

# GREENING OHIO INDUSTRY

A REPORT FROM  
POLICY MATTERS OHIO

AMANDA WOODRUM

NOVEMBER, 2009

## AUTHOR

Amanda Woodrum is a researcher at Policy Matters Ohio. Amanda received both a master's in economics and a law degree from the University of Akron, as well as a bachelor's from Bowling Green State University. Amanda founded the Akron law student newspaper and served as its editor-in-chief, and co-authored an article on Ohio's constitutional provision for education that has been referenced in a number of court cases. She also clerked for the Cleveland law department and the Summit County Council (where she received a commendation for commitment to public service).

## ACKNOWLEDGEMENTS

I would like to thank Randy Schutt for his inspiration for this report, as well as his thoughtful feedback. I would also like to thank the Apollo Alliance and other state and local Apollo affiliates for their contributions, as well as Recycled Energy Development, the Ohio Environmental Council, and Community Research Partners. As always, I wouldn't have gotten very far with this report without the help of brilliant interns, in this case Nathaniel Hopkin, and Meena Chelvayohan. I'd also like to give a special thanks to my Research Director, Zach Schiller, for keeping me on the right track, and our Executive Director Amy Hanauer for exceeding the call of duty on this report, including the review and re-review of multiple incarnations of this report. As always, we are ever grateful for the generous support we receive from the Joyce Foundation and the Energy Foundation, without which it would not have been possible to do this work. Any errors and omissions in the report are the sole responsibility of the author.

**POLICY MATTERS OHIO**, the publisher of this study, is a nonprofit, nonpartisan policy institute dedicated to researching an economy that works for Ohio. Policy Matters seeks to broaden debate about economic policy by doing research on issues that matter to working people and their families. With better information, we can achieve more just and efficient economic policy. Areas of inquiry for Policy Matters include work, wages, education, housing, energy, tax and budget policy, and economic development.

## Executive Summary

Ohio's manufacturing sector is a prime first target for achieving energy savings and emissions reductions. Although many manufacturers are modernizing—becoming more high skill, high tech and efficient—Ohio's manufacturing industry remains heavily dependent on fossil fuels. To reduce our dependence on polluting fuel, most of which is purchased from outside Ohio, we can help our manufacturers better manage energy use. Savings could be reinvested in facilities, products, and workers. Despite significant job losses, manufacturing remains the largest sector in Ohio's economy, and our industrial sector consumes 33 percent of the energy we use, including large amounts of electricity from Ohio's electric power industry which ranks second only to Texas in carbon emissions. In 2006, Ohio manufacturers together spent an estimated \$5.6 billion on energy, averaging \$260,000 each. Carbon reduction strategies can help secure Ohio's place in the global market by making Ohio's manufacturers leaner and greener.

**Industrial energy assessments could generate big savings, if implemented, with the added benefit of significantly reducing emissions in Ohio.** Nationwide, manufacturers who undertake energy assessments implement fewer than 40 percent of recommendations because capital investments required for energy saving measures compete with other capital needs, and energy savings may not meet internal goals. Social benefits from reduced emissions are typically not considered. Our analysis of data from the University of Dayton Industrial Assessment Center found that only about half of efficiency recommendations were implemented. The total savings from over 6,000 recommendations made, if implemented, would have been \$105.6 million annually while the one-time cost would have been \$104.9 million. The average cost per manufacturer, around \$120,000, would have been recouped within slightly less than one year. More than 1,100 of the recommendations had no cost.

**Nearly 70 percent of energy generated from fossil fuels at electric plants is lost during generation or transmission on our outdated grid.** This inefficiency translates into unnecessary toxic and carbon emissions, and a waste of scarce resources. Every kilowatt-hour of electricity we use means 3.3 kilowatt-hours worth of polluting fossil fuels must be burned at a power plant. By capturing heat typically wasted during electricity production, we can slash the billions we spend on polluting fossil fuels. Heat generated during electricity production is discarded and cooled using water or cooling towers. At the same time this heat is being discarded by our electric industry, manufacturers are purchasing fuel for use on site to create heat for heating and cooling needs. If we could transfer heat lost from the electric power sector to our manufacturers, we could dramatically reduce waste and energy costs. However, transporting heat becomes impractical beyond three miles. Our centralized electrical power system means existing power plants are too remote to transfer heat to industrial centers.

**By decentralizing electricity production through adoption of combined heat and power technology (CHP), we can reduce energy use and emissions nationally by 20 percent.** If we got 20 percent of generation from CHP in Ohio, it would mean a \$10.5 billion capital investment that would produce \$2.9 billion in energy savings annually, create over 40,000 jobs, and reduce emissions by 36 million metric tons (the equivalent of taking 6.6 million cars off the road). Because of our industrial infrastructure Ohio could be a leader in producing gas turbines, steam turbines, high-pressure steam lines, valves, railroad engines, cooling towers, and the other essential parts of CHP systems. Ohio is

already home to firms that do this kind of production, like Steam Power LLC, based in Milford and reXorce Thermionics, based in Akron.

Recognizing the value of targeting the industrial sector in its carbon reduction strategy, the state of Ohio instituted a number of measures to encourage industrial efficiency. Ohio passed both an advanced energy standard and an energy efficiency standard that requires utilities, by 2025, to increase advanced energy use to 25% and reduce total energy consumed by 22%. Investments in industrial efficiency and combined heat and power qualify towards meeting goals set forth in the law. Ohio also removed barriers to combined heat and power technology by passing new interconnection standards. Finally, Ohio's Energy Office made industrial efficiency a priority as part of its state energy program for federal stimulus dollars.

