

A REPORT FROM:

POLICY
MATTERS
OHIO



GENERATING ENERGY,
GENERATING JOBS

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POLICY MATTERS OHIO, the publisher of this study, is a nonprofit, nonpartisan statewide research institute dedicated to bridging the gap between research and policy in Ohio. Policy Matters seeks to broaden the debate about economic policy in Ohio, by providing quantitative and qualitative analysis of important issues facing working people in the state. Other areas of inquiry for Policy Matters have included unemployment compensation, workforce policy, wages, education, housing, energy, tax and budget policy, and economic development.

THE APOLLO ALLIANCE is a nonpartisan national organization, dedicated to building a broad-based constituency in support of a sustainable and clean energy economy that will create good jobs, reduce dependence on foreign oil, and create cleaner and healthier communities. The Apollo Alliance is demonstrating that a socially just, environmentally balanced and economically prosperous future is attainable. It seeks to liberate the U.S. economy and our national security from dependence on fossil fuels, through investment in clean energy technology and sustainable infrastructure.

EXECUTIVE SUMMARY

Ohio could be a lead economic beneficiary from a national commitment to renewable energy. Increased use of renewable energy would reduce dependence on foreign fuel, stimulate the domestic economy, improve the environment, help control energy usage costs over the long term, and generate jobs in Ohio and other states. Policy Matters Ohio and the national Apollo Alliance commissioned the Renewable Energy Policy Project to examine the effect on Ohio manufacturing employment of meeting a national renewable energy production target of 74,000 megawatts of renewable energy -- 50,000 megawatts of wind energy, 9,260 megawatts of photovoltaic or solar energy, 8,700 megawatts of biomass energy, and 6,077 megawatts of geothermal energy. This brief report is drawn from that larger paper, which is available at www.policymattersohio.org/generating.htm.

Generating these renewable energy levels, which were derived from projections by renewable industries and advocates, would require a \$71.8 billion nationwide investment in wind energy, solar/photovoltaics, bio-mass steam generators, and geothermal technologies. This would be enough to power about 53 million U.S. homes.

With the proper policy supports, Ohio stands to gain more than \$3.64 billion of the national investment, ranking Ohio fifth among the states. Ohio's strong manufacturing infrastructure and workforce makes it likely that this state would see a greater share of the benefits than almost all other states, including some with larger populations.

More than 36,000 companies nationwide currently produce component parts similar to the parts needed in renewable energy equipment.¹ These firms are poised to modify their current capacity to begin manufacturing parts for the new equipment. Ohio has more than 2,000 firms currently producing component parts, ranking it third among states, with only California and Texas having more potential firms that could see gains.

To produce these component parts at the scale required to generate this level of renewable energy would require more than 380,000 new component parts manufacturing positions nationwide. Ohio ranks fourth among states in potential job gains, with more than 22,000 Ohio manufacturing jobs predicted to result from this investment, behind only California, Texas and Illinois.

Specifically, the state could gain:

- ◆ More than 13,000 jobs from wind investment, more than any state but California;
- ◆ Nearly 6,000 jobs from solar investment, exceeding all but five other states;
- ◆ More than 1,800 jobs from geothermal investments, more than all but California; and
- ◆ More than 1,800 jobs from biomass, among the top nine states (several stand to gain between 1,800 and 1,900).

Job and investment gains from this national commitment could be spread throughout the state of Ohio – 85 of the state's 88 counties have a firm that is currently manufacturing products that could be modified for use in renewable energy production. Large counties in Ohio stand to benefit substantially, with job creation projections of more than 2,500 jobs in Cuyahoga County; more than 1,000 jobs each in Lorain, Hamilton and Summit Counties; and more than 500 jobs each in Miami, Lucas, Franklin, Montgomery, Wood, Stark, Sandusky, Lake and Mahoning Counties. Investments are projected to be more than \$400 million in Cuyahoga County, more than \$200 million in Lorain, and Hamilton Counties, and more than \$100 million each in Summit,

¹ As of 1997 Economic Census, the most recently available data at the time of publication.

Miami, Lucas, Franklin, Montgomery, Wood, Warren and Stark Counties. Capturing this job and investment potential would require national and state commitments to renewable energy and assertive behavior by Ohio firms.

To generate this level of demand and ensure that American and Ohio workers play a role in the renewable energy economy will require state and federal policy change. The report concludes with four sets of policy recommendations to capture the component manufacturing positions domestically, increase demand for renewable energy, encourage supply of renewable energy, and increase productivity in the renewable sector.

Significant renewable energy investments at the state or federal level would have other benefits over the long term. The principal benefits are in reduced dependence on foreign energy and a cleaner environment. There are also other potential economic benefits for states like Ohio. Farmers could sell biomass, utility workers could operate the equipment, skilled tradespeople could gain jobs installing equipment. This brief paper highlights one very narrow benefit – the potential job and investment growth if Ohio firms were to produce the component parts for equipment used nationwide to generate alternative energy. Future research from Policy Matters Ohio and the Apollo Alliance will illustrate other economic and environmental benefits from more sustainable energy policy.

INTRODUCTION

Developing renewable energy could result in tremendous national security, economic, and environmental benefits to Ohio and the United States. Using renewable energy would reduce dependence on foreign fuel, make foreign policy less closely tied to energy concerns, and improve national security. Having a more diverse energy portfolio would also reduce demand for natural gas, bringing price stability to that market and increasing consumers' energy supply choices.² Environmentally, this approach would reduce emissions and other forms of pollution (or at least halt their increase), reduce sources of global warming, and improve community health.

Although the principal reasons to invest in alternative energy have to do with national security and environmental health, these investments would have economic benefits as well. Using more renewables would increase investment in local economies, reduce leakage of resources out of the country, restore America's leadership in technology innovation, improve global economic competitiveness, and reduce our trade deficit. It could generate job growth in the U.S., particularly in states like Ohio with strong manufacturing capability. Many of the resulting jobs would be high-skill, high-paying manufacturing and construction positions.

There are various ways that national policy could stimulate investment in renewable energy and help domestic manufacturing play a role. The federal government could begin purchasing its energy from renewable sources, creating instant demand and changing the nature of our energy production system. Congress could impose upon utilities requirements that they begin producing a certain percentage of their energy from renewable sources. We could better assess the public costs of pollution associated with traditional energy sources, and use that information to begin taxing pollution, thereby encouraging use of cleaner sources. We could appropriate a large expenditure of public funds on purchase of renewable energy. Or we could offer incentives of various kinds to companies and individuals that make renewable energy investments. This paper concludes with some suggestions to stimulate use of renewable energy, but it is important to understand that there is more than one way to arrive at the outcomes outlined here.

