

Building an Energy Efficient Arizona

Opportunities to Save Money
and Reduce Pollution



Building an Energy Efficient Arizona

Opportunities to Save Money
and Reduce Pollution

Arizona Public Interest Research Group
Education Fund

By William Scown, Jeannie Scown,
Ben Kitto and Diane E. Brown

Arizona PIRG
Education Fund

Summer 2010

Acknowledgments

The authors thank Dr. David Berry at Western Resource Advocates for his comments on earlier drafts. The authors also thank Travis Madsen and Elizabeth Ridlington from the Frontier Group and Johanna Neumann and Amy Gomberg for their work compiling information, including case studies, for the report.

The authors bear responsibility for any factual errors. The views expressed in this report are those of the authors and do not necessarily reflect the views of those who provided editorial review.

© 2010 Arizona PIRG Education Fund

About the Arizona PIRG Education Fund:

With public debate around important issues often dominated by special interests pursuing their own narrow agendas, the Arizona PIRG Education Fund offers an independent voice that works on behalf of the public interest. The Arizona PIRG Education Fund, a 501(c)(3) organization, works to protect consumers and promote good government. We investigate problem, craft solutions, educate the public, and offer Arizonans meaningful opportunities for civic participation.

For additional copies of the report:

Arizona PIRG Education Fund
130 N. Central Avenue, Suite 202
Phoenix, AZ 85004

(602) 252-9227 (phone)

(602) 252-9201 (fax)

info@arizonapirg.org

www.arizonapirg.org

*Cover Photos: Compact fluorescent bulb, Edelmar of iStockphoto.com; Money, Jake Levin; Electricity meter, Ken Kiser.
Layout: Harriet Eckstein Graphic Design*

Table of Contents

Executive Summary	1
Introduction	4
Arizona's Electricity Woes	6
Background	6
Energy Bills Are Rising	7
Importing Fuel Drains Money from Arizona's Economy	8
Arizona's Electricity System Contributes to Air Pollution that Damages Health	8
Arizona's Electricity System Contributes to a Dwindling Water Supply	11
The Role of Efficiency in Solving Arizona's Energy Challenges	13
The Benefits of Energy Efficiency	13
Cost Savings and Economic Growth	13
Reduced Costs for New Energy Facilities	14
Reduced Pollution	14
Arizona Is Rich in Potential Energy Savings	14
Examples of Energy Efficiency at Work	16
Efficiency Programs Help Homeowners Tap into Energy Savings Potential Within Their Homes	16
Replacing Outdated Appliances with Efficient Alternatives	17
Choosing Efficient Furnaces and Air Conditioners	18
Increasing the Use of Energy-Efficient Lighting	19
Building New Homes to Be Efficient from the Start	20
Helping Low-Income Families Cut Energy Costs	21
Efficiency Programs Help Businesses, Industry and Institutions Manage Energy Costs	22
Helping Small Businesses Install Efficient Equipment	23
Building and Expanding with Energy Smart Design	24
Cutting Energy Costs through Highly Efficient Lighting	25
Upgrading Industrial Facilities with Efficient Equipment	26
Designing Energy-Efficient Industrial Processes	27
Energy Efficiency Can Help Avert an Energy Crisis	28
Saving Energy Quickly to Prevent Rolling Blackouts	29
Policy Recommendations	31
Notes	33

Executive Summary

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

Arizona has seen its population grow at a rate of 3.3% per year on average from 2000-2006. Utilities in Arizona have forecasted that electricity demand will grow about 3.5% per year, compared to 2% for the nation. Peak demand for electricity doubled in 15 years between 1990 and 2005, from 8,000 MW to 16,000 MW; and is forecasted to double over the next twenty years, 2006-2025, from 16,000 MW to 32,000 MW. The increased peak demand for electricity is projected to require an additional 16,000 MW of resources, equivalent to approximately 32 large power plants.

The majority of energy sources Arizona uses today wreaks havoc on household budgets across the state, contributes to air pollution, and consumes scarce water resources. Residential electricity prices increased 9.8 percent from May 2007 to May 2008. Over a majority (70 percent) of electricity used in Arizona comes from coal-fired and natural gas-fired power plants. In addition, the natural gas burned in Arizona's power

plants is imported from other states, which results in Arizona spending nearly a billion dollars a year to import out-of-state energy resources rather than supporting local jobs and businesses.

The cleanest, cheapest and fastest way to reduce the use of dirty and dangerous energy sources is to use energy more wisely by improving efficiency. To meet the growing energy demands of the future at a price we can afford, the Arizona Corporation Commission and the Arizona state legislature must ensure that utilities establish and implement strong energy efficiency programs.

For guidance on how to move toward that new goal, Arizona 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. Arizona 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.
- 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

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

\$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 over 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 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 Arizona would reduce pollution by the same amount as taking one million cars off the road for a year.

Arizona 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 Arizona Corporation Commission 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 Arizona Corporation Commission 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 Arizona Corporation Commission could consider a more generous cost recovery rate for utilities. The cost of efficiency programs should be borne fairly by all types of users.
- Arizona should establish a comparable natural gas efficiency program to help reduce demand for natural gas.

Introduction

Arizona is sitting on a vast reserve of energy waiting to be used. This energy lies not in untapped oil reserves or new seams of coal waiting to be discovered, but in Arizona’s homes, businesses, institutions and industrial facilities. It is the wasted energy that is lost each day through leaky homes and inefficient appliances and equipment.

Arizona can tap into this resource through energy efficiency: getting more out of the energy we already use. Capturing the state’s energy efficiency potential could create jobs for Arizonans and keep more money in the state’s economy.

Improving efficiency includes weatherizing existing buildings, constructing better-sealed and better-designed new buildings, and replacing inefficient appliances and equipment. Tens of thousands of Arizonans—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.

Improved energy efficiency within Arizona could mean less consumer spending

on monthly utility bills, easing pressure on tight household budgets and giving Arizonans more money to spend locally. This, in turn, will help support local jobs and businesses.

Arizona has tremendous energy efficiency potential. When other states have looked for energy efficiency opportunities, they have found them in the residential, commercial, and industrial sectors. By deploying energy efficiency programs designed to capture these unused resources, other states are saving substantial amounts of electricity, reducing air pollution, saving consumers money, and improving their economies.

To offer Arizona 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 comprehensive statewide efforts to conserve energy. These programs deliver substantial, tangible benefits directly to individuals and businesses that participate and indirectly to energy customers statewide. By adopting

and implementing strong Energy Efficiency Standards, Arizona can reap these same benefits.

Arizona already has a skilled workforce and the technological know-how to reduce its energy consumption, insulate its

economy from price spikes and help put Arizona back on the right track. What Arizona needs now are effective programs with adequate funding to put its citizens' knowledge into action.