**Ohio ranks in the top five states for potential energy production through CHP technology, but we rank 43<sup>rd</sup> in adoption of this technology.** Further policy change could help encourage adoption of combined heat and power technology and the implementation of other efficiency measures. We recommend the state of Ohio:

1. Support climate change legislation. The climate bills currently under consideration provide tools, capital, and the technical assistance necessary to make efficiency spending worthwhile for companies and the community. The Initiative for Manufacturing Productivity in Advanced Competitive Technologies (IMPACT) proposal of Senator Sherrod Brown, and the industrial efficiency legislation introduced by Senator Jeff Bingaman reshape existing industrial efficiency programs and provide additional resources for the transition to clean energy. Additional provisions ensure funds for workforce training in lean manufacturing techniques.
2. Extend and expand Ohio's Advanced Energy Fund, which is currently set to expire and is wholly inadequate in size. Use some of the proceeds to facilitate investments in efficiency and CHP. Support HB 301, expanding and extending the fund.
3. Provide free industrial energy assessments, efficiency training, and implementation assistance to manufacturers to encourage private investment. Provide resources to do the assessments and ensure availability of capital for this purpose, by ensuring access to low-interest loans from revolving loan funds. Companies receiving state or federal public funds for retooling should be required to undergo energy assessments and implement recommendations to make them greener.
4. Investigate the potential for municipal power authorities to build combined heat and power plants on brownfields in order to provide manufacturers affordable and stable energy prices through long-term power purchase agreements (green incentives).

It is a good time to invest in manufacturing efficiency. The resulting energy savings can solidify Ohio's manufacturing stronghold in the new global clean energy economy, and make Ohio a more sustainable and vibrant state with a vital role in the nation's future.

## Greening Ohio Industry

Manufacturing fits into the green-collar jobs picture in a number of ways, some of which are frequently overlooked.<sup>1</sup> First, Ohio's skilled workforce and industrial infrastructure, coupled with smart policy, poise Ohio to capture thousands of good manufacturing jobs making green products, such as wind turbines and their component parts. This potential has gotten significant attention in Ohio over the last few years. Less discussed is how manufacturers can also contribute dramatically to carbon reduction by becoming more efficient and better at managing energy use. Enhanced industrial efficiency can reduce the amount of money we spend on polluting fossil fuels, most of which are purchased from out of the state or out of the country. We can use our energy savings to boost Ohio's economy by reinvesting in facilities, products and workers, and reduce pollution at the same time. Many of Ohio's manufacturers are modernizing, and "inside modern manufacturing facilities, you'll see the most productive, highly-skilled labor force in the world applying the latest in information, innovation, and technology," according to the Alliance for American Manufacturing.<sup>2</sup> However, the Alliance points out that manufacturing is heavily dependent on fossil fuels, and as global energy prices rise, manufacturing is significantly affected, making investments in energy alternatives critical in the long run, including efficiency.

In total, across all sectors, Ohioans spent more than \$48 billion on energy in 2007, mostly on polluting fossil fuels purchased primarily from outside Ohio.<sup>3</sup> Of that, roughly \$35 billion was spent on fuels purchased elsewhere. We purchase two-thirds of our coal, 89 percent of our natural gas, and 98 percent of our petroleum products from outside Ohio. Our industrial sector consumes 33 percent of the energy we use in Ohio, and accounts for nearly one third of Ohio's emissions (32 percent), when considering emissions from both on-site fuel consumption and industrial demand for electricity. Ohio ranks second in the nation for the amount of carbon emitted by our electric power industry.

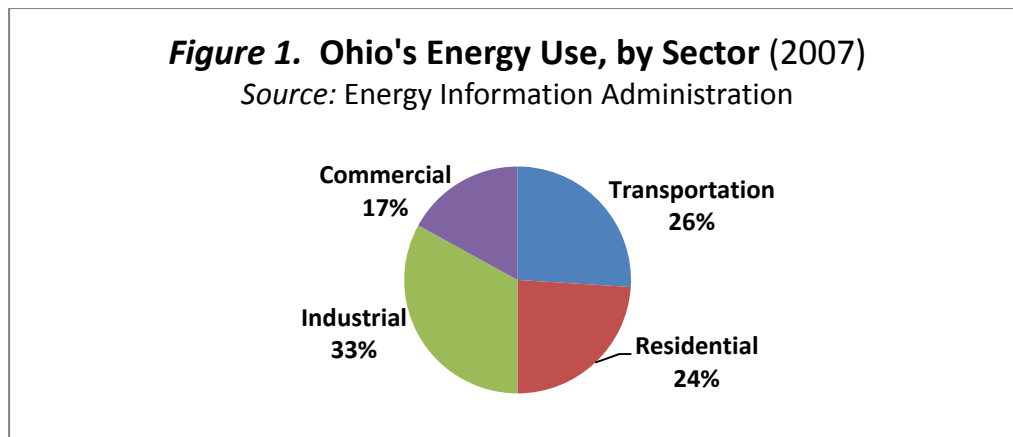
---

<sup>1</sup> According the Apollo Alliance, a national coalition of labor, environmental, community groups, as well as responsible employers, green-collar job is a well-paid, career track job that contributes significantly to preserving or enhancing environmental quality. In order to "significantly enhance or preserve the environment," a worker must engage in activities that reduce energy use from polluting fuels; reduce emissions from fossil fuels that continue to be used; and/or increase the amount of energy used from renewable, and non-polluting, energy sources.

