

## Sources & Methodology

Six-digit North American Industry Classification System (NAICS) codes were analyzed for all counties within the Appalachian region. The NAICS codes, collected by the US Census Bureau and compiled into County Business Pattern (CBP) data, reflect industry-specific manufactured components that are similar to, or substitutable for, the major manufactured components in the biomass, solar, and wind energy industries, as identified by the Renewable Energy Policy Project.<sup>73</sup>

Several NAICS codes are relevant to more than one renewable energy industry. Where establishments or jobs exist that may serve more than one industry, aggregated sector data is presented with shared sectors included in parentheses.

Important socio-economic and population data is included for each sector and region as well, on a county by county basis. Five socio-economic status designations, determined and assigned annually by ARC, reflect county-level economic indicator thresholds based upon three-year average unemployment rates, *per capita* market incomes and poverty rates.<sup>74</sup> The five classifications are as follows:

- 1) **Distressed:** 150 percent or greater of US average unemployment rate; 67 percent or less of US average *per capita* market income; and 150 percent or greater of US average poverty rate; or twice the poverty rate and past one other threshold,
- 2) **At-Risk:** 125 percent or greater of US average unemployment rate; 67 percent or less of US average *per capita* market income; and 125 percent or greater of US average poverty rate; past two of the distressed level thresholds,
- 3) **Transitional:** any county that is worse than the US average for one or more of the above indicators but does not fully meet the criteria for distressed or at-risk designations,
- 4) **Competitive:** 100 percent or less of US average unemployment rate; 80 percent or more of US average *per capita* market income; and 100 percent or less of US average poverty rate, and
- 5) **Attainment:** 100 percent or less of US average unemployment rate; 100 percent or more of US average *per capita* market income; and 100 percent or less of US average poverty rate.

Finally, population estimates and county level designations created by the Office of Management and Budget were included for each ARC county with renewable energy manufacturing potential. Metropolitan Statistical Areas (labeled 'Metro') reflect regions that have "at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as

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<sup>73</sup> Sterzinger, G. and M. Svrcek. (2005) "Component Manufacturing: Ohio's Future in the Renewable Energy Industry." Renewable Energy Policy Project.

<sup>74</sup> Appalachian Regional Commission; Online Resources: County Economic Status, Fiscal Year 2006: [www.arc.gov/index.do?nodeId=56](http://www.arc.gov/index.do?nodeId=56)

measured by commuting ties.”<sup>75</sup> Micropolitan Statistical Areas (labeled ‘Micro’) reflect regions that have “at least one urban cluster of at least 10,000 but less than 50,000 population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties.”<sup>76</sup> Each of these designations is defined in terms of whole counties, or equivalent entities such as the independent cities in Virginia. Counties not meeting either criteria are labeled ‘Rural/ Other’ for the purposes of this report.

Results of the analysis are presented in three major sections:

- 1) **Appalachian Regional Totals:** presenting summaries of each states’ total manufacturing potential by resource and regional totals;
- 2) **Sector Specific Totals:** presenting employment and firm totals for the biomass, solar and wind industries individually and across all ARC member states;
- 3) **State by State Totals:** presenting counties for each state with substantial potential for renewable component manufacturing.

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<sup>75</sup> Office of Management and Budget Bulletin No. 06-01: Appendix – as corrected May 26, 2006. Metropolitan, Micropolitan, and Combined Statistical Areas and New England City and Town Area Definitions: [www.whitehouse.gov/OMB](http://www.whitehouse.gov/OMB)

<sup>76</sup> *Ibid.*

## **Potential Manufacturing Capacity in Appalachia**

The Appalachian Regional Commission (ARC), tasked with the goal of promoting economic development within the greater Appalachian region, is composed of representatives from each of its 13 member states: Alabama, Georgia, Kentucky, Maryland, Mississippi, North Carolina, New York, Ohio, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia. This section of the report presents an analysis of the capacity of the Appalachian region to supply major components for the wind, solar and biomass renewable energy industries. This section provides information compiled on existing manufacturing establishments, employment totals, locations and sector concentrations within the region.

The analyses that follow are aimed at demonstrating the relative capacity of Appalachia as a whole, of ARC individual member states, and then ARC counties, to manufacture components for the renewable energy sector. These analyses reflect not only the potential capacity to manufacture renewable components from existing establishments within the region, but also the potential distribution of increased manufacturing that might accompany continued growth in the renewable energy sector. Analysis in this section of the report reveals distribution of existing establishments within states, and potential clusters of manufacturers with the potential to produce parts for individual energy sectors. The results are presented for each major energy sector, the Appalachian region as a whole, as well as for each ARC member state.

### ***Resource Sector Analyses***

The first section of this analysis considers manufacturing potential specific to each of the renewable sources considered.

Appalachian counties were categorized as having high concentrations of manufacturing potential by meeting one of the following four criteria:

- 1) Employment of 100 or more in firms with the technical capacity to produce components for the wind industry;
- 2) Ten or more establishments with the technical capacity to produce components for the wind industry;
- 3) Five or more distinct components that could serve the industry;
- 4) An average establishment size of 125 employees or more.