Because Ohio has infrastructure that enables it to produce parts used in alternative energy generation, Ohio should be a lead initial economic beneficiary from a national investment in renewable energy. This report describes how Ohio compares to other states, and details the potential benefits to every Ohio county from a large national investment in renewable energy. The numbers were derived from an economic model, developed by the Renewable Energy Policy Project (REPP) in Washington DC.³ The report was prepared by Policy Matters Ohio in collaboration with the Apollo Alliance, and draws heavily from a longer report prepared by REPP, both of which are available at www.policymattersohio.org/generating.htm.

² Because of Ohio's climate and industrial make-up, the state uses high volumes of natural gas. Ohio has few reserves, so high gas prices are a huge revenue drain on the state economy. In 2005, the American Council for an Energy Efficient Economy (ACEEE) reported that Ohio imports over 87% of its natural gas. In 2006, imported natural gas was expected to siphon over \$5 billion from Ohio's economy, in estimates made prior to refinery disruptions caused by the 2005 hurricanes (Martin Kushler et al. *Examining the Potential for Energy Efficiency to Help Address the Natural Gas Crisis in the Midwest*. ACEEE. 2005).

³ Estimating positive effects of one type of spending doesn't capture negative effects of reducing other spending. If \$71.8 billion is spent on renewable energy, that money will either be taken from savings or withheld from other investments or expenditures. It is possible that those other areas would also have generated jobs or other positive outcomes. Often analysts fail to acknowledge this. In this case, the expenditure is shown to promise potential economic and employment benefits in Ohio and environmental, economic and national security benefits nationwide. While there may be a more productive uses, this is clearly preferable to much current spending, including current spending on foreign fuel.

BIG INVESTMENT, BIG RETURNS

Renewable energy creates more jobs than other sources of energy: according to a California study, renewables generate four times as many jobs per megawatt of installed capacity as natural gas and 40 percent more jobs per dollar invested than coal.⁴ We examine the effect on manufacturing employment of a \$71.8 billion nationwide investment in wind energy, solar or photovoltaics, bio-mass steam generators, and geothermal technologies. Such an investment would generate 50,000 megawatts of wind energy, 9,260 megawatts of photovoltaic or solar energy, 8,700 megawatts of biomass energy, and 6,077 megawatts of geothermal energy.⁵ These are targets of renewable energy production that have been generated by advocates for energy independence, in consultation with the wind, solar, biomass and geothermal industries. Together, this amount of renewables would enable us to power about 53 million American homes.⁶

Various industry organizations and government agencies have suggested that the number of megawatts from renewable sources modeled here would be ambitious but reasonable goals for renewable production over the next few decades. For example, our wind generation estimate of 50,000 megawatts is about half of what the American Wind Energy Association (AWEA) projected should be invested in wind power over the next twenty years. AWEA believes that by 2020, with consistent policy support, wind can provide at least 6 percent of U.S. electricity, or about the same amount of electricity that hydropower provides today. Currently, the total installed U.S. wind energy capacity is just 6,740 megawatts as of January 2005, according to the AWEA.

The Solar Energy Industry Association's Solar Power Roadmap projects that the nation could install 9,260 megawatts in new solar photovoltaic capacity by the year 2025, which would meet half of the nation's new electricity-generating needs over that period.⁷ The 6,077 megawatts in geothermal energy and the 8,700 megawatts of biomass are both based on projections of the impact of a requirement by the U.S. government that utilities implement a 20 percent renewable portfolio standard, as calculated by the Energy Information Administration (EIA) of the United States Environmental Protection Agency (EPA). A 20 percent renewable portfolio standard would require that utilities produce 20 percent of their power from renewable sources. Together, these investments would result in more than 74,000 megawatts of energy from renewable sources.

ASSESSING THE IMPACT

More than 36,000 companies nationwide are currently producing component parts similar to the parts needed in renewable energy equipment.⁸ These firms would be poised to modify their current capacity to begin manufacturing the parts for the new equipment.

⁴ Brad Heavner and Susan Churchill. *Renewables Work*. CalPIRG. 2002.

⁵ The recently passed Energy Policy Act of 2005 provided some minor support for renewable energy development but stopped well short of supporting a significant national commitment.

⁶ Union of Concerned Scientists, "53 Senators Call For Renewable Standard in Energy Bill", October 6, 2003, http://www.ucsusa.org/news/press_release/53-senators-call-for-renewable-standard-in-energy-bill.html, accessed October 2005.

⁷ *Our Solar Power Future: The U.S. Photovoltaics Industry Roadmap, through 2030 and Beyond*, Solar Energy Industry Association, September 2004, available at <http://www.seia.org/roadmap.pdf>, accessed September 2005.

⁸ The data in this report is based on the 1997 Economic Census, the most recent available at the time of publication. Since December of 1997, Ohio and the U.S. have lost 20.5 percent 18.9 percent of their manufacturing jobs, respectively. Particularly in the cases where plants have actually closed, this will

The analysis considers all component parts of equipment used in generating alternative energy.

- ◆ Wind energy is produced primarily by wind turbines, which have a variety of component parts including rotors, generators, and gears, among others. California is the only state with more current capacity than Ohio in this type of production.
- ◆ Solar energy is produced by using photovoltaic (PV) devices to generate electricity directly from sunlight. It requires solar panels, crystalline silicon modules, and pipes, among other components.
- ◆ Geothermal energy production uses tanks, pipes, steam turbines, wells, and electric generators, all of which are used to extract liquid from below ground, turn it into steam, and use that steam to generate electricity.
- ◆ Biomass energy is produced in a similar manner to a coal plant, but requires additional equipment and modifications so that raw materials other than coal can be used – these consist primarily of residue from logging operations, but may also include agricultural residue.

CALCULATING THE JOB GAINS

To produce these component parts at the level required to generate more than 74,000 MW of renewable energy would require more than 380,000 new component parts manufacturing positions nationwide if manufacturing is done domestically. REPP used government data to determine where those positions would likely be created. Beginning in 1997, the U.S. government began using the North American Industry Classification System (NAICS) to classify products and services provided by firms on the continent. Companies reporting the same NAICS code are involved in similar activities. For example, every company that reports “333911” manufactures some type of pump. Using this system, REPP determined the number of companies currently involved in activities similar to the manufacturing of renewable energy components. The NAICS codes have levels of detail up to ten digits, with each digit indicating a higher level of detail. For example, a first digit of 3 indicates Manufacturing, 333 is “Machinery Manufacturing,” 333911 is “Pump and Pumping Equipment Manufacturing,” and 333911148M is “All other centrifugal pumps, over 6 inches discharge.” REPP matched each component with a 10-digit code, the highest level of detail in the NAICS, in order to ensure correct coding, but used the slightly broader 6-digit code to identify firms producing similar parts and therefore potentially capable of meeting new market demand for renewable components.