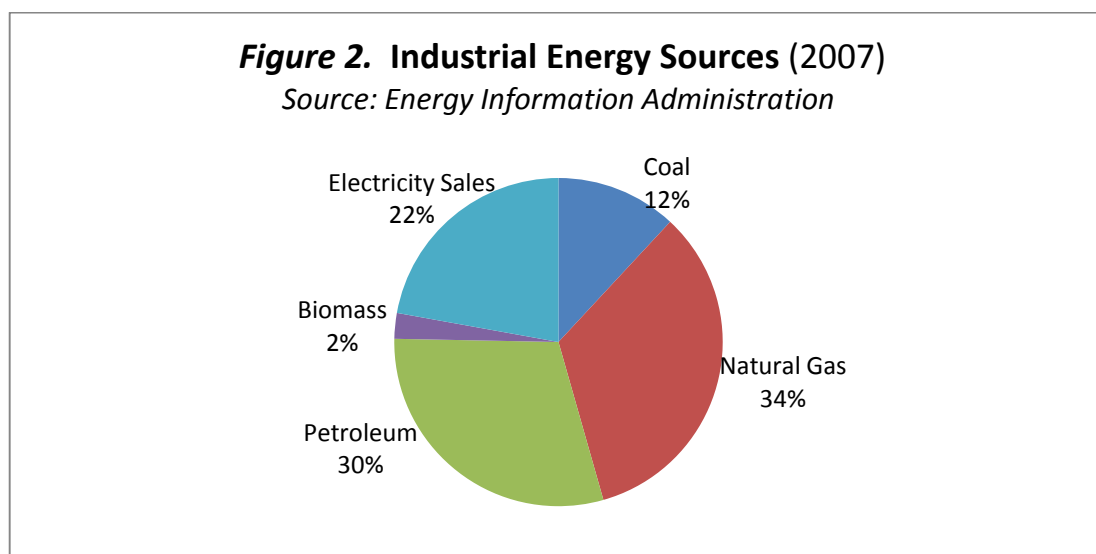
<sup>2</sup> Alliance for American Manufacturing at <http://www.americanmanufacturing.org/issues/manufacturing/>.

<sup>3</sup> The Energy Information Administration defines the industrial sector as "An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, fishing and hunting (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products."

**Ohio's Energy Use, by Sector.** Ohio uses a lot of energy, in large part due to our energy-intensive industry. Ohio ranks fifth in the nation for total energy consumption, and Ohio's industry—made up of manufacturing, construction, and agriculture—ranks fourth in energy use.<sup>4</sup> Nationally, manufacturing accounts for approximately 90 percent of industrial sector energy use.<sup>5</sup> Figure 1 shows that our industrial sector consumes more energy than any other sector of Ohio's economy, accounting for 33 percent of the energy we use in Ohio.



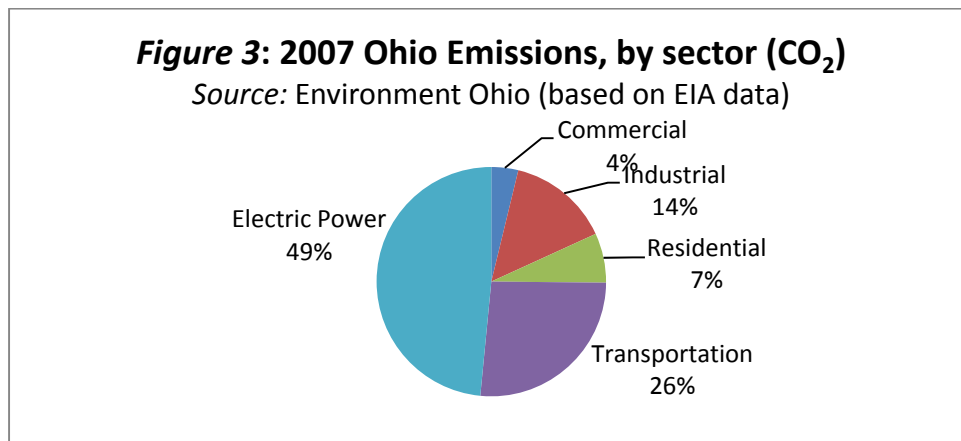
**Industrial Energy Use, by Source.** Ohio's industrial sector acquires energy from a variety of sources, with electricity sales making up only one fifth of its total energy use (see figure 2). Ohio's manufacturers also burn fuels on site to meet heating and cooling needs in the manufacturing process, while electricity is used to meet power needs. Energy generated from biomass accounts for two percent of Ohio's industrial energy use.



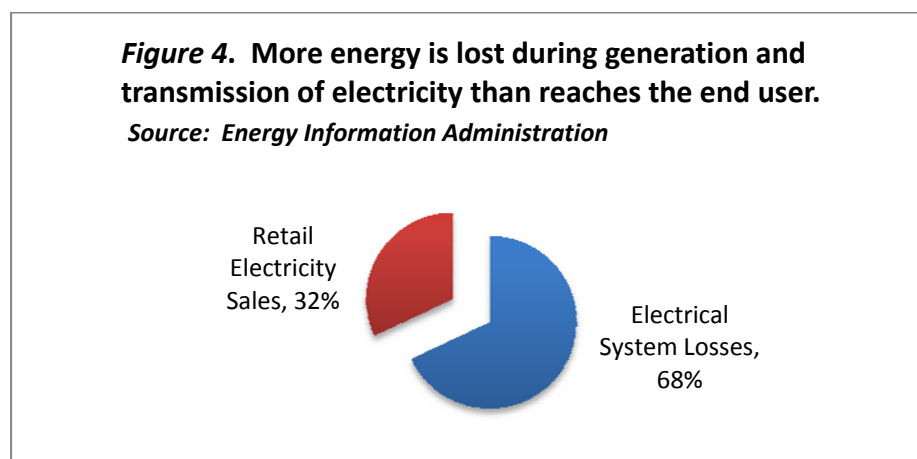
<sup>4</sup> Energy Information Administration, 2007.

<sup>5</sup> Energy Information Administration, Mark Schipper, *Energy-Related Carbon Dioxide Emissions in U.S. Manufacturing* (2006).