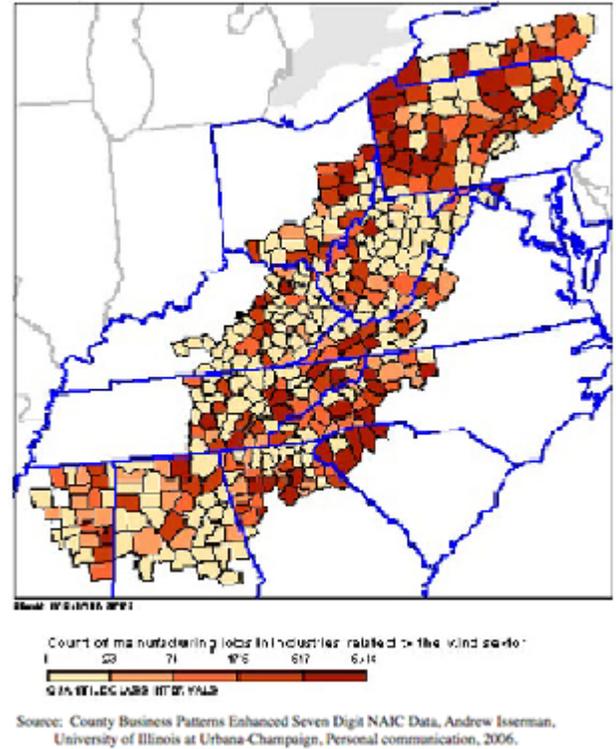
## Wind

Results of the analysis revealed that there are currently almost 90,000 jobs and over 1,300 establishments in Appalachia manufacturing components related to those needed by the wind industry. Each ARC member state has a wind manufacturing potential exceeding 800 jobs.

83,269 jobs/1,254 establishments in exclusive wind category  
 89,579 jobs/1,318 establishments in aggregate wind category

Of particular importance is the degree of concentrated manufacturing that exists in the region. Figure 11 shows by county where concentrations exist with over 100 jobs. These sites provide opportunities for industry to procure significant amounts of components or several component types from one consolidated area.

**Figure 11**  
 Number of Jobs in Industries with the Potential to Produce Parts & Components for the Wind Industry



**Table 5. Counties with Concentrated Wind Manufacturing Potential.**  
 This table includes counties with job totals of 1,500 or greater. Jobs producing components relevant to other sectors are noted in parentheses in the first column, with each county listed in decreasing order based upon the number of jobs within each respective county.

Sector	State	County	# of Estabs	# of Jobs	# of Components	Socio-Economic Status	Population Class	Primary City(s)
Wind (Biomass/Solar)	PA	Erie	66	5,374	8	Transitional	Metro	Erie
Wind (Biomass)	SC	Greenville	23	4,595	8	Competitive	Metro	Greenville
Wind	PA	Westmoreland	42	2,012	6	Competitive	Metro	Pittsburgh
Wind (Biomass/Solar)	GA	Gwinnett	36	1,894	7	Attainment	Metro	Atlanta Sandy Springs Marietta
Wind (Biomass/Solar)	NY	Broome	18	1,889	8	Transitional	Metro	Binghamton
Wind	SC	Anderson	27	1,865	4	Transitional	Metro	Anderson
Wind (Biomass/Solar)	PA	Allegheny	59	1,809	9	Attainment	Metro	Pittsburgh
Wind	PA	Lycoming	17	1,715	6	Transitional	Metro	Williamsport
Wind (Biomass/Solar)	TN	Knox	36	1,570	8	Transitional	Metro	Knoxville

The major wind turbine components consist of:

- The rotor, which includes blades, hub and pitch drive, nacelle and tower;
- The nacelle, which includes frame, generator, power train, drive shaft and electronic equipment;
- The tower, which includes rolled steel, flanges and bolts, and concrete base.

The following components, as identified by their NAICS codes, were considered in this report:

- Plastics product manufacturing
- Iron foundries
- Fabricated structural metal
- Printed circuits and electronics assemblies
- Measuring and controlling devices
- Motors and generators
- Electronic equipment and components
- Turbines, turbine generators and turbine generator sets
- Industrial and commercial fans and blowers

Currently, the most limited point in the supply chain involves the production of the wind turbine gearbox, a part of the nacelle. Manufacturing related to gearbox production includes:

- Ball and roller bearings
- Industrial speed chargers
- Power transmission equipment

Analysis reveals that Appalachia produces over 17 percent of the nation's ball and roller bearings and over 11 percent of the nation's power drives. Both of these parts are fundamental components of the turbine gearbox, for which significant shortfalls in production exist. Ball bearing manufacturing is concentrated in South Carolina, Tennessee, Georgia and New York with almost 4,800 total jobs. Appalachia produces a substantial portion of the nation's generator sets as well, with over 25 percent of the country's manufacturing for this component. Finally, there are over 12,700 potential jobs and almost 150 establishments with the potential capacity to manufacture parts for this industry in counties designated 'At-Risk' or 'Distressed' by ARC.

Based upon this analysis, the Appalachian region may have a significant opportunity to capitalize on this expanding industry. This is particularly the case as large firms expand production capacity within the US, with Gamesa's new manufacturing facility in Pennsylvania a case in point. Regional components manufacturers can exploit an opportunity such as this, as Motors & Controls International of Hazelton, PA has.

## Solar

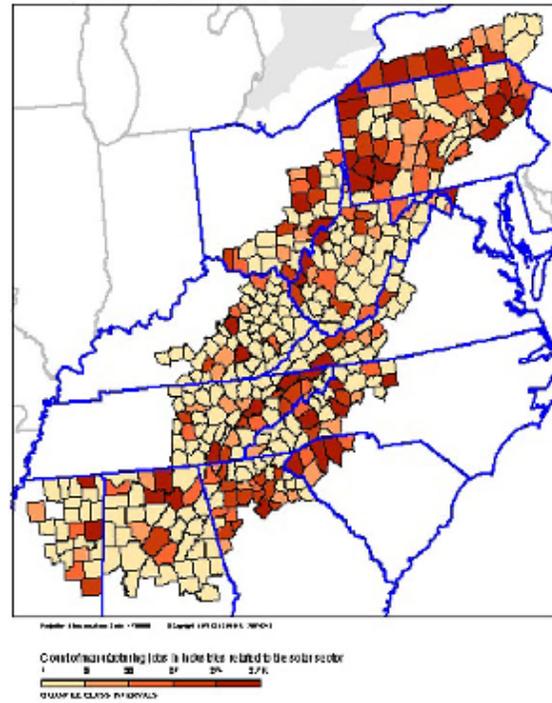
Results of the analysis revealed that there are currently almost 41,000 jobs and over 650 establishments in Appalachia manufacturing components related to those needed by the solar industry. Twelve of the thirteen ARC member states have a solar manufacturing potential exceeding 790 jobs.

