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Dear Public Utilities Commissioners,

Today, Environment Ohio joined with other energy efficiency companies and advocates to release a new report "*The Power of Efficiency: Opportunities to Expand the Economy, Save Money and Reduce Pollution in Ohio.*" The report details successful energy efficiency programs around the country and makes recommendations for Ohio's future energy efficiency programs. Other states have used energy efficiency programs to delay the need to build new power plants, reduce pollution, create jobs, and strengthen the economy for society as a whole.

The report profiles specific energy efficiency programs in other states and shows how they benefit homeowners, businesses and industry. For example:

- Through public education and targeted rebates, New York encourages homeowners to replace outdated and inefficient appliances with energy-saving models. Participating families save an average of \$600 per year in energy costs.
- Wisconsin created a program to help manufacturers and industrial facilities reduce energy use, providing technical advice, training, information and financial incentives. In 2006, Wisconsin businesses saved more than \$17 million through energy efficiency.
- Minnesota's largest electric utility helps businesses identify opportunities to reduce lighting costs and provides rebates to facilities that install energy-efficient lighting. From 2001 to 2003, the program saved businesses and institutions in Minnesota nearly \$16 million on electricity—savings that will last many years.

Efficiency programs in other states are also creating jobs and growing the economy. For example, New York's Energy Smart programs have created 4,200 jobs since 2002, and Wisconsin's Focus on Energy program is expected to increase disposable income for Wisconsin residents by more than \$4 billion over 25 years and are to create 60,000 person-years of employment.

Energy efficiency investments are extremely cost effective. For example, every dollar spent on efficiency in Connecticut yields about \$4 in consumer savings over time. Efficiency resources also cost less than new energy facilities or new power lines. In 2005, efficiency programs in Wisconsin saved electricity for 3 cents per kWh and natural gas for 18 cents per therm—60 to 80 percent less than average retail prices.

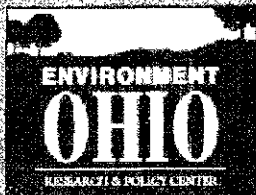
We hope that you will consider the suggestions in this report as you are considering the rate plans for each of the utilities that are preparing to meet each year's energy efficiency savings requirements.

Sincerely,

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Opportunities to Expand the Economy, Save Money and Reduce Pollution in Ohio



The Power of Efficiency

Opportunities to Expand the Economy,
Save Money and Reduce Pollution in Ohio

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October 2008

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The authors bear any responsibility for factual errors. The recommendations are those of Environment Ohio Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

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Environment Ohio Research & Policy Center is a 501(c)(3) organization. It is dedicated to protecting Ohio's air, water and open spaces. It investigates problems; crafts solutions; educates the public and decision-makers; and helps Ohioans make their voices heard in local, state and national debates over the quality of the environment and people's lives.

Frontier Group conducts research and policy analysis to support a cleaner, healthier and more democratic society. Our mission is to inject accurate information and compelling ideas into public policy debates at the local, state and federal levels.

For more information about Environment Ohio Research & Policy Center or for additional copies of this report, please visit www.environmentohio.org.

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Executive Summary

Ohio is at an energy crossroad—with a dirty past and the chance for a clean energy future.

The energy sources Ohio uses today wreak havoc on household budgets across the state, create air pollution and contribute to global warming. Residential electricity prices increased 9 percent from May 2007 to May 2008. At the same time, 86 percent of electricity used in the Buckeye State comes from coal-fired power plants, with the result that Ohio has the second highest emissions of global warming pollution from electricity generation of any state. In addition, 70 percent of the coal burned in Ohio's power plants is imported from other states, meaning that Ohio spends billions of dollars to import out-of-state energy resources rather than supporting local jobs and businesses.

The cleanest, cheapest and fastest way to address this crisis is to use energy more wisely by improving efficiency. Ohio has a long history of providing energy efficiency services to low-income populations through its weatherization programs, but it has lagged far behind other states in energy efficiency funding for all customers. Earlier this year, however, Ohio adopted

energy efficiency legislation that requires electric utilities to obtain energy savings of 22 percent of their annual sales by 2025 by improving energy efficiency. To achieve this long-term goal—in which we can get more heat, light and work from the same amount of energy—the Public Utilities Commission of Ohio must ensure that utilities (or an independent third-party administrator) establish strong energy efficiency programs today.

For guidance on how to move toward that new goal, Ohio can look to states across the country that have adopted strategies to increase energy efficiency. These programs help to reduce energy use while delivering financial savings for citizens, businesses and institutions. Ohio deserves nothing less.

Energy efficiency programs can help homeowners tap into vast potential energy savings, offsetting up-front costs and delivering long-term savings on energy bills. For example:

- Through public education and targeted rebates, New York encourages homeowners to replace outdated and

inefficient appliances with energy-saving models. Participating families save an average of \$600 per year in energy costs.

- New Jersey offers rebates to homeowners who purchase efficient furnaces or air conditioners. Tens of thousands of New Jersey households have participated and now save an average of \$63 per year on heating and cooling.
- California utilities provide discounts on compact fluorescent light bulbs, which deliver the same levels of light as incandescent bulbs while using 75 percent less electricity and lasting up to 10 times as long. Pacific Gas & Electric estimates that in 2007, its customers installed about 25 million efficient bulbs—which will yield on the order of \$300 million in electricity savings over time.
- Vermont educates home builders about energy-efficient design and building techniques, increasing the quality of home construction. In 2006, 22 percent of all new homes in the state met Energy Star performance standards, with energy bills at least 30 percent lower than a typical home.
- Ohio helps low-income customers reduce their energy bills through free home energy audits and weatherization. In 2004–2005, the program saved the average low-income family \$75 to \$268 per year.

Energy efficiency programs can help businesses, industry, local governments and institutions achieve new competitiveness by managing their energy use. For example:

- In Massachusetts, a utility offers

free energy audits for small business customers, plus financial incentives toward the installation of efficient equipment—paying up to 70 percent of the cost of the new equipment, with interest-free financing on the rest. Participating businesses typically see a 30 percent reduction in their energy use.

- New York offers a program that helps schools, hospitals, businesses, factories and local governments incorporate energy-efficient design and install efficient equipment at the time of construction, when it is most cost-effective. The program offers up to \$55,000 in design assistance, free ongoing advice from trained architects and engineers, incentives for the purchase of energy efficient technologies and rewards of up to \$15,000 for achieving high-energy performance.
- Minnesota's largest electric utility helps businesses identify opportunities to reduce lighting costs and provides rebates to facilities that install energy-efficient lighting. From 2001 to 2003, the program saved businesses and institutions in Minnesota nearly \$16 million on electricity—savings that will last many years.
- Connecticut offers a program that helps businesses to replace outdated equipment with energy-efficient models—covering the entire additional cost of efficient equipment over standard versions.
- Wisconsin created a program to help manufacturers and industrial facilities reduce energy use, providing technical advice, training, information and financial incentives. In 2006, Wisconsin businesses saved more than

\$17 million through energy efficiency. **In addition to helping individual homeowners and businesses, energy efficiency programs benefit society as a whole.**

- Efficiency programs create jobs and grow the economy. For example, New York's Energy Smart programs have created 4,200 jobs since 2002, and Wisconsin's Focus on Energy program is expected to increase disposable income for Wisconsin residents by more than \$4 billion over 25 years.
- Energy savings function like virtual power plants—but without the need to build costly infrastructure. For example, efficiency measures deployed in Connecticut from 2000 to 2006 will, over time, save the equivalent of the electricity needs of 2.8 million Ohio homes for a year; and between 2001 and 2005, New Jersey's efficiency programs reduced electricity demand enough to replace a medium-sized power plant (450 megawatts).
- Efficiency programs reduce energy prices for everyone. By reducing demand, energy efficiency programs can put downward pressure on the price of electricity, and reduce the need to build expensive new plants.
- Energy efficiency is extremely cost effective. For example, every dollar spent on efficiency in Connecticut yields about \$4 in consumer savings over time. In Wisconsin in 2005, efficiency upgrades saved electricity at a cost of 3 cents per kWh saved. Had those efficiency investments not occurred, consumers would have had to buy that electricity at an average retail cost of 7.5 cents per kWh.

- Energy efficiency programs can cut back on pollution, including the pollutants that cause global warming. A 10 percent improvement in electricity efficiency in Ohio would have reduced pollution by the same amount as taking 2.5 million cars off the road for a year.

Ohio can realize the benefits of energy efficiency by establishing energy efficiency programs such as those highlighted above. To achieve this:

- Utilities need to propose effective programs to the PUCO for review, and work in collaborative processes to refine their proposals. Their efficiency programs—whether run by the utility or by an independent program administrator—must serve all electricity consumers, including residential, commercial and industrial power users.
- The PUCO should monitor and evaluate the results of efficiency programs adopted by utilities to ensure that they deliver meaningful results at a reasonable cost.
- When achieving energy savings up to the amount required in law, utilities should be allowed to recover the cost of energy efficiency programs but not be allowed to collect more than is actually spent on energy efficiency investments. If utilities implement more ambitious programs, the PUCO could consider a more generous cost recovery rate for utilities. The cost of efficiency programs should be borne fairly by all types of users.
- Ohio should establish a comparable natural gas efficiency program to help reduce demand for natural gas.

Introduction

Ohio is sitting on a vast reserve of energy, waiting to be used.

This energy isn't untapped oil reserves or new seams of coal waiting to be discovered, but rather lies in Ohio's homes, businesses, institutions and industrial facilities. It is the wasted energy that is lost in vast quantities each day through leaky homes and inefficient appliances and equipment.

Ohio can tap into this vast resource through energy efficiency: getting more work out of the energy we already use. Capturing the state's energy efficiency potential could create jobs for Ohioans and keep more money in the state's economy.

Improving efficiency requires weatherizing existing buildings, constructing better-sealed and better-designed new buildings and replacing inefficient appliances and equipment. Tens of thousands of Ohioans—such as electricians, carpenters, truck drivers, heating and air conditioning installers—already have the construction and manufacturing skills that would enable them to begin work immediately on energy efficiency upgrades. And just as regional investment in renewable energy technology has created new jobs manufacturing wind turbines in Ohio for export to

other states, focusing on energy efficiency could boost Ohio's role as an exporter of efficient appliances and equipment.

Improved energy efficiency within Ohio means that consumers will spend less money on monthly utility bills, easing pressure on tight household budgets and giving Ohioans more money to spend locally. This, in turn, will help support local jobs and businesses.

There is no doubt that Ohio has tremendous energy efficiency potential. When other states have looked for efficiency opportunities, they have found them everywhere. By deploying energy efficiency programs designed to capture these unused resources, other states are saving substantial amounts of electricity, while also cutting global warming pollution, reducing air pollution, saving consumers money and improving their economies.

To offer Ohio a picture of how other states are capturing their energy efficiency resources, this report presents case studies of some of the nation's most effective energy efficiency programs.

All of these programs are stable, well funded and part of a comprehensive, statewide effort to conserve energy. All of

these programs deliver substantial, tangible benefits—directly for individuals and businesses that participate and indirectly for every energy customer statewide. With strong implementation of its new efficiency law, Ohio can reap these same benefits.

Ohio already has the skilled workforce

and the technological know-how to reduce our energy consumption, insulate our economy from price spikes and help put Ohio back on the right track. What we need now are effective programs with adequate funding to put our knowledge into action.

Ohio's Electricity Woes

Electricity consumption in Ohio results in multiple problems, especially large amounts of global warming pollution and air pollution. In addition to dealing with the impact of this pollution, Ohio residents also face rising energy bills.

Energy Bills Are Rising

At the same time that the costs of heating a home and driving a car have been rising, electricity bills have been going up. Residential customers are not the only

Figure 1. Ohio's Historical Residential Electricity Rates³

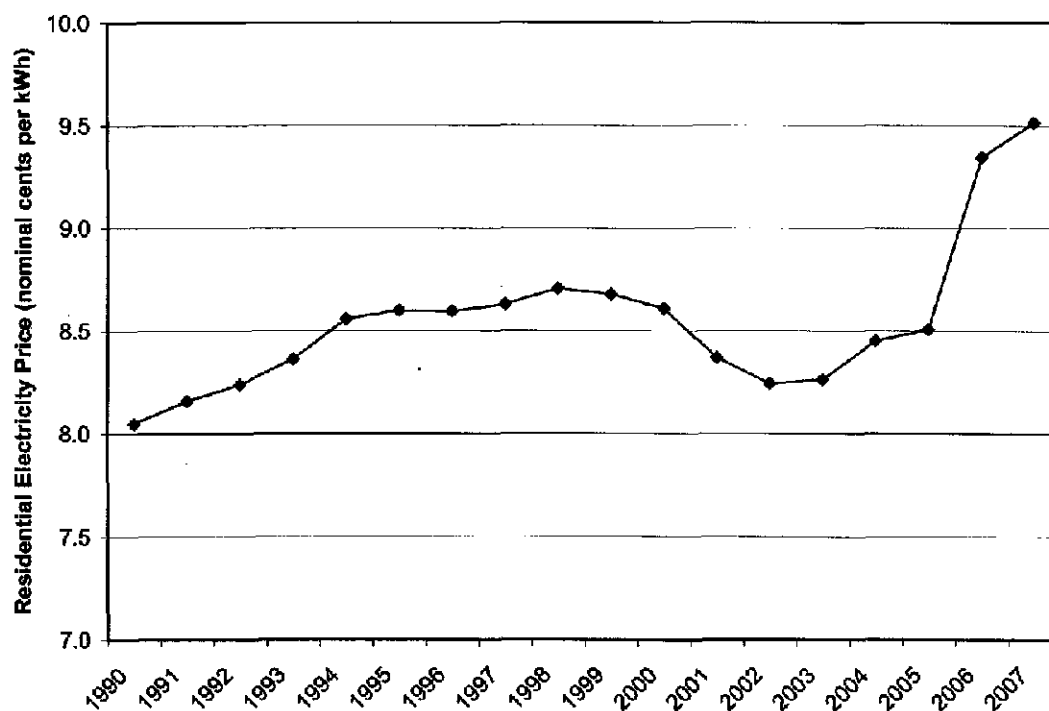
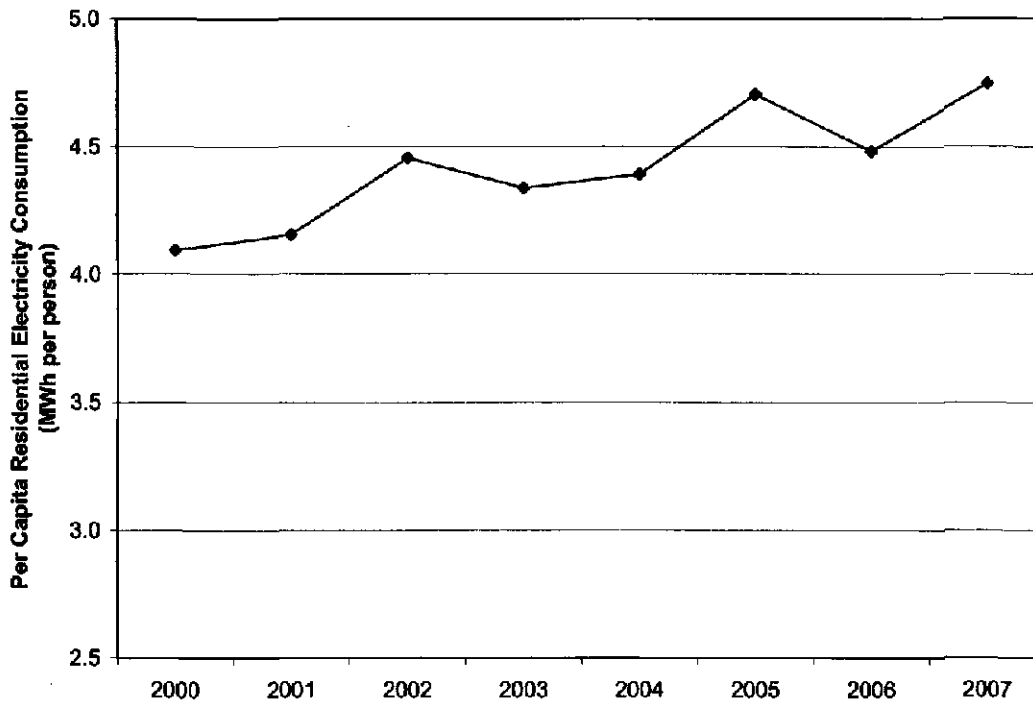