**Energy Use and Carbon Emissions:** Electricity generation is a major source of carbon emissions, representing almost half of total emissions (see figure 3 below). Ohio's electric power industry ranks second only to Texas for the amount of carbon it emits. The industrial sector accounts for more than 1/3 of total electric power consumption in Ohio, and electricity use accounts for the majority of manufacturers' energy-related carbon emissions.<sup>6</sup> In addition to emissions resulting from industry's demand for electricity (17 percent of total emissions), emissions produced from fuels consumed directly on industrial sites account for 14 percent of total emissions.<sup>7</sup>



**Electricity is an inefficient source of energy.** Our electrical grid system is antiquated and needs an overhaul. Nearly 70 percent of all energy generated from fossil fuels at electric power plants is lost during generation or transmission on our outdated grid system. Melissa Mullarkey from Recycled Energy Development, a company which builds more efficient combined heat and power facilities, says of conventional electricity production, “for every three lumps of coal you put in, you only get one out.”<sup>8</sup> Ultimately, this inefficiency translates into large amounts of unnecessary toxic and carbon emissions. Figure 4 demonstrates that more energy is lost during generation and transmission of electricity than actually reaches the end user of that power.



<sup>6</sup> Energy Information Administration data and report, *Emissions in U.S. Manufacturing* (cited above).

<sup>7</sup> An additional 14% of Ohio's emissions can be attributed to other forms of energy use by Ohio's industry.

<sup>8</sup> Interview with Melissa Mullarkey, Recycled Energy Development (June 19, 2009).

**Ohio ranks low in energy productivity.** Historically, fossil fuel energy was cheap and pollution emissions were ignored to grow our industrial economy. In recent decades, fossil fuel prices have become volatile and emissions have become harder to ignore. As a result, we decreased our industrial energy consumption, per real dollar of gross domestic output, by 41 percent since 1980.<sup>9</sup> However, our nation’s energy productivity—the amount of goods we produce per unit of energy consumed—continues to trail both Japan and NW Europe, and is the lowest of all developed nations.<sup>10</sup> Japan produces more than double the amount of output of the United States, per unit of energy input, while northwestern Europe is 23 percent more energy productive. Among states, Ohio ranks 30<sup>th</sup> for its level of energy productivity (see Table 1).

**Table 1. Ohio ranks 30<sup>th</sup> among states for the amount of output we get per energy input (\$1 million output per trillion btu input).**

State	GDP by State (in millions)	Trillion Btu	Energy Productivity (\$1 million in output per trillion btu of energy input)	Rank	State	GDP by State (in millions)	Trillion Btu	Energy Productivity (\$1 million output per trillion btu of energy input)	Rank
NY	\$1,105,020	4,064	272	1	SD	35,211	292	121	27
Conn	212,252	871	244	2	Missouri	229,027	1,964	117	28
Mass	352,178	1,515	233	3	Nebraska	80,360	693	116	29
RI	46,699	218	215	4	Ohio	462,506	4,049	114	30
California	1,801,762	8,492	212	5	NM	75,192	711	106	31
Delaware	61,545	302	204	6	Maine	48,021	456	105	32
NH	57,820	314	184	7	Tenn	245,162	2,331	105	33
Hawaii	62,019	344	180	8	Iowa	129,911	1,235	105	34
Maryland	264,426	1,489	178	9	Kansas	116,986	1,136	103	35
NJ	461,295	2,744	168	10	Idaho	52,110	530	98	36
Nevada	129,314	777	166	11	Texas	1,148,531	11,835	97	37
Florida	741,861	4,602	161	12	SC	151,703	1,692	90	38
Colorado	235,848	1,479	159	13	Indiana	249,229	2,904	86	39
Arizona	245,952	1,578	156	14	Oklahoma	136,374	1,609	85	40
Illinois	617,409	4,043	153	15	Arkansas	95,116	1,149	83	41
Vermont	24,627	162	152	16	Alabama	164,524	2,132	77	42
Wash	310,279	2,067	150	17	Kentucky	152,099	2,023	75	43
Virginia	384,132	2,611	147	18	Montana	34,266	462	74	44
NC	390,467	2,700	145	19	Miss	87,652	1,240	71	45
Oregon	158,268	1,108	143	20	WV	57,877	851	68	46
Minn	252,472	1,875	135	21	ND	28,518	428	67	47
Penn	533,212	4,006	133	22	Wyoming	31,544	496	64	48
Utah	105,574	806	131	23	Alaska	44,887	724	62	49
Wisconsin	233,406	1,846	126	24	Louisiana	207,407	3,766	55	50
Michigan	379,934	3,027	126	25	<b>U.S.</b>	<b>13,715,741</b>	<b>101,468</b>	<b>135</b>	
Georgia	391,241	3,133	125	26					

Sources: Bureau of Economic Analysis and Energy Information Administration

<sup>9</sup> McKinsey & Company, *Unlocking Energy Efficiency in the U.S. Economy* (July 2009) at

<sup>10</sup> Dept. of Energy, Oak Ridge National Laboratory, *Combined Heat & Power, Effective Energy Solutions for a Sustainable Future* (December 2008).

**Ohio's manufacturing sector remains the largest sector in Ohio's economy and is the third largest in the nation.** Despite significant declines in manufacturing, the Midwest is still a manufacturing hub. As a percentage of our gross state product, manufacturing remains the largest sector of the economy for many midwestern states. Table 2 shows that Ohio, Illinois, Indiana, Michigan, and Wisconsin all rank in the top ten for the size of their manufacturing sector, as a percent of total state economic activity, as do nearby New York and Pennsylvania. Ohio's large manufacturing sector provides a prime first target for achieving energy savings and emissions reductions in Ohio.