34,693 jobs/ 571 establishments in exclusive solar sector  
 40,757 jobs/ 668 establishments in aggregate solar sector

Figure 12 shows where regions of concentration with over 100 jobs exist by Appalachian county for potential solar equipment manufacturing. These sites provide opportunities for the industry to procure a significant amount of components or several component types from one consolidated area.

Figure 12

Number of Jobs in Industries with the Potential to Produce Parts & Components for the Solar Industry



Source: County Business Patterns Enhanced Seven Digit NAIC Data, Andrew Isserman, University of Illinois at Urbana-Champaign, Personal communication, 2006.

**Table 6. Counties with Concentrated Solar-Related Component Job Totals of 1,000 or Greater. Jobs that are relevant to other sectors are noted in parentheses in the first column, with each ARC county listed in decreasing order based upon the number of jobs within each respective county**

Sector	State	County	# of Estabs	# of Jobs	# of Components	Socio-Economic Status	Population Class	Primary City(s)
Solar	WV	Wood	3	2,710	2	Transitional	Metro	Parkersburg Marietta (OH) Vienna
Solar (Biomass/Wind)	PA	Allegheny	40	2,612	8	Attainment	Metro	Pittsburgh
Solar (Biomass/Wind)	NC	Watauga	31	1,923	6	Transitional	Micro	Boone
Solar (Biomass)	PA	Westmoreland	19	1,487	7	Competitive	Metro	Pittsburgh
Solar (Biomass)	SC	Greenville	15	1,485	5	Competitive	Metro	Greenville
Solar (Biomass/Wind)	SC	Spartanburg	10	1,322	5	Transitional	Metro	Spartanburg
Solar	NC	Forsyth	11	1,319	4	Attainment	Metro	Winston-Salem
Solar	NC	Burke	2	1,277	2	Transitional	Metro	Hickory Lenoir
Solar	PA	Luzerne	12	1,152	4	Transitional	Metro	Morgantown Scranton Wilkes-Barre

PV cells consist of 10 different manufacturing components, all of which are already being manufactured in the ARC counties in some capacity.

The following components, as identified by their NAICS codes, were considered in this report:

- Plastics Material and Resin Manufacturing
- Unlaminated Plastics Film and Sheet (Except Packaging)
- Flat Glass
- Sheetmetal Work Manufacturing
- Semiconductors and Related Devices
- Current-Carrying Wiring Device Manufacturing
- Instrument Manufacturing for Measuring and Testing
- Storage Batteries
- Electronic Equipment and Components, NEC
- Switchgear and Switchboard Apparatus Manufacturing

Analysis reveals that the Appalachian region produces over 17 percent of the flat glass in the nation, mentioned as a major part of photovoltaic modules. Tennessee alone has almost 1,000 jobs producing flat glass.

Appalachia also produces over 14 percent of the nation's plastics material and resin manufacturing, another major part of a PV module. Finally, there are almost 3,000 potential jobs and over 60 establishments with the potential capacity to manufacture parts for this industry in ARC designated 'At-Risk' or 'Distressed' counties.



provide opportunities for the industry to procure significant amount of components or several component types from one consolidated area

The following components, as identified by their NAICS codes, were considered in this report:

- Mineral Wool,
- Power Boiler and Heat Exchanger,
- Industrial Valve,
- Construction Machinery,
- Air Purification Equipment,
- Heating Equipment,
- Conveyor and Conveying Equipment,
- Fluid Power Cylinder and Actuators,
- Power, Distribution, Specialty Transformer,
- Railroad Rolling Stock,
- Heavy Gauge Metal Tank,
- Air Conditioning and Warm Air Heating Equipment,
- Pump and Pumping Equipment,
- Air and Gas Compressor,
- Overhead Traveling Crane,
- Hoist and Monorail System,
- Turbines, Turbine Generators and Turbine Generator Sets,
- Switchgear and Switchboard Apparatus, and
- Electronic Equipment and Components, and other general purpose machinery and instrument related equipment.

Finally, our analysis shows that there are almost 6,000 jobs and over 90 establishments in ARC designated “At-Risk” or “Distressed” counties involved in the manufacturing of equipment suited for the biomass industry.

As with the wind and solar industries, these components and their six-digit NAICS codes were identified as central to biomass steam generation facility manufacturing by the Renewable Energy Policy Project.

## Appalachian Regional Totals

This section of the analysis reflects potential renewable energy manufacturing totals for the region as a whole. Total potential employment and establishment figures for all counties within the regions' member states and ARC counties' are shown in Figures 14a and 14b, respectively.

These figures reflect that approximately 30 percent of the potential jobs from renewable energy manufacturing within each ARC member state as a whole exist in ARC counties, while approximately 27 percent of the establishments reside in ARC counties. ARC counties currently possess almost 200,000 jobs suited to produce renewable energy components and almost 3,000 existing manufacturers within the region possess the capacity to produce renewable energy components.