Arizona's Electricity Woes

Background

Arizona utilities have predicted that electricity demand will grow about 3.5 percent per year, compared to the 2 percent national average. Peak demand for electricity in Arizona doubled in fifteen years between 1990 and 2005, from 8,000 MW to 16,000 MW and is forecasted to double from 2006-2025, from 16,000 MW to 32,000 MW according to the Southwest Energy Efficiency Project. This increase will require an additional 16,000 MW of resources, equivalent to about thirty-two large power plants.

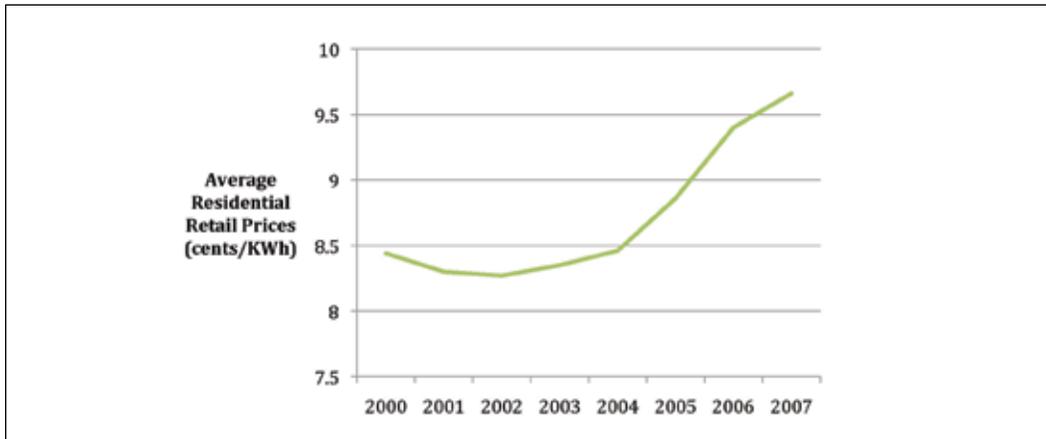
Two major, investor-owned utilities serve the state: Arizona Public Service Company (APS) and Tucson Electric Power Company (TEP). APS is the state's largest electric utility, serving more than one million customers. TEP serves nearly 375,000 customers in southern Arizona, and is a subsidiary of UNS Electric, which provides electric service to more than thirty Arizona communities. Salt River Project (SRP), a political subdivision of the state of Arizona, serves nearly one million customers in the Phoenix area. The remainder of Arizona is served by thirteen

electric cooperatives, and the state's natural gas needs are met by Southwest Gas and UniSource Energy Services.¹

Arizona's fossil fuel resources consist of coal deposits in the Black Mesa Basin, located in the northeast part of the state. Arizona imports natural gas from Texas and the Rocky Mountain region. The Palo Verde nuclear plant provides about 24 percent of Arizona's total electricity generation. Palo Verde is the nation's largest nuclear plant and has the second-highest rated capacity of any power plant in the United States. Hydroelectric power is provided by the Glen Canyon and Hoover Dams, located on the Colorado River in Northern Arizona.²

In Arizona, the water-energy link is critical. Electricity generation accounts for almost half the nation's water use, according to the U.S. Geological Survey. In particular, coal and nuclear-power plants have large water demands. Rapidly rising electricity consumption in Arizona has resulted in multiple problems, including growing costs for new capacity, increased air pollution and increased water consumption.

Figure 1. Arizona's Historical Residential Electricity Rates⁶



Energy Bills Are Rising

At the same time that the costs of cooling a home and driving a car have been rising, electricity bills have been going up for residential, commercial, and industrial users. 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 Arizona rose 13 percent.³ (See Figure 1). The residential cost of electricity for Arizonans increased 9.8 percent from May 2007 to May 2008.⁴ Cost increases have been continuous, and residential electricity use cost Arizonans 9.74 cents per kilowatt hour in 2009.⁵

In conjunction with rising rates, per capita electricity consumption in Arizona increased by 13 percent from 2000 to 2007.⁷ The net result is that Arizona consumers spent 59 percent more on electricity in 2007 than in 2000 (in total nominal dollars).⁸

Price increases in Arizona's commercial and industrial sectors have been similar to those for residential customers. Since 2000 in Arizona, residential rates have increased 14.5 percent, commercial rates have grown by 12.7 percent, and industrial rates have increased by 14.8 percent.⁹ (See Figure 2).

Figure 2. Arizona Per Capita Usage (megawatt hours/person)¹⁰

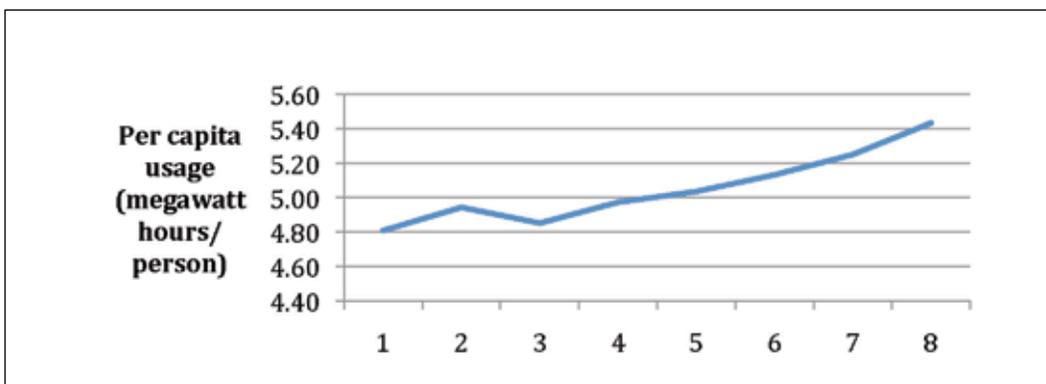
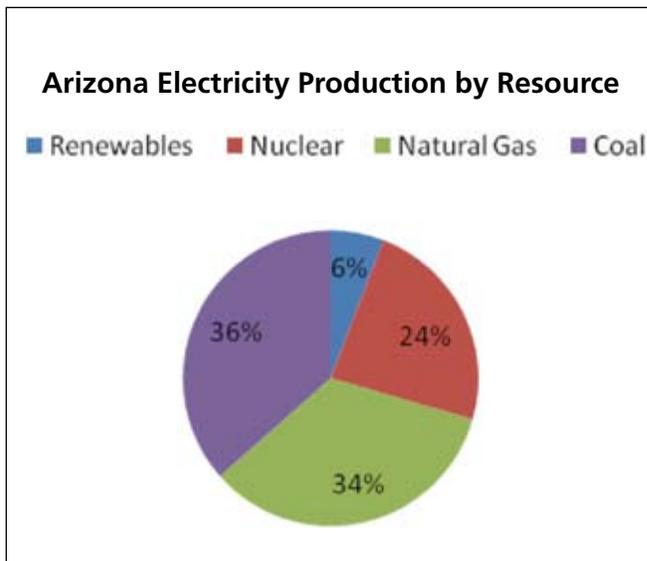


Figure 3. Most Electricity in Arizona Is Generated in Coal-Fired, Nuclear Power and Natural Gas-Fired Plants¹¹



While Arizona has maintained authority to review and regulate electricity prices, the cost of producing power continues to rise, indicating that consumers are likely to see higher prices in the years to come unless energy efficiency resources are increased. Arizona's two largest electric utilities have recently increased rates; however, in both instances, energy efficiency investments were also increased which should ultimately result in lower monthly bills for ratepayers which bodes well for their ratepayers. (See Figure 3).

