

# Renewable Energy

## Component Manufacturing in South-Central Pennsylvania



### Executive Summary

*Prepared by*

## The Regional Economic Development District Initiatives *of* South-Central Pennsylvania

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**The South-Central Workforce Investment Board**  
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## Executive Summary Renewable Energy Component Manufacturing in South-Central Pennsylvania

As an economic development tool, this broad study includes a general description of the technology and market characteristics for renewable energy (part 1); an examination of the south-central region in terms of the market segments where the area can and does have competitive advantage (part 2); and an evaluation of regional economic development resources, including the region's innovation capacity – essential tools for transitioning regional industries into new renewable energy markets (part 3).

The primary use for this study is to provide background information and preliminary guidance for a newly formed industry partnership in renewable energy. It is intended to help guide the agenda and focus of the partnership, and to expedite the initial startup activities of the partnership by organizing basic industry information and identifying initial steps that need to be taken. The study may be used to help inform state policy with respect to the economic development of this industry cluster, including incentives and regulation. It may also be used to help coordinate grassroots efforts by workforce development and economic development organizations across Pennsylvania.

Renewable energy includes the generation of power using *wind, solar, geothermal, hydroelectric, and biomass* systems, and the production of *biofuels* including ethanol and biodiesel. These energy sources are part of the larger energy market. This primer provides a general overview of power generation and distribution along with a look at how the energy market is segmented.

The first broad division of the overall energy market is between *electrical power* and *transportation and heating fuels*. The second division on the electric side is between *utility scale power* and what is generally referred to as *distributed power*. Utility scale power is available to and through the existing power grid, and is generated by regulated electric utilities. Distributed power is typically smaller in scale and more localized.

*REDDI sees enormous potential in the manufacture of renewable energy components and systems based on the region's competitive advantage in manufacturing.*

The third level of market segmentation focuses on activity and includes *direct production* of renewable energy; the *logistics and support* industries; *commodity support* industries that focus on issues surrounding the sourcing of feedstocks and emerging brokerage activities related to carbon credits; and the *manufacturing of components and systems* for renewable energy production facilities

both nationally and globally. REDDI sees enormous potential in this last segment, based on the region's existing competitive advantage in manufacturing.

This kind of portfolio approach provides some insight into how to position the regional industry cluster. First, through coordinated effort the region can anticipate market growth and utilize its current competitive advantage to gain substantial market share. This requires a clear understanding of both the existing capacity and the emerging market, and a clear strategy among industries, intermediaries and government to ensure adequate capital and human resources to target and respond to market opportunities. Second, even as our industries exploit their existing competitive advantage with current technologies, the region must expand its capacity for innovation to develop new technologies and components systematically.

The primer addresses the basic technology behind wind, solar, hydroelectric, geothermal, biomass power and biofuels. Each chapter describes the current level of technology, the market, and potential innovations that could lead to more widespread adoption and lower costs. The final chapter in this section will briefly discuss two emerging technologies that may one day provide clean, safe, renewable energy. The first is fuel cell technology. The second, which has its roots in the REDDI region, is Sea Solar Power.

### **Renewable Energy Component Manufacturing**

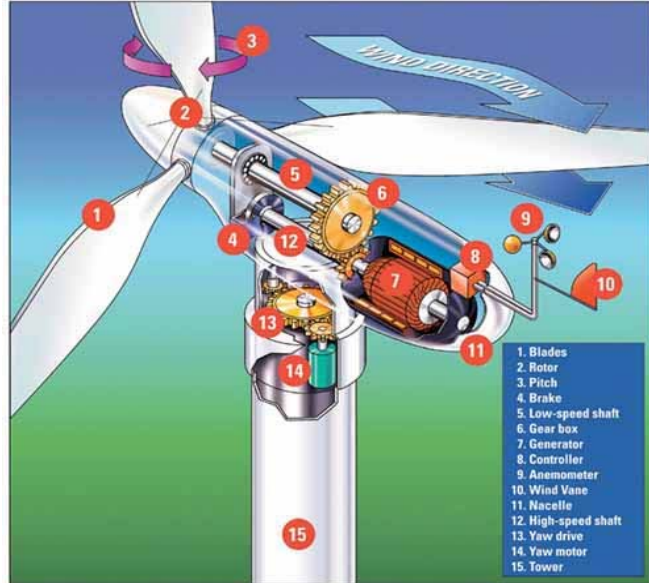
This report shows that for most renewable energy submarkets the region has the potential to be competitive in the production of key components. The region is already a leader in the production of Hydro-turbines, and several local firms have begun to make inroads into the manufacture of components for other renewable energy systems.