Figure 2. Ohio's Per Capita Residential Electricity Use Is Growing⁶



electricity users who have experienced this increase; commercial and industrial users have also seen large increases. There is reason to believe that bills will continue to rise as the cost of coal soars.

In the residential sector, rising bills are the result of higher electricity prices and growing per capita consumption. From 2000 to 2007, residential electricity prices in Ohio rose 11 percent.¹ (See Figure 1.) This year, prices appear to be heading up again. The residential cost of electricity for Ohioans increased 9 percent from May 2007 to May 2008.²

At the same time that rates are rising, Ohioans are consuming more electricity. Per capita electricity consumption in Ohio increased by 16 percent from 2000 to 2007.⁴ (See Figure 2.) The net result is that Ohio consumers spent 29 percent more on electricity in 2007 than in 2000 (in nominal dollars).⁵

Price increases in Ohio's commercial sector have been similar to those for residential customers, but the industrial

sector has experienced much larger price jumps in the past few years. Since 2000, Ohio's residential rates have increased 11 percent and commercial rates have grown by 13 percent, but the state's industrial rates have increased by 32 percent.⁷ (See Figure 3.)

While Ohio has maintained much of the state's authority to review and regulate electricity prices, the inescapable fact is that the cost of producing power continues to rise, indicating that consumers are likely to see higher prices in the years to come. In late July, for example, the price of coal mined in Ohio and surrounding states was \$138 per ton, more than twice the cost of just a year earlier.⁹ Given that 86 percent of Ohio's electricity comes from coal, this fuel cost increase will translate into higher electricity prices.¹⁰ (See Figure 4.) Three of the four major electric investor-owned utilities have filed to increase rates that will be effective January 1, 2009. The proposed increases range from 5 to 15 percent per year over the next three years.

Figure 3. Ohio's Historical Industrial Electricity Rates⁸

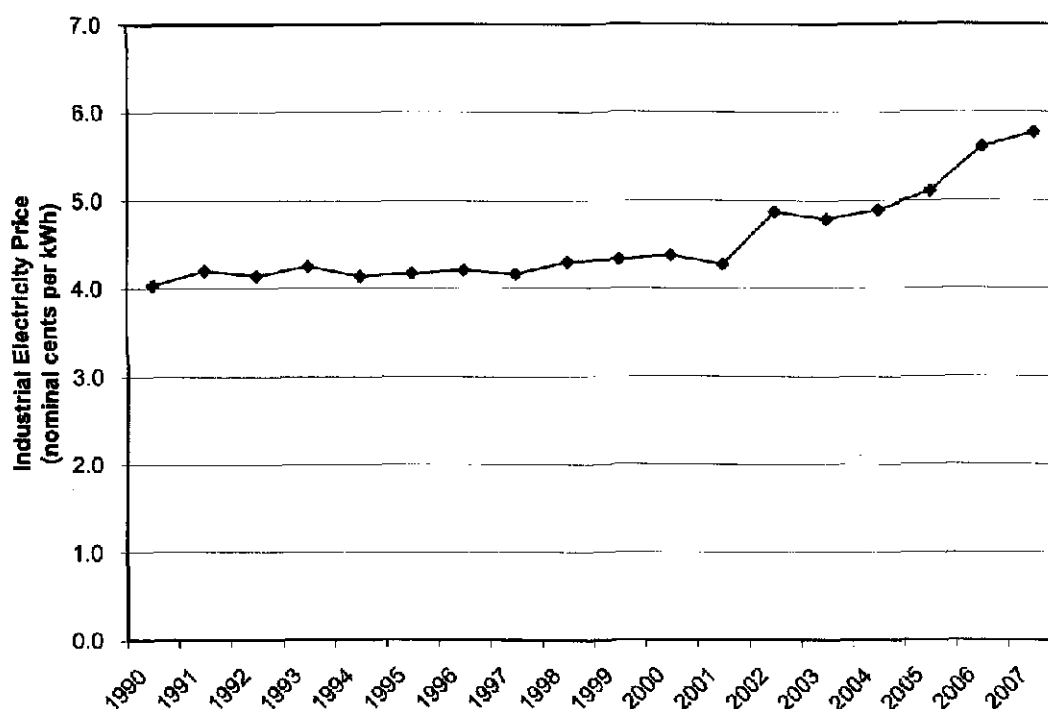
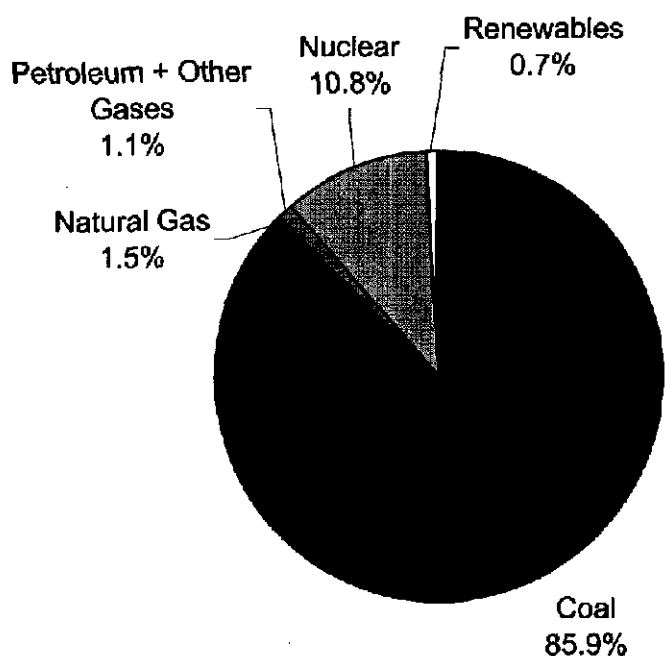


Figure 4. Most Electricity in Ohio Is Generated in Coal-Fired Power Plants¹¹



Importing Fuel Drains Money from Ohio's Economy

Energy is a major expense in Ohio's economy. And because Ohio imports much of its energy supplies from out of state, energy expenses represent a significant drain on the state's economy.

In 2006, Ohioans spent \$11.8 billion on electricity for residential, commercial and industrial uses.¹² This is equal to about 2.7 percent of Ohio's gross state product, the total value of all goods and services produced in the state for the year.¹³

Ohio imports much of the fuel needed to generate electricity. Although Ohio mines produce a significant amount of coal, 70 percent of the coal burned in Ohio is still imported from other states.¹⁴ (See Figure 5.) As a result, Ohio sends \$1.7 billion annually to other states to purchase coal for its power plants.¹⁵ Improving

energy efficiency will reduce the amount of money that Ohio spends on fuel and will increase funds available to support the local economy and jobs in Ohio.

Ohio's Electricity System Contributes to Global Warming

The generation of electricity produced 129 million metric tons of carbon dioxide in 2006, a reflection of Ohio's dependence on highly polluting coal-fired power plants.¹⁷ As a result, Ohio has the second-highest emissions of global warming pollution from electricity generation of any state.¹⁸

Nearly half of the state's global warming pollution comes from the electric sector, making electricity generation the single biggest contributor in Ohio to the problem of global warming. (See Figure 6.) The projected impacts of global warming in Ohio are wide-ranging and could significantly alter the state's environment, harm the economy and impair public health.

Figure 5. State of Origin of Coal Burned in Ohio Power Plants¹⁶

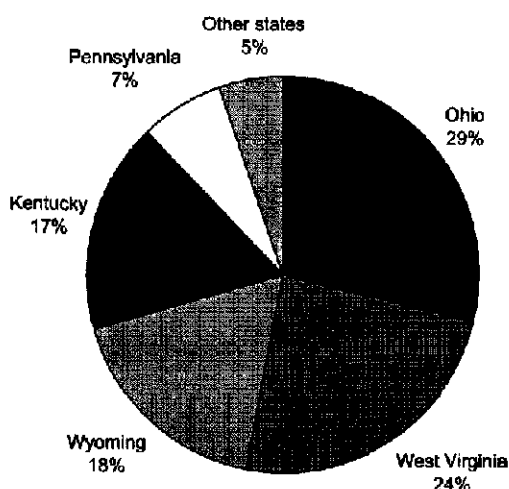
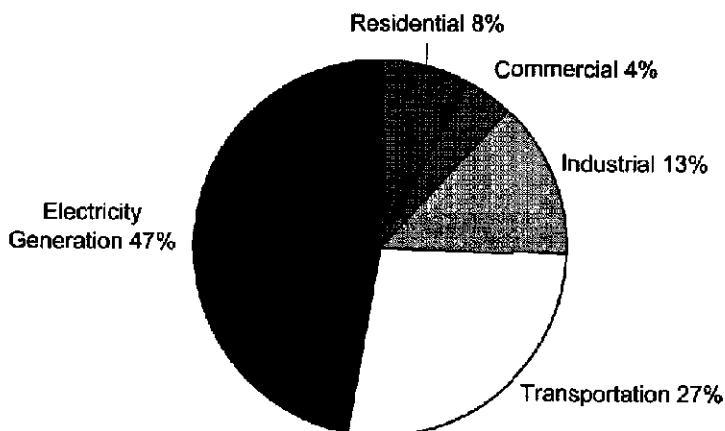


Figure 6. Electricity Generation Produces Almost Half of Ohio's Carbon Dioxide Pollution¹⁹



The cause of Ohio's high emissions from electricity generation is the state's heavy reliance on coal-fired power plants, which release lots of global warming pollution for every megawatt-hour of electricity produced. Currently, 86 percent of the electricity generated in Ohio is produced at coal-fired power plants.²⁰ Less than 1 percent of Ohio's electricity comes from truly renewable energy resources.²¹

To generate one megawatt-hour of electricity, an average coal-fired power plant in Ohio produces 2,070 pounds of carbon dioxide.²² In contrast, a typical natural-gas-powered facility in Ohio releases 1,250 pounds of carbon dioxide to produce the same amount of electricity, while energy efficiency or energy from wind turbines and solar panels releases none.

Electricity Generation Releases Air Pollution That Damages Health

Coal-fired electricity generation creates smog and soot pollution that contributes to respiratory and cardiovascular disease.

Smog (Ground-Level Ozone)

In 19 of Ohio's counties, ozone pollution is so severe that the air is regularly unsafe to breathe.²³

Smog results when a mixture of pollutants—including nitrogen oxides released by burning coal—reacts under intense sunlight to form ozone. A natural layer of ozone exists high in the atmosphere, absorbing ultraviolet radiation from the sun. However, when pollutants create ozone near the ground, it becomes a threat to public health. When inhaled, ozone damages lung tissue and causes short-term swelling. With long-term exposure at even low levels, it causes permanent and irreversible damage.

Ozone makes lung tissues more sensitive to allergens and less able to ward off infections.²⁴ It scars airway tissues, meaning that children exposed to ozone pollution develop lungs with less flexibility and capacity than normal. During high smog days, otherwise healthy people who exercise can't breathe normally.²⁵

Scientific studies show the severe and long-term impact that ozone exposure has on respiratory health:

- People who were raised in less polluted areas have lungs that work better than their schoolmates who grew up in polluted cities. For example, a study of college freshmen revealed that those who lived for four or more years in a county with high ozone levels can't breathe as well as freshmen from cleaner areas.²⁶
- Exposure to ozone may cause asthma in children.²⁷ Children who exercise frequently in smoggy areas are more than three times as likely to develop asthma as those in cleaner parts of the country.²⁸

Ozone pollution also increases deaths. People with heart failure or lung disease

are vulnerable to even low levels of ozone pollution. Multiple independent studies conducted in the U.S. and in cities around the world have found that the number of deaths increases as ozone pollution rises.²⁹

Taken together, these studies paint a picture of profound and irreversible respiratory damage beginning with an infant's first breath of ozone-tainted air, leading to impaired lung development, chronic respiratory disease, and increased death rates.

Soot (Particulate Matter)

Particulate matter pollution, even more widespread than high levels of ozone, makes the air unsafe to breathe in 27 Ohio counties.³⁰

Soot comes from burning fossil fuels and mostly consists of extremely small and practically invisible particles in the air. Some types of soot are simply unburned fuel particles, but other types of soot are created when pollutants react with each other in the atmosphere. Particles can contain hundreds of different chemicals from cancer-causing agents like polycyclic aromatic hydrocarbons, as well as metals like arsenic and zinc.

Forty to 1,000 times smaller than the width of a human hair, these fine particles result from burning fossil fuels like coal. Fine particles can remain suspended in the air for weeks. When inhaled, they are able to penetrate deep into the lung where they deliver their toxic payload. In contrast, larger particles such as dust or pollen travel shorter distances and are more effectively trapped in the body's upper airway.