Importing Fuel Drains Money from Arizona's Economy

Although Arizona mines produce coal to provide its electricity, the natural gas burned in Arizona for electricity generation is imported from other states. As a result, Arizona sends just under \$430 million annually to other states to purchase natural gas for its power plants.¹² With a

significant portion of Arizona's fuel supply coming from outside the state, energy expenses represent a significant drain on the state's economy.

In 2007, Arizonans spent \$6.6 billion on electricity for residential, commercial and industrial uses, the equivalent of 2.6 percent of Arizona's gross state product.¹³

Improving energy efficiency will reduce the amount of money that Arizona spends on fuel and increase funds available to support the local economy and jobs in Arizona.¹⁴

Arizona's Electricity System Contributes to Air Pollution that Damages Health

Electricity generation in Arizona produced 54.7 million metric tons of carbon dioxide in 2007, a reflection of Arizona's coal-fired and gas-fired power plants.¹⁵

One third of the Arizona's global warming pollution comes from the electric sector, making electricity generation a large contributor to the state's impact on global warming. (See Figure 4). The projected impacts of global warming in Arizona are wide-ranging and could significantly alter the state's economy, environment, and public health.

The leading cause of Arizona's high emissions from electricity generation is the state's reliance on coal-fired power plants. Currently, 34 percent of the electricity generated in Arizona is produced at coal-fired power plants.¹⁷ Less than 6 percent of Arizona's electricity comes from renewable energy resources.¹⁸ In generating one megawatt-hour of electricity, an average coal-fired power plant in Arizona produces 2,070 pounds of carbon dioxide.¹⁹ In contrast, a typical natural-gas-powered facility in Arizona releases

roughly 900 pounds of carbon dioxide in producing the same amount of electricity, while energy efficiency or energy from wind turbines and solar panels releases no carbon dioxide.

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

Smog (Ground-Level Ozone)

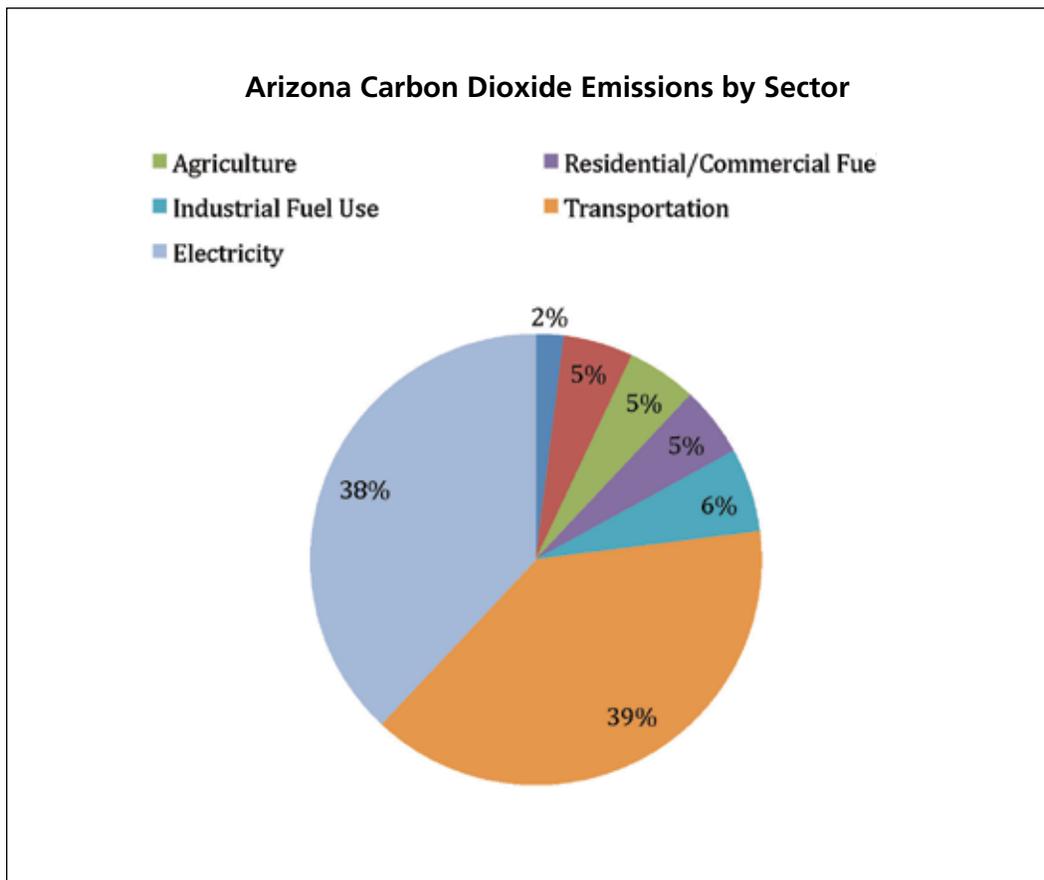
Smog results when a mixture of pollutants—including nitrogen oxides released by burning coal—reacts under intense sunlight to form ozone. A natural layer of ozone exists high in the atmosphere, absorbing ultraviolet radiation from the

sun, but ground-level ozone poses a significant threat to public health. When inhaled, ozone damages lung tissue and causes short-term swelling. With long-term exposure—even at low levels—ozone can cause irreversible damage.

Ozone makes lung tissues more sensitive to allergens and less able to ward off infections.²⁰ Children exposed to ozone pollution can develop lungs with less flexibility and capacity than normal. During high smog days, otherwise healthy people who exercise often cannot breathe normally.²¹

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

Figure 4. Arizona Carbon Dioxide Emissions by Sector¹⁶



- One study found that individuals raised in less polluted areas' lungs work better than schoolmates who grew up in polluted cities. A study of college freshmen revealed that those who lived for four or more years in a county with high ozone levels cannot breathe as well as freshmen from cleaner areas.²²
- Another study found exposure to ozone may cause asthma in children.²³ Children who exercise frequently in smoggy areas are three times more likely to develop asthma as children from cleaner parts of the country.²⁴

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 cities around the world have found that the number of deaths increases as ozone pollution rises.²⁵

Taken together, these studies paint a picture of profound 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)

Soot is produced by fossil fuel combustion 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 are created when pollutants react with each other in the atmosphere. Particles can contain hundreds of different chemicals from carcinogens like polycyclic aromatic hydrocarbons to metals like arsenic and zinc.