REPP used several sources to calculate the relationship between component cost, amount of investment in each component, and job creation in manufacturing each part. Researchers there determined the cost per megawatt of energy for each NAICS code, and used that calculation to generate investment and job data.⁹ To illustrate, consider the wind turbine gearbox, which costs \$80,000 per megawatt of wind capacity. REPP multiplied this by the 50,000 megawatts of wind

negatively affect the ability to capitalize on these new production opportunities. Ohio constituted 5.9 percent of U.S. manufacturing employment in December 1997 and 5.8 percent of that employment in August 2005, so there is not reason to think that the relative percentage of jobs that would come to Ohio would have changed substantially since the 1997 Economic Census. At that time, 36,000 firms in the nation were engaged in this kind of production. The release of the new economic census data is imminent – when that occurs, Policy Matters Ohio and the Apollo Alliance will issue an update to these findings.

⁹ Sources include the National Renewable Energy Laboratory of the United States Department of Energy Office of Energy Efficiency, the Wind Partnerships for Advanced Component Technology (WindPACT) study produced by NREL, the solar PV industry roadmap, the NREL Solar Energy Technologies Program, the Electric Power Research Institute’s (EPRI’s) “Next Generation Geothermal Power Plants” and the Capital Costs documents for the McNeil Generating Station in Burlington, VT.

that this project would generate. This results in a total investment in gearbox manufacturing of \$4 billion, which the researchers allocated geographically based on where similar parts are currently being made. For example, in Cuyahoga County, there are currently 419 employees working at firms operating in the NAICS code for gearboxes, as compared to 13,991 employees in the entire U.S. Therefore, Cuyahoga gets 419/13,991 or 2.99 percent of the four billion dollars, which means approximately \$120 million goes to Cuyahoga County for the NAICS code associated with gearboxes. The total investment for a county or state is a simple sum of the investment for all NAICS codes.

REPP assigned a manufacturing job creation ratio to each component to determine the number of new jobs required to produce a certain number of megawatts. For example, REPP examined the number of gearboxes currently produced annually, the cost of that production and the number of full-time-equivalent employees required for that production. Researchers then determined the number and cost of gearboxes needed to produce a megawatt of wind. They assumed that future investment and employment in gearbox manufacture would correspond to current employment and costs in the industry. Obviously future production will not correspond precisely to current production – some firms will likely emerge as dominant in the industry and some may be able to produce in a more efficient way than current production allows, particularly as time goes on.

Table 1 below shows, at a national level, the projected number of jobs per megawatt of power, the overall number of megawatts our policy changes would demand, and the total number of manufacturing jobs that is likely to be created at a national level in order to produce this energy. This analysis projects that producing 74,037 megawatts of renewable energy nationally, with the majority coming from wind and the rest fairly evenly divided between solar, geothermal and biomass, could result in more than 381,000 jobs nationally.

Table 1			
Renewable energy investments and national job creation potential			
Energy source	Projected jobs per megawatt of power	Number of megawatts	Total number of manufacturing jobs, nationally
Wind	3.48616	50,000	174,308
Solar Photovoltaic	15.21026	9,260	140,847
Geothermal	4.84927	6,077	29,469
Biomass – Dedicated Steam	4.25897	8,700	37,053
		74,037	381,677

Source: Renewable Energy Policy Project

The analysis determined the number of manufacturing employees in each state, and in each Ohio county, who are currently producing component parts that are similar to those required in renewable energy-generating equipment. This produced a broad map of U.S. manufacturing activity and a detailed map of Ohio manufacturing activity, based on firms that have the technical potential to become active manufacturers of components for equipment used in one of these four areas. It is important to note that other positions – in construction, agriculture, logging, and other fields – would be created as a result of this kind of investment. This analysis only considers growth in manufacturing employment.

IMPACT ON OHIO

If a national commitment were made to generate 74,000 megawatts of energy from renewable sources, which would require an approximate investment of \$71.8 billion, Ohio would stand to benefit disproportionately in job and investment potential. Ohio is among the top five states in terms of investment potential, the top three states in terms of number of firms, and the top four states in terms of number of workers that are already manufacturing component parts comparable to those needed in the new equipment. These companies and workers would be poised to reap the benefits from this national investment.

Ohio has more than 2,000 firms currently producing component parts comparable to those needed for renewable energy production, more than any other state but California and Texas. Table 2 below breaks down the \$71.8 billion national investment to demonstrate how that investment could be allotted among the states, for the top ten states. If Ohio firms that are currently active in component part manufacturing move to be part of this new market, more than \$3.647 billion dollars of the national investment could be spent in Ohio, ranking Ohio fifth among the states.

As the table makes clear, Ohio could be poised to benefit more than most other states from this sort of national investment.

State	Number of Firms	Millions of dollars of investment in wind	Millions of dollars of investment in solar	Millions of dollars of investment - geothermal	Millions of dollars of investment in biomass	Millions of dollars of investment in total
California	4,658	2,350	6,058	842	511	9,762
Texas	2,795	1,593	4,008	363	497	6,460
New York	1,605	1,357	1,456	746	465	4,025
Pennsylvania	1,839	1,412	1,872	342	326	3,952
Ohio	2,156	1,925	1,097	337	288	3,647
Illinois	1,961	1,660	1,452	256	272	3,640
Indiana	1,154	1,681	694	267	240	2,882
Wisconsin	1,123	1,677	431	153	273	2,534
North Carolina	940	819	1,001	329	319	2,468
Michigan	1,817	1,468	480	105	155	2,207
U.S. Total	36,474	26,968	32,930	6,020	5,885	71,802

Source: Renewable Energy Policy Project, 1997 Economic Census

Many of the states likely to benefit in investments and job creation are, like Ohio, among the states that experienced more dramatic job loss in the last recession and its wake. Table 3 below shows the new manufacturing jobs that could be created in the top twenty benefiting states, with this sort of nationwide investment. More than 22,000 Ohio manufacturing jobs are likely to result from this investment. Only three states stand to create more manufacturing jobs than the state of Ohio does.

