



Plug
Into
Clean
Power:

Your Options for **Cleaner Energy**
in Pennsylvania

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Environmental information is available electronically via the Internet. Visit DEP through the PA PowerPort at www.state.pa.us or directly at www.dep.state.pa.us (directLINK "Growing Greener").



A web space dedicated to helping you learn how to protect and improve the environment. The site features the largest collection of environmental videos available on the Internet and is produced by the nonprofit Environmental Fund for Pennsylvania, with financial support from the Pennsylvania Department of Environmental Protection, (877) PA-GREEN.



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Clean Air Council is a member-supported, nonprofit, environmental organization dedicated to protecting everyone's right to breathe clean air. The Council's five major programs are Clean Air, Clean Energy, Sustainable Transportation, Waste Reduction & Recycling and Indoor Air Quality. The Council works through public education, community advocacy and government oversight to ensure implementation, enforcement and improvement of environmental laws.

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How to Use This Guide

The purpose of this guide is to present the various clean energy options available to Pennsylvanians today. The guide is intended to serve as a starting point for residential and commercial customers who are interested in learning more about options for renewable energy and energy efficiency technologies. The guide focuses solely on cleaner energy options as they

relate to electricity production and use. There are many other renewable energy

INTRODUCTION

and energy efficiency applications, particularly within the transportation sector (i.e., alternative fuel vehicles, electric and hybrid-electric vehicles, compressed natural gas vehicles, etc.) that are also important components of a sustainable energy future.

The guide provides the following information for readers:

- Basic first steps necessary for producing cleaner power on-site;
- Six major clean energy options available in Pennsylvania – (1) wind energy, (2) solar energy, (3) hydropower, (4) geothermal energy, (5) biomass, landfill gas, and municipal solid waste, and (6) fuel cells;
- Resource applications, costs and benefits, site assessment and suitability, options for residential or self-generation, and more for each clean energy option discussed;
- Tips for both residential and commercial customers on how to choose an electricity supplier that offers a clean, renewable energy product and on how to use energy more efficiently both at home and in the workplace;
- Financial help available to make investing in renewable energy and energy efficiency more affordable for Pennsylvanians; and
- Links to further information on the topics introduced.



What is Renewable Energy?

Renewable energy is energy that can be replenished at the same rate that it is used. Renewable energy resources come either directly or indirectly from the sun or by tapping heat from the earth's core. The most prevalent renewable energy resources – wind, solar, hydropower, geothermal, and biomass – are readily available throughout the United States. The energy originating from these resources is often converted into electricity for use in homes and businesses. Renewable energy resources can also be used directly for space heating and cooling, water heating, and pumping of water.

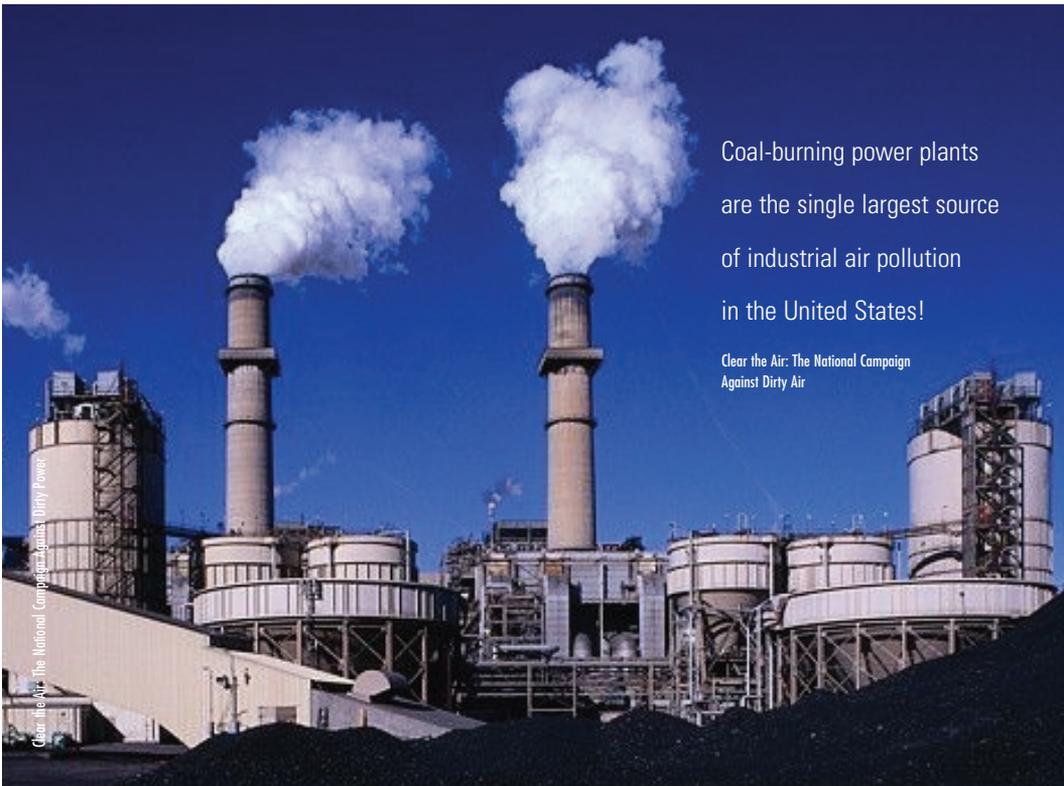
Since the beginning of civilization, humans have used renewable energy sources to do everything from generating warmth to powering machinery. The sun's rays can be captured to provide heat and to generate electrical power. Air temperature fluctuations caused by the sun's rays, in combination with the rotation of the earth, generate wind energy. Today, the wind turbine, a modern version of the windmill, can convert wind energy into electricity. Heat from the sun is also important to the vitality of plants and trees, which, in turn, can be used for biomass power. The sun also feeds the hydrologic cycle, allowing water to be one of the more prominent renewable, electricity-generating resources. Geothermal energy, the final renewable energy resource, taps heat from beneath the earth's surface rather than drawing upon the sun's rays.

Why is Renewable Energy Important in Pennsylvania?