Fine particles penetrate to the deepest part of the lung, where they are attacked and absorbed by immune cells. In an experiment in England, ultra fine carbon particles showed up in the immune cells of every child tested—even in a three-month-old infant.³¹

The chemicals delivered into the body by inhaled particulates are very dangerous.

Some of them cause cancer, some cause irritation to lung tissues and some cause changes in the function of the heart.³² As a result, particulates cause and aggravate a host of health problems, including lung cancer and cardiovascular disease.

Particulate pollution can cause irreversible damage to children, interfering with the growth and development of the lungs. For example, researchers at the University of Southern California followed the health of over 1,000 ten-year-olds until they reached 18. Children who lived in areas with higher levels of particulate pollution were less able to breathe with normal capacity.³³

Even short-term exposure to particulate matter pollution is deadly, killing upwards of 50,000 Americans every year. In fact, according to the largest study of the effects of particulates on mortality, breathing the air in major U.S. cities is about as dangerous as living or working with a smoker.³⁴

Severe Pollution in Ohio

With its heavy reliance on coal-fired power plants that contribute to smog and soot

formation, Ohio has severe air pollution problems.

Ozone pollution is so bad in 19 of Ohio's counties that the air fails to comply with the U.S. Environmental Protection Agency's standards for air that is safe to breathe.³⁵ The counties, which include the Cincinnati, Cleveland-Akron-Lorain, and Columbus metropolitan areas, are home to more than 6 million people.³⁶ But the problem is not limited to those urban areas. According to the American Lung Association, every Ohio county that has air pollution monitors—32 in all—experienced two or more days in 2005 when the air was unsafe to breathe due to high levels of ozone.³⁷

Particulate matter pollution in excess of the Environmental Protection Agency's standards afflicts 27 Ohio counties where 1.9 million people live.³⁸ In some areas of the state, soot pollution appears to be getting worse. In its 2007 annual evaluation of air quality in cities and counties around the state, the American Lung Association found that soot pollution had worsened significantly in Cleveland and Cincinnati, compared to previous years.³⁹

The Role of Efficiency in Solving Ohio's Energy Challenges

Investing in energy efficiency will help Ohio address the many problems of its current electricity system—high global warming pollution, health-damaging air pollution, rising energy bills and the exodus of dollars from the state's economy. Ohio has tremendous energy efficiency potential. Developing this potential will not only address the problems listed above and boost the state's economy, but will also improve the reliability of the state's electricity system at a lower cost than building new generation and transmission facilities.

The Benefits of Energy Efficiency Cost Savings and Economic Growth

Increased energy efficiency and economic growth go hand in hand.

In the late 1970s in America, a mix of higher energy prices and government programs such as tighter appliance and automobile efficiency standards created conditions for both reduced energy consumption *and* robust economic growth.

From 1979 to 1982, total energy use in the U.S. consistently declined, and energy consumption did not surpass its 1979 level again until 1988.⁴⁰ Over that nine-year period of 1979 to 1988, the nation's inflation-adjusted gross domestic product (GDP) increased by 30 percent.⁴¹

The nationwide trend continues today. Over the past two decades, America has consistently used less energy to produce more economic wealth. In 1980, the U.S. used 15,000 BTU for every dollar in gross domestic product; by 2006, we were using only 8,750 BTU—a drop of more than one-third.⁴²

However, the United States still remains a profligate user of energy compared to many of our peers in the industrialized world. America's economy remains 50 percent more energy intensive than that of the United Kingdom and more than twice as energy intensive as that of Japan.⁴³ On a per capita basis, the United States uses more energy than the vast majority of industrialized countries, surpassed only by Norway, Luxembourg, Iceland and Canada.⁴⁴

By improving energy efficiency, we could achieve more economic benefits,

Conservation versus Efficiency

Though they both help to reduce energy bills and cut pollution, conservation and efficiency are distinct. Efficiency means using improved technology to achieve greater productivity from a given unit of energy, whereas conservation can mean not using that energy at all. In an industrial setting, conservation means running a factory for fewer hours per day and thus producing less. Efficiency means upgrading equipment or improving the timing of a process to use less energy to create the same amount of product. At home, efficiency might mean replacing conventional light bulbs with compact fluorescent bulbs, while conservation might involve turning off the lights when you leave the room. Both efficiency and conservation are valuable—why illuminate an unoccupied room?—but this report focuses on the long-lasting savings available with efficiency.

including cheaper energy, more jobs and improved economic stability.

Energy Cost Savings

Energy efficiency can save consumers money on their electricity and gas bills. Energy efficiency programs help consumers use less energy, which directly translates into monetary savings. However, these cost savings will be realized only if the PUCO ensures that electric utilities recover the costs of their energy efficiency investments in a fair way.

The energy cost savings from reduced electricity consumption will likely be greater in coming years as measures to reduce global warming pollution are implemented. Options for reducing global warming pollution from the electric sector include a cap-and-trade program or even a carbon tax, which could raise the price of power from coal plants.

Investments in efficiency can also make energy cheaper—not just for those who make the investments, but for the entire economy. By reducing demand, energy efficiency programs can put downward pressure on the price of electricity and natural gas.

Jobs and Economic Growth

In addition to saving money on energy,

investments in efficiency will generate jobs for Ohio workers and economic development for Ohio communities.

Energy efficiency investments create jobs directly in construction and manufacturing. Workers are needed to improve insulation and sealing of homes; skilled architects and builders are required to perform energy-efficient new construction and remodeling; and trained manufacturing workers are needed to build energy-efficient appliances.

Ohio workers would not need to learn new skills or even change jobs to benefit from investments in energy efficiency. Already, 125,000 workers in Ohio have the relevant skills for retrofitting buildings to improve efficiency.⁴⁵ Other workers have the skills needed for manufacturing more-efficient appliances that could be sold here and in other states. Development of strong energy efficiency programs in Ohio could help to build the state's role in providing efficient equipment and training to other states. Furthermore, jobs directly related to energy efficiency cause a multiplier effect, supporting other jobs, such as in retail, food preparation and transportation.

One 2005 study estimates that a national clean-energy strategy, coupled with a shifting of federal energy subsidies

to renewables and efficiency, could create as many as 154,000 new jobs in the United States and increase net wages by \$6.8 billion.⁴⁶ In its recent meta-analysis of energy efficiency studies, the American Council for an Energy-Efficient Economy (ACEEE) projected that were national energy efficiency improved by 23 percent, employment could increase by 500,000 to 1,500,000 jobs by 2030 and that national GDP could increase by 0.1 percent.⁴⁷

Energy efficiency also protects existing jobs by reducing uncertainty for commercial and industrial employers. By reducing their overall energy use, these employers are less vulnerable to spikes in the cost of fuel and can feel more comfortable hiring and retaining staff.

Energy efficiency gives people extra money that they can spend locally, stimulating Ohio's economy and creating jobs. Investments in efficiency also replace expenditures for fuel (much of which is imported from out of state) with expenditures for labor and materials produced at home.

Improved Economic Stability

Energy efficiency would reduce Ohio's exposure to price spikes, supply disruptions and other repercussions of our reliance on fossil fuels.

Rate increases, such as those that have affected Ohio's electricity consumers in the past few years and the 5 to 15 percent hikes currently proposed for the next few years, would have smaller consequences in a highly efficient system. Energy efficiency could also insulate Ohio from the impacts of unpredictable events, such as the periodic rail transportation bottlenecks that have caused spikes in the price of coal or hurricanes that have damaged natural gas infrastructure and caused the price to soar temporarily.

Reduced Costs for New Energy Facilities

Efficiency measures are much cheaper than generating and delivering any type of

electricity. In 2002, energy efficiency programs supported by public benefit funds in New England produced energy savings at an average lifetime cost of 2.4 cents per kWh.⁴⁸ Northeast Energy Efficiency Partnerships estimates that capturing all remaining achievable energy efficiency potential in New England would cost just 3.1 cents per kWh.⁴⁹ A study of potential efficiency measures in the Southwest identified energy efficiency measures across all sectors of the economy that could result in electricity savings at an average cost of 3 cents per kWh (year 2008 dollars). The study concluded that the benefits of the efficiency measures exceeded their costs by more than 400 percent.⁵⁰

In comparison, the cost of generating electricity from many different types of technology has increased in the past few years as demand for power infrastructure has increased worldwide. For example, the federal Energy Information Administration estimates that the cost of generating electricity from a new coal-fired power plant in 2015 would equal 6.2 cents per kWh.⁵¹ The California Energy Commission estimates that the cost of power from a new nuclear facility would equal 11.8 cents per kWh (2007 dollars).⁵² In contrast, energy efficiency measures often can be purchased for just 3 cents per kWh.

The cost savings from energy efficiency and peak demand control programs will become even greater compared to adding generation when the cost of carbon control measures are included.

Reduced Pollution

As mentioned earlier, Ohio's electric sector released 129 million metric tons of carbon dioxide in 2006, nearly half of the state's total carbon dioxide emissions. Improving energy efficiency in the state would reduce generation and therefore global warming emissions.

If Ohio had used electricity 10 percent more efficiently in 2004, for example, it

could have cut global warming pollution from the electric sector by more than 12 million metric tons.⁵³ Economy-wide, that would have resulted in a nearly 5 percent reduction in total global warming pollution in the state. Measured another way, it is equal to taking 2.5 million cars off the road for a year, 38 percent of all automobiles in Ohio.⁵⁴

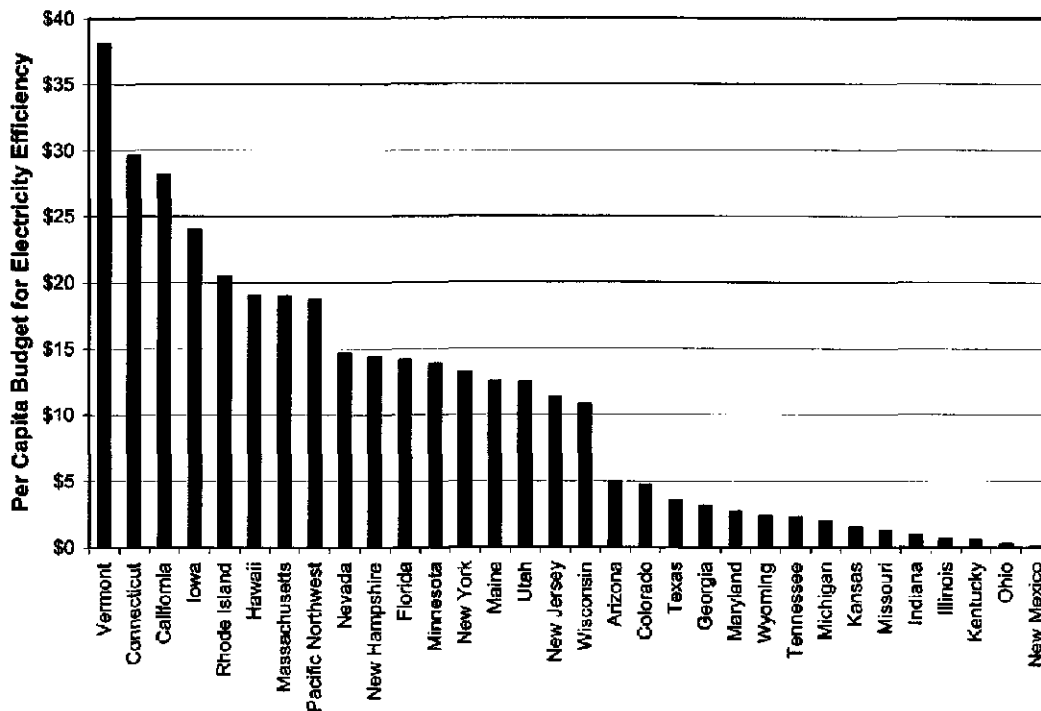
Ohio Is Rich in Potential Energy Savings

Opportunities for improved energy efficiency exist virtually everywhere that energy is used. Residential and commercial savings can be achieved with more efficient lighting, better insulation and weathersealing of buildings, and more efficient furnaces, air conditioners and other appliances. In the industrial sector, potential efficiency improvements include more efficient motors, furnaces, ovens, cooling and drying equipment, and compressed air

systems. More than two-thirds of electricity use in industry is for electric-powered motors.⁵⁵ In addition to installing more efficient motors, industrial facilities can improve the efficiency of motor systems and optimize systems. Better sensors and controls can time manufacturing processes to use the least energy necessary for the same quality performance.

Despite the ready availability of cost-effective energy efficiency, Ohio has never invested very much money in improving the efficiency of homes, businesses or industrial operations in the state. For the past 15 years, Ohio has invested much less money per capita in electric and natural gas energy efficiency than the national average.⁵⁶ At its peak in 1993, Ohio spent approximately \$3 per person per year on electric and natural gas efficiency, compared to an average of nearly \$7 nationally. In subsequent years, spending at both the national level and in Ohio has declined. In 2004, Ohio spent just \$1.41 per person on energy efficiency.⁵⁷

Figure 7. 2007 Per Capita State Budgets for Electric Efficiency Programs⁶⁰



Data on just electric efficiency efforts are even more striking. (See Figure 7.) In 2007, Ohio budgeted a mere \$0.28 per person on improving the efficiency of electricity use, compared to an average of \$10.79 for all states with electric efficiency programs.⁵⁸ (Ohio's spending has increased since 2007 with approval from the PUCO of energy efficiency programs operated by Duke and First Energy.⁵⁹) Vermont topped the list of the states most committed to electric efficiency at \$38.08 per person. In the Midwest, Iowa budgeted \$23.97 per person, Minnesota budgeted \$13.86 and Wisconsin budgeted \$10.79. By spending these funds on cost-effective energy efficiency improvements, these states recoup all their spending through reduced energy bills and ultimately save money.

While Ohio's low rate of investment in energy efficiency means that the state has forgone significant cost savings in recent years, it also means that any increased spending on efficiency should yield rapid and substantial returns.

ACEEE analyzed the findings of 48 assessments of energy efficiency potential at the state, regional or national level. ACEEE found that, on average, the studies

identified the potential for a 23 percent improvement in energy efficiency, with financial benefits twice as great as the costs.⁶¹ The studies reviewed by ACEEE projected a range of energy efficiency potentials. The most conservative study found savings of just 6 percent, while the most ambitious study projected efficiency savings of 33 percent.⁶² The studies that found lower projected savings often used a shorter study period, in some cases as few as five years.