Table 3
Potential number of firms to benefit and jobs to result from national investment in 74,000 megawatts of renewable energy, by state, top twenty states

Location	Number of Firms	New Jobs Wind	New Jobs Solar	New Jobs Geothermal	New Jobs Biomass	Total New Jobs
California	4,658	14,147	24,288	3,320	2,848	44,602
Texas	2,795	10,000	12,299	1,841	3,261	27,401
Illinois	1,961	11,303	8,472	1,455	1,715	22,946
Ohio	2,156	13,215	5,957	1,896	1,854	22,922
Pennsylvania	1,839	9,029	8,119	1,538	1,832	20,517
New York	1,605	7,876	6,318	3,136	2,683	20,013
Indiana	1,154	11,186	3,834	1,410	1,524	17,954
Wisconsin	1,123	11,335	2193	845	1,844	16218
Michigan	1,817	10,369	2,457	587	1,021	14,435
North Carolina	940	4,897	4,722	1,350	2,006	12,976
Missouri	662	4,346	3,992	1,398	888	10,624
Massachusetts	1,089	3,635	5,538	481	549	10,203
Florida	1,359	3,693	4,332	454	549	9,028
Tennessee	744	4,214	2,894	478	1,031	8,617
South Carolina	419	4,194	2,427	927	623	8,171
New Jersey	1,157	3,283	3,530	512	608	7,934
Georgia	747	3,587	3,068	462	589	7,706
Minnesota	929	3,970	1,820	621	967	7,377
Virginia	530	4,096	1,547	421	449	6,513
Alabama	551	4,287	872	497	548	6,204
U.S. Total	36,474	174,308	140,847	29,469	37,053	381,677

Source: Renewable Energy Policy Project, 1997 Economic Census

Ohio stands to gain jobs in all four of the investment areas. The state could gain:

- ◆ More than 13,000 jobs from wind investment, exceeding all but one other state;
- ◆ Nearly 6,000 jobs from solar investment, exceeding all but five other states;
- ◆ More than 1,800 jobs from geothermal investments, exceeding all but two other states; and
- ◆ More than 1,800 jobs from biomass, among the top seven states (several are nearly tied).

As Tables 2 and 3 show, many of the other states likely to benefit are among states that suffered substantial job loss during the 2001 recession and its wake. California, Texas, Illinois, and Pennsylvania join Ohio among the top five states likely to benefit from these investments. Midwest states, along with Pennsylvania and New York, could all be strong beneficiaries.

Ohio would be likely to benefit disproportionately from investment in renewable energy because the state has an existing manufacturing base in most of the industries relevant to production of renewable energy components. Table 4 below summarizes information found above for the state of Ohio, showing potential benefits in number of firms, overall financial investment and number of jobs.

Table 4
Summary of potential benefits to Ohio
From large national investment in renewable energy

	Number of Firms	Potential investment (in millions)	Potential new FTE Jobs
Wind	1,045	\$1,924.70	13,215
Solar	500	\$1,097.10	5,957
Geothermal	202	\$337.40	1,896
Biomass	750	\$287.50	1,854
Total:	2,156 ¹⁰	\$3,646.70	22,922

Source: Renewable Energy Policy Project

OHIO COUNTIES – URBAN, RURAL AND SUBURBAN COMMUNITIES TO GAIN

This section examines the effect on specific Ohio counties from this national investment. For a more detailed description of the precise NAICS codes likely to gain employment in any given county, go to our interactive website at www.policymattersohio.org/generating.htm.

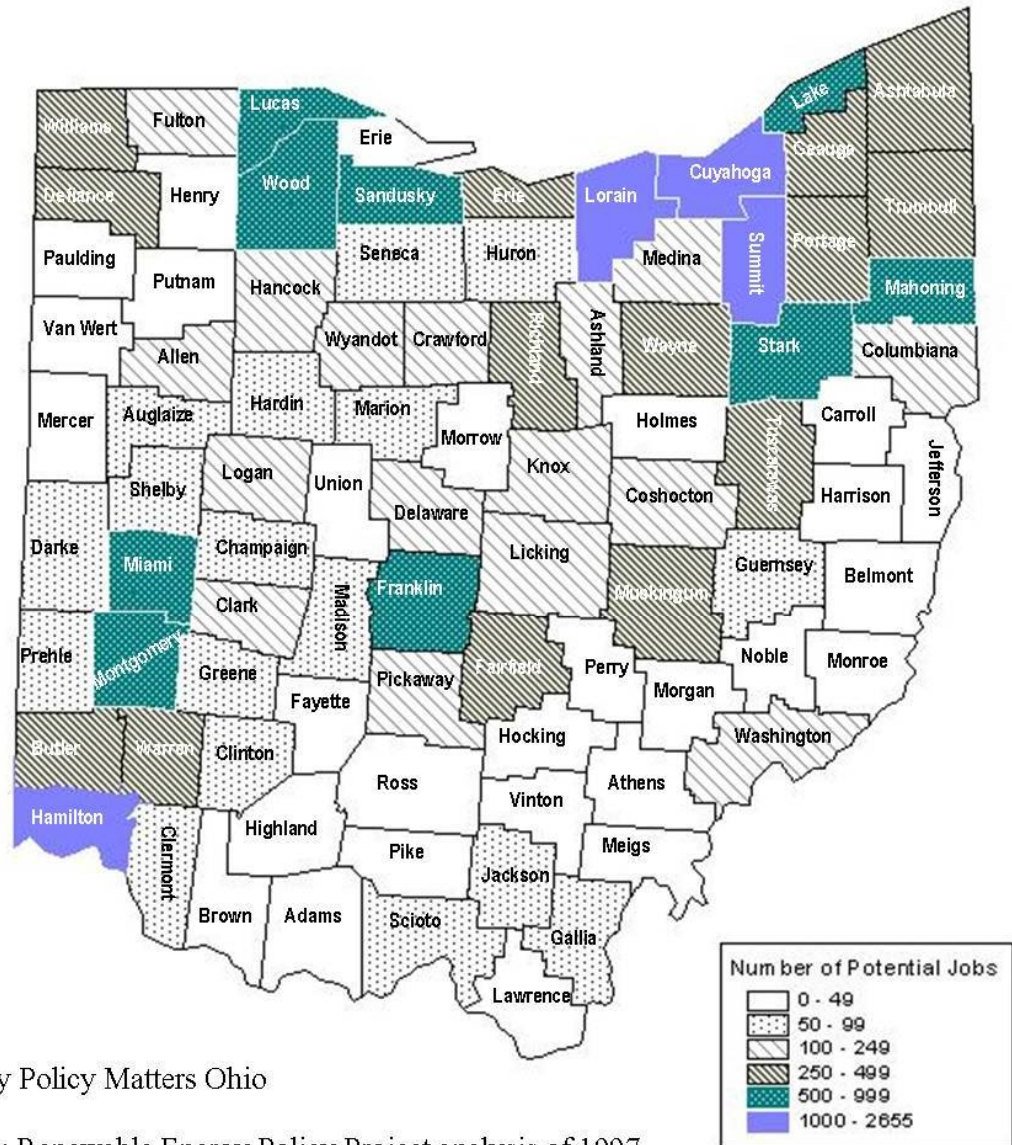
As with the state level data, REPP determined potential investment and job gains at the county level by determining the current number of firms and workers currently operating in the NAICS code that would cover the new equipment production. Obviously these projections are not guarantees – firms in Ohio would have to act to take advantage of the new opportunities. It is likely that the breakdown of new production would not end up corresponding precisely to current production distribution. However, it is reasonable to assume that a firm that is currently producing .01 percent of gearboxes used nationwide could be poised to produce .01 percent of new gearboxes demanded.