The notion of grouping or clustering certain manufacturing industries in south-central Pennsylvania differ-

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ently than the existing cluster definition of manufacturing developed by L&I began with the recognition that certain firms in the region had the potential to be competitive in the industries that manufacture components for renewable energy systems. The main organizing principle for this cluster definition was the potential for competitive advantage in a specific market – renewable energy systems and components. While different from the L&I definitions, this cluster definition is equally legitimate for the purposes of organizing diverse but related industries around a common market. This is a fundamentally different purpose for defining a cluster than the purposes which led to L&I’s definition.



Wind Turbine Source: U.S. Department of Energy

The Renewable Energy Component Manufacturing Cluster is comprised of six subclusters. Each subcluster is defined as the collection of industries responsible for manufacturing the components that make up the systems for that renewable energy platform. Each sub-cluster faces its own opportunities and challenges. Wind energy offers the most immediate promise for local manufacturers. Solar PV also offers several opportunities, with the caveat that a market shift to thin film technology may be on the horizon. Hydroelectric turbine manufacturing is solidly represented within the region with two well established firms, however additional opportunity is limited. The region has core strength in the manufacturing of components that

**Table 7.4: Core Renewable Energy Cluster Employment**

Description	Adams	Berks	Cumberland	Dauphin	Franklin	Lancaster	Lebanon	York	REDDI
Cluster Employment	682	2,052	911	3,168	840	4,436	1,129	2,684	15,902
% of Cluster Employment	4%	13%	6%	20%	5%	28%	7%	17%	100%
% of County Employment	2%	1%	1%	2%	2%	2%	2%	2%	2%
Number of Firms	6	41	12	18	8	41	14	45	185
% of Cluster Firms	3%	22%	6%	10%	4%	22%	8%	24%	100%
Avg Firm Size	114	50	76	176	105	108	81	60	86
Avg Annual Wage	\$ 47,090	\$ 37,276	\$ 54,354	\$ 68,704	\$ 44,143	\$ 44,676	\$ 47,168	\$ 40,056	\$ 48,535
<b>Cluster-wide Shift-Share Analysis</b>									
Employment Change 2000 - 2004	(242)	65	(380)	(126)	(219)	(167)	(147)	(1,481)	(2,697)
Share Component	(2)	(4)	(3)	(7)	(2)	(9)	(3)	(9)	(39)
Industry Mix	(160)	(344)	(224)	(571)	(184)	(798)	(221)	(722)	(3,224)
Competitiveness	(80)	413	(153)	452	(33)	640	77	(750)	566
Location Quotient	3.68	2.21	1.26	3.15	2.82	3.44	4.32	2.78	2.81

Data Source: PA Department of Labor & Industry, RDAT 2004.

could be used in geothermal plants, however the opportunities for collective action are limited due to the level of customization in the finished product. Opportunities also exist for manufacturers in a wide range of industries in the construction of ethanol facilities. New biodiesel firms are now active in the region, and economic developers should nurture their continued development.

### Focusing on the Core Cluster

This report ultimately focuses on a set of core industries that are both competitive and have the potential to actively pursue opportunities in many renewable energy sub-markets. Comprised of approximately 185 firms in 14 industries, the core has strong location quotients and local competitive job growth. With 15,902 workers, the core cluster represents nearly two thirds of the overall cluster’s workers, but only one third of the firms. Average firm size is 86 employees. Average wages are \$48,535, 37% higher than the average wage for the region, \$35,370.

NAICS Code	Description	Wind	Solar PV	Hydro	Geothermal	Ethanol	Biodiesel	REDDI	High	Firms	Employment	
326199	All other plastics product manufacturing	x				x		1.35	2.91	York	65	3,486
327211	Flat Glass		x					4.85	4.85	Cumberland	3	
331210	Iron, steel pipe and tube from purchased steel				x	x	x	1.74	8.72	Berks	5	353
332311	Prefabricated metal buildings and components					x		1.74	32.17	Lebanon	10	412
332312	Fabricated Structural Metal manufacturing	x			x	x		2.80	7.57	Lancaster	40	1,868
332410	Power boiler and heat exchanger manufacturing				x	x	x	4.18	15.91	Lancaster	7	632
332420	Metal tank, heavy gauge, manufacturing				x	x	x	3.27	6.98	Dauphin	6	590
332911	Industrial Valve Manufacturing			x	x	x	x	1.53	1.53	Lancaster	2	
332919	Other metal valve and pipe fitting mfg			x		x	x	5.08	22.23	Lancaster	2	
333611	Turbines, Turbine Generators and Turbine Generator Sets	x		x	x	x		3.29	19.29	York	2	
333613	Mechanical Power Transmission Equipment Manufacturing	x			x			3.84	3.84	Franklin	2	
333922	Conveyor and conveying equipment mfg					x	x	1.62	5.27	York	13	365
334418	Printed Circuit Assembly Manufacturing	x			x	x		1.97	1.97	Lebanon	16	769
335931	Current-Carrying Wiring Device Manufacturing		x			x		15.40	15.40	Adams	12	4,891
	<b>Subcluster Total</b>										185	15,902

Data Source: PA Department of Labor & Industry, RDAT 2004.

