

Part Three: Job Potential of Alternative Energy Futures

In this section we look closely at three sectors and their job growth potential nationally. Drawing on other studies, the starting point of discussions of growth in these sectors assumes an expansion of energy production using alternative sources. Next, the increase in energy output using alternative sources is translated into growth in demand for key hardware components used in the production of energy (converted into megawatts) for the respective sources: Wind, Solar and biomass. In addition, estimates are made of the number of workers required to construct new energy capacity in the sectors and to operate production facilities once new capacity is added. In turn this increase in demand for inputs and labor is then translated into person hours and ultimately into jobs per increase in megawatt generation.

In this assessment we report the general findings of studies produced by various groups, especially the Renewable Energy Policy Project, a consulting firm in Washington, D.C. These studies provide estimates of the number of new jobs that would be created for a finite level of new energy generated employing alternative energy technologies. Given the number of assumptions that have to be made in order to provide an accurate estimate of job generation potential in the ARC region due to an expansion of energy generation from Solar, Wind and biofuels, we do not construct such a computation here. This activity should form the basis of a more detailed research investigation that takes into account the location of firms producing components for these industries and their presence in the ARC region and the potential for installation of productive capacity of these renewable energy sources.

At a gross level, in a 2006 study completed for the state of Wisconsin, which compares the national employment impact of an increase in energy production of 74,000 MW by the most prevalent alternative energy sources, the yield was roughly 180,000 gross jobs in the top ten states. Of these, Ohio, New York, Pennsylvania and North Carolina ranked in the

top ten (Table 4). Almost 70,000 of the 180,000 gross jobs anticipated to be generated by the expansion of these sectors is estimated to occur in Appalachian states. This is more than 40 percent of the gross jobs assumed to occur in conjunction with growth of these three sectors.* Thus growth in demand for energy generated using renewable sources has potential to generate significant new jobs in ARC states.

Table 4: Jobs and Investment for 74,000 MW Renewable Energy Development						
Location	# of Firms	New Jobs (Wind)	New Jobs (Solar)	New Jobs (Geothermal)	New Jobs (Biomass)	New Jobs (Total)
CA	5,409	12,830	19,558	3,387	2,481	38,256
TX	3,358	10,024	9,289	1,864	2,869	24,048
IL	2,289	12,013	7,720	1,358	1,550	22,641
OH	2,465	11,937	4,733	2,031	1,813	20,514
NY	1,925	7,415	5,848	3,260	2,653	19,176
PA	2,188	7,841	6,308	1,363	1,564	17,076
IN	1,321	10,079	2,995	1,277	1,345	15,595
WI	1,331	10,079	1,977	815	1,190	14,061
MI	2,050	9,750	2,657	602	914	13,023
NC	1,096	4,391	4,423	1,123	1,480	11,417

Source: Source: REPP Component Manufacturing Wisconsin's Future in the Renewable Energy Industry, 2006 *Exclusive of Geothermal energy.

Wind Energy

Energy from the wind is generated by wind turbines. Turbines are composed of rotors, vanes, gears, and other mechanical and electrical components (Table 5). California and Ohio are the top two parts producers for turbines. Job creation related to wind energy developments looks something like a pyramid; 70% of the potential job creation is in manufacturing the components, 17% in the installation, and 13% in operations and maintenance. New investments in wind technology in turn drives new orders for manufacturing related to all components required

to build a new wind generator.

A 2006 report of REPP for the state of Wisconsin uses the following figures to determine the job impacts of increased investment in the sector. According to REPP estimates, every 1,000 megawatts of energy generated by wind requires \$1 billion in equipment investment. In rough terms this expansion in energy output is estimated to create 3,000 FTE. An increase of 50,000 MW of energy generated from wind results in 20,000 new jobs in the top 20 component-producing states. Eight of the top 20 states are in Appalachia. Based on Appalachia's fractional share of existing employment in wind-related parts industries, Appalachian states would likely to gain as much as a third of those jobs (+-7,000). Ohio is expected to gain the second largest number of jobs, behind California.

A closer look at the supply base of states' manufacturing key components for the wind energy industry, as seen in Table 6, shows Appalachia states benefit significantly from the installed base of potential supplier firms and resulting employment.