Forty to 1,000 times smaller than the width of a human hair, fine soot particles result from burning fossil fuels, like coal. Soot can remain suspended in the air for

weeks. When inhaled, soot penetrates deep into the lung, where it delivers its toxic payload. Larger particles, such as dust or pollen, travel shorter distances and are more effectively trapped in the body's upper airway.

Inhaled particulates are particularly dangerous, causing cancer, irritating lungs, and causing changes in heart function.²⁶ As such, particulates cause and aggravate many health problems, including lung cancer and cardiovascular disease.

Short term exposure to particulate pollution kills more than 50,000 Americans each year. 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.²⁷

Severe Pollution in Arizona

With its increasing reliance on coal-fired power plants that contribute to smog and soot formation, Arizona has potential severe future air pollution problems.

Ozone and particulate pollution in metropolitan Phoenix is already a problem due to transportation sources. In 2010, the American Lung Association ranked Phoenix the worst city in the country for year round particle pollution.²⁸ Adding coal and gas-fired electrical generation plants to meet future demand can only add to what is already a severe pollution problem.²⁹

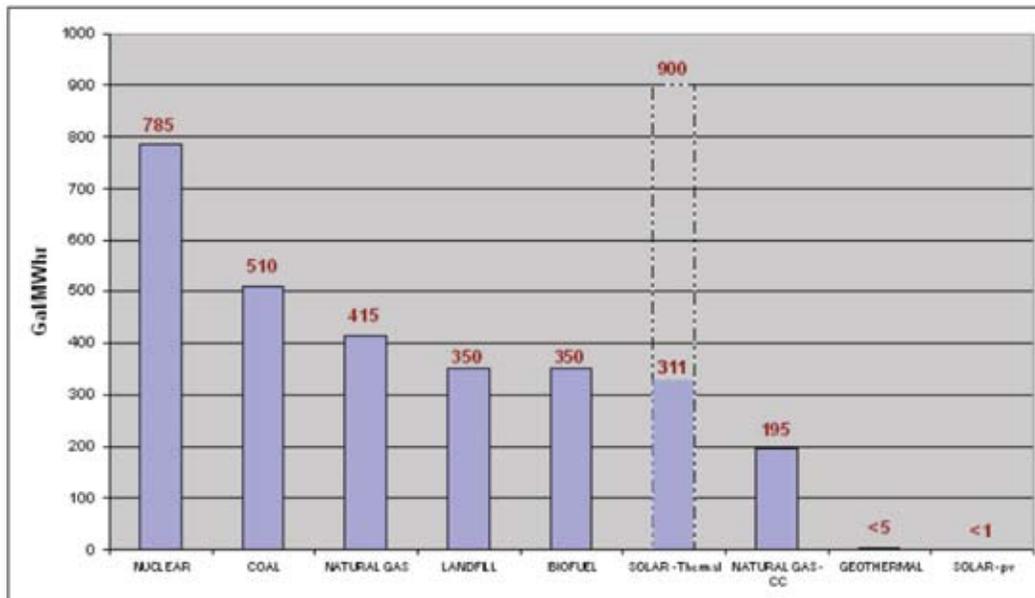
Ozone and particulate matter pollution in excess of the U.S. Environmental Protection Agency (U.S. EPA) standards afflicts Arizona cities, impacting more than six million people.³⁰ Maricopa County ranks worst among counties in Arizona for particle pollution and ozone pollution. As a result, Arizona has one of the highest asthma rates in the country: the Arizona Asthma Coalition states that more than 600,000 Arizonans are affected by asthma.³¹

Arizona's Electricity System Contributes to a Dwindling Water Supply

In Arizona, water and energy—our most important and precious natural resources—are inextricably linked. A 2007 Arizona State University study by Martin Pasqualetti and Scott Kelley found that

meeting the growing power demands with conventional resources will further stress Arizona's limited water supplies. The water cost of nuclear power generation is greatest of any energy resource at 785 gallons of water used per one megawatt-hour (MWhr) of electricity generated, followed by coal at 510 gal/MWhr.³²

Figure 5 Average Gallons of water needed to generate one MWhr of electricity from generating facilities



The Role of Efficiency in Solving Arizona's Energy Challenges

Investing in energy efficiency will help Arizona address the many problems of its current electricity system: rising energy bills, the exodus of dollars from the state's economy, health-damaging pollution and significant water consumption. Developing Arizona's energy efficiency potential will address the problems listed above and boost the state's economy and energy reliability, at a lower cost than building new generation and transmission infrastructure.

The Benefits of Energy Efficiency Cost Savings and Economic Growth

Energy efficiency and economic growth go hand in hand.

In the late 1970s in America, 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 1988.³³ Over the nine-year period from 1979 to 1988, the nation's inflation-adjusted gross domestic product increased by 30 percent.³⁴

The national trend continues today. Over the past two decades, the U.S. 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, the U.S. was using only 8,750 BTU—a drop of more than 40 percent.³⁵

However, the U.S. still remains a profligate user of energy compared to many of its industrialized peers. The U.S. economy remains 50 percent more energy-intensive than the United Kingdom's and more than twice as energy-intensive as Japan's.³⁶ On a per capita basis, the U.S. uses more energy than most industrialized countries, surpassed only by Norway, Luxembourg, Iceland, and Canada.³⁷

Improving energy efficiency would create more economic benefits, including cheaper energy, more jobs, and improved economic stability.

Conservation Versus Efficiency

Though both help to reduce energy bills and pollution, conservation and efficiency are distinct. Efficiency means using improved technology to achieve greater productivity from a unit of energy, whereas conservation means finding a way to not use that energy at all. In an industrial setting, efficiency is accomplished by maintaining equipment, while conservation requires running a factory for fewer hours per day and turning off equipment and lights. At home, efficiency can be achieved by replacing conventional light bulbs with compact fluorescent bulbs. An example of conservation at home would be turning off the lights when one leaves the room. Both efficiency and conservation are valuable but this report focuses on the long-lasting, easily achieved savings available with efficiency.

Energy Cost Savings

Since using less energy directly reduces energy expenditures, energy efficiency can save consumers money on both electricity and gas bills.

Cost savings yielded by reduced energy consumption are forecasted to increase as global warming reduction measures—which are expected to increase the price of power from coal plants—are implemented.

Energy efficiency investments will make energy less expensive for investors and consumers alike. By reducing energy demand, efficiency programs will 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 can generate jobs for Arizona workers and economic development for Arizona communities.

Investing in energy efficiency creates construction and manufacturing jobs: workers are needed to improve insulation and sealing in homes; architects and

builders are required to perform energy-efficient construction and remodeling; and manufacturers are needed to build energy-efficient appliances.

Many Arizona workers could transition to energy-efficiency jobs with minimal training. Development of strong energy efficiency programs in Arizona has the potential 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, infusing income into the local economy that is then used to support other jobs in retail, food preparation and transportation.

In its recent meta-analysis of energy efficiency studies, the American Council for an Energy-Efficient Economy (ACEEE) projected that if our nation's energy efficiency improved by 23 percent, employment could increase by 500,000 to 1,500,000 jobs by 2030.³⁸

Investments in efficiency also can replace expenditures for fuel, a significant portion of which is imported from out-of-state, with expenditures for labor and materials produced in Arizona.