While fossil fuel resources (coal, oil, and natural gas) may seem plentiful now, their supply is limited; the cost to extract and use these resources is likely to continue to increase to the point where it will no longer be economical. The use of fossil fuels is particularly damaging to the environment, destroying both the short and long-term sustainability of the planet. Air, water, and land pollution, resulting from the burning of fossil fuels, also negatively impacts human health.

Nuclear power, while it does not result in the same damaging air pollution when used to create electricity, has other associated environmental and public health problems. Everything from nuclear power generation to the transport and disposal of radioactive waste pose serious threats to human health. Renewable energy resources offer a safe, abundant, and economically viable solution to the problems caused by traditional energy production and use.

The hidden costs of non-renewable energy (to the environment, to human health, and otherwise) make renewable energy, in many cases, more desirable than fossil fuels or nuclear power. Consequences of a non-renewable, energy-based economy include: an unstable reliance on foreign oil; air emissions that are damaging to public health and the environment; radioactive waste; and overall reliance on a capital-intensive, highly-centralized energy system.



Coal-burning power plants
are the single largest source
of industrial air pollution
in the United States!

Clear the Air: The National Campaign
Against Dirty Air

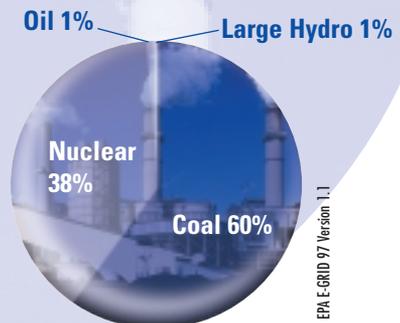


Primary Environmental and Human Health Impacts from Fossil Fuel Electricity Production

Pollutant	Environmental and Human Health Impacts
Nitrogen Oxides (NOx)	<ul style="list-style-type: none">• Helps form acid rain, which damages forests; acidifies lakes and streams, killing fish; and damages buildings and other man-made structures;• Combines with volatile organic compounds (VOCs) in the presence of sunlight to form ground-level ozone, which damages crops and forests and impacts the health of those with respiratory ailments, such as asthma, particularly affecting children and the elderly;• Forms regional haze, which reduces visibility in national parks and other pristine places.
Sulfur Dioxide (SO ₂)	<ul style="list-style-type: none">• Helps form acid rain (see above for impacts).
Particulate Matter (PM)	<ul style="list-style-type: none">• When inhaled, imbeds in lungs causing respiratory disease and premature death.
Carbon Dioxide (CO ₂)	<ul style="list-style-type: none">• Primary greenhouse gas, causing global climate change (global warming, which results in increased temperature and sea level).
Mercury (Hg)	<ul style="list-style-type: none">• Causes neurological and developmental damage, particularly within fetuses, infants, and children.
Arsenic (As)	<ul style="list-style-type: none">• Neurotoxin, endocrine disruptor, and known human carcinogen of high potency.

More than 98 percent of Pennsylvania's electricity is generated from fossil fuel and nuclear resources. Hydropower is Pennsylvania's most readily used form of renewable energy, representing one percent of the state's overall electricity generation, although wind and solar continue to grow in popularity.

Electricity Generation in Pennsylvania



More About Pennsylvania Power Plant Pollution

Increasing the amount of electricity generated from renewable energy resources could bring substantial public health and environmental benefits to Pennsylvania. Ground level ozone (or smog) levels in certain areas of the state frequently exceed the health standard set by the federal government. High ozone levels impact the health of those with asthma and other respiratory ailments, most severely affecting children and the elderly. Fossil fuel combustion emits nitrogen oxides (NOX) and volatile organic compounds (VOCs), the two main air pollutants that contribute to ground level ozone. A high number of nuclear power plants in close proximity to densely populated areas throughout the state poses the on-going risk for accidents, both at the generation and transport stages. Environmentally, Pennsylvania still suffers from acid rain pollution, a result of sulfur dioxide (SO₂) emissions from fossil fuel combustion. Increases in carbon dioxide (CO₂) emissions, a leading greenhouse gas emitted primarily from Pennsylvania's older, coal-fired power plants, contribute to global climate change, or global warming. A greater emphasis on producing and purchasing renewable energy within the state can help to alleviate these problems and bring both economic and energy security benefits to Pennsylvania.

Clear the Air: The National Campaign Against Dirty Power



Using Energy More Efficiently

Wiser energy use can reduce energy bills, both at home and at the workplace, and help reduce pollution. Using energy more efficiently, whether by installing fluorescent light bulbs, buying more efficient appliances, or better insulating walls and windows, can lead to real economic savings. Simple efficiency improvements can save up to 50 percent on energy bills. Reducing the energy needed by the end-user through improved efficiency measures also helps to ease the demand placed on electric utilities for power.



Making the Decision to Generate Your Own Electricity

The first step toward generating your own electricity is deciding whether or not it is the right thing for you. There are many reasons to pursue self-generation. Economically, generating your own electricity can help to reduce and, in some cases, avoid monthly electricity bills. Your particular location may be well suited to generate electricity. For example, the location may have an

SELF-ASSESSMENT :

FIRST STEPS TO PRODUCING CLEANER POWER

abundance of on-site renewable resources or may not have access

to the electricity grid, making it more economical to pursue self-generation. Choosing to generate your own electricity may fit in with personal values of environmental protection and energy independence.

Upon making the decision to pursue self-generation, it is important to determine your household's daily energy needs by conducting a load analysis. A load analysis will help you assess your energy options. Your energy load should include anything that uses electricity, whether on a continual basis like a refrigerator or on an intermittent basis like a computer. To determine your daily energy consumption, multiply each appliance's wattage by the number of hours that it is used in a day. Wattage information can either be found on a sticker attached to the appliance itself or on a tag affixed to the appliance's electrical cord. Another option is to purchase an AC (alternating current) watt-hour meter to measure the amount of power used over time. Contacting your local utility and asking for historical energy use data in kilowatt-hours is another easy way to obtain load analysis information for your home or business. Calculating your daily energy needs will help you determine what size system is necessary to power your household. In the following chapter, resource-specific information will further explain the first steps needed to install residential renewable energy systems.