Table 5. Key Wind Energy Industries	
NAICS Code	Description
326199	All other plastics products
331511	Iron foundries
332312	Fabricated structural metal
332991	Ball and roller bearings
333412	Industrial and commercial fans and blowers
333611	Turbines and turbine generators and turbine generator sets
333612	Speed changer, industrial
333613	Power transmission equipment
334418	Printed circuits and electronics assemblies
334510	Measuring and controlling devices
335312	Motors and generators
335999	Electronic equipment and components NEC

Table 6. Location of Employment by State, Sectors that Generate Inputs for Wind Energy–related Products

State	326199	331511	332312	332991	333412	333611	333612	333613	334418	334519	335312	335999	Total
OH	47,179	10,650	4,171	4,566	1,140	177	807	1,448	1,352	2,447	4,581	3,195	80,511
PA	26,259	4,969	7,009	1,303	316	1,073	815	972	2,413	2,387	2,056	924	50,304
NY	19,522	478	2,227	2,205	522	3,276	1,055	1,140	10,411	2,040	1,710	2,690	47,375
NC	14,682	385	2,684	2,152	355	1,502	310	1,006	2,098	517	3,312	535	30,229
TN	12,817	3,056	2,850	1,615	19	-	17	745	2,156	1,093	3,649	381	28,407
AL	8,329	6,401	3,774	784	142	375	22	182	2,223	254	483	245	21,213
GA	9,756	1,511	3,073	1,955	155	-	250	94	1,242	554	1,954	253	20,898
SC	7,646	440	2,969	6,244	75	1,449	452	125	15	91	721	316	20,532
VA	9,009	2,323	3,440	7,724	392	3	424	3	463	406	1,461	504	20,201
KY	11,423	412	1,232	601	44	-	-	1,104	537	15	2,426	97	17,332
MD	5,589	24	597	-	10	3	3	371	363	555	174	271	8,355
WV	1,751	120	566	-	-	-	49	-	182	75	151	49	3,270
MS	3,357	124	1,430	-	-	175	-	209	750	40	3,215	358	9,568
TOTAL	177,319	30,893	36,022	29,149	3,170	8,033	4,204	7,399	24,205	10,464	25,893	9,818	358,195

Table 7. Number of Employees, Partial List of Ohio Counties with Industries contributing to components for Wind energy

OH County	326199	331511	332312	332991	333412	333611	333612	333613	334418	334519	335312	335999	Total
Adams	15	-	-	-	-	-	-	-	-	-	-	-	15
Allen	75	189	15	-	-	-	-	75	-	-	184	-	538
Ashland	404	-	-	-	-	-	-	-	-	-	35	-	439
Ashtabula	2,573	3	-	-	-	-	-	-	-	-	-	-	2,576
Athens	35	-	-	-	-	-	-	-	-	-	-	-	35
Auglaize	15	175	-	-	-	-	-	-	-	-	-	-	190
Belmont	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown	-	-	-	-	-	-	-	-	-	-	3	-	3
Butler	788	35	49	-	175	-	-	75	69	-	15	-	1,206
Carroll	77	-	-	-	-	-	-	-	-	-	-	-	77
Champaign	409	-	-	-	-	-	-	-	-	-	-	-	409
Clark	347	-	7	-	-	-	-	-	-	15	35	7	411
Clemont	235	-	175	-	-	-	-	-	-	15	-	-	425
Clinton	284	35	35	-	-	-	7	-	-	-	-	-	361
Columbiana	799	230	55	-	-	-	-	-	-	-	-	-	1,084
Coshoctan	-	375	3	-	-	-	-	-	-	-	-	-	378
Crawford	375	-	3	750	-	-	-	-	-	-	-	-	1,128
Cuyahoga	1,998	1,031	250	24	175	-	419	504	129	459	589	216	5,794
Darke	359	-	-	-	-	-	-	-	-	-	35	3	397
Defiance	-	1,003	175	-	-	-	-	-	-	-	7	-	1,185

Delaware	37	284	15	-	-	-	-	-	-	-	-	-	386
Erie	752	175	-	1,000	-	-	-	175	-	49	-	-	2,151

A more refined estimate of the region’s job potential can be gleaned from a table that examines jobs in firms in the state of Ohio that produce products considered as potential inputs to wind turbines. While the majority of jobs are concentrated in the most populated counties in the state, nonetheless, spillovers to surrounding counties are likely given the distribution of manufacturing in the state (Table 7). Nineteen counties produce parts related to the Wind products industries. Of those, seven have more than 1000 jobs each or almost 14,000 job.