Improved Economic Stability

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

Rate increases, such as those that have affected Arizona's electricity consumers in the past few years, would have smaller consequences in a highly efficient system. Energy efficiency could also insulate Arizona from the impacts of unpredictable events, such as periodic rail transportation bottlenecks that cause spikes in the price of coal and hurricanes that damage natural gas infrastructure and cause prices to temporarily soar.

Reduced Costs for New Energy Facilities

Efficiency measures are much cheaper than generating and delivering other energy sources. 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.³⁹ Northeast Energy Efficiency Partnerships estimates that capturing all remaining achievable energy efficiency potential in New England would cost just 3.1 cents per kWh.⁴⁰ 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 (2008 dollars). The study concluded that the benefits of the efficiency measures exceeded costs by more than 400 percent.⁴¹

In comparison, the cost of generating electricity from dirty and dangerous energy sources is likely to increase as demand for power infrastructure increases worldwide. The 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.⁴² The California Energy Commission estimates that the cost of power from a new nuclear facility would equal 11.8 cents per kWh (2007 dollars).⁴³ 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 costs of carbon control measures are included.

Reduced Pollution

As noted above, Arizona's electric sector released nearly 55 million metric tons of carbon dioxide in 2007, accounting for nearly half of the state's total carbon dioxide emissions. Improving energy efficiency in Arizona would reduce generation and therefore lower global warming emissions.

If Arizona used electricity 10 percent more efficiently, it would have cut global warming pollution from the electric sector by more than five million metric tons, the equivalent of taking one million cars off the road for a year.⁴⁴

Arizona Is Rich in Potential Energy Savings

Energy efficiency can be improved virtually everywhere energy is used. Residential and commercial savings can be achieved with more efficient lighting, better insulation and weather sealing, 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.⁴⁵ In addition to installing more efficient motors, industrial facilities can improve the efficiency of and optimize motor systems. Better sensors and controls can time manufacturing processes to use the least energy necessary for the same quality performance.

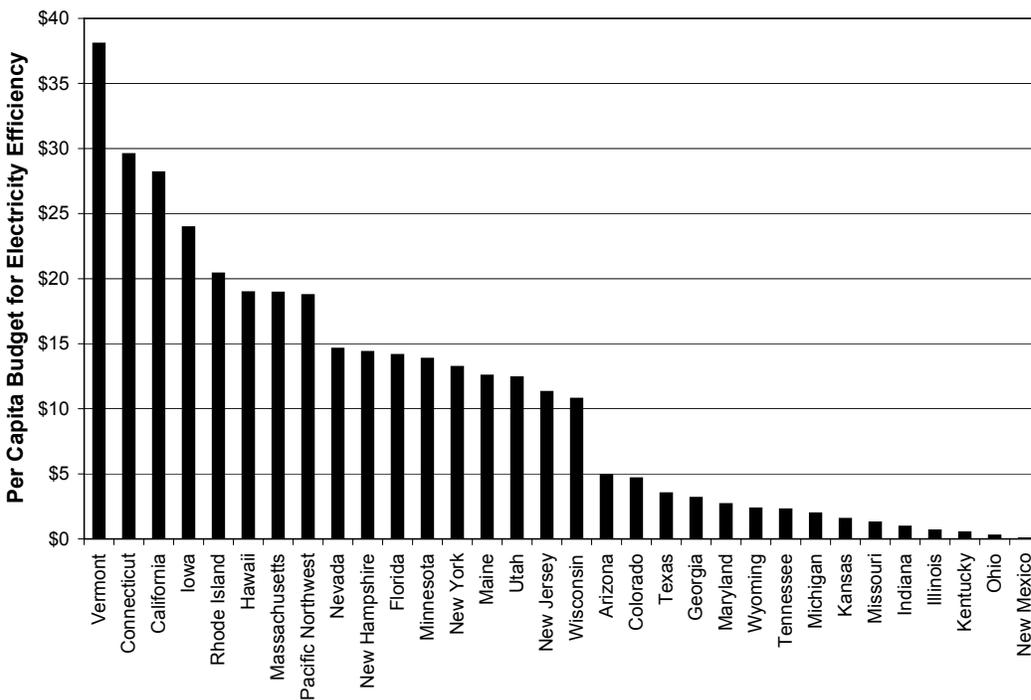
Despite the ready availability of cost-effective energy efficiency, Arizona has not significantly invested in improving the efficiency of homes, businesses, or industrial operations. Although energy efficiency investments in Arizona are starting to expand, for the past fifteen years, Arizona has invested less money per capita in electric and natural gas energy efficiency than the national average.⁴⁶ In 2007, Arizona spent an estimated total of \$32 million on energy efficiency spending or 0.5% of utility revenues. Arizona spent approximately \$4.90 per person per year on electric efficiency, compared to an average of nearly \$7 nationally and an average of \$10.79 for

states with electric efficiency programs.⁴⁷ Vermont topped the list of the states most committed to electric efficiency with expenditures of \$38.08 per person. Dollars spent on cost-effective energy efficiency improvements are recouped in reduced energy bills and also can save states money.

While Arizona's low rate of investment in energy efficiency means that the state has forgone significant cost savings in recent years, it also means that 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 and projected a range of energy efficiency potentials, with the most conservative study finding savings of 6 percent and the most ambitious study projecting efficiency savings of 33 percent.⁴⁹ The studies found that lower projected savings often correlated with a shorter study period, in some cases as few as five years.

Figure 6. 2007 Per Capita State Budgets for Electric Efficiency Programs⁴⁸



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 some of the nation's most effective energy efficiency programs. Each story outlines how the program works; describes how the utility or efficiency service provider interacts with homeowners, businesses, or industries; and examines the benefits the program offers for participants and society.

These case studies show the types of activities and benefits that could happen in Arizona, if the state makes smart investments in energy efficiency.

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

Arizona's homes are packed with energy-saving opportunities. Energy efficiency programs can help homeowners unlock this potential, as has been demonstrated in other states across the country.

New York encourages homeowners

to replace 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. A Minnesota gas utility offers subsidized home energy audits to help identify promising areas for weatherization improvements. 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. Ohio helps targeted low-income customers reduce their energy bills through free home energy audits and weatherization.

Energy efficiency programs save individual homeowners money and increase the comfort of their homes. At the same time, they reduce statewide demand for electricity and natural gas, reducing costs 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. But after moving into the house in January, the Denley's first electricity and natural gas bill came in at \$400.