There is every reason to believe that Ohio's energy efficiency potential is at least as great as the national average. Statewide, Ohio is the nation's fourth largest electricity consumer but has spent less than the national average on efficiency for the past 15 years, suggesting that the state has much untapped potential.

Past studies of Ohio's potential confirm this idea. A study by ACEEE in 1994 identified big opportunities for improving efficiency, arguing that Ohio could upgrade its efficiency by 26 percent by 2010.⁶³ Since the release of that study, however, the state has done little to develop efficiency and energy use has continued to rise.

Ohio's New Energy Efficiency Law

Despite the ready availability and benefits of improved efficiency, energy consumers often do not make the investments needed to capture this energy efficiency potential. Consumers may not know about energy efficiency technologies or have an accurate way of computing the relative costs and benefits of adopting them. Even when efficiency improvements are plainly justifiable in the long run, consumers may resist adopting technologies that cause an increase in the initial cost of purchasing a building or piece of equipment. In some cases, as with low-income individuals, consumers may not be able to afford the initial investment in energy efficiency, regardless of its long-term benefits. In rental properties where the tenants are responsible for paying utility bills, neither the landlord nor the renter has much incentive to invest in energy efficiency because the party paying for the improvement does not reap the financial benefits.

Recognizing this disconnect between the social benefits of investing in efficiency and the individual costs of adopting energy efficiency measures, Ohio recently joined the ranks of the many states that have established energy efficiency requirements.

What the New Law Requires

After more than a year of work and debate by Ohio's state legislators from both parties, on May 1, 2008, Governor Strickland signed Senate Bill 221 into law. The legislation creates a strong energy efficiency resource standard that requires each major electric utility to invest in energy efficiency. This means that Ohio joins the ranks of 16 other states that have made this type of commitment to energy efficiency.⁶⁴ Senate Bill 221 also contains a renewable energy standard that will increase the use of renewable electricity.

The energy efficiency standard requires Ohio's electric utilities to improve the efficiency of electricity use by their customers. In 2009, utilities must invest enough money to save 0.3 percent of the electricity they would otherwise have sold. This savings requirement increases over time, as shown in Table 1.

This electric efficiency requirement means that total electricity consumption in Ohio could decline in coming years, instead of increasing by 8 percent from 2007 to 2025 as is currently projected.⁶⁵ In 2007, Ohio consumed approximately 162

Table 1. Required Energy Efficiency Savings in Senate Bill 221

Year	Annual Electric Efficiency Savings as Percent of Total Sales
2009	0.3%
2010	0.5%
2011	0.7%
2012	0.8%
2013	0.9%
2014	1.0%
2015	1.0%
2016	1.0%
2017	1.0%
2018	1.0%
2019	2.0%
2020	2.0%
2021	2.0%
2022	2.0%
2023	2.0%
2024	2.0%
2025	2.0%

million MWh of electricity. Without energy efficiency, use is projected to rise to 174 million MWh. Meeting this increased demand would require construction of one or two new 1,000-megawatt capacity, coal-fired power plants.⁶⁶ Adding this new capacity would be extremely expensive: the 1,000-megawatt American Municipal Power Generating Station coal plant currently under consideration for Meigs County, for example, is expected to cost \$2.5 billion.⁶⁷

However, as Ohio improves the efficiency with which it uses electricity as required by Senate Bill 221, electricity demand will actually fall to 142 million

MWh annually.⁶⁸ (See Figure 8.) The 32 million MWh of saved electricity is enough to power 3.3 million Ohio homes at today's consumption levels and equal to the output of four 1,000-megawatt coal-fired power plants.⁶⁹

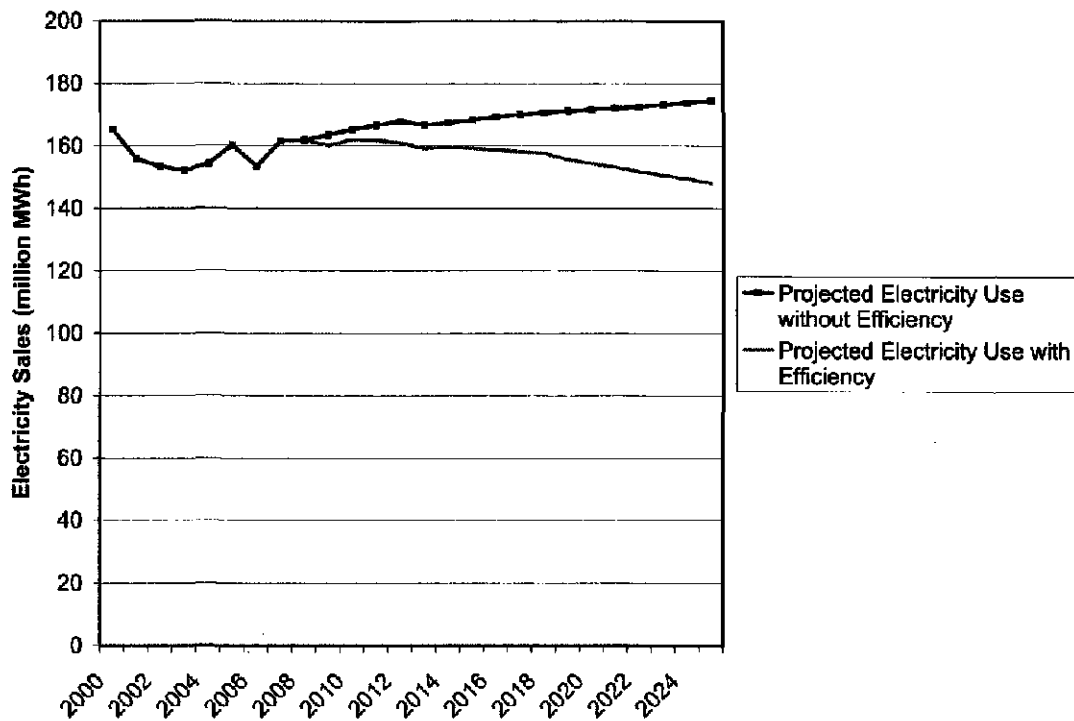
In addition to the overall electric efficiency requirement, Senate Bill 221 also includes a requirement that utilities reduce peak demand, the amount of electricity consumed at the point during the day when the most energy is used economy-wide. Peak demand is an important influence on the cost of electricity because utilities must build and maintain adequate generation and transmission capacity to provide power to all customers when demand is greatest—typically on a hot summer day—even though some of that capacity will remain idle for much of the year. Reducing peak demand through targeted load-management programs means that utilities and their customers do not have to spend as much for new peaking power plants.

Ohio's new law requires each electric utility to save 1 percent of peak demand in 2009. From 2010 through 2018, the utilities must reduce their peak demand by 0.75 percent each year such that by 2018 they have shaved off a total of 7.75 percent of peak energy demand.

Capturing Ohio's Full Efficiency Potential

Now that Ohio has adopted energy efficiency requirements, the key challenge will be implementing the law effectively. Utility companies or an independent administrator must establish programs to achieve the savings called for in Ohio's requirements. The PUCO must provide adequate oversight to ensure the programs achieve savings at a reasonable cost to consumers.

Figure 8. Ohio's Projected Electricity Consumption⁷⁰



The programs outlined in this report can provide guidance for the PUCO and Ohio's utilities about what can be accomplished with strong efficiency programs

implemented with thorough oversight. These case studies show that energy efficiency savings are available for all customer classes and save money for consumers.

Real-World Examples of Energy Efficiency at Work

Many states across the country provide funding for electricity and gas utilities or other entities to run energy efficiency programs. The best energy efficiency programs systematically drive the penetration of efficient technologies and practices into the marketplace where they can make the greatest difference.

These programs reduce electricity and natural gas consumption through a variety of strategies, including:

- Educating consumers about energy efficiency;
- Providing discounts or incentives for the purchase of highly efficient products and equipment;
- Offering energy audits and weatherization assistance to homeowners;
- Consulting with businesses and industry on energy-efficient practices; and
- Improving the efficiency of design and materials in new schools and commercial buildings.

The following case studies present brief snapshots of a few of the nation's most effective energy efficiency programs, some of them offered by utilities that sell power in Ohio as well as in other states. Each story outlines how the program works; describes how the utility or efficiency service provider interacts with homeowners, businesses or industry; and examines the benefits the program offers for participants and society as a whole.

These case studies offer a glimpse of the types of activities and benefits that could happen in Ohio, if the state makes smart investments in energy efficiency.

Efficiency Programs Help Homeowners Tap into the Energy Savings Potential Within Their Homes

Ohio's homes are packed with energy-saving opportunities. Energy efficiency programs can help homeowners unlock this potential.

For example, New York encourages

homeowners to replace outdated and inefficient appliances with energy-saving alternatives through public education and targeted financial rebates. New Jersey offers rebates to homeowners who purchase efficient furnaces or air conditioners. California utilities provide discounts on highly efficient compact fluorescent light bulbs, available from thousands of local retailers. Vermont educates home builders about energy-efficient design and building techniques. And Ohio helps targeted low-income customers reduce their energy bills through free home energy audits and weatherization.

All of these efficiency programs serve to save individual homeowners money and increase the comfort of their homes. At the same time, these programs reduce statewide demand for electricity and natural gas, keeping costs low for all energy consumers.

Replacing Outdated Appliances with Efficient Alternatives

Donna and Mark Denley of Albany, New York, bought their dream home in December 2003. It had all the charm of an older house, and its 1,600 square feet included three bedrooms and one and a half baths. But with old appliances, air leaks and poor insulation, it also presented a real problem: after moving into the house in January, the Denleys' first combined electricity and natural gas bill was a nightmarish \$400.

They turned to the New York State Energy Research and Development Authority (NYSERDA) for help. They hired a contractor to perform a home energy audit and identified potential improvements. They chose to install an Energy Star-certified boiler and refrigerator, added attic insulation and performed air sealing and duct work. NYSERDA financed the improvements through a low-interest loan. By installing energy-efficient products, the Denleys cut their typical monthly

An Energy Star clothes washer can cut electricity and water use by as much as 50 percent.

energy consumption by 40 to 50 percent, saving \$1,847 a year.⁷¹

The project was quite cost-effective, both from the Denleys perspective and from NYSERDA's point of view. For every dollar spent on the project, the family saves \$2.56 in energy costs.⁷²

NYSERDA reaches New Yorkers like the Denleys through its New York Energy Smart Products program. The program reaches out to a broad audience, building awareness about energy-efficient products and providing funding options for energy efficiency upgrades.

Energy Star appliances are a focal point of the Energy Smart Products program. Energy Star appliances are much more efficient than their conventional counterparts. For example, an Energy Star refrigerator can reduce electricity costs by up to \$100 per year. And an Energy Star clothes washer can cut electricity and water use by as much as 50 percent.⁷³

To encourage New Yorkers to purchase appliances bearing the Energy Star label, the Energy Smart Products program runs public service campaigns, including print and television advertisements, magazine articles, store displays and utility bill insert flyers.

The program also provides substantial financial incentives. Energy Smart Products

reduces loan rates for homeowners who wish to perform renovations recommended by certified energy auditors. These renovations may include more efficient appliances, heating and air conditioning systems, lighting, windows, hot-water systems or insulation and weatherization improvements.⁷⁴ After completing an application, a homeowner can receive an interest rate reduction of up to 4 percent below market.

The Energy Smart Products program has achieved important successes. In 2006, more than 2,000 new Energy Star certified homes were built. More than 3,200 homeowners performed Energy Star upgrade projects, saving families an average of \$600 per year.⁷⁵ And efficient appliances play an important role in these savings: NYSERDA reports annual savings of 600 kWh per home resulting from upgrades to more energy-efficient appliances alone.⁷⁶

Altogether, New York's Energy Smart programs currently save about 3.1 billion kWh of electricity per year—equivalent to the needs of nearly 320,000 Ohio homes.⁷⁷ Energy Smart programs have also reduced peak electricity demand in New York by 1,214 MW—equivalent to the output of a very large power plant.⁷⁸

Energy Smart is funded by a system benefits charge paid by all utility users.⁷⁹ The charge, established in 1996, now requires utilities to collect a sum equal to 1.42 percent of the utility's 2004 revenue and submit it to NYSERDA. About half of this funding goes to pay for Energy Smart programs.⁸⁰ According to a very conservative cost-benefit analysis performed by NYSERDA, program benefits exceed costs by 2.1 times.⁸¹

The program helps to conserve electricity and gas, reducing demand on New York's energy infrastructure. As a result, utilities can delay the construction of new power plants, gas lines and power lines, saving all utility customers money and increasing the reliability of service.

Choosing Efficient Furnaces and Air Conditioners

When Steve Angelucci moved into his South Jersey home, it came with electric baseboard heat and leaky windows. It also came with a massive heating bill.⁸² To reduce the amount of money he was burning up every winter, he replaced leaky windows and converted to a multizone natural gas heating system.⁸³

Many homeowners across New Jersey find themselves in the same position that Mr. Angelucci was in when he bought his house. Because furnaces, air conditioners and ventilation systems are relatively expensive to replace, many homeowners tolerate inefficient home heating and cooling—and the high energy bills that result.

To help homeowners make the leap to replace old and inefficient furnaces and air conditioners with new, highly efficient models, the state of New Jersey started two programs, called CoolAdvantage and WarmAdvantage, in 1999.

The programs offer cash incentives to homeowners, ranging from \$300 to \$450. Higher-efficiency products earn higher rebates, and the program flexibly adjusts its efficiency standards over time as better technologies arrive on the market.⁸⁴

While high-efficiency appliances make up only 4 to 5 percent of the national heating and cooling market, in New Jersey they account for 30 percent.

CoolAdvantage and WarmAdvantage also require air conditioner and furnace replacements to be installed by certified technicians. The technicians ensure that the appliance is appropriate for the home's size and that it is properly installed.⁸⁵ These requirements maximize the equipment's efficiency.