Job and investment gains from this national commitment could be spread throughout the state of Ohio – 85 of the state’s 88 counties have a firm that is currently manufacturing products that could be modified to be used for renewable energy production. Large counties in Ohio stand to benefit substantially, with job creation projections of more than 2,500 jobs in Cuyahoga County; more than 1,000 jobs each in Lorain, Hamilton and Summit Counties; and more than 500 jobs each in Miami, Lucas, Franklin, Montgomery, Wood, Stark, Sandusky, Lake and Mahoning Counties. Investments are projected to be more than \$400 million in Cuyahoga County, more than \$200 million in Lorain, and Hamilton Counties, and more than \$100 million dollars each in Summit, Miami, Lucas, Franklin, Montgomery, Wood, Warren and Stark Counties.

The map on the next page and Table 5 on the following two pages show each Ohio county along with its projected investment and manufacturing job growth as a result of a national investment in sustainable energy.

¹⁰ In some cases, the same companies produce component parts that could be used for more than one of the renewable investment areas. Therefore, the actual number of potentially benefiting firms is smaller than the sum of the firms that could benefit from each area separately. This total was taken from Tables 2 and 3, and is not the sum of information in Table 4.

Generating Energy, Generating Jobs: A County Map of Potential Job Gains in Ohio



Map by Policy Matters Ohio

Source: Renewable Energy Policy Project analysis of 1997 Economic Census.

For a detailed county-by-county assessment, visit www.policymattersohio.org/apollo2005/ohio_map.htm

The table on the next two pages provides more detailed information for each Ohio county. The first column lists the county name, the next four columns show investment and job gains from biomass, geothermal, solar and wind energy respectively, and the final column shows a total investment and manufacturing job gain for each county. The total jobs and investment listed for all of Ohio, when adding counties together, results in a slightly lower number than we found when looking at Ohio statewide, because confidentiality issues sometimes prevent the census bureau from providing information at a county level.¹¹ For more detailed discussion of particular counties, please visit our interactive website www.policymattersohio.org/generating.htm.

¹¹ In smaller counties, there may be only one or two firms that fit the description provided here. In those cases, if the census bureau provided information, readers could identify the firm being discussed, with potential negative consequences for firm confidentiality. For Ohio as a whole, our projections would predict 22,922 jobs and \$3.6467 billion in investment. The county total finds a slightly lower 22,578 jobs and 3.6618 billion in investment. Thus, this table may slightly understate the potential benefits in some small Ohio counties.

Table 5
Potential investment and potential new manufacturing jobs in Ohio counties
From renewable energy investments (in millions of dollars)