Making Sense of Electricity Terms

Power and energy are two terms that are often interchanged, yet have very different meanings. Power is the ability to do work and in electricity terms, refers to capacity. Energy is the actual performance of work or the use of that ability over a period of time. For example, a wind turbine may have the power or capacity to produce one kilowatt of electricity. However, the actual output, or energy, depends upon other factors, such as how strongly the wind is blowing, and cannot be determined until it is actually produced. Thus, the turbine has the capacity to produce one kilowatt of electricity but until it actually produces it, no energy is generated.

Electric power or capacity is measured in watts and electricity is measured in watt-hours. A 60-watt capacity light bulb, if used for 1,000 hours of lighting, will use 60,000 watt-hours of electricity or 60 kilowatt-hours (1,000 watts equals one kilowatt and 1,000,000 watts equals one megawatt).

Net Metering

Net metering enables customers with small residential systems that generate electricity from renewable energy sources to sell some or all of the electricity back to utilities through the power grid. Net metering is an important option to

consider when contemplating generating your own electricity on-site. Net metering programs have numerous environmental and economic benefits, including encouraging private investment in renewable energy resources, stimulating local economic growth, diversifying energy resources, and protecting the environment through a reduction in the use of fossil fuel-generated electricity. Twenty-two states across the country, including Pennsylvania, now have net metering programs, many through net metering laws or regulations.

Pennsylvania's net metering regulation (52 PA Code 57.34), passed in 1998, covers all renewable electric and fuel cell technologies up to 50 kilowatts; however, the regulation instructs each individual utility to file its own net metering policy.

For more information on net metering in Pennsylvania, contact the Pennsylvania Public Utility Commission at (717) 783-1740 or your local electric utility company.



Warren Greiz, INREL

CASE STUDY

PECO Energy's Net Metering Program

PECO Energy, the state's first electric utility to adopt a net metering tariff, recently increased its system limit to 40 kilowatts and streamlined its interconnection requirements, making it easier for customers to install and connect a net metering system. PECO Energy offers three net metering options:

Option A

Customer is billed for net usage (total electricity used from the electric grid minus the electricity generated by the customer) and is not subject to an additional monthly meter charge, but does not have the ability to sell any excess power generated back to the grid (customer must have two meters).

Option B

Customer is billed for net usage and is subject to an additional monthly meter charge, but has the ability to sell excess power back to the grid (customer must have two meters).

Option C

Same as Option B, however a single, dual-directional meter is used.



Wind Energy

Wind power has played an important and longstanding role in the history of energy production, and has been used for hundreds of years to pump water and grind grain for agricultural purposes. Now, a new and exciting chapter in wind power's rich history is underway. Today the wind turbine, a more updated

version of the windmill, transforms wind energy into electricity.

RENEWABLE ENERGY

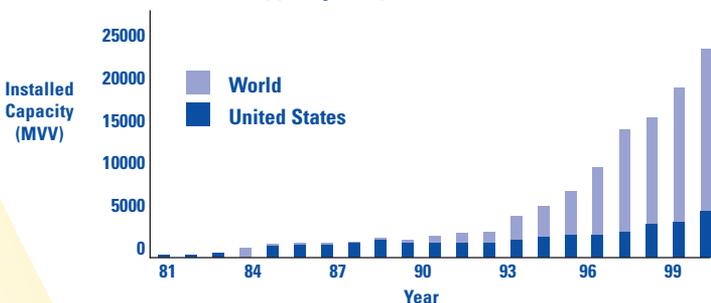
APPLICATIONS IN PENNSYLVANIA AND HOW THEY CAN WORK FOR YOU

Wind Energy Applications

Wind turbines can operate alone or connected to a utility's power grid and can be large or small. Power generated from smaller, isolated turbines is most often used to pump water, for communications, or for residential power generation. These distributed "small wind" systems typically have the capacity to generate up to 50 kilowatts of power, or enough to power anywhere from one to 20 homes (varying on the size of the chosen turbine). More than one wind turbine in the same area comprises a wind farm. Wind farms are best known for their applications as utility-scale sources of electricity. Utility-scale wind turbines, like those used on U.S. wind farms, are typically rated anywhere from 750 kilowatts to two megawatts of power capacity.

Wind power is growing at a staggering rate in the United States and abroad. Internationally, in the year 2001 alone, the wind energy industry installed approximately 6,500 megawatts of new wind energy generating capacity.

U.S. and World Wind Energy Capacity



In Pennsylvania, wind farms have been constructed in Hazleton, Garrett, Mill Run, and Somerset and a wind farm in Waymart is projected to be operational by the end of 2003. At least five additional large-scale wind projects are being proposed. In addition to its large-scale wind farms, Pennsylvania has over 12 small wind turbines producing less than 100 kilowatts each.

Pennsylvania Wind Farms

Hazleton, Luzerne County, PA	Pilot project installed in 1999 by Energy Unlimited; 2 turbines (65 kilowatt output per turbine)
Garrett, Somerset County, PA	Installed in 2000; 8 turbines; 10.4 megawatt facility; powers approximately 2,500 homes; owned by Green Mountain Energy
Mill Run, Fayette County, PA	Installed in 2001; 10 turbines (1.5 megawatt output per turbine); 15 megawatt facility; expected to power approximately 5,700 homes; output owned by Exelon Power Team and marketed statewide by Community Energy, Inc.
Somerset, Somerset County, PA	Installed in 2001; 6 turbines (1.5 megawatt output per turbine); 9 megawatt facility; output owned by Exelon Power Team and marketed statewide by Community Energy, Inc.
Waymart, Wayne County, PA	Expected in 2003; 52 megawatt facility; output to be owned by Exelon Power Team and marketed statewide by Community Energy, Inc.

In the next two years, the U.S. wind industry expects to install \$120 million worth of equipment in Pennsylvania. Wind farms in Mill Run and Somerset alone (16 turbines, 1.5 megawatts each, for a total of a 24-megawatt output) provide enough electricity annually to serve approximately 8,200 Pennsylvanian homes, or more than 20,000 people. Since Pennsylvania has one of the most advanced customer choice programs in the country, wind facilities in the state have been built mainly in response to strong customer demand for clean energy. Studies show that 4 percent of land in the state is favorable for utility-scale wind energy production, of which only 0.4 percent would be occupied by wind powering equipment. The wind power generated on this small amount of land could be used to meet 30 percent of the state's overall electricity needs.