**Table 2. Ohio ranks third in size of manufacturing sector. Manufacturing remains Ohio's largest sector, representing 18% of Gross State Product (2008)**

<i>In millions of dollars</i>						
Rank by size of Manufacturing Sector	All Industry Total	Manufacturing	Mining & Utilities	Construction	Wholesale Trade	Retail Trade
<b>United States</b>	14,165,565	1,637,671	631,367	581,537	818,787	885,486
	100%	12%	7%	4%	6%	6%
<b>1. California</b>	1,846,757	181,134	49,217	67,770	105,131	118,624
	100%	10%	3%	4%	6%	6%
<b>2. Texas</b>	1,223,511	158,803	180,173	58,853	76,378	71,988
	100%	13%	15%	5%	6%	6%
<b>3. Ohio</b>	471,508	84,058	13,565	16,262	30,118	30,282
	100%	18%	3%	3%	6%	6%
<b>4. Illinois</b>	633,697	78,759	16,703	25,786	43,987	35,161
	100%	12%	3%	4%	7%	6%
<b>5. North Carolina</b>	400,192	77,956	7,953	16,628	21,732	24,979
	100%	19%	2%	4%	5%	6%
<b>6. Pennsylvania</b>	553,301	75,497	20,109	21,928	33,042	33,339
	100%	14%	4%	4%	6%	6%
<b>7. New York</b>	1,144,481	69,136	22,024	34,088	53,199	57,345
	100%	6%	2%	3%	5%	5%
<b>8. Indiana</b>	254,861	63,780	7,808	10,287	14,438	15,881
	100%	25%	3%	4%	6%	6%
<b>9. Michigan</b>	382,544	61,757	11,246	13,020	23,258	25,758
	100%	16%	3%	3%	6%	7%
<b>10. Wisconsin</b>	240,429	48,854	4,730	9,379	13,648	14,569
	100%	20%	2%	4%	6%	6%

Source: Bureau of Economic Analysis at <http://www.bea.gov/regional/gsp/>

## Saving energy is cheaper than producing it

By investing in energy efficiency, and capturing heat typically wasted during conventional electricity production, we can significantly reduce the billions we spend on polluting fossil fuels largely purchased from outside Ohio. By targeting the manufacturing sector of our economy for energy savings, where large amounts of energy are concentrated in the hands of relatively few users, we can make significant progress towards reducing emissions while increasing the productivity of energy inputs into our manufacturing sector. The achievement of significant energy savings would allow Ohio's manufacturers to invest more to increase their productivity, wages, profits, or jobs. The average manufacturer in Ohio spent approximately \$260,000 on energy in 2006. In total, Ohio manufacturers spent an estimated \$5.6 billion on energy during the same period: \$2.8 billion for fuels consumed on site, and \$2.8 billion on electricity (to consume more than 57 billion kilowatt-hours of electricity).<sup>11</sup> If we encourage Ohio manufacturers to invest more in energy efficiency and assist them in accessing cogeneration technology—a technology that allows for the generation of electricity on site or near the end user, while simultaneously capturing and employing heat power typically wasted during conventional electricity production—industry could reduce its use of electricity and fuel, lower its costs, and play a leading role in reducing emissions in Ohio.

### 1. Energy Efficiency in the manufacturing process

Since manufacturers are not in the energy business, they are typically not experts on energy production or energy management and may be unaware of energy-saving opportunities. Even for a company thoroughly educated on energy savings investment opportunities, capital financing may be difficult to procure and not the highest priority. Nonetheless, most manufacturers could realize significant permanent energy savings that more than pay for themselves within a short amount of time. For the most energy-intensive industrial consumers, the chemical sector, energy can represent as much as 60 percent of total costs.<sup>12</sup> For most manufacturers, it represents less than 5 percent of total operating costs, but a much higher percentage of controllable costs.<sup>13</sup> It is in both our society's interest, and that of our manufacturing firms and their employees, to dedicate public resources toward educating manufacturers on energy saving opportunities, encouraging manufacturers to take steps to achieve these savings, and helping to ensure capital financing is available to them. The result will be increased competitiveness, more jobs, and reduced emissions.

Nationwide, manufacturers who receive thorough energy assessments in order to identify opportunities to save energy and money in energy-intensive industrial manufacturing systems—implement fewer than 40 percent of recommendations, on average.<sup>14</sup> According to manufacturers and industry analysts, this low adoption rate occurs because capital costs for energy saving measures compete with other capital investment projects, and energy savings returns may not meet internal requirements, or the payback periods may be too long. Plus, social benefits from reduced emissions

---

<sup>11</sup> 2006 Annual Survey of Manufacturers at [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-ds\\_name=AM0631AS102](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-ds_name=AM0631AS102).

<sup>12</sup> Energy Information Administration, Ch. 6 Industrial Sector Energy Consumption of International Energy Outlook 2009 at <http://www.eia.doe.gov/oiaf/ieo/industrial.html>.

<sup>13</sup> Alliance to Save Energy, *Strategic Industrial Efficiency: Reduce Expenses, Build Revenues, and Control Risk* (2003).

<sup>14</sup> U.S. Dept. of Commerce, International Trade Administration, Office of Energy and Environmental Industries, *Energy Policy and U.S. Industry Competitiveness* at <http://www.trade.gov/td/energy/energy%20use%20by%20industry.pdf>.

are typically not factored into the equation. According to the U.S. Dept. of Commerce, firms have typically been more focused on how to enhance revenues rather than how to lower costs. However, the current downturn in the economy has spurred a change in approach that reflects current circumstances, with companies beginning to investigate more their options to become leaner. One of those frequently overlooked measures is energy efficiency. Energy efficiency measures produce energy savings, and can often even increase plant capacity for expanded production. It is a good time for Ohio to help its manufacturers invest to become leaner and greener, so they can come out of this recession ready to compete in an increasingly global marketplace.