The programs reach out to individuals like Steve Angelucci through broad education campaigns but also pay attention to retailers and contractors—two groups essential to strong appliance efficiency programs. Retailers learn how to grow the market share of energy-efficient products, and contractors are trained on how to install the equipment and promote it to their customers.⁸⁶

New Jersey further uses CoolAdvantage and WarmAdvantage to encourage development in “smart growth” areas, as designated by the state growth plan. For newly constructed homes, rebate dollars are available only to homeowners who decide to build inside the zones New Jersey has designated for residential growth.⁸⁷ Smart growth contributes to the state's overall push for efficiency, because dense communities are more efficient than sprawling development, offering savings in energy, carbon emissions and water consumption.⁸⁸

In 2005, CoolAdvantage and WarmAdvantage signed on 27,510 participants, who averaged annual savings of 546 kWh and \$62.95 each—for a total savings of more than \$1.7 million.⁸⁹ The program has also significantly built the market share of high-efficiency products. While high-efficiency appliances make up only 4 to 5 percent of the national heating and cooling market, in New Jersey they account for 30 percent.⁹⁰

These results are possible because New Jerseyans invest a little money through their energy bills each month. Each customer pays a small system benefits charge equal to approximately 3 percent of the

electricity bill. The typical residential electricity consumer paid \$13 in 2006, of which slightly more than 25 percent supported energy efficiency programs like CoolAdvantage and WarmAdvantage through the New Jersey Clean Energy Program.⁹¹ (The rest of the charge helped to pay for renewable energy, low-income assistance and other costs.)

Efficiency measures installed as a result of the New Jersey Clean Energy Program during 2005 will save 4 billion kWh of electricity and 120 million therms of natural gas over their entire lifetimes. Altogether, New Jersey's Clean Energy Program achieved these results at a net cost of \$0.024 per kWh and \$0.22 per therm—less than 25 percent of prevailing retail costs for energy. As a result of the programs, New Jerseyans will save \$520 million on their energy bills over time.

By 2005, New Jersey's energy efficiency programs produced annual electricity savings sufficient to power nearly 40,000 Ohio homes.⁹²

New Jersey's efficiency programs also cut peak electricity demand by 450 MW, reducing the need to site, build and operate expensive new power plants—saving money for all energy consumers in New Jersey.⁹³

Increasing the Use of Energy-Efficient Lighting

In 2001, an energy crisis caused rolling blackouts to sweep across California. In addition to many dark evenings, this crisis provided a unique opportunity to promote greater efficiency across the state.

In response to the energy crisis, California policymakers allocated over \$900 million to energy efficiency programs.⁹⁴ The state reserved part of the funding specifically for residential energy efficiency improvements, particularly in lighting.

With this funding, the Pacific Gas and Electric Company (PG&E) established the Upstream Residential Lighting Program,

Compact fluorescent light bulbs produce the same amount of light as traditional incandescent bulbs, but use up to 75 percent less energy and last up to 10 times as long.

aimed at increasing the market share of highly efficient compact fluorescent light bulbs (CFLs) sold to residents of California. CFLs produce the same amount of light as traditional incandescent bulbs, but use up to 75 percent less energy and last up to 10 times as long.

PG&E partnered with retailers and manufacturers to offer CFLs at a discounted price. By the end of 2001, the program had encouraged residents to purchase over 7 million CFLs—20 times more than sales in any previous year.⁹⁵

Today, California continues to fund the lighting program through a Public Goods Charge, in which utilities charge ratepayers a 1 percent surcharge on their electric utility bills.⁹⁶ The state pools the resulting money and spends it on services and programs, like the Upstream Residential Lighting Program, that serve the public interest.⁹⁷

Through the Upstream Residential Lighting Program, PG&E transfers funds to providers of CFLs, who are then able to offer large discounts on energy-efficient lighting.⁹⁸ Customers receive the discount automatically, with no need for coupons, forms or any waiting period.⁹⁹

The Upstream Residential Lighting Program has been enormously successful in increasing the market penetration of CFL lighting. During the second quarter of 2001, the market share of CFLs increased from less than 1 percent to 8 percent, while incandescent bulb sales dropped 22 percent.¹⁰⁰ Two years after the program's roll-out, more than 1,000 lighting retailers were participating.

For the more than 1.35 million customers of PG&E who have taken advantage of the Upstream Residential Lighting Program, the scenario is win-win: cheaper light bulbs *and* lower energy costs.¹⁰¹ Through the program, retailers have sold more than 30 million CFLs through 2006. During their useful lives, these bulbs will save nearly 2.4 billion kWh, translating into enormous monetary savings for individual consumers.¹⁰² In 2007 alone, PG&E estimates that 25 million CFLs were installed in its service area, cumulatively saving approximately 1.8 billion kWh of electricity.¹⁰³ In other words, lightbulbs installed through 2007 will save electricity in amounts equivalent to the needs of nearly 190,000 Ohio homes for one year.

The exceptional success of PG&E's Upstream Residential Lighting Program is attributable to the fact that it requires almost no effort on the part of consumers: by working with retailers and manufacturers, the utility is able to create direct savings for residents of California.

Moreover, the benefits extend to everyone who uses California's electricity grid. By reducing demand for electricity, the Upstream Residential Lighting Program reduces strain on California's energy infrastructure, reducing the likelihood of rolling blackouts in the future.

Building New Homes to Be Efficient from the Start

Energy Star homes use more than 30 percent less energy than a typical new home and offer significant dollar savings on

monthly energy bills. Energy Star homes also offer lower maintenance costs, better indoor air quality, greater comfort and higher resale value.¹⁰⁴ Many Ohio homeowners already know this, because more than 12 percent of new homes built in Ohio in 2006 met Energy Star requirements.¹⁰⁵ Based on experience elsewhere, this percentage could be even higher.

To increase the penetration of Energy Star construction into the new home market, the Vermont Energy Star Homes program connects developers and individual families to Energy Star qualified builders and provides free assistance throughout the process of building a home. The program is operated by Efficiency Vermont, an independent organization that offers a variety of energy efficiency services to utility customers in the state.

Before construction begins, Efficiency Vermont reviews a home's design plans. Based on choices in lighting, insulating, heating and appliances, Efficiency Vermont's experts estimate how much the owner will spend on energy. They also recommend ways to improve these choices and offer cash rebates as incentive to install more energy-efficient appliances.¹⁰⁶ Once a house is built, Efficiency Vermont makes sure it is airtight, to minimize energy loss through drafts and gaps in insulation. Once a home meets minimum energy efficiency standards, Efficiency Vermont certifies it as an Energy Star Home.¹⁰⁷

In 2006, Efficiency Vermont offered assistance with more than 2,000 home construction projects. The program certified 586 homes, or 22 percent of Vermont's new home market, as Energy Star Homes.¹⁰⁸ The average participating home reduced electricity consumption by 2,000 kWh per year, saving on the order of \$200 per year on electricity bills. Altogether, the program's activities in 2006 will conserve 39 million kWh of electricity, enough to power 4,000 Ohio homes for a year. The program also reduced peak demand for

electricity by more than 0.4 MW.¹⁰⁹

In addition to the Energy Star Homes program, Efficiency Vermont operates more than a dozen other energy efficiency initiatives. Altogether, in 2006, Efficiency Vermont's activities produced 56 million kWh of annual electricity savings—equivalent to the annual needs of about 5,800 Ohio homes. Cumulatively, efficiency measures promoted by the organization account for more than 5 percent of the state's electricity demand. In recent years, these efficiency measures have reduced the annual rate of growth in electricity demand by two-thirds.¹¹⁰

Efficiency Vermont and the Vermont Energy Star Homes program are possible because Vermonters pay a systems benefit charge on their utility bills. The charge varies by utility. The money goes to an independent nonprofit organization, which created Efficiency Vermont in 2000 to administer the state's energy efficiency programs.¹¹¹

By reducing electricity demand, Efficiency Vermont reduces the need for utilities to deploy their most expensive

The average
participating home
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consumption by
2,000 kWh per year,
saving on the order
of \$200 per year on
electricity bills.

Ohio's Electric
Partnership Program
prioritizes assistance
for households most
in need of efficiency
services: families with
the highest energy use
and those who are
farthest behind
in payments.

electricity resources, saving all electricity consumers money. At the same time, efficiency resources produce savings at a cost of 3.6 cents per kWh—about a third of what it would cost to generate electricity at a new power plant. Vermont recognizes that energy efficiency is the cheapest electricity resource—and thus has created effective programs to capture available savings potential.

Helping Low-Income Families Cut Their Energy Costs

When it comes to energy prices, low-income families bear a greater burden than do middle- and upper-income households. During 2008, low-income families will spend an average of 17 percent of their yearly earnings to heat, cool and light their homes, compared to an average of 4 percent for higher income families.¹¹² In Ohio, as in many states around the country, stagnant wages and rising electricity

prices have increased this burden in recent years.

In recognition of the challenge that low-income households face, Ohio created several programs to help low-income families in 1999 when it deregulated the state's electric industry. One such program is the Electric Partnership Program (EPP) developed by the Ohio Department of Development (ODOD). EPP provides energy efficiency services to customers with incomes under 150 percent of the federal poverty line.¹¹³ The program combines efficiency with customer education measures and is generally delivered in conjunction with federally funded and/or gas-utility-funded weatherization programs to maximize efficiency and cost-effectiveness.

EPP prioritizes assistance for households most in need of efficiency services: families with the highest energy use and those who are farthest behind in payments. Customers who agree to receive assistance are visited by an auditor who evaluates home energy use, identifies potential improvements and offers energy-saving tips and tools. Efficiency upgrades include blower-door-guided air sealing (caulking and weather-stripping), water heater and pipe insulation, appliance swaps, thermostat replacement and more efficient lighting. The program includes follow-up customer education visits and additional monitoring of energy savings.

Through the EPP's first four-and-a-half years, customers received approximately 19,000 efficient refrigerators, 7,000 efficient freezers and 234,000 compact fluorescent light bulbs.¹¹⁴ From April 2004 through March 2005, EPP improved the energy efficiency of more than 10,000 households.¹¹⁵ The typical home heated by electricity reduced energy use by 11 to 12 percent.¹¹⁶ Average net savings were 1,615 kWh for high-use customers and 697 kWh for moderate-use customers. Total electricity and natural gas improvements saved low-income households \$75 to \$265

per year on their utility bills, depending on their level of energy use. The efficiency measures continue to pay dividends over the life of the measures, saving consumers energy and money for as long as 20 years.

EPP services are available in every public utility service territory, funded by a small fee charged to all utility ratepayers. Benefits accrued to all electricity consumers as the program added \$17.7 million to Ohio's economy in 2003.¹¹⁷ Ohio should consider expanding the program to ensure all low-income households receive energy efficiency assistance.

Efficiency Programs Help Businesses, Industry and Institutions Manage Energy Costs

Businesses and industries in Ohio can improve their competitiveness by managing their energy costs. And schools, hospitals, local governments and other institutions in Ohio can devote more resources to their core missions by keeping their energy bills in check. Energy efficiency programs can help to identify opportunities to save energy and finance improvements.

For example, a utility in Massachusetts works to reduce electricity costs for small business customers by encouraging the installation of energy-efficient equipment with free energy audits and financial incentives. New York offers a program that assists schools, hospitals, businesses, factories and local governments to incorporate energy-efficient design and install efficient equipment at the time of construction, when it is most cost-effective. Minnesota's largest electric utility helps businesses identify opportunities to reduce lighting costs and provides rebates to facilities that install energy-efficient lighting.

Connecticut provides technical and

financial assistance for businesses to replace outdated equipment with energy-efficient models. Wisconsin provides technical advice, training, information and financial incentives to promote energy efficiency in manufacturing and industrial processes. And California runs a highly visible consumer education campaign, promoting rapid reductions in energy demand to mitigate or prevent potential energy crises—preventing billions of dollars of lost productivity during power outages.

All of these efficiency programs reduce energy costs for individual businesses and institutions. At the same time, these programs provide benefits for all of society by reducing strain on energy infrastructure and preventing the need to invest in new energy facilities.

Helping Small Businesses Install Efficient Equipment

As a wholesale distributor of fresh flowers, Andy Hattub knows how important it is to keep flowers at the right temperature. Hattub manages Fall River Florist Supply in Fall River, Massachusetts—a business that depends on the ability to deliver cut flowers that are as fresh as possible.

The success of the business also depends on keeping costs down to remain competitive. Realizing that electricity is a major expense at the flower warehouse, Hattub turned to National Grid's Small

Small businesses that participate in the program typically see a 30 percent reduction in energy use.

Business Services Program for help with reducing energy costs.

National Grid, an electric utility servicing parts of Massachusetts, identified the facility's cooling system as a good place to find potential energy savings. Program staff advised Hattub to install energy-efficient cooler controls and then provided \$21,559 to help pay for the upgrade. With the efficient controls, Hattub conserves 52,094 kWh of electricity annually, saving \$4,584 in energy costs per year.¹¹⁸

The Small Business Services Program, run by National Grid, is aimed at reducing electricity costs for small business customers by encouraging the installation of energy efficient equipment.¹¹⁹

Small businesses are often reluctant or unable to pay the up-front costs of energy efficiency improvements, even if they make financial sense in the long term.¹²⁰ To overcome market barriers preventing the spread of energy-efficient technology, the Small Business Services Program offers:

- Free energy audits;
- Financial incentives for the installation of efficient equipment, totaling up to 70 percent of the installation cost;
- Further incentives, including interest-free financing for the remaining 30 percent of the installation cost for 24 months, or a 15 percent discount if payment is made in one lump sum.¹²¹

The program offers a variety of cost-cutting, energy-saving equipment, including lighting upgrades, energy-efficient time clocks, photovoltaic cells for outdoor lighting, programmable thermostats and walk-in coolers.¹²²

National Grid's Small Business Services Program has been successful in promoting energy efficiency in a hard-to-reach market because it makes the process so easy for participating facilities: the program

performs the audit, makes recommendations, deals with the contractors and even cleans up the waste afterwards. Additionally, the Small Business Services Program has done an excellent job of pushing the latest technological improvements in efficiency and therefore remains vital after nearly 20 years in operation.

Since the program's inception in 1989, it has worked with 40,000 participants, cumulatively saving more than 160 million kWh of electricity (equivalent to the needs of more than 16,000 Ohio homes in one year).¹²³ Participating small businesses typically see a 30 percent reduction in energy use, cumulatively saving more than \$30 million on electricity bills.¹²⁴

The program is extremely cost-effective. National Grid achieved these savings with an investment of less than \$7 million—with benefits exceeding costs by more than 400 percent.¹²⁵

The project has been so effective in delivering energy savings that after utilities in Massachusetts deregulated in 1998, policymakers continued to invest in it. The Massachusetts Legislature established a systems benefit charge, which utility customers pay on their utility bills, to fund energy efficiency programs in the state—such as National Grid's Small Business Services Program.¹²⁶

The program provides tangible benefits for participating businesses and for Massachusetts as a whole. By conserving electricity, the program helps maintain the reliability of the electricity system, protecting customers against price spikes, and reducing electricity costs statewide.