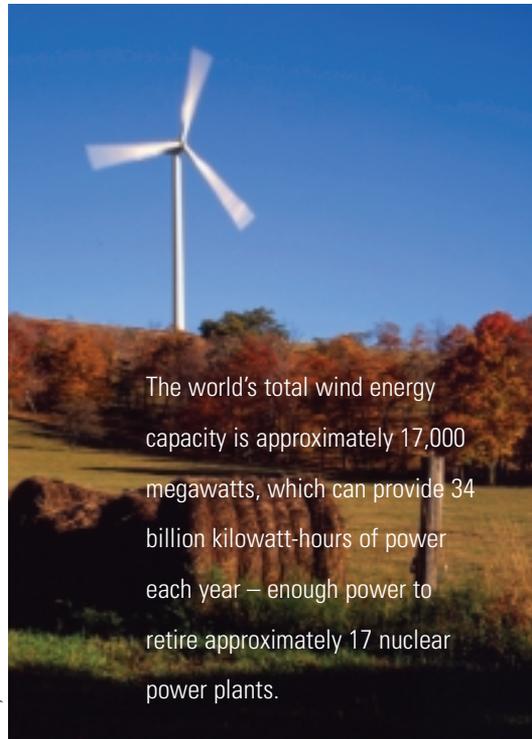
Only 4% of Pennsylvania's land space is needed to produce 30% of the state's overall electricity needs with wind power.



Costs and Benefits of Wind Energy

Wind energy is both environmentally sound and economically feasible. The use of wind to generate electricity results in no harmful air emissions or radioactive waste, making this resource far cleaner than fossil fuels or nuclear power. Some may cite noise pollution, intermittency, and adverse effects on bird populations as negative impacts of wind energy. However, improvements in wind turbine technology have significantly reduced turbine noise to less than that of a hair dryer. Intermittency, while still an issue with wind energy, can be resolved by supplementing energy generated by wind with energy from the electric grid or from another, more localized source like a generator. Siting decisions now take into account the proximity of the wind farm to sensitive bird and raptor populations in order to prevent avian deaths. As turbine designs increase in size, the speed at which the blade tips rotate slows significantly. The result is a decrease in noise and in bird and raptor deaths.

The production of wind energy is extremely pragmatic in a number of ways. The scattered or even somewhat concentrated presence of wind turbines on a large stretch of land does not render the land unusable. Cattle can graze on land within even a few feet of a turbine. In fact, wind development in farming areas often enhances the value of the land and increases the income generated from it.



The world's total wind energy capacity is approximately 17,000 megawatts, which can provide 34 billion kilowatt-hours of power each year – enough power to retire approximately 17 nuclear power plants.

Today, the wind energy industry shows tremendous economic promise. The Electric Power Research Institute calls wind power “nearly cost-competitive with today’s conventional sources.” Furthermore, unlike oil and natural gas fuel prices that are subject to price fluctuation, wind generation offers stable, long-term prices. The wind industry also has the potential to create more new job opportunities than the traditional fossil fuel industries. According to the New York State Energy Office, the wind industry creates, on average, 27 percent more jobs per unit of energy produced than the coal industry.

According to the American Wind Energy Association, if two percent of Pennsylvania’s electricity consumption (1,000 megawatts) were to be generated from wind power:

© 2002, Euron Wind



- Approximately 750 short-term construction jobs and 450 long-term operations positions would be created;
- Rural economic development would be boosted by increased local tax revenues of \$7 million and lease payments of \$2.6 million to landowners; and
- Greenhouse gas emissions would be cut by 2.7 million tons a year – the equivalent of planting 235 million trees or not driving 4 billion miles.



CASE STUDY

Pennsylvania Universities and State Government Buy Wind!

In 2001, the Pennsylvania wind industry was given a promising boost when Carnegie Mellon University, the University of Pennsylvania, and Pennsylvania State University's University Park campus all agreed to purchase 5 percent of their total electricity needs from new wind power generated in western Pennsylvania.

The wind energy that will be used to power these university facilities will be generated by 1.5-megawatt wind turbines, recently installed in the fall of 2001 at the Exelon-Community Energy wind farms in Mill Run and Somerset. The 24 megawatts of new wind energy generated at these two sites will produce 63,000 megawatt-hours of electricity – enough to power 8,000 homes. Compared to the same amount of fossil fuel-generated electricity, the output from these wind farms will avoid approximately 75 million pounds of carbon dioxide emissions annually, which is equivalent to taking 5,400 cars off the road or planting more than 10,000 acres of trees each year.

The Pennsylvania government will purchase 100 million kilowatt-hours of green power for 2002 and 2003 from renewable sources like wind power, landfill gas, hydroelectric and – for the first time – solar energy sources. This represents approximately 5 percent of the state's total usage. Twenty percent of this purchase of green power will be supplied by the new Exelon-Community Energy wind farms in Fayette and Somerset counties. This purchase will provide electricity for several state agencies. The State System of Higher Education's 14 member universities – including Bloomsburg, California, Cheyney, Clarion, East Stroudsburg, Edinboro, Indiana University of Pennsylvania, Kutztown, Lock Haven, Mansfield, Millersville, Shippensburg, Slippery Rock, and West Chester – will purchase wind energy as part of the State of Pennsylvania green power contract. These large government and university purchases spurred Allegheny College, Bucknell University, Dickinson College, Franklin & Marshall College, Gannon University, Gettysburg College, Juniata College, Swarthmore College and Drexel University to buy wind power to supply a portion of their electricity needs.