The Department of Commerce's Manufacturing Extension Partnerships (MEPs), the Department of Energy's Industrial Assessment Centers, and Ohio's Edison Welding Institute all provide technical expertise and education to manufacturers on how to achieve energy savings. Participants realize significant energy savings. Based on the average value of \$10,000 to \$15,000 for these services, per manufacturer served, Ohio would need between \$200 and \$300 million to reach all companies in Ohio. Our analysis of data from the University of Dayton Industrial Assessment Center found that:

- Auditors recommended an average of seven efficiency improvements for each participant surveyed between 1981 and 2009. Only about half of these recommendations for Ohio companies were implemented.
- The total savings from over 6,000 recommendations made, if all had been implemented, would have been \$105,661,858 each year, while the upfront cost would have been a one-time amount of \$104,929,999. The average cost per manufacturer, around \$120,000, would have been recouped within slightly less than one year, on average. Some payback periods were instant (those costing \$0 to implement), while others, such as using the most efficient type of electric motors, had paybacks between 20 and 65.5 years.<sup>15</sup> Measures with instant paybacks were more likely to be adopted than measures with longer payback periods.
- More than 1,100 of the recommendations had no cost (things like rescheduling to avoid peaks, turning off equipment when not in use, less wasteful packaging). The highest cost was \$4,500,000 for "Equipment", a recommendation that was implemented, paying itself off in 8.3 years.
- Energy savings from recommendations range from \$42 (by changing Procedures/Equipment/Operating Conditions) to \$1,785,600 (by installing sensors to detect defects). Examples include installing storm windows and doors, turning off equipment during breaks, repairing faulty insulation in furnaces, re-using or recycling hot and cold exhaust air, more efficient lighting, rescheduling plant operations to avoid peak load hours, and recovering heat from exhaust steam.

## *2. Generating Cleaner Energy: Save the Heat (and recycle it).*

Manufacturers consume energy mostly in two ways: they burn fuels on-site, largely to heat chemicals, metals, and glass in industrial processes and for drying paint, but also to provide heating and cooling of buildings and to power vehicles; and they access the electric power grid largely to run electric motors that drive metal cutting tools and conveyer belts, but also to power welding tools, electric furnaces, and electric forklifts. Electricity is also used to light, heat, and cool buildings. Both

<sup>15</sup> Dollar amounts are not adjusted for inflation.

sources of energy (on-site fuel burning and electricity) produce carbon dioxide emissions. The production of electricity is enormously inefficient, yielding vast amounts of wasted energy and unnecessary emissions, largely because of heat loss in the electricity production process. Nationally, 63 percent of all energy used in the production of electricity is lost during generation. An additional seven percent of net electricity generated is lost during transmission and distribution through our antiquated grid system. In Ohio, between heat loss during electricity production, and grid losses during transmission, we lose nearly 70 percent of energy used to produce electricity. In other words, every kilowatt-hour of electricity we use in our homes, business, and industry, means 3.3 kilowatt-hours worth of polluting fossil fuels must be burned at an electric power plant.

Heat generated during the production of electricity is discarded through pressure release vents and cooled using lake or river water or cooling towers. At the same time this heat is being discarded, however, Ohio's manufacturers are purchasing fuel to create heat for their heating and cooling needs. If we could transfer the heat lost from the electric power sector to our manufacturers and others, we could reduce enormous amounts of waste in electrical production, while also reducing the need for manufacturers to purchase additional fuel for heating and cooling. However, transporting heat requires the use of expensive heavily insulated pipes, with great losses over any distance, and so becomes impractical beyond three miles. Our centralized electrical power system, located at the far corners of the state, means existing power plants are far too remote to transfer heat to power urban industrial centers.

By investing to decentralize electricity production through adoption of combined heat and power technology (CHP)—a 100-year-old technology that harnesses both the heat and power produced during electricity production—we can reduce our energy use and the associated emissions nationally by 20 percent.<sup>16</sup> Where there is a need for both electricity and process steam at an industrial location, CHP facilities use fuel to make steam in order to turn an electric generator, and then use the leftover steam in the factory's processes. These generators reduce manufacturing costs and use our scarce resources more efficiently. CHP systems can nearly double the energy efficiency of our current system of producing heat and power separately.<sup>17</sup>

---

<sup>16</sup> Department of Energy, Oak Ridge National Laboratory, *Combined Heat & Power: Effective Energy Solutions for a Sustainable Future* (2008) at [http://apps1.eere.energy.gov/news/progress\\_alerts.cfm/pa\\_id=131](http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=131). See also testimony to subcommittee of the U.S. Senate Finance Committee from the President of Renewable Energy Development on the history of Cogeneration in the U.S., starting with Thomas Edison's first power plant.

<sup>17</sup> Department of Energy, Oak Ridge National Laboratory, *Combined Heat & Power: Effective Energy Solutions for a Sustainable Future* (2008) at [http://apps1.eere.energy.gov/news/progress\\_alerts.cfm/pa\\_id=131](http://apps1.eere.energy.gov/news/progress_alerts.cfm/pa_id=131).

### **Increasing cogeneration capacity will stimulate capital investments and create green jobs.**

According to a report from the Department of Energy, Oak Ridge National Laboratory, if we set a national goal to achieve 20 percent generation capacity from combined heat and power plants, we can save the equivalent of nearly half the energy consumed by U.S. households (5.3 quadrillion btu of fuel annually), generate nearly \$234 billion in capital infrastructure investments, create nearly a million highly-skilled jobs, and reduce emissions by such a large amount that it would be equivalent to removing half of the passenger vehicles on the road (800 million metric tons).<sup>18</sup> A similar goal in Ohio would mean a \$10.5 billion capital investment that would produce \$2.9 billion in energy savings annually, create over 40,000 green jobs, and reduce emissions by 36 million metric tons (the equivalent of taking 6.6 million cars off the road). Because of Ohio's expertise and infrastructure for producing equipment for heavy industry, Ohio should be a leader in producing things like gas turbines, steam turbines, high-pressure steam lines, valves, railroad engines, cooling towers, and the other essential parts of CHP systems. Not only should we be installing such equipment, but our state can be a leader in producing it. Ohio is already home to some of the firms that do this production. Steam Power LLC, a company based in Milford Ohio, is a supplier of steam turbine generator sets, and steam boiler heat recovery systems that improve steam plant efficiency and CHP system payback. reXorce Thermionics, a company collaborating with Parker Hannifin and the University of Akron, and based in Akron Ohio, is currently developing a new kind of combined heat and power technology for use under difficult operating conditions. Greater demand for CHP will mean a greater need for suppliers of this technology.