However, the share of employment (Figure 15) and the location of establishments (Figure 16) are not equally distributed among all of the ARC member states or their respective counties. Pennsylvania possesses the largest job potential in the region, followed by Tennessee, North Carolina and South Carolina, respectively. Employment totals range from 1,438 in Maryland, possessing 1 percent of the potential, up to 60,115 in Pennsylvania with 30 percent of the employment potential. Pennsylvania also leads in total number of establishments with renewable manufacturing potential.

It is important to note that the number of counties encompassed within Appalachia varies greatly among member states, ranging from all of West Virginia's 55 counties to 52 of Pennsylvania's, to only six from South Carolina and three from Maryland.

Figure 14a

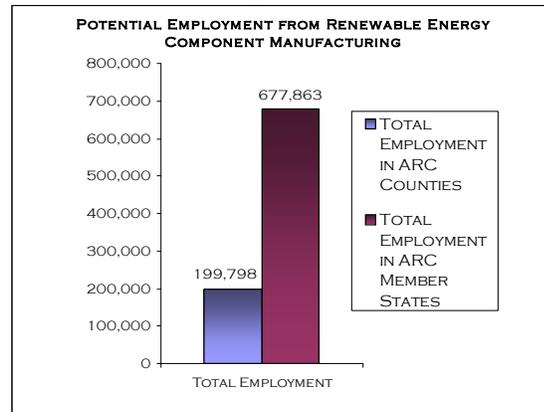
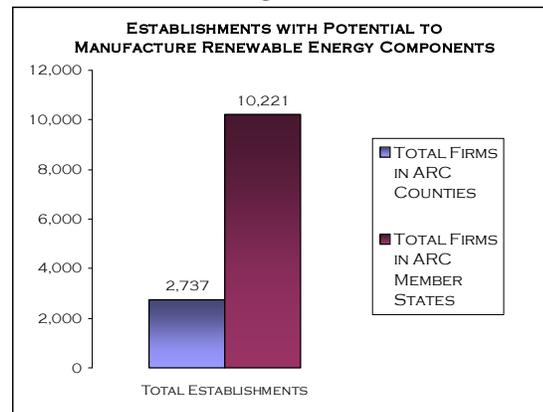
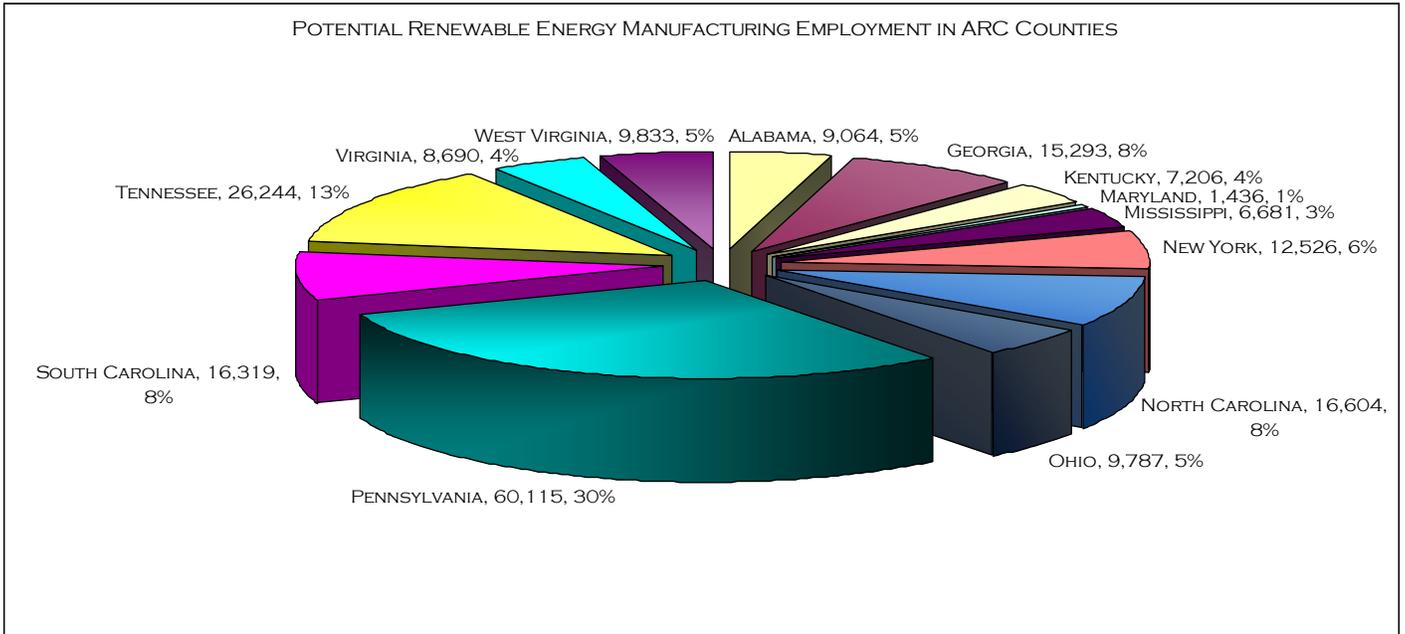