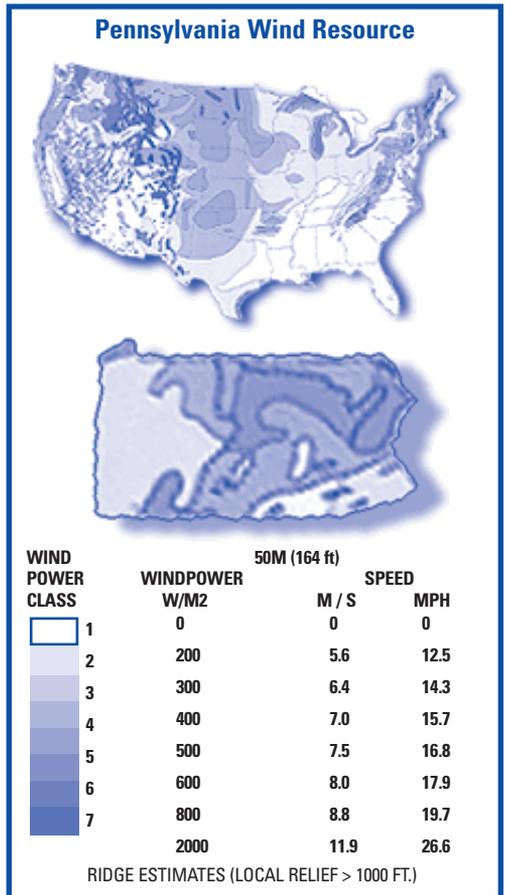


Wind Energy Site Assessment and Suitability

Certain characteristics dictate the effectiveness of a site for wind power development, including the natural distribution of wind in that particular geographic area, vegetation and any man-made site constraints, such as zoning ordinances and previous land use decisions (i.e., housing development). Particularly in urban and suburban areas, a potential wind project may require review by a local zoning authority. In some areas, local government limits the installation of structures taller than 30 feet. The feasibility of developing a particular wind site depends not only upon wind speed and current land use, but also on more complicated factors such as daily and seasonal wind speed variations and the proximity of the site to existing transmission lines. Wind farms require large plots of land and are ideally suited for farming regions.

A wind turbine has the highest capacity value in areas where there is a good match between wind output and utility loads. In other words, locations where the wind peaks at the same time as the utility is required to produce the highest amount of electricity should be considered for wind development.

According to the U.S. Department of Energy, a potential wind site should have average annual wind speeds of at least nine miles per hour or more. Wind speeds in a particular area can be found through the U.S. Department of Energy or through a local airport or weather bureau. Maps of modeled



Note that these general maps may not show all of the available resources. Some terrain and meteorological effects can result in excellent localized wind resources in areas not shown here.



wind speed and power at various heights are available electronically at www.pawindmap.org. Prior to siting a wind turbine or wind farm, on-site wind measurement is strongly encouraged. A recording anemometer can be used to measure on-site wind speeds. An anemometer can give exact wind measurements for long periods of time, after which wind averages can be determined.

Residential Wind Power Systems

The following components make up a wind energy system: a wind turbine, a tower, wiring and "balance of system" components (controllers, inverters and/or batteries). Wind turbines constructed for residential use normally consist of a rotor, a tail (which keeps the blades facing into the wind) and a generator mounted on a frame.

The rotor, which consists of two, or more commonly three blades, captures and converts the kinetic energy of the wind into a rotary motion that drives the generator. According to the U.S. Department of Energy, a 1.5-kilowatt turbine (operating at an average annual wind speed of 14 miles per hour) can generate enough electricity to power a home that uses approximately 300 kilowatt-hours of electricity per month.

In general, the higher the tower, the more the wind energy system can produce. The rule of thumb, according to the U.S. Department of Energy, is to install a turbine on a tower that allows at least a 30-foot clearance above any obstacle that is within 300 feet of the tower. There are two types of towers: self-supporting (or free-standing) and guyed, consisting of a simple framework of metal strips supported by cables and earth anchors. The majority of residential wind turbine towers are guyed.

Balance of System Equipment

Balance of system (BOS) equipment refers to the additional parts that make up the overall self-generation system. Often with smaller systems, direct current (DC) technologies (mainly certain types of lighting) can operate directly off the batteries and an inverter is not needed to convert the electricity into alternating current (AC). However, in order to run standard household appliances, such as most computers, televisions and kitchen appliances, AC is needed. No batteries are needed in grid-connected systems; only the appropriate inverter to make the system compatible with the utility grid is necessary.

DC System Equipment

Battery In an off-grid system, batteries store electricity for later use. Certain types of batteries, such as deep-cycle batteries, provide electricity over longer periods of time. The cost depends upon many factors. Dealers can help you select the type and capacity of battery best suited for your system.

Charge Controller A charge controller regulates the flow of electricity from the generation source to the battery and eventually on to its end use.

AC System Equipment

Inverter An inverter converts direct current (DC) into alternating current (AC). Different types of inverters produce different qualities of electricity. For example, televisions and lights do not require high quality electricity. However, computers and high-grade electronics do.





CASE STUDY

Small Wind Systems

Paul Burmeister, a farmer in central Kansas, has been able to provide constant and reliable wind energy for his home and farm for nearly 14 years. The 10-kilowatt Bergey EXCEL-S wind turbine that he purchased in 1984 has thus far generated approximately 183,000 kilowatt-hours of electricity and has had minimal repairs. Not only has he succeeded in providing electricity for his own use, but he has also been able to sell a large amount to a local electric cooperative, Midwest Energy, Inc. The electricity produced by the turbine is measured using two separate meters – one to measure the amount of electricity going into the electricity grid and the other to measure the utility-generated electricity used by the farm. Each month, Midwest Energy calculates the difference between the two meters. Prior to installing the turbine, Burmeister’s monthly electricity bills averaged \$50 to \$60. Now, bills often run as low as \$5 a month. Due to its high elevation, few trees, and estimated wind speeds of 13 miles per hour, the Burmeister farm is an ideal location to maximize on wind energy.

Source: American Wind Energy Association





Solar Energy

Virtually all of the earth's energy resources, including both fossil fuels and renewables, originate from the sun. Today, solar energy not only takes the form of the more basic passive solar design, but is also applied through highly advanced, cost-effective photovoltaic cells and other solar energy technologies.



Erin Pappas

“The earth receives as much energy from sunlight in 20 days as is believed to be stored in the earth's entire reserves of coal, oil, and natural gas.”

Michael Brower, author of *Cool Energy* (1994)

Solar Energy Applications

Solar energy can be divided into three major categories – passive solar, solar-thermal and photovoltaic.