They hired a contractor through the New York State Energy Research and Development Authority (NYSERDA) to perform a home energy audit and identify potential improvements. The Denley's installed 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. These energy efficiency improvements cut the Denley's

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

typical monthly energy consumption by 40 to 50 percent and saved them \$1,847 in a year.⁵⁰ The project was cost-effective for both the Denleys and NYSERDA.⁵¹

NYSERDA reaches citizens like the Denleys through its New York Energy Smart Products program, which builds awareness about energy-efficient products and provides 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: a refrigerator can reduce electricity costs by up to \$100 per year and a clothes washer can cut electricity and water use by up to 50 percent.⁵²

The New York Energy Smart Products program encourages Energy Star® appliance purchases by running public service campaigns including print and television advertisements, magazine articles, store displays, and utility bill insert flyers.

The program also provides substantial financial incentives, reducing loan rates for homeowners who 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.⁵³ A homeowner may receive an interest rate reduction of up to 4 percent below market.

The Energy Smart Products program has been successful. 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.⁵⁴ 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.⁵⁵

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 homes.⁵⁶ 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.⁵⁷

Energy Smart is funded by a system benefits charge paid by all utility users.⁵⁸ The charge, established in 1996, has required utilities to collect 1.42 percent of the utility's revenue and submit it to NYSERDA. About half of this funding goes to pay for Energy Smart programs.⁵⁹ According to a very conservative cost-benefit analysis performed by NYSERDA, program benefits more than double outweigh the costs.⁶⁰

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 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, leaky windows, and a massive heating bill.⁶¹ To reduce the amount of money he was burning up every winter, he replaced the windows and converted to a multi-zone natural gas heating system.⁶²

Many homeowners across New Jersey

find themselves in positions similar to Angelucci's when they buy homes. 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 encourage homeowners to replace old and inefficient furnaces and air conditioners with new, highly efficient models,

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.

the state of New Jersey started two programs, CoolAdvantage and WarmAdvantage, in 1999.

The programs have offered cash incentives to homeowners, ranging from \$300 to \$450. Higher-efficiency products earn higher rebates, and the program adjusts its efficiency standards as better technologies arrive on the market.⁶³

CoolAdvantage and WarmAdvantage require air conditioner and furnace replacements to be installed by certified technicians, ensuring that the appliance is appropriate for the home's size and is properly installed.⁶⁴ These requirements maximize equipment efficiency.

The programs reach individuals like Angelucci through broad education campaigns but also target retailers and contractors, who are essential to strong appliance efficiency programs. Retailers are taught how to grow the market share of energy-efficient products, and contractors

are trained to install the equipment and promote its use among customers.⁶⁵

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.⁶⁶ Smart growth contributes to the state’s overall push for efficiency, because dense communities are more efficient than sprawling developments, offering savings in energy, carbon emissions, and water consumption.⁶⁷

In 2005, CoolAdvantage and WarmAdvantage enrolled 27,510 participants, who achieved average annual savings of 546 kWh and \$62.95 and total savings of more than \$1.7 million.⁶⁸ By 2005, New Jersey’s energy efficiency programs produced annual electricity savings sufficient to power nearly 40,000 homes.⁶⁹ The program has 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.⁷⁰

In New Jersey, 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.⁷¹ As a result of the programs, New Jerseyans will save \$520 million on their energy bills over time.

New Jersey’s efficiency programs also have cut peak electricity demand by 450 MW, saving money for energy consumers in New Jersey by reducing the need to site, build, and operate expensive new power plants.⁷²

Increasing the Use of Energy-Efficient Lighting

In 2001, an energy crisis caused rolling blackouts across California. This crisis provided a unique opportunity to promote energy efficiency across the state which California policymakers seized by allocating over \$900 million to energy efficiency programs.⁷³ The state specifically reserved a portion of the funding for residential energy efficiency improvements.

With this funding, the Pacific Gas and Electric Company (PG&E) established the Upstream Residential Lighting Program, aimed at increasing the market share of highly efficient compact fluorescent light bulbs (CFLs) sold to residents of California.

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.⁷⁴

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.⁷⁵ The state pools the resulting money and spends it on services

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 ten times as long.

and programs, like the Upstream Residential Lighting Program, that serve the public interest.⁷⁶

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.⁷⁷ Customers receive the discount automatically, with no need for coupons, forms or any waiting period.⁷⁸

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.⁷⁹ 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.⁸⁰ Through the program, retailers have sold more than 30 million CFLs. During their useful lives, these bulbs will save nearly 2.4 billion kWh, translating into enormous monetary savings for individual consumers.⁸¹ 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.⁸² In other words, light bulbs installed through 2007 will save electricity in amounts equivalent to the needs of nearly 190,000 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 30 percent less energy than typical new homes 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.⁸³ 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

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

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.⁸⁴ 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.⁸⁵

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.⁸⁶ The average participating home reduced electricity consumption by 2,000 kWh per year, saving on the order of \$200 per year on electricity bills. The program also reduced peak demand for electricity by more than 0.4 MW.⁸⁷

In addition to the Energy Star® Homes program, Efficiency Vermont operates more than a dozen other energy efficiency initiatives. Cumulatively, efficiency measures promoted by the organization have accounted 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.⁸⁸

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.⁸⁹

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

When it comes to energy prices, low-income families bear a greater burden than do middle- and upper-income households. 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.⁹⁰ 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 furthest 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

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

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.⁹¹ From April 2004 through March 2005, EPP improved the energy efficiency of more than 10,000 households.⁹² The typical home heated by electricity reduced energy use by 11 to 12 percent.⁹³ 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.

Efficiency Programs Help Businesses, Industry, and Institutions Manage Energy Costs

Businesses and industries in Arizona can improve their competitiveness by managing their energy costs. And schools, hospitals, local governments and other institutions in Arizona 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, and his business depends on its 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 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

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

\$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.⁹⁴

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.⁹⁵

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.⁹⁶ To overcome market barriers preventing the spread of energy-efficient technology, the Small Business Services Program has offered:

- 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.⁹⁷

The program has also offered 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.⁹⁸

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 over 40,000 participants, cumulatively saving more than 160 million kWh of electricity (equivalent to

the needs of more than 16,000 homes in one year).⁹⁹ Participating small businesses typically see a 30 percent reduction in energy use, cumulatively saving more than \$30 million on electricity bills.¹⁰⁰

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.¹⁰¹

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.¹⁰²

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

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

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.¹⁰³

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 has covered 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 ac-

ording 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 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.¹⁰⁴ Additionally, the program offers the ongoing advice of trained architects and engineers hired by NYSERDA.¹⁰⁵ Since 2002, the broader Energy Smart program has saved consumers over \$198 million and created more than 4,200 jobs.¹⁰⁶

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.¹⁰⁷ 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 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.¹⁰⁸

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.¹⁰⁹

The average facility that works with Xcel's Lighting Efficiency program reduces its energy costs by 35 percent annually.

