several Economic Sectors: Global and U.S. GDP by Sector (2010)



Source: AEEI Analysis of World Bank, CIA World Factbook, U.S. Energy Information Administration's Annual Energy Review 2010, EIG Alternative Investments - December 2010. Note: U.S. energy expenditures are from 2009.

Figure 3: Historical and Projected Global Energy Demand: Global Energy Demand 1965 - 2030



The growth in global demand, combined with a modernization in the world's energy systems, translates into an enormous business opportunity. The International Energy Agency (IEA) predicts that the global energy system will require \$37.9 trillion in investment between 2010 and 2035 (see Figure 4).

In this global market, there is a growing preference for energy that is secure, clean, affordable – that is, advanced energy. Electric and plug-in hybrid cars, natural gas fueled trucks, high-performance buildings, energy-saving industrial processes, and the latest in wind turbines and nuclear power plants – these are just some of the examples of advanced energy, as they diversify energy sources, reduce health and environmental costs, and use energy more productively.

While the domestic market in the U.S. will be the focus of modernization efforts, new growth in energy demand is expected to come almost entirely – 96% in fact – from developing countries as shown in Figure 3. Even here, American companies and operations are highly competitive, in advanced energy industries ranging from nuclear, which had U.S. exports totaling \$2.32 billion in 2009, to solar photovoltaics (PV), for which U.S. net exports hit \$1.9 billion in 2010.

In Arkansas, with its strong bioenergy resources, strategic location as a wind manufacturing hub, robust transportation system, low cost of living and access to university research and training, the advanced energy industry is establishing a strong foothold and has great capacity for growth. As part of its efforts to build and foster a robust advanced energy economy, Arkansas Advanced Energy Association (AAEA) asked Advanced Energy Economy Institute (AEEI) to undertake this analysis to develop a conservative estimate of employment in Arkansas’s advanced energy industry.

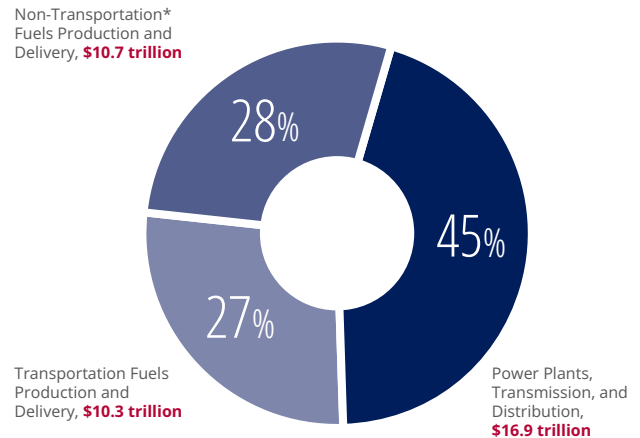
METHODOLOGY

In order to construct a reliable and conservative estimate of the number of Arkansans working in the advanced energy industry, AEEI reviewed a number of datasets, including those from the U.S. Bureau of Labor Statistics and the Pew Charitable Trust. After review, AEEI found that the Battelle-Brookings Database would provide the most reliable dataset for analysis. This database was the only one in which each job counted is associated with an actual company; the final jobs estimates of the other datasets are based on extrapolation from survey data. And, while it does not contain every advanced energy category, the chosen dataset includes the most robust set of the categories that AEEI hoped to include in its jobs analysis.

The database covers employment on a company-by-company basis using a Dun & Bradstreet national business dataset and additional research to refine the accuracy of the workforce figures for each company. In order to determine the number of jobs in companies that work in multiple advanced energy sectors or outside of advanced energy, jobs are apportioned to the advanced energy sector(s) based on percentages of revenue generated from relevant advanced energy goods and/or services.