The state of Ohio has instituted a number of measures to encourage industrial efficiency and encourage adoption of combined heat and power, but more can be done. In 2007, on the Governor's initiative and through a bi-partisan legislative effort, Ohio passed both an advanced energy standard and an energy efficiency standard that requires Ohio's utility companies to increase the amount of advanced energy they use to 25% by 2025, and to reduce the total amount of energy consumed 22% by 2025. The law also sets benchmarks requiring utility companies to ramp up their performance over time. Investments in industrial efficiency and combined heat and power qualify towards meeting these goals. In addition, under the same legislation, Ohio removed many of the existing barriers to combined heat and power technology by passing new interconnection standards. Finally, Ohio's Energy Office within the Ohio Department of Development made industrial efficiency a priority target as part of its State Energy Program for federal stimulus dollars (allotting \$15 million of \$96 million allotted).

*Ohio ranks in the top five states for potential energy production through CHP technology, but table 3 shows Ohio ranks 43<sup>rd</sup> in the nation in adoption of this technology.* Ohio has the potential to produce over 8,000,000 kW worth of power, according to the 2008 CHP/ DHC Collaborative U.S. Scorecard put out by the International Energy Agency, an intergovernmental organization acting as an energy policy advisor for 28 member countries including the United States in their effort to secure reliable, affordable, and clean energy for their citizens. However, currently less than one percent of Ohio's electric power is generated from CHP technology. The only states that rank below Ohio are not typically seen as heavy manufacturing states.

---

<sup>18</sup> The Oak Ridge National Laboratory used the following numbers to calculate the capital investment and job creation: *Assumed Cost:* \$1,500 per kilowatt installed cost. *Job Creation:* Four jobs for every \$1 million in capital investment CHP.

**Table 3. Ohio ranks 43rd in the adoption of efficient power production technology. Other nearby industrial states do better (2007, CHP as a % of total capacity).**

	Combined Heat and Power Capacity (Megawatts)	Total Electric Power Industry Capacity (Megawatts)	% CHP Use	State Ranking: Adoption of CHP technology
US	76,104	1,087,791	7.0%	
DE	1,182	3,525	33.5%	1
ME	1,256	4,522	27.8%	2
HI	653	2,674	24.4%	3
LA	6,812	30,158	22.6%	4
TX	18,069	111,098	16.3%	5
NJ	3,060	20,154	15.2%	6
OR	1,581	13,802	11.5%	7
MI	3,487	33,037	10.6%	8
CA	7,064	68,522	10.3%	9
NY	4,349	42,769	10.2%	10
MA	1,517	15,299	9.9%	11
IN	2,428	30,050	8.1%	12
AK	156	2,163	7.2%	13
VA	1,729	25,270	6.8%	14
MD	872	13,442	6.5%	15
PA	2,896	49,176	5.9%	16
AL	1,941	33,230	5.8%	17
CO	796	13,735	5.8%	18
WI	982	16,976	5.8%	19
MN	749	13,984	5.4%	20
ID	182	3,518	5.2%	21
CT	442	8,561	5.2%	22
FL	3,158	63,145	5.0%	23
SC	1,133	25,078	4.5%	24
NV	500	11,526	4.3%	25
NC	1,192	29,654	4.0%	26
AR	627	16,462	3.8%	27
GA	1,425	39,767	3.6%	28
IA	450	13,389	3.4%	29
UT	251	7,521	3.3%	30
OK	715	21,901	3.3%	31
NM	253	7,934	3.2%	32
WA	860	28,720	3.0%	33
WY	160	7,036	2.3%	34
IL	1,049	48,654	2.2%	35
WV	345	16,986	2.0%	36
TN	422	22,962	1.8%	37
MT	100	5,658	1.8%	38
MS	313	18,184	1.7%	39
NH	59	4,494	1.3%	40
RI	24	2,022	1.2%	41
MO	193	22,195	0.9%	42
OH	309	36,707	0.8%	43
VT	9	1,090	0.8%	44
ND	43	5,346	0.8%	45
AZ	152	28,730	0.5%	46
KS	39	12,200	0.3%	47
NE	13	7,422	0.2%	48
SD	2	3,127	0.1%	49
KY	-	23,351	0.0%	50

Source: Energy Information Administration, State historical tables for 2007, on EPA capacity by state.

## Conclusion and Policy Recommendations

Concentrating on the manufacturing sector to reduce energy consumption and emissions represents a promising strategy. The result would not only be reduced carbon emissions, but also increased efficiency, producing energy savings that leave more resources available for reinvestment, job creation, profit, and productivity increases. Policy changes could do much to encourage and assist the manufacturing sector in taking advantage of the newest technology to maximize efficiency.

First, we can provide green incentives in lieu of tax incentives to manufacturers, and/or require companies to employ energy efficient practices in order to qualify for existing tax incentives. State and Local taxes are usually less than one percent of the cost of doing business.<sup>19</sup> Ohio manufacturers pay seven times more for energy than they do for taxes.<sup>20</sup> When we dole out unconditional abatements, we do nothing to improve manufacturers' performance, while we deprive our state and local budgets of the resources required to invest in public infrastructure and provide essential public services. Instead, we should support manufacturers in a way that also benefits the community.