As the U.S. moves towards energy independence and a portfolio approach to energy production, the opportunities for local manufacturers are significant. While the opportunities are great, the chief threat is technological change and product obsolescence. Certain renewable energy technologies are undergoing rapid technological change that will profoundly affect the demand for their components. This is particularly true in the solar PV industry, and thus this report recommends caution with respect to that sub-market.

To support the growth of opportunities in the manufacture of renewable energy components, economic and workforce developers should continue their efforts in identifying and working with those firms with a desire to enter the market. Several specific strategies initially present themselves. First, economic developers can begin to market the region collectively through industry trade groups, journals, and shows. Second, Economic development organizations can assist local firms in developing a sophisticated approach to working with international firms. Third, they can facilitate improvements in product quality and certification. Fourth, they can assist with the process of innovation through enhancement of the innovation infrastructure of the region. Finally, they can assist firms in securing the capital and human resources necessary to compete in the manufacture of renewable energy components and systems.

#### **Strengthening Innovation Capacity**

Innovation means the creation of new products, services or processes that add economic value to individuals, firms and the economy. It is the activity that happens between the act of discovery, creation or invention, and the appearance of new products and services in the marketplace. It is the process by which new ideas are converted into new products and services. Innovation is also the way that existing processes are changed to make the production of goods and services better, faster, more efficient and less costly. It is the creation of economic value which distinguishes innovation from invention or creativity.

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- 1. Begin to market the region collectively through industry trade groups, journals, and shows.*
- 2. Assist local firms in ... working with international firms.*
- 3. Facilitate improvements in product quality and certification.*
- 4. Assist with the process of innovation through enhancement of the innovation infrastructure of the region.*
- 5. Assist firms in securing the capital and human resources necessary to manufacture renewable energy components and systems.*

Table 2.1 Educational Attainment & Per Capita Income for the REDDI Region, Adjacent States and the U.S.

EDUCATIONAL ATTAINMENT	Adams	Berks	Cumberland	Dauphin	Franklin	Lancaster	Lebanon	York	REDDI	PA	MD	US
Population 25 years and over	67,776	267,392	154,448	176,044	97,660	325,513	88,206	286,071	1,463,110	8,431,859	3,717,512	195,932,824
Less than 9th grade	3,484	18,252	4,817	6,546	5,886	27,235	5,952	12,610	84,681	356,247	155,064	12,743,556
9th to 12th grade, no diploma	7,407	32,869	11,736	14,299	11,368	38,826	9,296	30,412	155,813	808,760	324,344	18,502,540
High school graduate (includes equivalency)	28,919	104,671	56,101	70,321	43,074	124,946	41,291	117,193	566,516	3,277,304	998,620	59,123,054
Some college, no degree	10,889	36,236	22,535	25,751	13,698	41,215	10,918	43,998	205,240	1,244,703	692,311	38,185,678
Associate's degree	4,254	18,288	11,174	13,394	6,912	18,964	4,862	20,741	98,589	600,673	244,076	14,486,202
Bachelor's degree	7,852	38,096	29,265	28,441	9,998	49,725	10,514	39,851	213,542	1,332,262	721,296	33,496,187
Graduate or professional degree	5,171	19,180	19,020	17,293	6,824	24,802	5,373	21,266	118,729	812,920	581,801	19,394,708
Percent high school graduate or higher	83.90%	81.00%	89.40%	88.20%	82.20%	79.80%	82.70%	85.00%	83.56%	86.20%	87.10%	84.10%
Percent bachelor's degree or higher	18.90%	21.40%	31.30%	26.00%	17.00%	22.90%	18.00%	21.40%	22.71%	25.40%	35.10%	27.00%
Percent advanced degree	7.83%	7.17%	12.31%	9.82%	6.78%	7.62%	6.09%	7.43%	8.11%	9.64%	15.65%	9.90%
Per capita income (dollars)	23,347	23,539	28,338	25,249	24,524	24,674	23,254	24,950	24,821	24,694	31,888	25,267

Source: U.S. Census, 2006 ACS

Under the university-led model of innovation and using the measures developed by the U.S. Council on Competitiveness one could easily conclude that the REDDI region has little, if any innovation capacity. The region’s education levels are below state averages and significantly below national averages. In terms of the percent of the region’s population with bachelor’s degrees, moving the region from its current 22% to the national average of 27% would require an additional 64,000 college graduates from a collection of schools that graduate roughly 12,000 per year in total. SAT scores, while slightly better than the Pennsylvania average, still fall below the national average. Graduate students who are generally associated with the presence of innovation are virtually non-existent in the region, and Research and Development funding is similarly diminutive. The region’s cities are making some strides towards the development of amenity infrastructure, but real diversity remains elusive. The region’s cities are among the most segregated in the nation with respect to race and income.