Built from lists of companies from multiple sources, the Battelle-Brookings database contains company and employment

Figure 4: Global Energy System Investment, 2010-2035: \$37.9 Trillion Investment Required by 2035 (in 2010 USD)



Sources: AEEI Analysis of IEA World Energy Outlook 2011.
Notes: Figures given are for the "New Policy Scenario", which is a scenario where current policy trends continue into the future. *Non-transportation fuels are primarily for power generation, heating, and industrial processes.

information in Arkansas for 39 industry segments, including some segments well outside the advanced energy industry. AEEI analyzed the companies in each segment and performed a crosswalk of each segment against its own classification of the advanced energy industry. Of the 39 industry segments in the database, AEEI's analysis identified 22 segments (shown in Figure 6) that fall within the advanced energy industry. Every job included in the count is associated with a company that provides goods or services in the advanced energy industry or a company that adds significant value to goods or services in the industry. There are other companies and professionals that do business in the advanced energy industry, but do not necessarily consider themselves part of that industry (e.g., electricians that do solar installations, but consider themselves full-service electricians, not solar installers). Employment in such firms is not included in this count of advanced energy jobs.

The 22 identified industry segments are provided in Figure 5. Companies in these segments (examples below) range from internationally recognized corporations to homegrown establishments and from new startups to veteran companies with many decades of experience, demonstrating the breadth of the advanced energy industry in Arkansas.

DEMAND-SIDE ADVANCED ENERGY

In the overall energy system, the “demand-side” refers to services and equipment that require energy. These can generally be broken into three primary categories: transport, buildings, and industry. Advanced energy's role in these categories is primarily to improve energy performance and reducing operating costs, for example by reducing the amount of energy input required to provide the desired service or changing the form of energy required. The dataset used covers, in part, companies providing advanced energy solutions in two of the three categories.

Transport

The Transport category includes both passenger and freight transport. Advanced energy plays a role in this category through improved design and materials in vehicles and propulsion systems. Transport comprises about 30% of global energy use, making it a target for reducing energy waste.

- The Electric Vehicle Technologies category includes companies that make electric and hybrid vehicles or supply those establishments with specialized parts. Arkansas Power Electronics International specializes in high-density, high power electronic solutions, including products for the electric vehicle market. Also, LGW, Inc. located in Fayetteville, has developed and installed multiple Energy Management Systems, a battery-based energy storage device with a variety of applications in residences, commercial buildings and manufacturing plants.

Buildings

The Buildings category, which makes up over a third of the global energy consumption, includes both residential and commercial buildings. Advanced energy's role in this category is to reduce energy consumption through better design and new technologies across heating and cooling, lighting, water, and information technology.

- The Appliances category includes companies that make high performance appliances used for cooking, heating, cooling, and other consumer and industrial applications. Viking Industries, a leader in professional home ranges, has a manufac-

turing location in Little Rock. Another large manufacturer in the state is Danfoss North America, located in Arkadelphia, where energy efficient compressors are built for residential, light commercial and commercial air conditioning and heat pump applications.

- The Energy-saving Building Materials category consists of firms that make building materials that save energy (e.g. windows, doors, insulation materials). Headquartered in northwest Arkansas, the nearly decade-old BioBased Technologies is serving the residential and commercial sectors with high-performing, more efficient spray polyurethane foam insulation. Founded in the same region in 1978, Stitt Energy Systems Inc. has likewise integrated resource efficiency and environmentally responsible design into its core business of residential construction.
- Energy-saving Consumer Products includes companies that make a wide variety of consumer products that meet higher performance standards, such as office products, computers, glass, and shades. For example, Baldor Electric Co. in Fort Smith sells top-of-the-line energy-efficient electric motors and adjustable speed drives to distributors and equipment manufacturers in more than 70 countries. Baldor also has locations in Ozark and Clarksville.
- The Architecture and Construction Services category includes establishments that provide architectural or engineering services for building projects that meet stringent performance standards. Conway-based Nabholz Construction Services, with well over \$400 million in worldwide revenue, was highlighted within ENR's 2008 selection of the Top 100 Green Contractors. Another such company is Fayetteville's Coger Custom Construction Co., which specializes in solar-heated water and PV panels equipped for grid-tie electric generation.
- The HVAC and Building Control Systems category includes firms that improve performance of the largest drivers of energy use in buildings. One such company is Little Rock-based Harrison Energy Partners, where a growing workforce of energy professionals offers a wide range of HVAC and energy solution services to make buildings operate more efficiently. Additionally, Rheem Manufacturing, which began manufacturing water heaters in the 1930s, is an industry leader in heating, cooling, and water heating solutions for both commercial and residential customers. With a branch in Fort Smith, the firm has become a prominent manufacturer of solar water heaters and complete solar energy systems.
- The Lighting category includes companies that make lighting equipment that meets high energy performance standards. Fayetteville's NextGen Illumination offers high quality LED lighting solutions, which effectively reduce energy consumption energy costs for customers. Another such company is Dardanelle-based IntenCity, which produces energy-saving solid-state lighting fixtures designed for demanding outdoor environments.
- The Professional Energy Services category includes establishments that provide certified professional services or services related to energy research, consulting, and design. One example company is BioEnergy Systems, LLC, a consulting firm and project development company based in Fayetteville that advances biomass energy systems and technologies. Additionally, Viridian USA, with its location in Little Rock, provides sustainable building consulting services ranging from LEED consulting to property condition assessments and cost segregation. Included in this category are contractors for utility-sponsored efficiency programs.