Rather than rely as heavily as we do on tax incentives, we should support our manufacturers in a way that also benefits society more generally, by encouraging them to take advantage of potential energy savings while reducing pollution emissions at the same time. If we use business incentives strategically, we can also achieve the simultaneous goals of modernizing our energy infrastructure, encouraging brownfield redevelopment, and spurring urban revitalization. To this end, we should investigate the possibilities of building publicly owned green-power plants on urban brownfield sites, creating eco-industrial parks where access to clean energy such as combined heat and power is readily available for low or no cost. Several states have moved in that direction, including Pennsylvania, Indiana, and New York.<sup>21</sup>

By ensuring access to reliable, affordable, and cleaner energy, we can help manufacturers use their energy more productively while reducing overall emissions in Ohio. There are a number of ways to achieve the multiple goals of promoting clean energy and good-paying manufacturing jobs using "green incentives," by educating them on their options, making clean affordable energy publicly available, and/or encouraging investments in energy efficiency and on-site cogeneration technology. We can use revolving loan funds to provide low-interest loans, and offer competitive grants, to ensure access to capital for renewable energy and energy efficiency investments. We can use municipal or public power authority to construct publicly-owned combined heat and power plants and enter into long-term power-purchasing agreements with manufacturers to provide them with affordable and stable energy and prices that reflect the benefits from reduced overall emissions in Ohio these plants represent. We can also green up existing tax incentives by putting requirements on those tax breaks, such as meeting LEED standards and requiring energy assessments with adoption of recommendations.

To ensure our manufacturers are properly motivated to undertake efficiency measures, we must put standards in place requiring emissions reduction, while also providing outreach and free technical

---

<sup>19</sup> Economic Policy Institute, *Rethinking Growth Strategies: How State and Local Taxes and Services Affect Economic Development* (2004) at [http://epi.3cdn.net/f82246f98a3e3421fd\\_o4m6iiklp.pdf](http://epi.3cdn.net/f82246f98a3e3421fd_o4m6iiklp.pdf).

<sup>20</sup> 2002 Economic Census: *Manufacturing* (2005) at [www.census.gov/prod/ec02/ec0231sg1.pdf](http://www.census.gov/prod/ec02/ec0231sg1.pdf)

<sup>21</sup> See <http://www.usc.edu/schools/sppd/research/NCEID/Websites.htm>.

assistance, and ensuring access to capital is available for these purposes. To that end, we recommend the state of Ohio:

1. Support climate change legislation. The climate bills currently under consideration provide tools, capital, and the technical assistance necessary to make efficiency spending worthwhile for companies and the community. The Initiative for Manufacturing Productivity in Advanced Competitive Technologies (IMPACT) proposal of Senator Sherrod Brown, and the industrial efficiency legislation introduced by Senator Jeff Bingaman reshape existing industrial efficiency programs and provide additional resources for the transition to clean energy. Additional provisions ensure funds for workforce training in lean manufacturing techniques.
2. Extend and expand Ohio's Advanced Energy Fund, which is currently set to expire and is wholly inadequate in size. Use some of the proceeds to facilitate investments in industrial efficiency and combined heat and power generation. Support Ohio Representative Mike Foley's bill in the Ohio House of Representatives, HB 301, expanding and extending the fund.
3. Provide free industrial energy assessments, efficiency training, and implementation assistance to Ohio's manufacturers to encourage private investment in energy management products and services. Provide enough resources to manufacturing extension partnerships, industrial assessment centers, and the Edison Welding institute to do the work. Ensure the availability of capital resources specifically for this purpose, by providing access to low-interest loans from revolving loan funds.
4. Companies receiving state or federal public funds for retooling, in order to enter the clean energy economy supply chain, should be required to undergo energy assessments and implement recommendations to make them lean and green.
5. As mentioned above, investigate the potential for municipal power authorities to build, or contract to build, combined heat and power plants on brownfields in order to help meet both the heat and power needs of multiple manufacturers and provide them affordable and stable energy prices through long-term power purchase agreements (green incentives).

These troubled economic times provide an opportunity to invest to make Ohio's manufacturers leaner and greener. The resulting energy savings and reduced emissions can solidify Ohio's manufacturing stronghold in the new global clean energy economy, and make Ohio a more sustainable and vibrant state with a more vital role in the nation's future.

**POLICY MATTERS OHIO** IS A NON-PROFIT, NON-PARTISAN RESEARCH INSTITUTE DEDICATED TO RESEARCHING AN ECONOMY THAT WORKS FOR ALL IN OHIO. POLICY MATTERS SEEKS TO BROADEN DEBATE ABOUT ECONOMIC POLICY BY PROVIDING RESEARCH ON ISSUES THAT MATTER TO OHIO'S WORKING PEOPLE AND THEIR FAMILIES. AREAS OF INQUIRY FOR POLICY MATTERS INCLUDE WORK, WAGES, AND BENEFITS; EDUCATION; ECONOMIC DEVELOPMENT; ENERGY POLICY; AND TAX POLICY. GENEROUS FUNDING COMES FROM THE JOYCE, GUND, CLEVELAND, PUBLIC WELFARE, KNOWLEDGEWORKS, NEW WORLD, ANNIE E. CASEY, SISTERS OF CHARITY AND W.K. KELLOGG FOUNDATIONS, THE ECONOMIC POLICY INSTITUTE, AND GREATER CLEVELAND COMMUNITY SHARES. TO THOSE WHO WANT A MORE FAIR AND PROSPEROUS ECONOMY... **POLICY MATTERS.**

3631 PERKINS AVENUE, SUITE 4C - EAST • CLEVELAND, OHIO 44114 • 216/361-9801

COLUMBUS: 300 E. BROAD STREET, SUITE 490 • COLUMBUS, OHIO 43215 • 614/221-4505

[HTTP://WWW.POLICYMATTERSOHIO.ORG/](http://www.policymattersohio.org/)



© 2009 Policy Matters Ohio. Permission to reproduce this report is granted provided that credit is given to Policy Matters Ohio. All rights reserved.