REDDI believes, however, that there *are* other models and successful strategies for overcoming the challenges we face. The region may not have much in the way of research universities, but it has access to both research universities and federal laboratories within a relatively short drive. While the region has less than 1,000 graduate students within its borders, there are over 40,000 within the meta-region. While the region only has about \$4 million in university R&D within its borders, it has proximity to over \$4 billion in university R&D, plus a substantial amount of R&D at federal labs. The region’s transportation network and broadband access, along with its solid industrial base, strong social networks and available resources in the form of local colleges and universities make it possible to grow the region’s innovation capacity under a more virtual model. Connecting firms and entrepreneurs to Research and Development assets can be solved in large measure with programs and technology. The latter problems of low education and lack of diversity requires a change in culture in order to achieve the necessary change.

*Under the university-led model the region has little, if any innovation capacity. However there are other models for overcoming our challenges*

Although each will enhance innovation capacity independently, both are required to sustain that growth. This report recommends strong advocacy positions on the basis of the negative economic impact these conditions have on the region.

This report recommends the following strategies to augment the efforts of the region's four KIZ's and strengthen the region's capacity for innovation. These suggestions are not prescriptive, but rather are made to facilitate further discussion on building innovation capacity.

1. Increase the percentage of residents in the REDDI region with Bachelor's degrees from its current level of 22.7% to at least the national average of 27%.
2. Support housing and community development policies that will increase diversity
3. Create a regional innovation network that includes the four Keystone Innovation Zones, the region's colleges and universities, economic developers, firms and entrepreneurs.
4. Create an "Innovation Environment" (Create the Buzz)
5. Partner with the region's colleges and universities to create the public space where "conversational communities can gather and exchange ideas.
6. Offer innovation and entrepreneurship training.
7. Host "technology "mash-up" events.
8. Implement a regional web-based idea management system.
9. Create a think-tank incubator similar to the Institute for Human and Machine Cognition (IHMC) in Pensacola, FL.

## *Strategies that can strengthen the region's innovation capacity*

- ◆ Increase the percentage of residents in the REDDI region with Bachelor's degrees from its current level of 22.7% to at least the national average of 27%.
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### Towards an Industry Partnership Agenda

In Pennsylvania, industry partnerships are organized for the purpose of providing targeted state support to similar industries on a range of economic development and workforce development issues. Typically the partnerships focus on issues that are not firm-specific, and in which collective action will improve conditions for most or all of the firms in the cluster. Workforce development is one of the prime focus areas of industry partnerships, as are infrastructure and business climate issues.

Throughout the latter half of 2007 REDDI and the Manufacturer’s Association held a series of regional meetings to gauge the level of interest in creating an industry partnership around the manufacture of renewable energy components.

Approximately 40 firms participated and provided valuable input, consistent with the findings of this study. Their comments, combined with REDDI’s other research suggests that a new industry partnership should initially focus on collective market research and regional outreach to recruit additional firms. This should be followed by the development and implementation of a targeted marketing strategy that connects local manufacturers with customers and provides resources and assistance for partnership firms to successfully negotiate new orders and meet customers’ expectations and quality concerns.

- ### Stakeholders and Partners
- ◆ REDDI
  - ◆ Manufacturer’s Association of South-Central Pennsylvania
  - ◆ Workforce Investment Boards – South-central, Lancaster, Berks and PA
  - ◆ PA Department of Labor and Industry
  - ◆ County Economic Development Corporations
  - ◆ Ben Franklin Technology Partners
  - ◆ Keystone Research Center
  - ◆ SEDA-COG
  - ◆ Renewable Energy Policy Project
  - ◆ Harrisburg Area Community College
  - ◆ U. S. Department of Labor

**Table 7.6: Core Renewable Energy Industry Cluster**

NAICS Code	Description	Adams	Berks	Cumberland	Dauphin	Franklin	Lancaster	Lebanon	York	REDDI	High	Firms	Employment	
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335931	Current-Carrying Wiring Device Manufacturing	x			x	x	x	x		15.40	15.40	Adams	12	4,891
	<b>Subcluster Total</b>	<b>3.88</b>	<b>2.21</b>	<b>1.26</b>	<b>3.15</b>	<b>2.82</b>	<b>3.44</b>	<b>4.32</b>	<b>2.78</b>	<b>2.81</b>			<b>185</b>	<b>15,902</b>

Data Source: PA Department of Labor & Industry, RDAT 2004.

The second focus of the partnership is helping firms develop the innovation capacity to transition into the renewable energy component market, and assist them in securing the necessary capital to competitively manufacture renewable energy components.

The third focus for the partnership is developing the workforce needed to manufacture renewable energy components and systems.