SUPPLY-SIDE ADVANCED ENERGY

Analogous to demand-side, the “supply-side” of the energy system refers to services and equipment that produce energy, often involving natural resources that are used to generate electricity or produce fuels as well as the infrastructure used to deliver electricity and fuels. These can also be broken into three primary categories: electricity, transport fuels, and non-transport fuels. Advanced energy’s role in this category is to produce and deliver energy in a way that is more secure, clean, and affordable. The dataset used covers, in part, companies in these categories.

Transport and Non-Transport Fuels and Infrastructure

The dataset used partially covers these two categories together.

- The Biofuels/Biomass category includes establishments that produce or develop energy from biological or agricultural materials. With an annual production capacity of 60 million gallons, FutureFuel Chemical Co., in Batesville, has emerged as one of the nation’s leading biodiesel production facilities. Boasting one of the most prominent gasification technologies in the world, PRM Energy Systems, located in Hot Springs, has helped lead the charge in improving the efficiency of bioenergy solutions.

Electricity Generation and Infrastructure

The Electricity Generation and Infrastructure category involves the production of electricity using advanced energy sources, such as renewable sources, nuclear energy, or natural gas. Also included are advanced transmission, distribution, and storage technologies designed to efficiently and safely transport and store electricity with fewer losses.

- The Nuclear Energy category includes establishments that provide nuclear power research and consulting services or generate nuclear power. Beginning operations in 1974, Russellville’s Arkansas Nuclear One has since been the primary electrical generator for the entire state of Arkansas. In total the plant, which was set up by Entergy Arkansas, generates 1,839 megawatts of power, accounting for 30% of the state’s total energy demand. Also in Russellville is Grace Manufacturing, a precision products company that specializes in prototypes, chemical etching, laser cutting, and packaging for the nuclear market.
- The Solar Photovoltaic category includes establishments that produce, develop, or install technologies that convert sunlight into electricity. Rocky Grove Sun Co., based in Kingston, works to design and sell solar equipment on a residential and commercial scale. As the oldest continually operating solar energy company in Arkansas, the company has successfully designed and installed over 500 PV systems throughout the state. At the other end of the spectrum, the Arkansas startup Silicon Solar Solutions is looking to extract more power from its patented, materials-saving large grain polysilicon technology, which can be used in wafer-based and thin-film products.
- The Wind category includes establishments that produce, develop, or install technologies or specialized components of those technologies that convert wind into energy. Nordex USA, Inc. has built a plant in Jonesboro that produces nacelles for 2.5 MW turbines, which launch the company’s latest efficiency class. A Nordex supplier, Beckmann-Volmer, has located a manufacturing plant in nearby Osceola and rolled out its first steel components in August, 2012. Similarly, LM Wind Power – the world’s largest manufacturer of rotor blades – has a significant manufacturing plant at Little Rock Port, employing several hundred people at peak production.