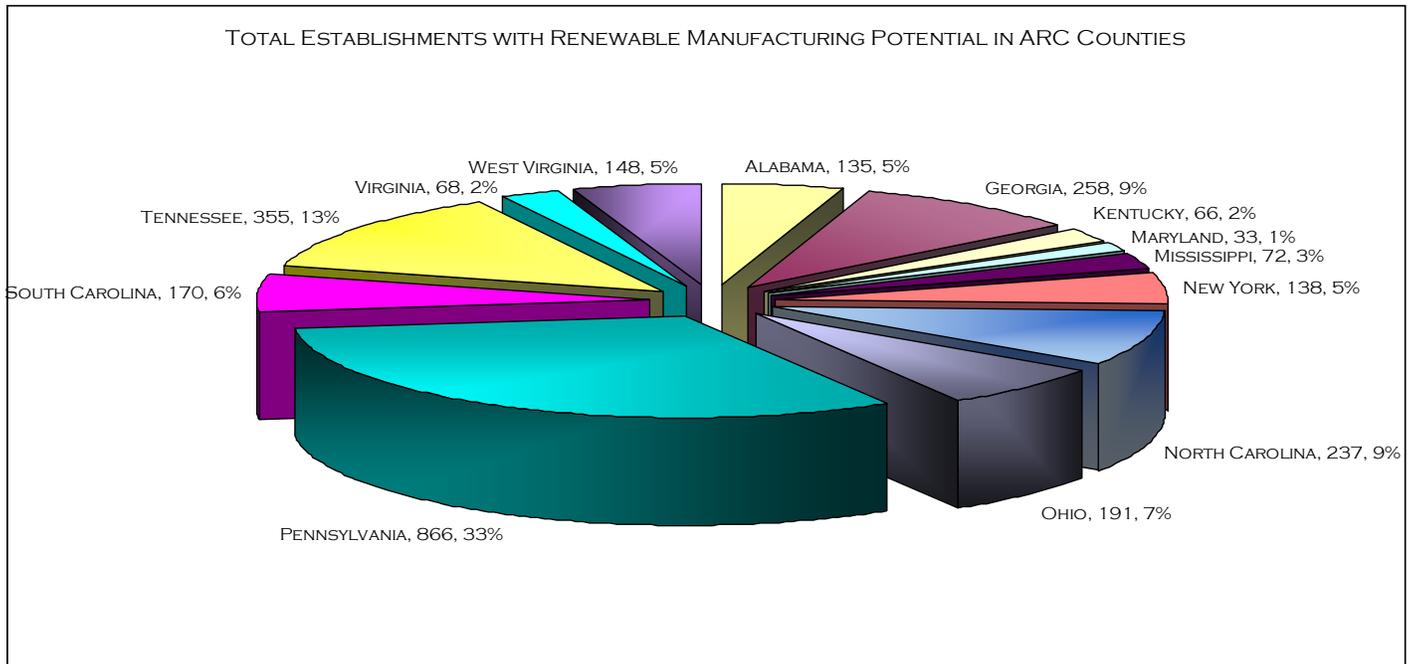
Figure 14b



**Figure 15. Percentage of potential employment for ARC member states, including totals for combined biomass, solar and wind facilities.**



**Figure 16. Percentage of manufacturing establishments for ARC member states, including totals for combined biomass, solar and wind facilities**

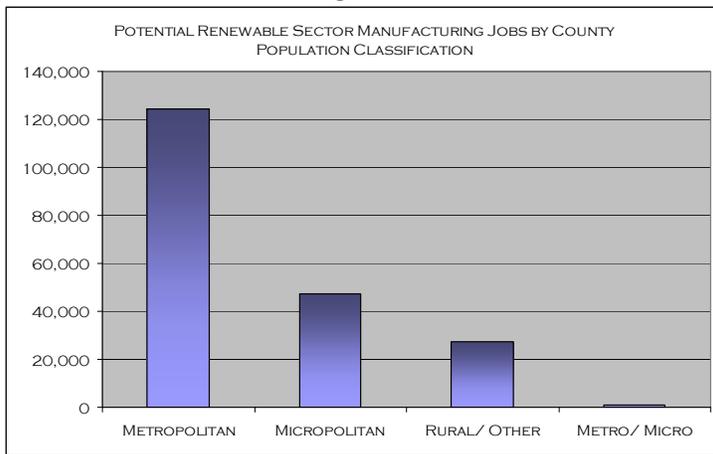


The proportion of jobs and potential establishments are also not equally shared among the renewable energy sectors considered. The ratio of jobs and establishments are shown in **Figures 15 and 16**, respectively. Wind, solar and biomass resource totals

include jobs and facilities that may be capable of producing components for multiple renewable technologies. For example, totals for both wind and biomass include the manufacturing of turbines, turbine generators and turbine generator sets. As a result, the aggregate totals for each resource are higher than the non-resource-based totals proposed for the region and for each state or county.

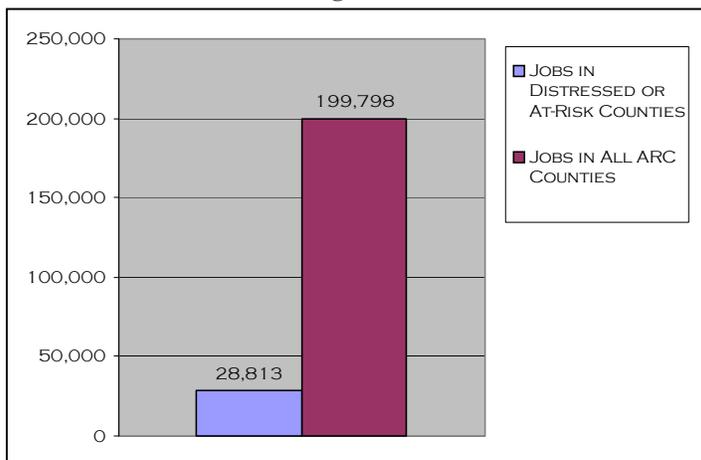
These figures demonstrate that the wind energy sector possesses the greatest manufacturing potential in ARC counties, with potential jobs totaling 89,579 and establishments totaling 1,318. Biomass follows closely, with potential job and establishment totals of 81,836 and 912 respectively. The solar energy sector possesses 40,757 potential jobs and 668 potential manufacturers in the region. Again, these figures reflect aggregated totals for each sector

**Figure 17**



The distribution of jobs and establishments between counties designated rural based on OMB’s population-based classification scheme is shown in Figure 17. The concentration of manufacturing within metropolitan areas within the Appalachian region is roughly three times that of those in micropolitan regions and roughly five times that of areas classified as rural/other.