Building and Expanding with Energy Smart Design

Hendy Avenue Elementary School in Elmira, New York, was originally built in 1929. Recently, administrators found that the facility was becoming outdated and was no longer large enough to meet the needs of the school district. Administrators

decided to renovate the existing building and build a 46,700 square foot addition.

Hendy Avenue administrators realized that the construction project presented a good opportunity to improve the energy efficiency of the school, reducing energy costs and making more money available for the core mission of the school: education. They applied for design and construction assistance from the New York State Energy and Research Development Authority (NYSERDA), which operates a New Construction Program aimed at improving building energy efficiency.

New Construction Program staff evaluated construction plans and identified cost-effective energy efficiency improvements. Staff recommended that the school install a high-efficiency system for heating, ventilating and cooling the building; premium efficiency pumps and motors; and low-energy fluorescent lighting and automatic controls.

The New Construction Program then provided financial incentives to the school district for these improvements, totaling \$58,907. The improvements reduced the school's energy consumption by 155,000 kWh of electricity per year and save the school \$21,622 annually—roughly equivalent to the salary of a part-time teacher.¹²⁷

The Energy Smart New Construction Program provides assistance to schools, hospitals, offices, retail centers, local governments and other institutional or commercial energy users across New York.

During the design phase, the New Construction Program provides technical advice on energy-saving opportunities and designs. The program covers the first \$5,000 in technical assistance costs, then half of all additional costs up to \$100,000. As the building is being designed, the program rewards designers according to the number of kWh the building will save, up to a maximum reward of \$15,000.

During construction, the New Construction Program provides monetary

The improvements save the school \$21,622 annually—roughly equivalent to the salary of a part-time teacher.

incentives to acquire energy-efficient technology. The program also offers incentives for buildings that meet Leadership in Energy and Environmental Design (LEED) standards, which include minimum requirements for energy efficiency.¹²⁸ Additionally, the program offers the ongoing advice of trained architects and engineers hired by NYSERDA.¹²⁹

Between July and December 2006 alone, the Energy Smart Focus Program assisted with 550 commercial or institutional construction projects.¹³⁰ Since 2002, the broader Energy Smart program has saved consumers \$198 million and created 4,200 jobs.¹³¹

The Energy Smart New Construction Program is supported by a systems benefit charge paid by utility customers in the state. The charge equals approximately 1.4 percent of each utility's 2004 revenue.¹³² New York's Public Service Commission created the systems benefit charge in 1998, in order to ensure that energy efficiency programs continued during and beyond the state's transition to a restructured electricity market. Money raised through the charge supports a portfolio of 38 programs, including the New Construction Program, that work to overcome market barriers and stimulate demand for energy-efficient products and services. As a result, Energy Smart serves to make energy more affordable and reliable for all New Yorkers.

Cutting Energy Costs through Highly Efficient Lighting

Caterpillar Paving Products, Inc. manufactures heavy duty vehicles for road construction at a facility in Minneapolis, Minnesota. At the facility, more than 500 employees work in two 10-hour shifts to cut and assemble parts into huge vehicles. Within the manufacturing facility, the lights are almost always on.

When facility managers learned about the availability of high-efficiency overhead lighting systems that could reduce electricity and maintenance costs, they became interested in a lighting upgrade for the facility. The fact that Xcel Energy, the regional electric utility, offered a rebate to help fund the lighting upgrade, made the deal too good to pass up.¹³³

Working with the Lighting Efficiency Program of Xcel Energy, Caterpillar Paving Products replaced more than 950 lighting fixtures with highly efficient T8 fluorescent lamps. Xcel provided a rebate of \$34,000, equivalent to about 20 percent of the overall project cost.¹³⁴

The benefits were immediately apparent. The new lighting reduced electricity consumption at the factory by about 45 percent, while providing equivalent or better lighting. The upgrade reduced annual electricity consumption by 1.5 million kWh

annually and reduced peak electricity demand by more than 0.17 MW.¹³⁵

Electricity savings translate directly into cost savings. The upgrade cut \$80,000 off of the facility's annual electricity bill. Additionally, the new lamps save \$14,000 per year in reduced maintenance costs. The lamps also emit less heat, reducing the need for air conditioning on hot summer days, providing further savings. With the rebate from Xcel, the project paid for itself in under a year and a half.¹³⁶

For most businesses, lighting is a major expense, accounting for up to 44 percent of monthly energy costs.¹³⁷ Improving lighting efficiency, however, is one of the easiest and most cost-effective ways of reducing these costs. To address this, in 1985 Xcel Energy of Minnesota established its Lighting Efficiency Program.

Lighting Efficiency is a conservation program directed at commercial and industrial energy customers. Through the program, Xcel Energy provides rebates to commercial and industrial facilities that purchase and install qualifying lighting equipment, including fluorescent lamps, compact fluorescent fixtures and LED signs.¹³⁸ In addition, Lighting Efficiency provides rebates on lighting retrofits to upgrade aging facilities, and funds lighting redesign studies that help businesses assess ways that they can reduce their lighting costs.¹³⁹

The Lighting Efficiency program is funded through the state of Minnesota's public benefits fund, which requires that Xcel spend 2 percent of its gross operating revenue on energy efficiency programs.¹⁴⁰ To support the program, Xcel ratepayers pay a Conservation Improvement Program fee.

The average facility that works with Xcel's Lighting Efficiency program reduces its energy costs by 35 percent annually.¹⁴¹ From 2001 to 2003, the Lighting Efficiency program spurred energy savings of over 200 million kWh—enough energy to power nearly 21,000 Ohio

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homes for a year. The lighting program saved participants nearly \$16 million over the period, with savings continuing for up to a decade or more. Over the same time period, Lighting Efficiency's budget cost was only \$12.2 million, making the program extremely cost effective.¹⁴²

Xcel Energy's Lighting Efficiency program is one of the best of its kind because it reaches out to businesses and industries who might be unaware of the cost savings potential of efficient lighting.

The resultant energy savings are not just a boon to businesses, but also to Minnesota as a whole. The lighting efficiency program helps to reduce the need to operate expensive power plants during periods of high electricity demand. The program also helps to reduce the need to build new power plants and transmission lines by conserving scarce resources. As a result, the lighting efficiency program delivers results for all energy customers, even those who do not participate directly.

Upgrading Industrial Facilities with Efficient Equipment

Schick-Wilkinson Sword manufactures razor blades and component parts for shaving systems at a production facility in Milford, Connecticut. The factory has been operating since the 1950s.

In 2006, Tony Sanzo, plant supervisor, was working to replace aging equipment at the facility while minimizing costs. Through the plant's electric distribution company, United Illuminating, Sanzo discovered that the Connecticut Energy Opportunities Program was available to help.

The Connecticut Energy Opportunities Program helped Sanzo identify outdated equipment that could be replaced with highly efficient alternatives, reducing energy and maintenance costs. The air conditioning system at the facility turned out to be a major energy sink. United Illuminating staff recommended that Schick replace the system with a smaller but more

efficient and equally effective model.

The Connecticut Energy Opportunities Program provided more than \$130,000 in incentives to help replace the air conditioning system. The upgrade saves Schick about \$16,000 per year in electricity costs, reducing consumption by about 143,000 kWh per year.¹⁴³

The Schick factory represents just one of many Connecticut industries that have realized energy and dollar savings through the Energy Opportunities Program. The program, a combined effort of United Illuminating, Connecticut Light & Power, and the Connecticut Energy Efficiency Fund, offers incentives for companies willing to replace existing equipment (with at least 25 percent of its useful life remaining) with high-efficiency alternatives.¹⁴⁴ Equipment ranging from motors to chillers to carbon dioxide controls is eligible.

The Energy Opportunities Program provides generous incentives, paying for up to 100 percent of the incremental cost of a project. Funding for the program derives from a conservation surcharge on Connecticut consumers' electricity bills, allocated for energy efficiency projects through the Connecticut Energy Efficiency Fund.

The Connecticut Legislature created the energy efficiency funding system in 1998. Since then, the results have been dramatic. From 2000 through 2006, the Connecticut Energy Efficiency Fund helped install efficiency measures that will

Efficiency measures
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\$4 in savings for
every \$1 spent.

yield 27 billion kWh in lifetime electricity savings—enough to power more than 2.8 million Ohio homes for a year.¹⁴⁵ Program managers estimated that efficiency measures installed in 2006 will yield \$4 in savings for every \$1 spent.¹⁴⁶

The benefits of the program extend beyond consumer savings. Connecticut's energy efficiency programs also enhance the reliability of Connecticut's electricity system and reduce the cost of generating and delivering electricity statewide.

Designing Energy-Efficient Industrial Processes

American Foods Group processes meat products for distribution at its packing plant in Green Bay, Wisconsin. The facility uses a great deal of electricity to power meat processing equipment, to keep meat cool in refrigeration rooms and to keep the facility well lit.

In recent years, American Foods Group has been hit hard by increased energy costs. Since 1999, Wisconsin industrial electricity prices have risen by nearly 40

percent, and natural gas prices more than doubled.¹⁴⁷ By 2005, the company was searching for simple and quick strategies to contain its rapidly rising energy costs.

Fortunately, American Foods Group was able to turn to Wisconsin's Focus on Energy Program for help. Focus on Energy offers technical and financial assistance to businesses and homeowners seeking to reduce energy use or develop small-scale renewable energy installations. Focus on Energy staff helped American Foods Group plan, implement and manage 16 different energy-saving projects. The company spent \$74,000 to purchase and install more efficient technology and adjust operations to improve efficiency. In the first year after the projects were completed, the company saved more than \$140,000 on energy—paying off the initial investment in just six months.

Based on its initial success, the company plans to implement 11 more projects to improve efficiency, estimated to save the company an additional \$900,000 per year.¹⁴⁸

Focus on Energy was created by the Wisconsin Legislature in 1999.¹⁴⁹ The state requires investor-owned electric and natural gas utilities to invest 1.2 percent of their annual revenues into a public benefits fund for energy efficiency, renewable energy and low-income household assistance programs.¹⁵⁰ A portion of the money is managed by Focus on Energy, an independent organization, to help individuals and industries across Wisconsin, like American Foods Group, realize energy savings. Focus on Energy offers a variety of levels of assistance, including:

- Advisors, who help companies evaluate existing systems, identify opportunities for greater efficiency and guide project implementation and management;
- Training company employees in practices for improved efficiency;

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the projects were
completed, American
Foods Group saved
more than \$140,000
on energy—paying off
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in just six months.

- Information and tools to educate companies on best practices and to help evaluate energy use;
- Generous rebates and financial incentives to help defray the cost of installing energy-saving equipment.

While assisting individual businesses, Focus on Energy helps to conserve limited resources and maintain the reliability and reasonable cost of the electricity and natural gas systems statewide. Overall in 2006, Wisconsin businesses saved over \$17.7 million by participating in Focus on Energy industrial and commercial programs, which represented energy savings of 111.6 million kWh of electricity and 9.7 million therms of natural gas.¹⁵¹ The savings account for 0.4 percent of Wisconsin's total industrial electricity use and 0.8 percent of its industrial natural gas use during the year.¹⁵²

Savings through Focus on Energy are extremely cost-effective compared to delivering new sources of electricity or natural gas. The program saves electricity at a cost of about 3 cents per kWh—compared to an average retail cost of electricity in 2005 of 7.5 cents per kWh.¹⁵³ On the natural gas front, the program yields savings at about 18 cents per therm, while in 2005, delivery of natural gas cost at least 81 cents per therm.¹⁵⁴

The dollar savings created by Focus on Energy translate into jobs and a stronger economy. The Public Service Commission of Wisconsin estimates that over a period of 25 years, Focus on Energy programs will create at least:¹⁵⁵

- 60,000 person-years of employment,
- \$4 billion in additional disposable income for Wisconsin citizens,
- \$9 billion in additional sales for Wisconsin businesses, and

- \$5 billion in added value for the state economy.

By helping businesses achieve energy savings, Focus on Energy reduces strain on Wisconsin's energy infrastructure—delivering savings at the lowest cost of any available energy resource and helping to grow the state economy.

Energy Efficiency Can Help Avert an Energy Crisis

Energy efficiency programs can deliver rapid results. Through widespread consumer education, efficiency programs can deliver rapid changes in conservation behavior. At the same time, efficiency programs lay the foundation for long-term changes in the way consumers think about energy use.

Saving Energy Quickly to Prevent Rolling Blackouts

In 2000 and 2001, the California energy crisis forced businesses and residents statewide to accept rolling blackouts—power outages that brought the economy and day-to-day life to a halt.

To bring the electric grid back into working order, policymakers needed to reduce energy demand quickly—on a scale of months rather than years. To address the issue, they devised a program to educate the public on the need to work together to conserve electricity. The “Flex Your Power” campaign was born. Within 12 months, electricity demand declined by 14 percent—equivalent to the output of 10 large power plants (5,900 MW in total).¹⁵⁶

The Flex Your Power program is focused on educating Californians on how to use energy and resources more efficiently. To reach this goal, Flex Your Power operates a comprehensive Web site; publishes an electronic newsletter and blog, as well

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as a variety of educational materials; and runs a highly visible television and radio campaign.

Flex Your Power educates Californians about opportunities to save energy in their homes, from adjusting the thermostat to improving insulation.¹⁵⁷ Additionally, Flex Your Power offers information on how to obtain rebates and incentives for energy-efficient appliances and services.¹⁵⁸

The program is best known in California for its ubiquitous television, radio and newspaper advertisements that emphasize the efficient use of power. Messages of past Flex Your Power media campaigns highlight the need for collective action, including, "Conserve, and it's not even hard," "Together we can get through this" and "Global warming is a choice." These campaigns have achieved an overwhelmingly positive reaction and brand identification with the state's residents.¹⁵⁹

Flex Your Power's media campaigns have been quite successful in educating the public on the benefits of energy efficiency: following the roll-out of the

television, newspaper, and radio advertisements, more people believed conservation can solve an energy crisis. Moreover, people who were aware of the Flex Your Power campaign were more likely to take active steps to conserve energy.¹⁶⁰

Energy efficiency measures, including the Flex Your Power campaign, have yielded huge energy and cost savings for residents of California. Since Flex Your Power's inception, per-capita energy use has dropped by more than 6 percent, ranking California among the top five most energy-efficient states nationwide.¹⁶¹ Energy savings in 2001 alone saved Californians an estimated \$660 million on their electricity bills, and helped avoid up to \$20 billion in projected costs of summertime blackouts.¹⁶² Estimates suggest that every dollar that California invests in energy efficiency will generate more than two dollars in consumer savings.¹⁶³

The Flex Your Power campaign is funded through California's Public Goods Charge, in which utilities charge ratepayers a 1 percent surcharge on their electric utility bills, which is pooled and spent on services and programs in the public interest.¹⁶⁴

California's Flex Your Power campaign is one of the country's best public education programs on energy conservation and efficiency because it is broad in scope, has a simple and accessible message and is well funded. As a result, the program, and others like it, has been able to transform California from a state mired in an energy crisis to a leader in energy efficiency. Citizens who take the Flex Your Power message to heart and work to reduce their energy use not only save money—they ensure the reliability and reasonable cost of the electricity and gas infrastructure for all Californians in the years to come.