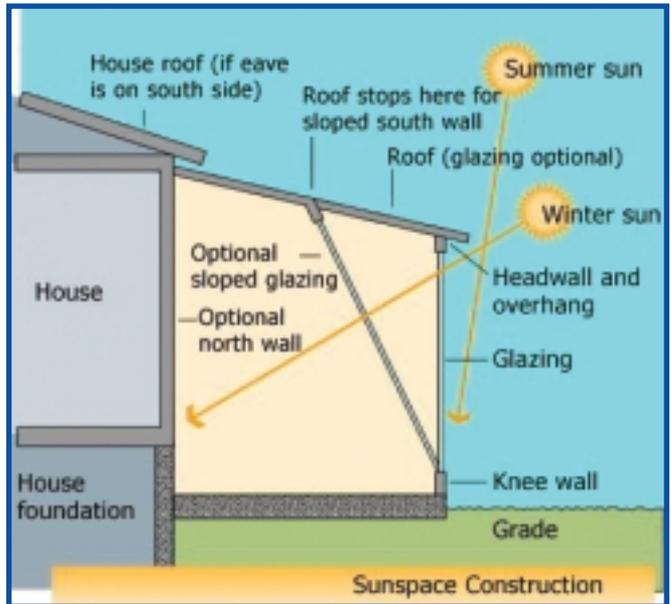
Passive Solar

Passive solar design takes advantage of a building's structure to capture the sun's heat, either storing or distributing it, reducing the need for conventional heating, cooling and/or lighting. Examples of passive solar design include large, south-facing windows, dark colored tile

floors, stone fireplaces, brick interior walls, "sunspaces" (or greenhouses) and super-insulation. Passive solar buildings are often equipped with features, such as overhangs and ventilation systems, which keep them cool in the summer months and warm in the winter months.

Commercial buildings present a

different type of challenge than residential ones because of the heavy lighting and equipment use. The most crucial aspect of passive solar design for commercial buildings is the building orientation relative to the solar path. Other aspects of passive solar design, such as shade trees and indoor atriums, coupled with energy efficiency measures, can help increase the overall efficiency of a commercial building.





Solar-Thermal

Power plants often use fossil fuels as a heat source to boil water. The steam from the boiling water then rotates a large turbine, activating a generator that produces electricity. Solar-thermal concentrating systems use sunlight as the heat source, eliminating the need for fossil fuels. There are three types of solar-thermal concentrating systems – parabolic troughs, parabolic dishes and central receivers. Parabolic troughs, primarily used for industrial purposes, are curved reflectors that focus sunlight into a line receiver in which fluid is heated. Parabolic dishes, also used in industrial applications, are bowl-shaped reflectors that focus sunlight into a small receiver through which passes a heat-transfer fluid. Central receivers, which have traditionally dominated the U.S. Department of Energy’s solar thermal program, are sun-tracking mirrors that focus sunlight onto a large receiver.

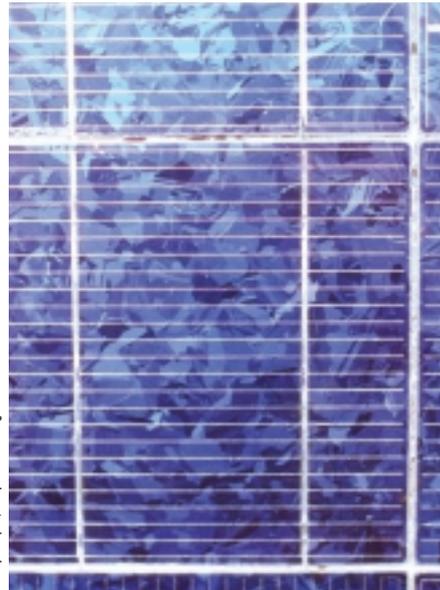
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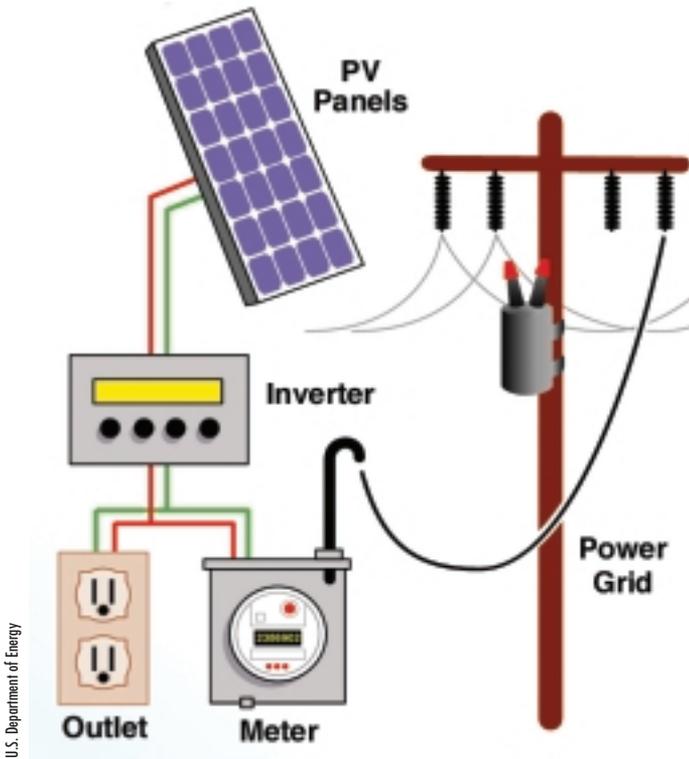


Photovoltaic Cells

Photovoltaic (PV) cells, or solar cells, convert sunlight directly into electricity. As the sun strikes a PV cell, the semi-conducting materials within the cell absorb the sunlight, producing electricity. Solar cells are often used as simple systems that power small calculators and wristwatches. More complicated systems provide electricity for pumping water, powering communications equipment, lighting homes, and running appliances. A series of solar cells form a PV array or “solar panel.” Between 10 and 50 solar panels are

Finley Shapiro, Shapiro Consulting





U.S. Department of Energy

needed to power an average household. PV panels are installed on buildings in places of maximum sun and minimal shade in order to take full advantage of the sun's power. There is very little maintenance required to sustain solar equipment. So long as panels are kept clean, they can last approximately 20 to 30 years.