A list of companies in the region that produce inputs for the wind energy industry cover the spectrum of key parts, suggesting that existing establishments have the potential to experience significant increases in demand is a national program is established to expand the production of wind energy nationally, regardless of the location of actual wind capture (Table 8).

Table 8. Companies in Appalachian States Producing Inputs for the Wind Energy Industry			
Part	Company	City/Town	State
Bearings	CAB Inc	Lionville	PA
	The Dyson Co	Painsville	OH
	CAB Inc	Oakwood	GA
	Hodge Foundry Inc	Greenville	PA
Brakes	Parker	Cleveland	OH
	Hilliard Corp	Elmira	NY
	Afab Tech LLC	Mansfield	OH
Gearboxes	Cleveland Gear Co	Cleveland	OH
	Michael Bryne CMFG	Mansfield	OH
	Canton Drop Forge	Canton	OH
	Peerless Winsmith Inc	Springville	NY
	The Cincinnati Gear Co	Cincinnati	OH
	Hodge Forge Inc	Greenville	PA
Generators	Hitachi America	Tarrytown	NY
	Motors and Controls Intl	Hazleton	PA

HUB	CAB Inc	Oakwood	GA
Nacelle Frame	Hodge Foundry Inc CAB Inc.	Greenville Oakwood	PA GA
Pitch Drive	Parker	Cleveland	OH
Power Electronics	ABB Inc Hitachi America Motors and Controls Intl 1 st Power.com	Raleigh Tarrytown Hazelton Mansfield	NC NY PA OH
Rotor Blades	Owens Corning	Toledo	OH
Shafts	The Dyson Corp CAB Inc	Painsville Oakwood	OH GA
Towers	Innovative Metal Products Newmark Inc Thomas and Betts Corp	Kenoza Lake Birmingham Memphis	NY AL TN

Source: Compiled by the autho

Solar Energy

Photovoltaic (PV) technologies can be used to convert energy from the sun directly into electricity. As much as 10–20% of the energy from the sun can be converted into electricity using existing photovoltaic technologies. Many parts of the United States particularly areas of the West, where land is relatively inexpensive and population is sparse, have the potential to generate energy sufficient to satisfy a significant portion of local energy needs. Given rising petroleum prices, experts suggest that the solar energy field could grow as much as 30% each year over the next 20 years, increasing installed capacity by more than 300%.

Inputs to the Solar energy industry comprise a range of goods from flat panels that absorb solar radiation, to batteries that store the received energy, to wires used in the distribution of the resulting power (Table 9). The job creation potential of expanded photovoltaic energy generation is significant due to the fact that the bulk of new employment occurs in the manufacturing phase of industry development. With known technology, four states in Appalachia are in the top 20 states that manufacture components for the photovoltaic industry (Table 10). Two of the nation's largest producers of photovoltaic components are in the region: the

Sharp Module Assembly facility in Tennessee and BP Solar in Maryland. States in Appalachia are home to more than 2,000 establishments that produce components used in the photovoltaic industry. A rough estimate of the number of jobs currently in sectors that produce products that are potential inputs to the PV industry is above 180,000 (Table 10). Using the same method of calculating job generation given a specified level of investment, states in Appalachia could experience an increase of up to 25,000 new jobs (Table 11). This constitutes almost a third of jobs in the top 20 states producing parts for the solar energy industry.

Table 9. Key Solar Energy Industries	
NAICS Code	Description
325211	Plastics material and resin manufacturing
326113	Unlaminated plastic film and sheet manufacturing
327211	Flat glass
331422	Copper wire
332322	Sheet metal work manufacturing
334413	Semiconductors and related devices
334515	Instrument manufacturing for measuring and testing electricity
335313	Switchgear and switchboard apparatus manufacturing
335911	Storage batteries
335931	Current carrying wiring devices manufacturing
335999	Electronic equipment and components NEC

Table 10. Location of Employment in Sectors that Generate Inputs for Solar Energy-Related Products