County	Biomass		Geothermal		Solar		Wind		Totals	
	Dollars (millions)	Jobs	Dollars (millions)	Jobs	Dollars (millions)	Jobs	Dollars (millions)	Jobs	Dollars (millions)	Jobs
Cuyahoga	\$ 19.30	130	\$ 20.70	141	\$ 117.50	641	\$ 257.10	1,743	\$ 414.60	2,655
Lorain	\$ 4.70	30	\$ 3.20	15	\$ 138.70	878	\$ 95.80	648	\$ 242.40	1,571
Hamilton	\$ 26.30	175	\$ 24.70	145	\$ 72.10	437	\$ 99.10	663	\$ 222.20	1,420
Summit	\$ 11.20	80	\$ 8.80	56	\$ 27.00	129	\$ 117.80	833	\$ 164.80	1,098
Miami	\$ 9.00	47	\$ 31.00	179	\$ 49.30	310	\$ 56.80	382	\$ 146.10	918
Lucas	\$ 4.50	29	\$ 3.00	14	\$ 88.60	463	\$ 34.20	222	\$ 130.30	728
Franklin	\$ 14.10	95	\$ 11.60	51	\$ 25.50	133	\$ 74.20	498	\$ 125.40	777
Montgomery	\$ 14.50	97	\$ 23.90	157	\$ 3.60	22	\$ 82.30	557	\$ 124.30	833
Wood	\$ 5.60	35	\$ 4.30	18	\$ 81.10	330	\$ 28.70	222	\$ 119.70	605
Warren	\$ 5.70	27	\$ 27.40	151	\$ 48.90	124	\$ 29.70	172	\$ 111.70	474
Stark	\$ 13.20	84	\$ 7.90	40	\$ 7.40	45	\$ 76.00	529	\$ 104.50	698
Sandusky	\$ 0.70	4	\$ 1.10	7	\$ 80.70	424	\$ 16.30	130	\$ 98.80	565
Lake	\$ 19.40	132	\$ 3.10	22	\$ 43.40	275	\$ 31.70	219	\$ 97.60	648
Mahoning	\$ 2.90	15	\$ 0.90	3	\$ 46.60	301	\$ 42.60	273	\$ 93.00	592
Richland	\$ 8.50	40	\$ 26.50	129	\$ 3.70	22	\$ 34.10	229	\$ 72.80	420
Butler	\$ 4.30	27	\$ 17.90	122	\$ 30.00	167	\$ 17.90	129	\$ 70.10	445
Tuscarawas	\$ 3.00	20	\$ 15.20	109	\$ 25.00	152	\$ 26.10	178	\$ 69.30	459
Williams	\$ 6.10	34	\$ 24.80	133	\$ 9.10	60	\$ 25.90	190	\$ 65.90	417
Fairfield	\$ 47.80	345	\$ 9.70	69	\$ 0.10	-	\$ 7.90	57	\$ 65.50	471
Wayne	\$ 8.50	56	\$ 2.70	17	\$ 6.90	48	\$ 42.70	305	\$ 60.80	426
Defiance	\$ 1.00	6	\$ -	-	\$ 1.00	8	\$ 54.00	365	\$ 56.00	379
Muskingum	\$ 0.20	1	\$ 0.20	1	\$ 41.50	314	\$ 10.80	78	\$ 52.70	394
Portage	\$ 0.10	-	\$ 0.10	-	\$ 16.50	92	\$ 31.70	234	\$ 48.40	326
Hancock	\$ 1.10	5	\$ -	-	\$ 35.00	127	\$ 10.90	81	\$ 47.00	213
Erie	\$ 0.90	4	\$ -	-	\$ 0.70	1	\$ 43.90	292	\$ 45.50	297
Trumbull	\$ 2.10	9	\$ 3.50	13	\$ 0.20	2	\$ 39.30	240	\$ 45.10	264
Ashland	\$ 5.80	31	\$ 23.80	128	\$ 5.00	33	\$ 7.30	53	\$ 41.90	245
Geauga	\$ 1.80	10	\$ 3.20	23	\$ 0.70	3	\$ 33.80	254	\$ 39.50	290
Pickaway	\$ 14.10	102	\$ 0.90	6	\$ 11.80	43	\$ 7.50	58	\$ 34.30	209
Ashtabula	\$ 1.40	8	\$ 2.30	10	\$ 1.90	12	\$ 28.40	226	\$ 34.00	256
Columbiana	\$ 2.50	13	\$ 5.00	26	\$ 0.40	3	\$ 22.00	158	\$ 29.90	200
Licking	\$ 3.30	23	\$ 1.00	6	\$ 5.00	18	\$ 19.70	125	\$ 29.00	172
Medina	\$ 2.80	18	\$ 3.60	25	\$ 9.80	40	\$ 10.90	78	\$ 27.10	161
Washington	\$ -	-	\$ 0.10	-	\$ 11.10	20	\$ 14.80	96	\$ 26.00	116
Fulton	\$ 3.90	17	\$ 6.60	23	\$ -	-	\$ 14.30	104	\$ 24.80	144
Crawford	\$ 0.40	1	\$ -	-	\$ 4.30	33	\$ 18.90	122	\$ 23.60	156
Knox	\$ 3.00	20	\$ 14.90	65	\$ 2.80	18	\$ 0.50	4	\$ 21.20	107
Wyandot	\$ -	-	\$ -	-	\$ -	-	\$ 20.30	154	\$ 20.30	154
Coshocton	\$ -	-	\$ -	-	\$ 3.00	4	\$ 16.40	115	\$ 19.40	119
Allen	\$ -	-	\$ -	-	\$ 1.90	8	\$ 17.30	117	\$ 19.20	125
Delaware	\$ 1.30	8	\$ 1.70	10	\$ 1.70	6	\$ 13.60	95	\$ 18.30	119
Logan	\$ 0.70	4	\$ 0.10	1	\$ 8.40	46	\$ 9.10	67	\$ 18.30	118
Clark	\$ 2.30	12	\$ 8.80	47	\$ 1.30	8	\$ 5.50	40	\$ 17.90	107
Hardin	\$ -	-	\$ -	-	\$ 3.00	5	\$ 14.60	91	\$ 17.60	96

County	Biomass		Geothermal		Solar		Wind		Totals	
	Dollars (millions)	Jobs	Dollars (millions)	Jobs	Dollars (millions)	County	Dollars (millions)	Jobs	Dollars (millions)	Jobs
Marion	\$ 3.00	13	\$ 6.00	20	\$ 0.20	-	\$ 8.20	41	\$ 17.40	74
Shelby	\$ 1.70	9	\$ 6.70	30	\$ 5.40	45	\$ 2.20	13	\$ 16.00	97
Clermont	\$ 0.20	1	\$ -	-	\$ 2.20	12	\$ 12.90	80	\$ 15.30	93
Darke	\$ 0.10	-	\$ 0.20	1	\$ 3.50	15	\$ 10.30	81	\$ 14.10	97
Greene	\$ 0.10	-	\$ -	-	\$ 0.50	2	\$ 11.70	85	\$ 12.30	87
Scioto	\$ -	-	\$ -	-	\$ 0.50	2	\$ 11.60	83	\$ 12.10	85
Jackson	\$ 0.20	1	\$ -	-	\$ -	-	\$ 11.80	84	\$ 12.00	85
Preble	\$ -	-	\$ -	-	\$ -	-	\$ 11.40	90	\$ 11.40	90
Huron	\$ 1.00	6	\$ 1.80	9	\$ -	-	\$ 8.30	61	\$ 11.10	76
Gallia	\$ -	-	\$ -	-	\$ -	-	\$ 10.80	65	\$ 10.80	65
Seneca	\$ 3.60	24	\$ 0.40	2	\$ 0.40	3	\$ 5.10	40	\$ 9.50	69
Madison	\$ 2.10	13	\$ -	-	\$ 0.10	1	\$ 6.80	49	\$ 9.00	63
Champaign	\$ 0.30	2	\$ -	-	\$ 4.10	22	\$ 4.50	36	\$ 8.90	60
Guernsey	\$ -	-	\$ 0.40	2	\$ 1.60	6	\$ 6.80	54	\$ 8.80	62
Clinton	\$ 0.10	-	\$ -	-	\$ -	-	\$ 8.60	61	\$ 8.70	61
Auglaize	\$ -	-	\$ -	-	\$ 0.10	1	\$ 8.20	56	\$ 8.30	57
Putnam	\$ -	-	\$ -	-	\$ 0.30	2	\$ 6.20	40	\$ 6.50	42
Henry	\$ -	-	\$ 0.10	-	\$ 0.30	2	\$ 5.70	45	\$ 6.10	47
Fayette	\$ -	-	\$ -	-	\$ -	-	\$ 5.40	43	\$ 5.40	43
Perry	\$ 1.60	6	\$ 3.20	12	\$ -	-	\$ 0.40	3	\$ 5.20	21
Lawrence	\$ 0.40	2	\$ 0.90	5	\$ 2.90	4	\$ 0.80	5	\$ 5.00	16
Highland	\$ -	-	\$ -	-	\$ -	-	\$ 4.50	36	\$ 4.50	36
Paulding	\$ -	-	\$ -	-	\$ 3.70	15	\$ 0.80	7	\$ 4.50	22
Union	\$ -	-	\$ -	-	\$ -	-	\$ 4.50	30	\$ 4.50	30
Mercer	\$ 0.10	-	\$ -	-	\$ 2.40	12	\$ 1.10	7	\$ 3.60	19
Morrow	\$ -	-	\$ -	-	\$ -	-	\$ 3.50	27	\$ 3.50	27
Holmes	\$ 0.10	1	\$ 0.10	-	\$ 0.50	3	\$ 2.10	16	\$ 2.80	20
Ross	\$ -	-	\$ -	-	\$ -	-	\$ 1.20	8	\$ 1.20	8
Carroll	\$ 0.10	-	\$ -	-	\$ -	-	\$ 0.80	7	\$ 0.90	7
Ottawa	\$ 0.40	3	\$ 0.30	1	\$ -	-	\$ 0.20	1	\$ 0.90	5
Vinton	\$ 0.90	6	\$ -	-	\$ -	-	\$ -	-	\$ 0.90	6
Meigs	\$ -	-	\$ -	-	\$ -	-	\$ 0.80	5	\$ 0.80	5
Hocking	\$ -	-	\$ -	-	\$ 0.70	6	\$ -	-	\$ 0.70	6
Van Wert	\$ -	-	\$ -	-	\$ 0.60	1	\$ -	-	\$ 0.60	1
Athens	\$ -	-	\$ -	-	\$ 0.10	-	\$ 0.40	3	\$ 0.50	3
Belmont	\$ -	-	\$ -	-	\$ 0.10	1	\$ 0.40	2	\$ 0.50	3
Brown	\$ -	-	\$ -	-	\$ 0.30	2	\$ 0.10	-	\$ 0.40	2
Adams	\$ -	-	\$ 0.10	-	\$ -	-	\$ 0.20	1	\$ 0.30	1
Harrison	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Jefferson	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Monroe	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Morgan	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Noble	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Pike	\$ -	-	\$ -	-	\$ -	-	\$ -	-	\$ -	-
Ohio Total	\$ 294.0	1,881	\$ 364.4	2,044	\$ 1,102.7	5,962	\$ 1,840.7	12,691	\$ 3,601.8	22,578