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.¹¹⁰

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.¹¹¹

For most businesses, lighting is a major expense, accounting for up to 44 percent of monthly energy costs.¹¹² 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 light-emitting diode (LED) signs.¹¹³ 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.¹¹⁴

The Lighting Efficiency program is funded through the state of Minnesota's public benefits fund, which has required that Xcel spend 2 percent of its gross operating revenue on energy efficiency programs.¹¹⁵ 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.¹¹⁶ From 2001 to 2003, the Lighting Efficiency program spurred energy savings of over 200 million kWh—enough energy to power nearly 21,000 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.¹¹⁷

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 Opportuni-

Efficiency measures installed typically yield an estimated \$4 in savings for every \$1 spent.

ties 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.¹¹⁸

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.¹¹⁹ 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 yield 27 billion kWh in lifetime electricity savings—enough to power more than 2.8 million homes for a year.¹²⁰ Program

managers estimated that efficiency measures installed in 2006 will yield \$4 in savings for every \$1 spent.¹²¹

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.¹²² 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

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

\$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.¹²³

Focus on Energy was created by the Wisconsin Legislature in 1999.¹²⁴ The state has required 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.¹²⁵ 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, to realize energy savings. Focus on Energy has offered 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;
- 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. Savings through Focus on Energy are extremely cost-effective compared to delivering new sources of electricity or natural gas. 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:¹²⁶

- 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 and 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).¹²⁷

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 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.¹²⁸ Additionally, Flex Your Power offers information on how to obtain rebates and incentives for energy-efficient appliances and services.¹²⁹

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.¹³⁰

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.¹³¹

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.¹³² 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.¹³³ Estimates suggest that every dollar that California invests in energy efficiency will generate more than two dollars in consumer savings.¹³⁴

The Flex Your Power campaign is funded through California’s Public Goods Charge, in which utilities have charged ratepayers a 1 percent surcharge on their electric utility bills, which is pooled and spent on services and programs in the public interest.¹³⁵

Within 12 months, electricity demand declined by 14 percent—equivalent to the output of 10 large power plants.

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 Californians in the years to come.

Policy Recommendations

Efficiency programs are the quickest and cheapest way to address Arizona's energy problems. By creating new and expanded energy efficiency programs, Arizona 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. Through energy efficiency, Arizona can reduce our reliance on polluting power plants and pave the way for a cleaner energy future with more energy generation from renewable energy resources. At the same time, Arizona can reduce the need to operate the most expensive power plants during periods of high demand, reducing energy costs statewide. Generating less power also means air quality should improve, making the air safer to breathe for Arizonans. And reducing the need for electricity generation also will decrease water consumption, helping Arizona to do its part to avoid the worst impacts of water shortages and global warming.

Overall, energy efficiency can deliver

concrete results for Arizona 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, Arizona should create a comprehensive energy program.

The first step is for adoption and implementation of an Energy Efficiency Standard of at least 20% by 2020 for electric utilities in Arizona. The following principles should be adhered to 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, utilities should be required 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 annual benchmarks and reporting their progress on improving efficiency, Arizonans should have the opportunity to review and publicly question the utilities' programs.
- Utilities and energy users should be fairly compensated for their investments in energy efficiency. Utilities should be rewarded for going beyond the requirements, and penalized if they fall behind.

Arizona 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 Arizona'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.

- Arizona should require natural gas utilities to implement energy efficiency programs to capture all cost-effective efficiency potential.

To complement the measures above, Arizona 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, Arizona 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 at community colleges, state universities and in local communities around the state to ensure that enough skilled workers are available to get the job done.

Notes

- 1 Southwest Energy Efficiency Project, Arizona, Utility Energy Efficiency Programs, Updated: January 2009.
- 2 U.S. Department of Energy, Energy Information Administration, State Electricity Profiles, June 2009.
- 3 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.
- 4 U.S. Department of Energy, Energy Information Administration, *DOE/EIA-0226 (2008/07) Table 5.6.A. Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, May 2008 and 2007*, 16 September 2008.
- 5 Electricity prices from U.S. Department of Energy, Energy Information Administration, *Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State*, available at http://www.eia.doe.gov/electricity/epm/table5_6_b.html, July 21, 2010.
- 6 See note 2.
- 7 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.
- 8 See note 1.
- 9 Ibid.
- 10 See note 2.
- 11 Ibid.
- 12 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, Table 1: Energy Price and Expenditure Estimates by Source, 1970-2005, Arizona*, 29 February 2008.
- 13 Ibid.
- 14 Ibid.
- 15 http://www.epa.gov/climatechange/emissions/state_energyco2inv.html
- 16 Arizona Greenhouse Gas Inventory

- and Reference Case Projections 1990–2020, <http://azclimatechange.gov/download/O40F9293.pdf>
- formally approved by the Arizona CCAG in March 2006*
- 17 See note 10.
- 18 <http://www.swenergy.org/publications/factsheets/AZ-Factsheet.pdf>
- 19 See note 10.
- 20 M. Gilmour, et al., “Ozone-Enhanced Pulmonary Infection with *Streptococcus Zoepidemicus* in Mice: The Role of Alveolar Macrophage Function and Capsular Virulence Factors,” *American Review of Respiratory Disease* 147: 753-760; I. Mudway and F. Kelley, “Ozone and the Lung: A Sensitive Issue,” *Molecular Aspects of Medicine* 21: 1-48, 2000.
- 21 W. McDonnell, et al., “Pulmonary Effects of Ozone Exposure During Exercise: Dose-Response Characteristics,” *Journal of Applied Physiology* 5: 1345-1352, 1983.
- 22 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.
- 23 U.S. Environmental Protection Agency, *Health Effects of Ozone in the General Population*, downloaded from www.epa.gov/03healthtraining/population.html, 29 September 2008.
- 24 R. McConnell, et al., “Asthma in Exercising Children Exposed to Ozone: A Cohort Study,” *The Lancet* 359: 386-391, 2002.
- 25 David Bates, “Ambient Ozone and Mortality,” *Epidemiology*, 16(4): 427-429, July 2005.
- 26 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.
- 27 C. Pope, et al., “Lung Cancer, Cardio-pulmonary Mortality, and Long-Term Exposure to Fine Particulate Air Pollution,” *Journal of the American Medical Association* 287: 1132-1141, 2002.
- 28 <http://www.stateoftheair.org/2010/city-rankings/most-polluted-cities.html>
- 29 American Lung Association, *State of the Air: 2007*, May 2007.
- 30 U.S. Environmental Protection Agency, *Particulate Matter (PM-2.5) Nonattainment Area Counties*, 15 August 2008.
- 31 <http://www.azasthma.org/asthma-in-az/asthma-in-az.aspx>
- 32 *Arizona Water Institute, Project Fact Sheet, 2007*
- 33 U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2003*, 7 September 2004, Table 1.1.
- 34 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.
- 35 In constant 2000 dollars. U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2006, Table 1.5: Energy Consumption, Expenditures, and Emissions Indicators, 1949-2006*, June 2007.
- 36 U.S. Department of Energy, Energy Information Administration, *International Energy Annual 2005*, 1 October 2007.
- 37 Ibid.
- 38 John A. “Skip” Laitner and Vanessa McKinney, American Council for an Energy-Efficient Economy, *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments*, June 2008.
- 39 Richard 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.
- 40 Optimal Energy, Inc. for Northeast Energy Efficiency Partnerships, *Economically Achievable Energy Efficiency Potential in*

New England, May 2005.