State	325211	326113	327211	331422	332322	334413	334516	335313	335911	335931	335999	Total
OH	3,808	2,778	394	-	7,469	1,510	1,929	3,292	943	2,360	3,195	27,678
PA	3,332	2,880	1,336	-	7,239	10,046	899	1,854	2,308	3,302	924	34,120
NY	1,141	1,602	409	245	6,889	10,378	2,313	565	403	2,285	2,700	28,930
NC	2,151	2,150	571	37	3,678	4,190	810	1,698	1,159	3,216	535	20,195
TN	1,033	880	2,127	15	2,188	92	56	1,556	376	414	381	9,118
AL	1,119	236	3	-	2,214	431	264	203	35	1,035	246	5,786
GA	1,343	2,357	3	75	2,930	16	448	1,938	1,859	586	253	11,808
SC	2,452	1,971	375	375	945	-	764	2,058	750	618	316	10,624
VA	238	2,836	-	35	2,772	3,768	300	678	10	123	564	11,324
KY	2,962	780	209	-	1,711	7	17	1,904	924	284	97	8,895
MD	79	416	15	7	1,734	771	564	1,225	5	34	271	5,121
WV	3,349	15	409	175	689	3	116	249	75	3	49	5,132
MS	1,053	483	-	-	1,365	-	177	426	375	249	358	4,486
TOTAL	24,060	19,384	5,851	964	41,823	31,212	8,657	17,646	9,222	14,509	9,889	183,217

Table 11.						
Location	# of Firms	New Jobs (Wind)	New Jobs (Solar)	New Jobs (Geothermal)	New Jobs (Biomass)	New Jobs (Total)
CA	4,658	14,147	24,288	3,320	2,848	44,602
TX	2,795	10,000	12,299	1,841	3,281	27,401
IL	1,961	11,303	8,472	1,455	1,715	22,946
OH	2,156	13,215	5,957	1,896	1,854	22,922
PA	1,839	9,029	8,119	1,538	1,832	20,517
NY	1,605	7,876	6,318	3,136	2,683	20,013
IN	1,154	11,186	3,824	1,410	1,524	17,954
WI	1,123	11,335	2,193	845	1,844	16,218
MI	1,817	10,369	2,457	587	1,021	14,435
NC	940	4,897	4,722	1,350	2,005	12,976

Source: Source: REPP Component Manufacturing Wisconsin's Future in the Renewable Energy Industry, 2006

Biomass Sectors

Conversion of plant material, human and animal waste, and trash to direct energy fuels such as methane or ethanol is termed biomass energy. Methane, a natural product of organic decomposition can be burned directly for heat or used to power a gas turbine or internal combustion engine driving a generator to produce electricity. Plant material such as crops rich in sugar or starch can be fermented and distilled to produce ethanol which can then be blended with gasoline. Promising new technologies (lignocellulose biorefineries) form the basis of a potential new industry converting lower cost waste wood and cellulose rich crops like switchgrass or fast growing trees into ethanol.

The biomass sector is composed of different subsectors based on the type and origin of the feedstock: conventional fermentation–distillation, lignocellulose, manure methane, wastewater treatment methane, and methane from landfills. Though not strictly a biomass source, ventilation air exhaust from coal mines also yields recoverable methane.

Considerable experimental work is being conducted on biomass to increase energy development. Few studies, however, are looking at ways to convert the energy embedded in different forms of biomass into jobs. According to a national study by REPP of the jobs potential of the expansion of energy production from biomass, as many as 32,000 new jobs could be created with a \$5 billion investment in productive technology, including both manufacturing and operations. Of the industries examined in this report, biomass is considered the most likely to generate the largest number of post-manufacturing operations and maintenance jobs (Table 12).

Table 12: Estimated Number of Firms, Investment, New jobs Expansion of Renewable Sources			
U.S	Firms	Investment (\$million)	New FTE Jobs
Wind	16,480	\$24,955.2	159,516
Solar	10,272	\$27,849.6	119,277
Geothermal	3,926	\$6,133.2	28,934
Biomass	12,020	\$5,296.8	32,632
Total	42,698	\$64,234.8	340,359

Source: Source: REPP Component Manufacturing Wisconsin's Future in the Renewable Energy Industry, 2006

Summary

In summary, it is evident that states in Appalachia are poised to benefit from alternative energy development. Many states in the region produce components used in the manufacture of three key sectors: wind, solar and biomass. In the next section we look specifically at nine detailed industry groups producing inputs for the wind and solar industries. With more information a similar assessment could be made for the biomass industry. These results highlight the fact that Appalachian states have high concentrations of employment in these key sectors compared with their fraction of employment nationally.