Source: Renewable Energy Policy Project analysis of 1997 Economic Census Data

CONCLUSION AND RECOMMENDATIONS

To stimulate ongoing nationwide demand for renewable energy and ensure that states like Ohio can produce component parts, national and state policy will have to better support the renewable energy economy. We could make countless recommendations for federal, state, and local policies that increase production and use of renewables. Below are four policies that can be applied at the federal and state level to capture component manufacturing jobs domestically, create a larger market for renewables, encourage continued production in that market, and improve the technology and productivity of the renewable energy sector.

Ohio has much to offer the renewable energy sector. A successful national renewable energy policy will develop flexible policies that draw on the manufacturing potential of states like Ohio, and the resource potential of states with strong wind, solar, geothermal or biomass resources. Ohio should form cooperative relationships with states that need our component parts to capitalize on their natural resources. All states should also support a core set of federal policies that will bring consistent, effective support for renewable development.

1. Help states like Ohio capture the component manufacturing jobs and investment

At the federal level: A national program to stimulate renewable investment should also aim to maximize use of domestic components in renewable projects. This could be accomplished by requiring or offering incentives for domestic content. Although a firm requirement for domestic manufacture might be challenged under newly expanded trade agreements, current law does not send a clear message, and other governments have such requirements. For example, a major wind program in Quebec currently requires projects to contain between 40 and 60 percent local content from the Gaspé Peninsula. Alternatively, the U.S. could provide incentives to use domestic components, perhaps crediting these utilities at a higher level. A domestic content program should be matched with efforts to increase efficiency of local manufacturing.

The job gains we discuss in this paper are possible, but European and Asian firms currently lead the renewables market. A comprehensive effort to target economic development resources to manufacturing conversion, including tax credits, subsidized loans, worker training, technical assistance in production process improvements, research grants and targeted state venture capital pools for product development and commercialization, would help American manufacturers better compete in the renewable market. These resources should be available to support conversion of existing industrial plant and equipment to produce finished products, components, and sub components throughout the supply chain. This can encourage early entry into emerging markets and protect workers.

In Ohio: Ohio needs to better understand the potential for renewable energy to revitalize its manufacturing base. The state should create and support a bi-partisan federal, state and local partnership of leaders from industry, government, universities, organized labor and economic development, that would use this report to identify specific firms with the potential, ability, and interest in participating in an expanded renewable development program. This group should reach out to potentially benefiting firms, workers, and communities with the economic development programming described here. In addition, state officials should establish collaborative relationships with neighboring states in the Midwest and Great Plains that have more to offer in wind and solar resources, and that need Ohio's component part manufacturing resources. By uniting and figuring out how the region as a whole can benefit from the renewable energy economy, we can help ensure that component jobs come to Ohio, and that we can meet renewable standards.

2. Create more demand for renewable energy

At the federal level: We can create a large market for renewables by phasing in a nationwide requirement that utilities produce more of their energy from renewable sources. Such a requirement, called a Renewable Portfolio Standard (RPS), would require utilities to move toward producing more of their energy from wind, solar, geothermal, and biomass. A national RPS would create immediate and growing demand for equipment that can produce that energy, sparking the job growth we model here, and leading to more sustainable, cleaner energy.

A nationwide system would work best if it were flexible – North Dakota has much more potential to produce wind power than Ohio, while Ohio could exceed many states in biomass capacity. One option would be to impose varying requirements on the states depending on their capacity to produce renewable resources. Another option would be to allow utilities in renewable resource-rich states to produce more than the minimum renewable energy required, and to sell renewable energy credits to utilities in renewable-poor states. The credits would correspond to a specific amount of energy generated from renewable sources. This is similar to the successful emissions credit trading done under the Clean Air Act. As mentioned, states that purchase domestic components could be rewarded through the crediting system.

In Ohio: Nineteen states have implemented Renewable Portfolio Standards. Although they vary widely depending on resources in the state and other factors, these standards have become the leading state-level policy tool for shifting U.S. energy consumption to clean sources. The Ohio House of Representatives recently voted against an amendment that would have established an Ohio RPS,¹² but states like Pennsylvania that have implemented these standards have become attractive destinations for renewable manufacturing investment – for instance, the Spanish wind turbine manufacturer Gamesa opened its first North American manufacturing location on the outskirts of Pittsburgh based on skill set and the instant market to sell their product in a state with an RPS. Ohio legislators should consider the currently introduced proposal for such a standard (HB 247), or should consider a less aggressive alternate version.