**Figure 18**



The total potential jobs within economically depressed counties within the ARC are shown in Figure 18 relative to job totals for all counties within the ARC.

The next section of this analysis examines sector specific employment and manufacturing establishments by individual ARC states. These results reflect county level totals.

## State Analyses

This section of the analysis contains employment and establishment totals for each Appalachian state, to the county level. State totals, combining all renewable employment and establishments are shown in Table 8, as well as the renewable industry with the highest employment totals for that state. Industries with close totals were included in parentheses.

**Table 8. State Employment and Establishment Data**

State	Total Employment	Total Establishments	Average Establishment Size	Primary Renewable Industry
Alabama	9,064	134	67.1	Biomass
Georgia	15,293	258	59.3	Wind
Kentucky	7,206	66	109.2	Wind
Maryland	1,436	33	43.5	Wind
Mississippi	6,681	72	92.8	Biomass
North Carolina	16,604	237	90.8	Wind (Solar, Biomass)
New York	12,526	138	70.1	Biomass (Wind)
Ohio	9,787	191	51.2	Wind
Pennsylvania	60,115	866	69.4	Biomass (Wind)
South Carolina	16,319	170	96.0	Wind (Biomass)
Tennessee	26,244	355	73.9	Wind
Virginia	8,690	68	127.8	Biomass
West Virginia	9,833	148	66.4	Solar (Wind)
<b>TOTALS</b>	<b>199,798</b>	<b>2,737</b>	<b>73.0</b>	

Each state in the Appalachian region possesses some degree of employment for each renewable energy sector reviewed. Summaries for each type of renewable resource are shown in Table 9. Appendix C contains detailed data on concentrated employment within each Appalachian state.

**Table 9.**

**Summary State Employment and Establishment Data by Renewable Resource\***  
 (\*Dominant manufacturing component is in parentheses)

<b>ALABAMA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	2,180	1,408	6,428
Establishments	29	34	94
County with Greatest Employment Concentration	Madison: 627 Jobs, 8 Facilities, 3 Components	Morgan: 444 Jobs, 2 Facilities, 2 Components	Jefferson: 1,280 Jobs, 25 Facilities, 12 Components
Employment in At-Risk Counties	424 (Ball and Roller Bearings)	73 (Current Carrying Wiring Devices)	895 (Conveyor and Conveying Equip)
<b>GEORGIA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	7,113	2,587	5,969
Establishments	126	77	67
County with Greatest Employment Concentration	Gwinnett: 1,894 Jobs, 36 Facilities, 7 Components	Gwinnett: 336 Jobs, 18 Facilities, 7 Components	Gwinnett: 1,342 Jobs, 25 Facilities, 11 Components
<b>KENTUCKY</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	4,499	1,545	1,482
Establishments	38	14	15
County with Greatest Employment Concentration	Jackson: 1,051 Jobs, 5 Facilities, 3 Components	Madison: 749 Jobs, 2 Facilities, 2 Components	Whitley: 520 Jobs, 1 Facility, 1 Component
Employment in At-Risk Counties	1,360 (Plastics Products)	357 (Sheetmetal)	320 (Switchgear and Switchboard)
<b>MARYLAND</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	851	465	124
Establishments	16	12	7
County with Greatest Employment Concentration	Washington: 676 Jobs, 13 Facilities, 7 Components	Washington: 391 Jobs, 10 Facilities, 4 Components	Washington: 88 Jobs, 6 Facilities, 5 Components
<b>MISSISSIPPI</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	3,517	1,042	2,346
Establishments	24	16	36
County with Greatest Employment Concentration	Lowndes: 535 Jobs, 5 Facilities, 3 Components	Alcorn: 401 Jobs, 1 Facility, 1 Components	Lee: 1,160 Jobs, 3 Facilities, 2 Components
Employment in At-Risk Counties	944 (Motors and Generators)	723 (Plastics Film & Sheet, Plastics Material & Resin)	373 (Power Boiler And Heat Exchanger)
<b>NEW YORK</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	5,544	1,613	6,495
Establishments	71	31	48
County with Greatest Employment Concentration	Broome: 1,889 Jobs, 18 Facilities, 8 Components	Steuben: 546 Jobs, 3 Facilities, 1 Component	Steuben: 1,905 Jobs, 8 Facilities, 5 Components
<b>NORTH CAROLINA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	4,619	4,350	5,542
Establishments	74	44	59
County with Greatest Employment Concentration	Watauga: 1,483 Jobs, 29 Facilities, 7 Components	Watauga: 1,923 Jobs, 31 Facilities, 6 Components	Buncombe: 1,632 Jobs, 13 Facilities, 9 Components
Employment in At-Risk Counties	1,685 (Plastics Products)	40 (Sheetmetal)	583 (Industrial Valve)
<b>OHIO</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	5,480	2,641	2,060
Establishments	94	44	57
County with Greatest Employment Concentration	Columbiana: 837 Jobs, 13 Facilities, 4 Components	Washington: 803, 6 Facilities, 2 Components	Tuscarawas: 861 Jobs, 9 Facilities, 7 Components
Employment in At-Risk Counties	648 (Iron Foundries)	122 (Plastics Material and Resin)	432 (Air Conditioning and Warm Air Heating Equip)