Policy Recommendations

Efficiency programs are the quickest and cheapest way to address Ohio's energy problems. By creating new and expanded energy efficiency programs, Ohio can reduce its overall demand for electricity. All energy customers in the state can benefit, whether they participate directly in an efficiency program or not.

Many states' energy efficiency programs have resulted in savings equal to a large coal-fired or nuclear power plant. Ohio's aging energy infrastructure includes two nuclear facilities, and numerous coal-fired power plants that fail to meet national air pollution standards. Through energy efficiency, Ohio can reduce our reliance on these polluting and archaic power plants and pave the way for a cleaner energy future with more energy generation from renewable energy resources. At the same time, Ohio can reduce the need to operate the most expensive power plants during periods of high demand, reducing energy costs statewide. And spending less money on electricity, much of it generated using coal purchased from out of state, means more money remains in Ohio to support local jobs and businesses.

Reducing the need for electricity

generation also will lower global warming pollution, helping Ohio to limit its total emissions and begin to do its part to avoid the worst impacts of global warming. Generating less power also means air quality should improve, making the air safer to breathe for millions of Ohioans.

Overall, energy efficiency can deliver concrete results for Ohio homeowners, businesses, industries, local governments and civic institutions. By reducing energy waste in buildings and infrastructure, energy efficiency programs can deliver substantial energy savings.

To capture its potential for energy efficiency and reap the full benefits of efficiency, Ohio should create a comprehensive energy program.

The first step is for the PUCO to maintain adequate oversight over utilities' efficiency programs to ensure the state is on track to achieve a major reduction in energy use each year leading up to 2025. Ohio's four investor owned utilities—American Electric Power (which includes Columbus Southern Power and Ohio Power), FirstEnergy (parent company to Ohio Edison, Toledo Edison and

Cleveland Electric Illuminating), Duke Energy and Dayton Power and Light—must propose efficiency programs in their energy rate plans for review and approval by the PUCO. The rate plans justify how much money the utilities will invest in their energy efficiency programs to obtain a given amount of efficiency savings. The PUCO should adhere to the following principles in implementing the programs:

- Utilities' energy efficiency programs must begin with the most cost-effective efficiency opportunities, allowing them to deliver sizeable results at the lowest cost.
- All customers should participate in funding the energy efficiency effort, and programs should be aimed at all customer classes—residential, commercial and industrial.
- To ensure that the utilities have developed the most effective energy efficiency programs for each area of the state, the PUCO should require utilities to engage in a collaborative stakeholder process. This type of proceeding allows for all categories of energy users to weigh in with their ideas for the types of programs that would be the most useful for them.
- In addition to the annual reports that utilities are required to file reporting their progress on improving efficiency, the state should hire independent auditors who have no involvement with program implementation to review the utilities' programs and to ensure program integrity.
- Utilities and energy users should be fairly compensated for their investments in energy efficiency. Regulators should reward utilities for going beyond the requirements, and

penalize utilities if they fall behind. Also, regulators should require utilities to deploy the most cost-effective energy efficiency measures first, ensuring the best results for the investment.

Ohio should create an energy efficiency goal aimed at reducing consumption of natural gas.

- Though some of the programs highlighted in this report address both electricity and natural gas use, energy efficiency programs specifically targeted at conserving natural gas can help to achieve even greater reductions in natural gas prices and insulate consumers from price spikes. As domestic supplies of natural gas decline in the future, natural gas efficiency programs will become an essential part of Ohio's energy infrastructure. Gas savings can also help to reduce electricity prices, since at periods of peak demand, electricity prices are determined largely by the cost of natural-gas-fired generation.
- Ohio should require natural gas utilities to implement energy efficiency programs to capture all cost-effective efficiency potential.

To support the measures above, Ohio should:

- Require all new construction to meet increasing energy efficiency performance standards, reducing energy consumption by 30 percent in the near term and aiming for net zero-energy buildings by 2030.
- Require all buildings that are up for sale to receive an energy audit and disclose this information to prospective buyers. This information would allow potential buyers to

include the efficiency of a building and the potential energy savings or costs into their buying decision.

Finally, the state should ensure that skilled workers are available to carry out energy efficiency tasks. By establishing a robust energy efficiency effort, Ohio will be creating a large demand for

skilled workers to carry out the necessary tasks to improve energy efficiency, from home weatherization to industrial process optimization. The state should support current workforce training programs and help create additional workforce training programs around the state to ensure that enough skilled workers are locally available to get the job done.

Notes

1. U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), downloaded from www.eia.doe.gov, 19 September 2008.
2. U.S. Department of Energy, Energy Information Administration, *Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, May 2008 and 2007*, 16 September 2008, DOE/EIA-0226 (2008/07) Table 5.6.A.
3. See note 1.
4. Electricity prices from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), downloaded from www.eia.doe.gov, 19 September 2008. Population estimates from Census Bureau, *Population Estimates, Population change and estimated components of population change: April 1, 2000 to July 1, 2007* (NST-EST2007-alldata), downloaded from www.census.gov/popest/datasets.html, 18 September 2008.
5. See note 1.
6. Ibid.
7. Ibid.
8. Ibid.
9. D. Hopey, "Coal Price Soars, Electric Rates Close Behind: Price on Spot Market Has Quadrupled Since 2000," *Pittsburgh Post-Gazette*, 27 July 2008.
10. U.S. Department of Energy, Energy Information Administration, *State Electricity Profiles 2006*, November 2007.
11. Ibid.
12. Ibid.
13. Ohio Gross State Product is \$440 billion: Northeast Midwest Institute, *Total Gross State Product by State: 2001-2005*, 19 January 2007.
14. U.S. Department of Energy, Energy Information Administration, *Cost and Quality of Fuels for Electric Power Plants*, 23 October 2007, Table 15.A.
15. Assuming 71 percent of coal purchases are from other states. Total expenditures on coal in 2005 were \$2.4 billion, from U.S. Department of Energy, Energy Information Administration, *State Energy Consumption, Price and Expenditure Estimates*, 29 February 2008. Table 1: Energy Price and Expenditure Estimates by Source, 1970-2005, Ohio.
16. See note 14.
17. See note 10.
18. Based on comparison of carbon dioxide emissions presented in U.S. Department of Energy, Energy Information Administration, *State Electricity Profiles 2006*, November 2007.
19. U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2006*, November 2007.

20. See note 10.
21. Ibid.
22. Ibid.
23. U.S. Environmental Protection Agency, *8-Hour Ozone Nonattainment Areas*, 15 August 2008.
24. M. Gilmour, et al., "Ozone-Enhanced Pulmonary Infection with *Streptococcus Zooepidemicus* in Mice: The Role of Alveolar Macrophage Function and Capsular Virulence Factors," *American Review of Respiratory Disease* 147: 753-760, 1993; I. Mudway and F. Kelley, "Ozone and the Lung: A Sensitive Issue," *Molecular Aspects of Medicine* 21: 1-48, 2000.
25. W. McDonnell, et al., "Pulmonary Effects of Ozone Exposure During Exercise: Dose-Response Characteristics," *Journal of Applied Physiology* 5: 1345-1352, 1983.
26. A. Galizia, et al., "Long-Term Residence in Areas of High Ozone: Associations with Respiratory Health in a Nationwide Sample of Nonsmoking Young Adults," *Environmental Health Perspectives* 107: 675-679, 1999.
27. U.S. Environmental Protection Agency, *Health Effects of Ozone in the General Population*, downloaded from www.epa.gov/03healthtraining/population.html, 29 September 2008.
28. R. McConnell, et al., "Asthma in Exercising Children Exposed to Ozone: A Cohort Study," *The Lancet* 359: 386-391, 2002.
29. D. Bates, "Ambient Ozone and Mortality," *Epidemiology*, 16(4): 427-429, July 2005.
30. U.S. Environmental Protection Agency, *Particulate Matter (PM-2.5) Nonattainment Area Counties*, 15 August 2008.
31. H. Bunn, et al., "Ultra-fine Particles in Alveolar Macrophages from Normal Children," *Thorax* 56: 932-934, 2001.
32. J. Pekkanen, et al., "Daily Variations of Particulate Air Pollution and ST-T Depressions in Subjects with Stable Coronary Heart Disease: The Finnish ULTRA Study," *American Journal of Respiratory Critical Care Medicine* 161: A24, 2000.
33. W.J. Gauderman, et al., "The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age," *The New England Journal of Medicine* 351: 1057-67, 9 September 2004.
34. C. Pope, et al., "Lung Cancer, Cardiopulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution," *Journal of the American Medical Association* 287: 1132-1141, 2002.
35. See note 23.
36. Ibid.
37. American Lung Association, *State of the Air: 2007*, May 2007.
38. U.S. Environmental Protection Agency, *Particulate Matter (PM-2.5) Nonattainment Area Counties*, 15 August 2008.
39. See note 37.
40. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2003*, 7 September 2004, Table 1.1.
41. U.S. Department of Commerce, Bureau of Economic Analysis, *National Economic Accounts: Gross Domestic Product*, downloaded from www.bea.doc.gov/bea/dn/home/gdp.htm, 2 March 2005.
42. In constant 2000 dollars. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2006*, June 2007, Table 1.5: Energy Consumption, Expenditures, and Emissions Indicators, 1949-2006.
43. U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2005*, 1 October 2007.
44. Ibid.
45. R. Pollin and J. Wicks-Lim, Political Economy Research Institute, University of Massachusetts, Amherst, *Job Opportunities for the Green Economy: A State-by-State Picture of the Occupations that Gain from Green Investments*, June 2008.
46. U.S. PIRG Education Fund, *Redirecting America's Energy: The Economic and Consumer Benefits of Clean Energy Policies*, February 2005.
47. J. A. Laitner and V. McKinney, American Council for an Energy-Efficient Economy, *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments*, June 2008.
48. R. Sedano, Regulatory Assistance Project, *Economic, Environment and Security Effects of Energy Efficiency and Renewable Energy: A Report for EPA and the New England Governors' Conference*, NEEP Policy Conference, 24 May 2005.
49. Optimal Energy, Inc. for Northeast Energy Efficiency Partnerships, *Economically Achievable Energy Efficiency Potential in New England*, May 2005.
50. H. Geller, et al., Southwest Energy

Efficiency Project, *The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest*, November 2002.

51. U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2008*, June 2008.

52. California Energy Commission, Electricity Analysis Office, *Levelized Cost of Electricity Generation by Resource Type*, 4 December 2007, available at www.energy.ca.gov/electricity/levelized_costs.html.

53. See note 19.

54. 2.5 million cars: Assuming a gallon of gasoline contains 19.6 pounds of carbon dioxide, that the typical vehicle is driven 12,000 miles per year and gets 22 miles per gallon. Total registrations in Ohio from U.S. Department of Transportation, Federal Highway Administration, Office of Highway Statistics, *Highway Statistics 2006*, December 2007.

55. A. M. Shipley and R. N. Elliott, American Council for an Energy-Efficient Economy, *Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?*, April 2006.

56. M. Kushler, American Council for an Energy-Efficient Economy, *The Midwest Energy Crisis and Why Energy Efficiency Must Be a Top Policy Priority* (presentation to the Council of State Governments, Midwestern Legislative Conference Annual Meeting), 28 August 2007.

57. M. Eldridge, et al., American Council for an Energy-Efficient Economy, *The State Energy Efficiency Scorecard for 2006*, June 2007.

58. Consortium for Energy Efficiency, *U.S. and Canada Energy Efficiency Budgets*, downloaded from www.cee1.org/ee-pe/2007/budgets-main.php3, 29 September 2008.

59. The PUCO approved the Duke settlement in Case No. 06-91-EL-UNC and the FirstEnergy companies' supplemental settlement in Case No. 05-1125-EL-ATA that together increased electric efficiency funding in the state to over \$100 million.

60. See note 58.

61. See note 47.

62. Ibid.

63. J. A. Laitner, et al., American Council for an Energy-Efficient Economy, *Energy Efficiency as an Investment in Ohio's Economic Future*, 1994.

64. American Council for an Energy-Efficient Economy, *Energy Efficiency Resource Standards (EERS) for Retail Electricity and Natural Gas*

Distributors, downloaded from aceee.org/energy/national/eers0908.htm, 3 October 2008.

65. Data on Ohio's historic electricity consumption comes from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), downloaded from www.eia.doe.gov, 19 September 2008. We then projected electricity consumption without any state investment in energy efficiency based on the growth rate for total electricity sales for the East North Central region as projected in U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2008*, June 2008. We adjusted the regional growth rate for Ohio's slightly lower population growth rate, per U.S. Census Bureau, Population Division, *Interim State Population Projections*, 2005.

66. Assuming a 1,000 MW facility operates with a 90 percent capacity factor.

67. American Municipal Power—Ohio, *American Municipal Power Generating Station—Project Overview*, downloaded from www.amp-ohio.org/pdf/baseload/ProjectOverview.pdf, 29 September 2008.

68. To calculate electricity consumption after investments in energy efficiency, we assumed that utilities implement efficiency programs that achieve savings each year as laid out in Table 1. The annual savings requirement was applied to a baseline of sales in the three previous years. For example, in 2010, savings were applied to the average sales from 2007 and 2008 (years in which no efficiency measures were required) and 2009 (a year in which consumption was slightly reduced thanks to efficiency requirements). We then multiplied consumption by the annual growth rate in electricity consumption for the East North Central region as projected in U.S. Department of Energy, Energy Information Administration, adjusted for Ohio's slightly lower population growth rate, per U.S. Census Bureau, Population Division, *Interim State Population Projections*, 2005.