Solar power can be used in a grid-tied system or in a distributed system. A solar grid-tied system links a series of solar panels through a power inverter to the utility's electric grid. The solar panels generate a direct current (DC) by drawing on energy from the sun. The inverter then converts that direct current to an alternating current (AC), which electronic devices and appliances can use. Batteries are not necessary to supplement the system and any excess electricity generated by the solar panels is redirected by the inverter back into the grid where it can be used on other premises.

Distributed systems work independently from a utility's electric grid, using batteries to store the power. Similar to a grid-tied system, distributed solar panels typically use a power inverter to convert the direct current from the sun into an alternating current, to be used on location. However, some systems function without an inverter and run only DC appliances.



Solar Energy Projects in Pennsylvania

In the spring of 1999, Green Mountain Energy installed the first source of new renewable energy as a direct result of customers choosing cleaner power – 1,400 solar panels (a 43- kilowatt array) on the roof of BJ's Wholesale Club in Conshohocken, PA, just outside Philadelphia.

In October of 2001, Green Mountain Energy, in conjunction with Sun Power Electric, installed a similar system at an IKEA store in Robinson Towne Centre, outside Pittsburgh. The power produced from this 30-kilowatt system will help to offset approximately 19 tons of carbon dioxide (CO₂) per year – equivalent to the CO₂ released by driving a car 42,500 miles (or 70 roundtrips from Pittsburgh to Philadelphia on the Pennsylvania Turnpike).

In addition to serving as a clean source of electricity in Pennsylvania, photovoltaic panels can also be used for solar powered electric fencing and water pumps in agricultural communities across the state. Efforts have been made to install demonstration solar waste pumping systems on dairy farms throughout Pennsylvania. These pumping systems could help provide water to livestock in remote areas where water sources and electrical lines are scarce and transportation costs are high.

Within the Greater Philadelphia Area, both the "Million Solar Roofs" initiative and local solar schools programs have helped to broaden the use of solar energy to electrify homes, schools, government offices and businesses. The Million Solar Roofs initiative is a U.S.

Department of Energy-led program that facilitates the installation of solar systems on the rooftops of businesses and residences with the goal of installing one million systems by 2010. More information is available on the Philadelphia Million Solar

Roofs Community Partnership website, located at www.phillysolar.org.

Thus far, Clean Air Council's Solar Schools Program has installed 2-kilowatt solar arrays on five schools across the state and has published an accompanying curriculum for teachers. More information is available on the Solar Schools Program website, located at www.cleanair.org.



Andreas Campbell

Costs and Benefits of Solar Energy

Few environmental issues arise in regard to solar power development. As with wind power, the use of solar power eliminates air emissions, such as carbon dioxide, sulfur dioxide, nitrogen oxides and mercury that result from the use of traditional fossil fuel energy sources. The manufacturing, transportation and set-up of solar power equipment may contribute to small quantities of air emissions, particularly when fossil fuels are used. The manufacturing of PV cells involves the generation of small quantities of hazardous materials. However, with proper handling, these materials pose little risk to humans or the environment. Certain applications of solar energy, such as central power stations, require large amounts of land, raising issues of wildlife protection and land use. Five acres of land are often needed for each megawatt of capacity. In previously developed urban areas, however, rooftop solar systems are a much more practical application, and can even help save on cooling costs by absorbing energy that would otherwise be transferred to the building's interior.

Economically, the solar industry still faces several barriers to its development such as low fossil fuel energy prices; financial subsidies, incentives, and taxes that are biased toward the fossil fuel industry; and the failure of the economic marketplace to account for the environmental impacts of traditional energy sources. However, within the past three decades, solar power has dropped in price from \$.80 per kilowatt-hour to \$.20 per kilowatt-hour. Today, solar power remains an economically viable alternative energy source, and the many financing programs and incentives available make it even more attractive to both home and business owners. Solar power is particularly economical when the electricity generated from photovoltaics is used to offset peak demand for electricity from conventional sources. Especially during the summer months, solar resources are the greatest in the middle of the day, coinciding with peak electricity demand to run air conditioners and other cooling devices.

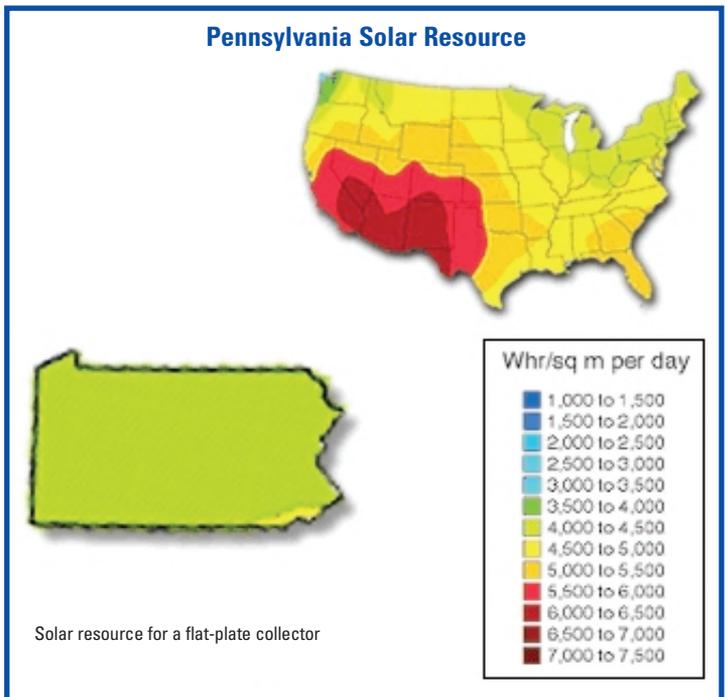
Today, solar power remains an economically viable alternative energy source, and the many financing programs and incentives available make it even more attractive to both home and business owners.