<b>PENNSYLVANIA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	23,649	10,789	32,309
Establishments	396	205	346
County with Greatest Employment Concentration	Erie: 5,374 Jobs, 66 Facilities, 8 Components	Allegheny: 2,612 Jobs, 40 Facilities, 8 Components	Erie: 6,835 Jobs, 40 Facilities, 15 Components
Employment in At-Risk Counties	314 (Power Transmissions)	211 (Unlaminated Plastics Film and Sheet)	94 (Heating Equip)
<b>SOUTH CAROLINA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	10,036	4,096	5,994
Establishments	92	41	46
County with Greatest Employment Concentration	Greenville: 4,595 Jobs, 23 Facilities, 8 Components	Greenville: 1,485 Jobs, 15 Facilities, 5 Components	Greenville: 3,715 Jobs, 19 Facilities, 8 Components
Employment in At-Risk Counties	1,219 (Ball and Roller Bearings)	40 (Plastics Material and Resin)	78 (Industrial Valves)
<b>TENNESSEE</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	13,590	3,707	9,845
Establishments	192	64	117
County with Greatest Employment Concentration	Knox: 1,570 Jobs, 36 Facilities, 8 Components	Hawkins: 723 Jobs, 2 Facilities, 2 Components	Hamilton: 3,322 Jobs, 29 Facilities, 12 Components
Employment in At-Risk Counties	389 (Plastics Products)	184 (Plastics Material and Resin)	42 (Air Conditioning and Warm Air Heating Equip)
<b>VIRGINIA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	3,453	793	4,931
Establishments	29	14	29
County with Greatest Employment Concentration	Russell: 736 Jobs, 1 Facility, 1 Component	Bristol City: 295 Jobs, 2 Facilities, 1 Component	Bristol City: 3,112 Jobs, 5 Facilities, 4 Components
Employment in At-Risk Counties	986 (Plastics Products)	81 (Semiconductors and Related Devices)	159 (Mineral Wool, Conveyor Equip)
<b>WEST VIRGINIA</b>	<b>Wind</b>	<b>Solar</b>	<b>Biomass</b>
Employment	3,688	4,414	2,055
Establishments	75	40	48
County with Greatest Employment Concentration	Ritchie: 1,177 Jobs, 3 Facilities, 1 Component	Wood: 2,710 Jobs, 3 Facilities, 2 Components	Hancock: 588 Jobs, 2 Facilities, 2 Components
Employment in At-Risk Counties	649 (Plastics Products)	123 (Plastics Material and Resin)	283 (Instruments and Related Products)

## ***Recommendations***

This report has identified where opportunities to manufacture components for the renewable energy sector exist for Appalachia. However, the establishments identified do not currently produce such components. In order to capitalize upon the growth within the renewable energy industries, given the particulars of their respective organizational characteristics, a shift from current production to renewable components production must occur. The best approach to transitioning to renewable components manufacturing is not immediately obvious, though several mechanisms are available that may successfully enable and encourage manufacturers to pursue opportunities within this arena.

Several states have taken steps to encourage manufacturers of renewable energy equipment to site facilities within their borders. Efforts range from direct negotiations with manufacturers and offering tax abatements and financial packages, to tax credits and incentives to any firm or facility producing components specific to renewable energy industries. Currently, nine states offer ‘Industry Recruitment’ incentives for renewable energy.<sup>77</sup> Industry Recruitment incentives consist of efforts and programs created to attract equipment manufacturers for renewable energy technologies. Such programs typically consist of tax credits and abatements, grants and negotiated commitments from the issuing entity to purchase a specified amount of production. Examples include Washington State’s tax abatement for solar energy manufacturers and wholesalers. In-state producers enjoy a 40 percent reduction in the state’s business and occupation tax. Washington’s policy also includes mechanisms to increase the tax incentive for facilities sited in economically depressed regions. Three ARC member states currently possess manufacturing recruitment incentives, including New York with its NYSERDA Renewable Energy Technology Manufacturing Incentive, Ohio with its Fuel Cell Grant and Loan Program, and Virginia with its Solar Manufacturing Incentive Grant program.

Attempts to transition existing manufacturers to pursue markets in renewable energy will likely differ from outright courting of new manufacturing. Outreach and education programs for manufacturers with the technical capacity to produce renewable energy components, such as those identified in this report, may be an appropriate mechanism to employ. The following is a brief list of potential tools to encourage renewable energy manufacturing in the Appalachian region.

### *Financial Incentives*

**Renewable Energy Manufacturers Tax Credits:** Such policies offer corporate tax incentives for companies engaged in renewable energy equipment manufacturing. Credits can be applied against gross receipts tax, manufacturers’ taxes and extraction taxes, among others, paid by manufacturers of renewable

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<sup>77</sup> Database for State Incentives for Renewables and Efficiency, Washington Incentives for Renewable Energy: website: [www.dsireusa.org](http://www.dsireusa.org)

equipment. The breadth and scope of renewable equipment and technologies eligible under such incentives are at the discretion of the instituting body.

**Renewable Energy Portfolio Standards (RPS) and Tax Credit Multipliers for In-State Manufacturing:** Such policies can be included in existing or pending renewable energy requirements and set asides such as RPS's or Renewable Energy Standards (RES) that enable those entities subject to the requirement to receive extra credits toward their requirement by purchasing equipment manufactured in a designated area. Increasing the effective tax incentive for consumers of renewable energy equipment that purchase from an in-state manufacturer can also be offered, to both residential and commercial entities.

**Tax Credits or Multipliers for Manufacturing in Distressed Regions:** Similar to the previous policy, credit multipliers can be provided to entities subject to RPS if they purchase equipment manufactured from distressed regions. More immediately, tax credit multipliers can be offered to renewable manufactures that site facilities in regions designated as economically distressed.