69. 4 million Ohio homes: Assuming the typical Ohio household uses 9,600 kWh of power annually, per Public Utilities Commission of Ohio, *Ohio's Electricity Green Pricing Programs, Frequently Asked Questions*, updated 22 April 2008. Four 1,000-MW: Assuming a 1,000 MW facility operating with a 90 percent capacity factor.

70. Data on Ohio's historic electricity consumption comes from U.S. Department of Energy, Energy Information Administration, *Current*

and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector (Form EIA-826), downloaded from www.eia.doe.gov, 19 September 2008. We then projected electricity consumption without any state investment in energy efficiency based on the growth rate for total electricity sales for the East North Central region as projected in U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2008*, June 2008. We adjusted the regional growth rate for Ohio's slightly lower population growth rate, per U.S. Census Bureau, Population Division, *Interim State Population Projections*, 2005. To calculate electricity consumption after investments in energy efficiency, we assumed that utilities implement efficiency programs that achieve savings each year as laid out in Table 1. The annual savings requirement was applied to a baseline of sales in the three previous years. For example, in 2010, savings were applied to the average sales from 2007 and 2008 (years in which no efficiency measures were required) and 2009 (a year in which consumption was slightly reduced thanks to efficiency requirements). We then multiplied consumption by the annual growth rate in electricity consumption for the East North Central region, adjusted as described above for Ohio's slightly lower population growth rate.

71. New York State Energy and Research Development Authority, *Home Performance with ENERGY STAR®: Albany County*, downloaded from www.getenergysmart.org, 15 November 2007.

72. Ibid.

73. Dollar, energy and water savings from New York State Energy and Research Development Authority, *ENERGY STAR® Qualified Appliances and Lighting*, downloaded from www.getenergysmart.org, 15 November 2007.

74. New York State Energy and Research Development Authority, *New York Energy Smart Loan Fund Program* (brochure), 17 September 2007. Available from www.nyserda.org/loan-fund/loanfundbrochure05.pdf.

75. Number of homes built and upgraded from New York State Energy and Research Development Authority, *New York Energy Smart Program Evaluation and Status Report: Year Ending December 31, 2006*, March 2007, 4-10. Annual per-household savings calculated by dividing annual savings by number of participating households, from New York State Energy and Research Development Authority, *Programs that Work: Stretching Every Dollar to Keep Energy Affordable for New Yorkers*, 11 November 2005.

76. New York State Energy and Research Development Authority, *New York Energy Smart Program Evaluation and Status Report: Year Ending December 31, 2006*, March 2007, 4-9.

77. New York State Energy and Research Development Authority, *New York Energy Smart Program Quarterly Evaluation and Status Report: Quarter Ending September 30, 2007*, November 2007.

78. Ibid.

79. New York State Energy and Research Development Authority, *System Benefits Charge*, downloaded from www.getenergysmart.org, 28 November 2007.

80. North Carolina State University, "New York Incentives for Renewables and Efficiency: System Benefits Charge," *Database of State Incentives for Renewables and Efficiency*, 1 August 2007.

81. New York State Energy and Research Development Authority, "Total Market Effects Test," *New York Energy Smart Program Quarterly Evaluation and Status Report: Quarter Ending September 30, 2007*, November 2007.

82. S. Angelucci, "No Place Like Home: Energy Savers," *Atlantic City Weekly*, 9 December 2004.

83. Ibid.

84. New Jersey Clean Energy Program, *COOL Advantage: Program Overview*, downloaded from www.njcleanenergy.com, 19 November 2007.

85. Ibid.

86. New Jersey Board of Public Utilities, Office of Clean Energy, *New Jersey's Clean Energy Program: 2005 Annual Report*, 2006, 19.

87. Public Service Enterprise Group, *COOL Advantage Program (Residential Central Air Conditioner/Heat Pump Rebate)*, downloaded from www.pseg.com, 19 November 2007.

88. One Planet Living, *EcoDensity*, downloaded from www.oneplanetliving.org/northamerica/EcoDensity.pdf, 29 November 2007.

89. Number of participants and kWh savings from Note 86. Dollar savings calculated by multiplying kWh savings by price/kWh, using New Jersey average retail residential electricity price in 2005, from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), 22 October 2007.

90. American Council for an Energy-Efficient

- Economy, *Residential Air Conditioning Exemplary Program: Cool Advantage*, New Jersey Clean Energy Collaborative, downloaded from www.aceee.org/utility/2acoolcollabnj.pdf, 19 November 2007.
91. New Jersey Clean Energy Program, *Societal Benefits Charge (SBC)*, downloaded from www.njcleanenergy.com/main/about-njcep/societal-benefits-charge/societal-benefits-charge-sbc, 10 October 2008.
92. Assuming the typical Ohio household uses 9,600 kWh of power annually, per Public Utilities Commission of Ohio, *Ohio's Electricity Green Pricing Programs, Frequently Asked Questions*, updated 22 April 2008.
93. See note 86.
94. M. Kushler and E. Vine, American Council for an Energy-Efficient Economy, *Examining California's Energy Efficiency Policy Response to the 2000/2001 Electricity Crisis: Practical Lessons Learned Regarding Policies, Administration and Implementation*, March 2003.
95. American Council for an Energy-Efficient Economy, *Residential Lighting Exemplary Program: Upstream Residential Lighting Program*, downloaded from www.aceee.org/utility/6cpgereslight.pdf, 13 November 2007.
96. California Public Utilities Commission, *Program Funding*, downloaded from www.cpuc.ca.gov/PUC/energy/electric/Energy+Efficiency/EE+General+Info/ee_funding.htm, 10 October 2008.
97. C. A. Kuduk and S. J. Anders, Energy Policy Initiatives Center, *Following California's Public Goods Charge: Tracking Contributions and Expenditures of the Renewable Energy Program and the PIER Program*, September 2006.
98. G. B. Fernstrom, Pacific Gas & Electric, *Residential Lighting Programs: PG&E's Role and Perspective*, 19 June 2007.
99. See note 95.
100. Ibid.
101. Ibid.
102. E-mail correspondence with Emily Behr, Senior Project Manager for Customer Energy Efficiency, Pacific Gas and Electric, 29 November 2007.
103. Ibid.
104. Efficiency Vermont, *Vermont ENERGY STAR Homes*, downloaded from www.efficiencyvermont.com, 30 November 2007.
105. U.S. Environmental Protection Agency, *Energy Star Homes Account for More Than 12 Percent of New Housing Construction in 15 States—Energy Efficient Homes Continue to Produce Savings* (press release), 12 July 2007.
106. Efficiency Vermont, *Vermont ENERGY STAR Homes – Incentives*, downloaded from www.efficiencyvermont.com, 30 November 2007.
107. Efficiency Vermont, *Here's How We Can Help*, downloaded from www.efficiencyvermont.com, 30 November 2007.
108. Number of participants from Efficiency Vermont, *Year 2006 Annual Report and Annual Energy Savings Claim*, October 2007, 52. Percent of new home construction based on 2,626 housing permits granted in 2006. From United States Census Bureau, *New Privately Owned Housing Units Authorized Unadjusted Units for Regions, Divisions, and States*, 2006.
109. Efficiency Vermont, *Year 2006 Annual Report and Annual Energy Savings Claim*, October 2007, 52.
110. Ibid.
111. Vermont Energy Investment Corporation, *Efficiency Vermont*, 2004.
112. M. Power, Economic Opportunity Studies, *The Burden of FY 2008 Residential Energy Bills on Low-Income Consumers*, 20 March 2008.
113. Ohio Department of Development, *Universal Service Fund Electric Partnership Program*, www.odod.state.oh.us/CDD/OEE/USFTEE-Main.htm, 10 October 2008.
114. D. York, M. Kushler and P. Witte, American Council for an Energy-Efficient Economy, *Compendium of Champions: Chroniding Exemplary Energy Efficiency Programs from Across the U.S.*, February 2008.
115. M. Blasnick, Michael Blasnick & Associates, for the Ohio Office of Energy Efficiency, *Ohio Electric Partnership Program Impact Evaluation*, 30 June 2006.
116. Ibid.
117. Quantec, for the Ohio Office of Energy Efficiency, *Ohio Home Weatherization Assistance Program Impact Evaluation*, 6 July 2006.
118. National Grid, *Cut Your Energy Costs: We Reduced the Bottom Lines for Our Businesses*, downloaded from www.nationalgridus.com/non_html/shared_small_business_brochure.pdf, 16 November 2007. Small business is defined as business customers with an average electricity consumption of 200 kilowatts or less per month.

119. National Grid, *Small Business Program*, downloaded from www.nationalgridus.com/masselectric/business/energyeff/3_small.asp, 16 November 2007.
120. American Council for an Energy-Efficient Economy, *Small Commercial Exemplary Program: Small Business Services Program*, National Grid, April 2003.
121. See note 119.
122. Ibid.
123. National Grid, *2006 Energy Efficiency Annual Report*, August 2007.
124. National Grid, *2006 Energy Efficiency Annual Report*, August 2007, and National Grid, *Cut Your Energy Costs: We Reduced the Bottom Lines for Our Businesses*, downloaded from www.nationalgridus.com/non_html/shared_small_business_brochure.pdf, 16 November 2007. Small business is defined as business customers with an average electricity consumption of 200 kilowatts or less per month.
125. See note 123.
126. North Carolina State University, "Massachusetts Incentives for Renewables and Efficiency: Energy Efficiency Fund," *Database of State Incentives for Renewables and Efficiency*, 8 September 2007.
127. New York State Energy and Research Development Authority, *New Construction Program: Elmira City School District*, downloaded from www.nyserda.org, 15 November 2007.
128. A LEED Green Building meets certain minimum standards in each of five categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, and indoor environmental quality. For more information on LEED Green Building standards, see U.S. Green Building Council, www.usgbc.org.
129. More information on Energy Smart school involvement program available at www.nyserda.org/Programs/schools/esmartschools.asp.
130. New York State Energy and Research Development Authority, *New York Energy Smart Program Evaluation and Status Report: Year ending December 31, 2006*, March 2007, 3-25.
131. New York State Energy and Research Development Authority, *New York Energy SmartSM Program*, 15 November 2007.
132. North Carolina State University, "New York Incentives for Renewables and Efficiency," *Database of State Incentives for Renewables and Efficiency*, 10 October 2008.
133. Xcel Energy, *Lighting Efficiency Case Study: Bright Idea: Upgrades at Manufacturing Facility Save Energy, Cut Costs, and Even Improve Productivity*, CSS#1813, January 2007.
134. Ibid.
135. Ibid.
136. Ibid.
137. Xcel Energy, *Lighting Efficiency: Save Money, Earn Rebates and Improve Lighting Quality*, download from www.xcelenergy.com, 16 November 2007.
138. American Council for an Energy-Efficient Economy, *Lighting Efficiency Excel Energy*, downloaded from www.aceee.org/utility/17xcelcommmn.pdf, 16 November 2007.
139. Xcel Energy, *Why a Lighting Redesign Study?*, April 2007.
140. Minnesota Department of Commerce, *Energy Utilities: Consumer Programs*, downloaded from www.state.mn.us/portal/mn/jsp/common/content/include/contentitem.jsp?contentid=536884782, 10 October 2008.
141. See note 153.
142. See note 138.
143. Incentive value and kWh savings from Energy Conservation Management Board, *Energy Efficiency: Investing in Connecticut's Future*, 1 March 2007, 22. Dollar savings calculated using average Connecticut industrial price per kWh in 2006, from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), 31 October 2007.
144. Connecticut Light and Power Company, *Energy-Efficient Service: Measure Lifetimes*, downloaded from www.cp-l.com, 30 November 2007.
145. Energy Conservation Management Board, *Energy Efficiency: Investing in Connecticut's Future*, 1 March 2007.
146. Ibid.
147. Average Wisconsin industrial electricity price in 1999 and 2006 from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), 31 October 2007. Average Wisconsin industrial natural gas price in 1999 and 2006 from U.S. Department of Energy, Energy Information Administration, *Wisconsin Natural Gas Industrial Price (Dollars per Thousand Cubic Feet)*, 31 October 2007.

148. Wisconsin Focus on Energy, *American Foods Group Finds Over \$1,000,000 in Low-Hanging Fruit*, 2007, 1.
149. State of Wisconsin, *Wisconsin Public Benefits Program Annual Report, July 1, 2005 to June 30, 2006*.
150. North Carolina State University, "Wisconsin: Focus on Efficiency Program," *Database of State Incentives for Renewables and Efficiency*, 8 August 2007.
151. See note 149.
152. Average Wisconsin industrial electricity price in 1999 and 2006 from U.S. Department of Energy, Energy Information Administration, *Current and Historical Monthly Retail Sales, Revenues, and Average Retail Price by State and by Sector* (Form EIA-826), 31 October 2007. Average Wisconsin industrial natural gas price in 1999 and 2006 from U.S. Department of Energy, Energy Information Administration, *Wisconsin Natural Gas Industrial Price (Dollars per Thousand Cubic Feet)*, 31 October 2007.
153. Focus on Energy performance: State of Wisconsin, *Wisconsin Public Benefits Program Annual Report, July 1, 2005 to June 30, 2006*; Retail electricity price: U.S. Department of Energy, Energy Information Administration, *State Electricity Profiles 2005 Edition*, DOE/EIA-0348, March 2007.
154. Ibid.
155. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2003*, 7 September 2004, Table 1.1.
156. Craig Canine, "California Illuminates the World," *On Earth Magazine*, Spring 2006.
157. Flex Your Power, *Upgrade Your Home*, downloaded from www.fypower.org/res/upgrade/, 12 November 2007.
158. Flex Your Power, *Rebates, Incentives and Services*, downloaded from www.fypower.org/res/tools/rgl.html, 12 November 2007.
159. American Council for an Energy-Efficient Economy, *Flex Your Power Campaign, State of California: California State and Consumer Services Agency, and Department of Consumer Affairs*, downloaded from www.aceee.org/utility/19aflexpowerca.pdf, 13 November 2007.
160. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Best Practices Benchmarking for State Energy Efficiency Programs*, 9 April 2007.
161. California Energy Commission, *U.S. Per-Capita Electricity Use By State*, 15 May 2006.
162. D. Bachrach, M. Ardema, A. Leupp, Natural Resource Defense Council, *Energy Efficiency Leadership in California: Preventing the Next Crisis*, April 2003.
163. See note 156.
164. C. A. Kuduk and S. J. Anders, Energy Policy Initiatives Center, *Following California's Public Goods Charge: Tracking Contributions and Expenditures of the Renewable Energy Program and the PIER Program*, September 2006.