RESULTS AND CONCLUSIONS

Based on a rigorous and conservative analysis of available data, Arkansas is home to at least 11,337 jobs in advanced energy, as of 2010 – a number nearly equal to current Arkansas employment in the accommodation services segment (i.e., hotels and motels) of the hospitality and leisure industry. As shown in Figure 5, the largest number of jobs, nearly 2,500, is found in heating, ventilation and air-conditioning (HVAC) and building controls – firms that improve performance of the largest drivers of energy use in buildings. The next largest number of jobs, nearly 2,100, is found in energy-saving consumer products – companies that make a wide variety of consumer products that meet higher performance standards, such as office products, computers, glass, and shades. Just as important is the wide range of categories in which Arkansas has significant employment – 10 of 22 advanced energy categories included 300 or more jobs. It is safe to say that advanced energy is establishing a firm base in Arkansas’s economy and is poised to grow as regional and global markets for advanced energy products and services take off.

Figure 5: Advanced Energy Employment in Arkansas by Category

SEGMENT	2010 JOBS
Architecture/Construction Services	814
Appliances	300
Battery Technologies	315
Biofuels/Biomass	433
Carbon Storage and Management	Less than 100
Electric Vehicle Technologies	800
Energy-saving Building Materials	1,858
Energy-saving Consumer Products	2,033
Fuel Cells	Less than 100
Geothermal	Less than 100
HVAC and Building Control Systems	2,403
Hydropower	748
Lighting	Less than 100
Nuclear Energy	1,186
Professional Energy Services	Less than 100
Renewable Energy Services	Less than 100
Smart Grid	Less than 100
Solar Photovoltaic	Less than 100
Solar Thermal	Less than 100
Waste-to-Energy	Less than 100
Wave/Ocean Power	Less than 100
Wind	350
Total	11,337

Source: AEEI Analysis of Battelle-Brookings Database. Notes: Employment rounded to the nearest 10, those categories with fewer than 100 jobs, “Less than 100” is listed to replace the actual number, and sum may differ from the total because of rounding.

1. Discover Arkansas Labor Market, http://www.discoverarkansas.net/admin/uploadedPublications/2088_LM_April_2012.pdf
 2. U.S. Department of Commerce. International Trade Administration. http://trade.gov/mas/ian/nuclear/tg_ian_003180.asp and Solar Energy Industries Association/Greentech Media Research http://www.seia.org/galleries/pdf/GTM-SEIA_U.S._Solar_Energy_Trade_Balance_2011.pdf
 3. <http://www.cnbc.com/id/41666606> and http://www.bizjournals.com/bizjournals/on-numbers/scott-thomas/2011/07/indiana-leans-heavily-on-manufacturing.html?appSession=408183809300208&RecordID=&PageID=2&PrevPageID=2&cpipage=1&CPIsortType=asc&CPIorderby=GSP_attributed_to_manufacturing
 4. Battelle-Brookings Database, http://www.brookings.edu/~media/Series/resources/0713_clean_economy_database.zip

APPENDIX

Figure 6: Industry Segments Included and Excluded in the AEEI Arkansas Analysis

Segments Included in Analysis

Appliances	Fuel Cells	Smart Grid
Architecture and Construction Services	Geothermal	Solar Photovoltaic
Battery Technologies	HVAC and Building Control Systems	Solar Thermal
Biofuels/Biomass	Hydropower	Waste-to-Energy
Carbon Storage and Management	Lighting	Wave/Ocean Power
Electric Vehicle Technologies	Nuclear Energy	Wind
Energy-saving Building Materials	Professional Energy Services	
Energy-saving Consumer Products	Renewable Energy Services	

Segments Not Included in Analysis

Air and Water Purification Technologies	Pollution Reduction	Remediation
Conservation	Professional Environmental Services	Sustainable Forestry Products
Green Building Materials	Public Mass Transit	Training
Green Chemical Products	Recycled-Content Products	Waste Management and Treatment
Green Consumer Products	Recycling and Reuse	
Organic Food and Farming	Regulation and Compliance	

Source: AEEI Analysis of Battelle-Brookings Database