**Research and Development and 'Advanced' Technology Grants and Loans:** Offering grants and low interest loans for entities engaged in innovative R&D or high tech technologies can encourage growth in the industry.

**Incubator Programs for Renewable Energy Industries:** These programs provide support through education, business services and even space for entrepreneurs interested in renewable energy technologies in the Appalachian region.

#### *Organizational or Educational Programs*

**Renewable Energy Manufacturing Business Outreach Programs:** These can establish or augment existing business and manufacturing education programs to provide education and information on opportunities to transition to or engage renewable energy industries.

**Bridging Local Manufacturing with Industry Suppliers and Vendors:** By providing a forum or infrastructure, programs can build bridges between the renewable energy industry and regional facilities capable or interested in producing equipment for that industry.

**Regional Renewable Energy Industry Consortia:** Consortia can provide an arena where active industries can enhance coordination in the region. Services to improve upon supply chain management and customer relationship management can also benefit the competitiveness of the region's renewable energy industries.

## *Other*

**Support for State and Federal Renewable Energy Policies:** Providing or continuing support for state and federal incentives that drive demand or reduce the costs of renewable energy technology and energy production will be important to continue near and long-term growth in these new industries. Renewable Portfolio Standards offer certainty for all levels of the renewable energy industry, from equipment manufacturers, to project developers and financiers, to utilities and consumers. Maintaining and supporting consistent tax credit policy, available over longer timeframes with established sunset clauses are also important, as evidenced by the cycling passage and expiration of the federal PTC for renewable energy.

**Production Tax Credits, Grants and Loans for Cellulosic Ethanol:** Tax credits based upon the units of renewable energy produced can encourage ethanol refining facilities to site within a given region. Providing incentives and low interest starter loans specific to the cellulosic industry can jump start the region in the production of this form of fuel. Grants associated with R&D in the cellulosic arena can also help establish a foundation for the nascent industry in the region, perhaps in association with existing research and educational institutions.

**Renewable Fuel Standards:** Augmenting the Federal Renewable Fuel Standard with passage of a long-term goal for cellulosic fuel production or consumption in the region can provide for certainty for investors and producers of cellulosic ethanol.

Immediate next steps, however, should involve an in-depth assessment of the manufacturers identified in this report. Beyond their technical capacity to produce components for renewable energy industries, important aspects of their transitional capacity must be gauged. Ownership and management structures must be identified in addition to assessing each establishment's interest and means to transition production capacity. Additionally, outreach to existing renewable energy industries, particularly those interested in diversifying their supply chain or expanding local energy production can provide important cues for expanding manufacturing capacity within the Appalachian region.

## **Conclusion**

As energy demands continue to increase and interest in clean, renewable sources grows, the economic opportunities to produce equipment for the production of renewable energy will expand. Investigating the characteristics of renewable energy industries expose where some of the greatest opportunities exist, for both near-term and long-term economic growth. The rapid expansion currently experienced within renewable energy industries such as wind and solar power has created a situation where the sub-components for these industries are in high demand. Producing such parts may be one of the most immediate opportunities to capitalize on this growth industry for a region with existing technical capacity to manufacture renewable energy equipment, such as Appalachia.

Even in a climate of increasing consolidation, demand is forcing large, integrated firms to outsource much of their non-essential components manufacturing. Windows of opportunity exist for manufacturers poised to produce these needed components, and can provide for long-term supply contracts with established companies. Where a handful of domestic manufacturers are currently producing parts for the renewable energy industry, dominated by states such as California, there is significant room for domestic demand for renewable energy equipment to be met with domestic supply. Sub-components manufacturing may be the most immediate and achievable opportunity for wide-scale engagement, particularly as large, international firms expand US-based production capacity to meet domestic demand. Already in both the wind and solar industries European wind firms and Japanese solar firms contract with US-based component manufacturers for needed parts.

This report provides an initial assessment of the potential capacity of the Appalachian region to supply components for the wind, solar and biomass industries. Where there is marked variation in each Appalachian state's capacity to produce parts for these three industries, analysis shows that substantial capacity exists to produce renewable energy components. Each state possesses some level of production capacity, for each of the three industries investigated, ranging from hundreds of jobs to tens of thousands of jobs for each single industry. As a whole, almost 3,000 establishments exist in Appalachia with the technical capacity to manufacture renewable energy equipment. These facilities employ almost 200,000 people in the region. Pennsylvania alone possesses over 60,000 jobs in potential renewable components manufacturing, followed by Tennessee with over 26,000 jobs. Maryland, with only three counties in the Appalachian region, still possesses over 1,000 jobs in potential renewable components manufacturing.

Even further, there are concentrated manufacturing potentials within each state that provide significant opportunities to develop regions of specialization for renewable energy industry-specific product manufacturing. Such concentrated regions are attractive to larger equipment suppliers interested in contracting for sub-components manufacturing.

Numerous mechanisms exist which can encourage domestic manufacturing at many levels. Financial incentives can enable or encourage both sub-components manufacturing as well as turn-key, integrated facility establishment. This can function to either grow a domestically- or locally-based firm through tax abatements, low interest loans to launch a new renewable energy enterprise or facilitate the siting of larger, established firms within a given region. Finally, fostering a renewable manufacturing-friendly zone through incubation, outreach and coordination can better enable local industry to transition to renewable energy manufacturing.

In addition to components manufacturing, Appalachia may contain the resource base to become a leader in cellulosic ethanol production. Given the current uncertainties regarding the nature and extent of the cellulosic resource within the region as well as the timeframe for available commercial cellulosic technology, it may be in the best interest of the region to position itself to be an early entrant into the industry. Getting in on the ground floor of the industry and becoming an early industry leader could produce substantial economic benefit to the region.