41 Howard Geller, et al., Southwest Energy Efficiency Project, *The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest*, November 2002.

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

43 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.

44 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 Arizona from U.S. Department of Transportation, Federal Highway Administration, Office of Highway Statistics, *Highway Statistics 2006*, December 2007.

45 Anna Monis Shipley and R. Neal 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.

46 Martin 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.

47 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.

48 See note 58.

49 Ibid.

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

51 Ibid.

52 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.

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

54 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* (brochure), 11 November 2005. Available from www.getenergysmart.org.

55 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.

56 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.

57 Ibid.

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

59 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.

60 "Total Market Effects Test" in 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.

61 Steve Angelucci, “No Place Like Home: Energy Savers,” *Atlantic City Weekly*, 9 December 2004.

62 Ibid.

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

64 Ibid.

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

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

67 One Planet Living, *EcoDensity* (fact-sheet), downloaded from www.oneplanetliving.org/northamerica/EcoDensity.pdf, 29 November 2007.

68 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.

69 Assuming the typical Arizona household uses 9,600 kWh of power annually, per Public Utilities Commission of Arizona, *Arizona’s Electricity Green Pricing Programs, Frequently Asked Questions*, updated 22 April 2008.

70 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.

71 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.

72 See note 86.

73 Martin Kushler and Edward 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.

74 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.

75 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.

76 Carolyn Adi Kuduk and Scott 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.

77 Gary B. Fernstrom, Pacific Gas & Electric, *Residential Lighting Programs: PG&E’s Role and Perspective*, 19 June 2007.

78 See note 95.

79 Ibid.

80 Ibid.

81 Email correspondence with Emily Behr, Senior Project Manager for Customer Energy Efficiency, Pacific Gas and Electric, 29 November 2007.

82 Ibid.

83 Efficiency Vermont, *Vermont Energy Star® Homes*, downloaded from www.encyvermont.com, 30 November 2007.

84 Efficiency Vermont, *Vermont Energy Star® Homes – Incentives* (fact sheet), downloaded from www.encyvermont.com, 30 November 2007.

- 85 Efficiency Vermont, *Here's How We Can Help*, downloaded from www.encyvermont.com, 30 November 2007.
- 86 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.
- 87 Efficiency Vermont, *Year 2006 Annual Report and Annual Energy Savings Claim*, October 2007, 52. Available from www.encyvermont.com.
- 88 Ibid.
- 89 Vermont Energy Investment Corporation, *Efficiency Vermont* (fact sheet), 2004. Available at www.veic.org.
- 90 Ohio Department of Development, *Electric Partnership Program*, www.odod.state.oh.us/CDD/OEE/USFTEEMain.htm, 10 October 2008.
- 91 Dan York, Marty Kushler and Patti Witte, American Council for an Energy-Efficient Economy, *Compendium of Champions: Chronicling Exemplary Energy Efficiency Programs from Across the U.S.*, February 2008.
- 92 Michael Blasnick, Michael Blasnick & Associates, for the Arizona Office of Energy Efficiency, *Arizona Electric Partnership Program Impact Evaluation*, 30 June 2006.
- 93 Ibid.
- 94 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.
- 95 National Grid, *Small Business Program*, downloaded from www.nationalgridus.com/masselectric/business/energyeff/3_small.asp, 16 November 2007.
- 96 American Council for an Energy-Efficient Economy, *Small Commercial Exemplary Program: Small Business Services Program*, National Grid, April 2003.
- 97 See note 119.
- 98 Ibid.
- 99 National Grid, *2006 Energy Efficiency Annual Report*, August 2007.
- 100 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.
- 101 See note 123.
- 102 North Carolina State University, "Massachusetts Incentives for Renewables and Efficiency: Energy Efficiency Fund," *Database of State Incentives for Renewables and Efficiency*, 8 September 2007.
- 103 New York State Energy and Research Development Authority, *New Construction Program: Elmira City School District*, downloaded from www.nyserda.org, 15 November 2007.
- 104 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.
- 105 More information on Energy Smart school involvement program available at www.nyserda.org/Programs/schools/esmartschools.asp.
- 106 New York State Energy and Research Development Authority, *New York Energy SmartSM Program*, 15 November 2007.
- 107 North Carolina State University, "New York Incentives for Renewables and Efficiency," *Database of State Incentives for Renewables and Efficiency*, 10 October 2008.

- 108 Xcel Energy, *Lighting Efficiency Case Study: Bright Idea: Upgrades at Manufacturing Facility Save Energy, Cut Costs, and Even Improve Productivity*, CSS#1813, January 2007.
- 109 Ibid.
- 110 Ibid.
- 111 Ibid.
- 112 Xcel Energy, *Lighting Efficiency: Save Money, Earn Rebates and Improve Lighting Quality*, download from www.xcelenergy.com, 16 November 2007.
- 113 American Council for an Energy-Efficient Economy, *Lighting Efficiency Excel Energy*, downloaded from www.aceee.org/utility/17axcelcommmn.pdf, 16 November 2007.
- 114 Xcel Energy, *Why a Lighting Redesign Study?*, April 2007.
- 115 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.
- 116 See note 153.
- 117 See note 138.
- 118 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.
- 119 Connecticut Light and Power Company, *Energy-Efficient Service: Measure Lifetimes*, downloaded from www.cp-l.com, 30 November 2007.
- 120 Energy Conservation Management Board, *Energy Efficiency: Investing in Connecticut's Future*, 1 March 2007.
- 121 Ibid.
- 122 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.
- 123 Wisconsin Focus on Energy, *American Foods Group Finds Over \$1,000,000 in Low-Hanging Fruit*, 2007, 1.
- 124 State of Wisconsin, *Wisconsin Public Benefits Program Annual Report, July 1, 2005 to June 30, 2006*, available at www.focusonenergy.com.
- 125 North Carolina State University, "Wisconsin: Focus on Efficiency Program," *Database of State Incentives for Renewables and Efficiency*, 8 August 2007.
- 126 U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 2003*, 7 September 2004, Table 1.1.
- 127 Craig Canine, "California Illuminates the World," *On Earth Magazine*, Spring 2006.
- 128 Flex Your Power, *Upgrade Your Home*, downloaded from www.fypower.org/res/upgrade/, 12 November 2007.
- 129 Flex Your Power, *Rebates, Incentives and Services*, downloaded from www.fypower.org/res/tools/rgl.html, 12 November 2007.
- 130 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.
- 131 U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, *Best Practices Benchmarking for State Energy Efficiency Programs*, 9 April 2007.

132 California Energy Commission, *U.S. Per-Capita Electricity Use By State*, 15 May 2006.

133 Devra Bachrach, Matt Ardema, Alex Leupp, Natural Resource Defense Council, *Energy Efficiency Leadership in California: Preventing the Next Crisis*, April 2003.

134 See note 156.

135 Carolyn Adi Kuduk and Scott 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.