Ohio does have a modest policy in place to stimulate demand for renewable energy (as well as energy efficiency), in the form of its Energy Loan Fund, which provides low-interest loans for energy efficiency and renewable energy investments. The money for the fund is raised through a small surcharge (or “rider”) on consumer electricity use (about nine cents per month for the typical Ohio consumer). Ohio’s Energy Loan Fund is currently set to stop collecting riders in 2011. Ohio should consider raising the rider and continuing to collect it after 2011 in order to increase the effectiveness and scope of this program.

3. Encourage production of renewable energy

At the federal level: The U.S. currently provides incentives to produce renewable energy through the federal Production Tax Credit. This credit provides producers with 1.9 cents for each kilowatt-hour of renewable energy they produce. The credit has typically been established for 2-3 year periods – a step in the right direction, but insufficient to allow for certain, stable growth. Because the credit has expired in the past, the wind industry has experienced boom and bust cycles, as producers ramp up or slow down project development based on the policy change. A ten-year extension to the credit would stabilize growth, allowing developers to know that the incentive will remain available for long enough to make investments worthwhile.

¹² Representative Skindell tried to add an RPS as an amendment to HB245, a revolving loan program to help local governments reduce the amount of time that heavy trucks or other vehicles idle their engines. As of 2002 Ohio’s electricity was generated from 90 percent coal, 7 percent nuclear, 1 percent natural gas, and 2 percent in small amounts from various sources, according to the U.S. Department of Energy.

Ensuring that renewable energy generators can contribute their excess power to the grid is vital. Ohio's strong net metering program is a good model. On a windy day, if a wind turbine on an Ohio farm produces extra electricity, that excess is fed into the grid and the farm's meter runs backward. When the wind stops, the farm draws power from the grid and the meter runs forward. Currently, 30 states require some utilities to offer net metering. A federal net metering requirement should be put in place at the level of the most ambitious state requirements.

In Ohio: The state could offer its own production incentives. One option would be a production tax credit at a percentage of the federal credit – some states actually provide larger incentives than the federal. For example, in May 2005, Washington State established production incentives of fifteen cents per kilowatt-hour for individuals, businesses or local governments that generate electricity from renewable sources, up to a \$2000 cap. These production credits work best when we ensure that they are available to small and large producers alike.

4. Improve productivity in the renewable energy sector

At the federal level: The U.S. should fund research and development to improve technology in the renewable marketplace. The cost of wind and solar energy has declined by more than 80 percent since 1980, but the technology could continue to improve. Research and development funding would help. Many current programs could be built upon. To name two: we could expand funding for the Department of Energy's Wind & Hydropower Technologies Program, which gives research grants to industry and universities to increase use of wind; or for the Biomass Research and Development Initiative, a joint project of the DOE and USDA, to provide grants for research, development, and demonstration projects on bio-energy.

In Ohio: Ohio could provide state support to research and development (R&D) efforts as some other states are doing. This would help position Ohio firms to take advantage of new production opportunities, and would ensure that products are technologically innovative. It would also make renewable power more feasible for Ohio. Ohio has relatively modest wind resources, but as turbines become more efficient, wind could provide a larger portion of our state's energy use. This state has relatively higher levels of biomass, which currently can be co-fired in existing coal plants. R&D on gasification of biomass could eventually make this resource much more productive. Supporting this type of research is essential to strengthening renewable energy, making it more productive and more competitive with traditional energy sources.

Whether it's capturing manufacturing investment and jobs, creating a market for renewables, encouraging their production, or improving their productivity, there is a role for federal and state policy change. Creative states, including many of the western states, are acting in new ways to innovate in this arena. Midwestern states have varying strengths, many of which are complimentary. Because the entire Midwest would benefit financially from producing renewable equipment, it makes sense for Ohio to collaborate with other states in the region to advocate for federal change in these areas, and to join each other in pushing for state change.

Forward-thinking policies could improve American energy efficiency, reduce dependence on foreign oil, preserve greenspace and make cities more vibrant. Many of these would also create jobs. Policy Matters Ohio and the Apollo Alliance will be exploring related policies like retrofitting public buildings and low-income housing to ensure higher performance, investing in mass transit, encouraging higher-performance vehicles and promoting alternative fuel. This paper explored only those policies that could directly lead to investment in renewable energy. We are pleased to join the lively debate on how best to ensure that Ohio workers and citizens benefit from smarter energy policy.

Want to know more about Apollo and Renewable Energy?



The Apollo Alliance is a national campaign committed to good jobs and clean energy in America.

For more information, visit their website at: www.apolloalliance.org.

Ohio has strong advocates committed to improved energy efficiency. Visit the Apollo Alliance space on the Policy Matters Ohio webpage for more information: http://www.policymattersohio.org/apollo_alliance.htm.

While this study focuses specifically on manufacturing component parts for renewable energy, other studies have shown the positive impact renewable energy has on state economies.

A few are listed below:

Repowering the Midwest: Job Jolt: <http://www.repowermidwest.org>.

Putting Renewable to Work: <http://ist-socrates.berkeley.edu/~rael/renewables.jobs.pdf>.

Nayak (2005). Redirecting America's Energy: The Economic and Consumer Benefits of Clean Energy Policies. Washington, D.C.: U.S. PIRG Education Fund.

Pletka and Wynne (2004). Economic Impact of Renewable Energy In Pennsylvania: Analysis of the Advanced Energy Portfolio Standard. Overland Park, KS: Black and Veatch Corporation.

Hoerner and Barrett (2004). Smarter, Cleaner, Stronger: Secure Jobs, A Clean Environment, and Less Foreign Oil. Oakland, CA: Redefining Progress.

Bailie and Bernow (2001). Clean Energy: Jobs for America's Future. Boston, MA: Tellus Institute.

THE APOLLO ALLIANCE IS A NONPARTISAN NATIONAL ORGANIZATION, DEDICATED TO BUILDING A BROAD-BASED CONSTITUENCY IN SUPPORT OF A SUSTAINABLE AND CLEAN ENERGY ECONOMY THAT WILL CREATE GOOD JOBS, REDUCE DEPENDENCE ON FOREIGN OIL, AND CREATE CLEANER AND HEALTHIER COMMUNITIES. THE APOLLO ALLIANCE IS DEMONSTRATING THAT A SOCIALLY JUST, ENVIRONMENTALLY BALANCED AND ECONOMICALLY PROSPEROUS FUTURE IS ATTAINABLE. IT SEEKS TO LIBERATE THE U.S. ECONOMY AND OUR NATIONAL SECURITY FROM DEPENDENCE ON FOSSIL FUELS, THROUGH INVESTMENT IN CLEAN ENERGY TECHNOLOGY AND SUSTAINABLE INFRASTRUCTURE.

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