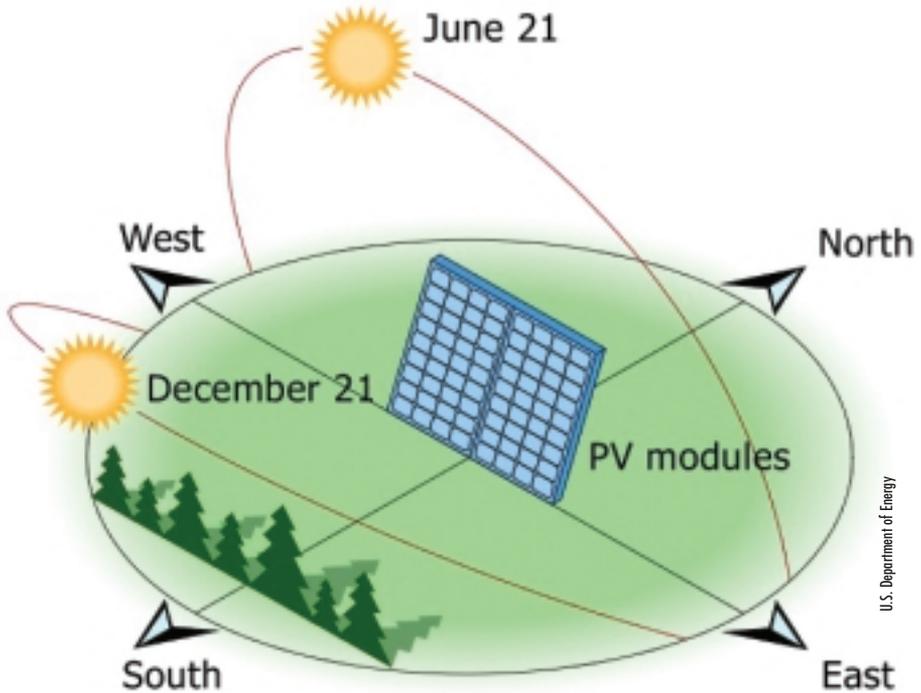


Solar Energy Site Assessment and Suitability

According to the U.S Department of Energy, there are three factors to consider when determining whether or not a site is suitable for PV systems.

- All solar systems in Pennsylvania, and in all of the Northern Hemisphere, must have southern exposure. For maximum output, PV systems should have sun exposure for a majority of the day, particularly during the peak hours of 10 am to 3 pm.
- Southern exposure should be free of obstacles that might shade the PV systems, such as trees, mountains and buildings. It is also important to consider the summer and winter paths of the sun as well as tree growth and future construction projects.
- Appropriate terrain and enough space are also needed to install PV systems.





SUN'S PATH IN THE SKY

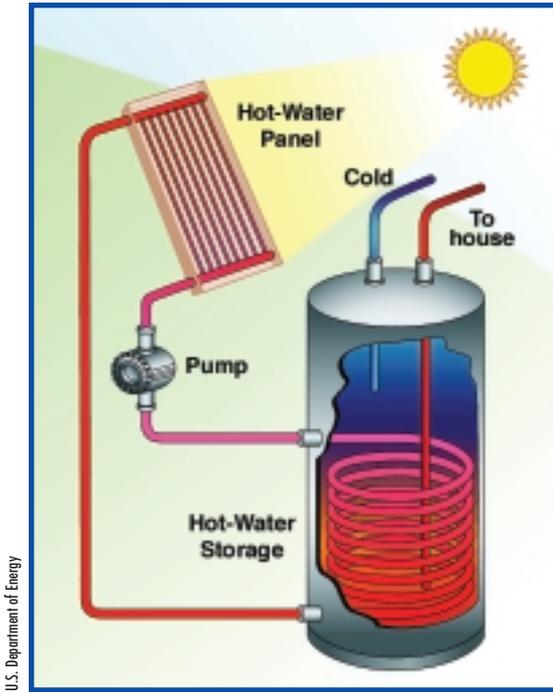
The output from PV systems is directly related to the time and weather; and different locations require different numbers of PV panels. However, contrary to myth, PV systems can produce electricity in poor weather. In fact, on cloudy days, systems can still produce up to 80 percent of their potential energy and up to 50 percent on hazy, humid days. Information on the solar resource of a particular location can be found through the National Oceanic and Atmospheric Administration (www.noaa.gov) or through the U.S. Department of Energy's National Renewable Energy Laboratory (www.nrel.gov).



Residential PV and Solar Water Heating Systems

PV panels can either be mounted facing the south or can be mounted on a tracking device that follows the path of the sun, maximizing the sun's rays throughout the course of the day. More recently, manufacturers have begun to integrate PV products into actual building materials. Several companies now offer rooftop shingles that look like the more traditional asphalt shingle, yet have PV cells integrated in them. In addition to the actual PV modules, other components of a residential PV system include a battery charge controller, batteries, an inverter or power control unit, safety disconnects and fuses, a grounding circuit and wiring.





Solar water heating systems can be either passive or active. Active systems need an electric pump to circulate fluid that transfers the heat. The majority of systems consist of a solar collector that is affixed to a south-facing roof with adequate solar exposure. Typically, these systems circulate either water or an antifreeze solution through the solar collector where the sun's heat warms the liquid. Storage tanks are used to store and provide a source for hot water. Solar water heating is more cost-effective than electric water heating and can save as much as 50 percent to 80 percent annually on utility bills. Similar to other major appliances, solar water heating

systems are often certified and/or labeled. For more information on certification and labeling for solar water heating systems, visit the Solar Rating and Certification Corporation's website at www.solar-rating.org.

Hybrid Systems

Hybrid systems combine two or more electricity generation sources into one system, such as wind and PV. There are several advantages of a hybrid system over a single generation system. Wind and solar energies often complement each other; while wind speeds can sometimes be lower in the summer months, the sun's rays are stronger. Hybrid systems maximize this relationship, producing power when it is needed. When wind and solar resources are low, hybrid systems can either provide power through batteries or through a generator powered by fossil fuels.



Hydropower

Water has been used throughout time to generate power on a worldwide scale. Currently, at least 15 percent of the world's electricity and approximately half of the renewable electricity generated in the United States comes from hydropower.

Hydropower Applications

Hydropower can be divided into two categories – low-impact (or small) hydropower and high-impact (or large) hydropower. Low-impact hydropower is considered a clean, renewable source of energy. Low-impact hydropower resources generate electricity by using either very small dams or no dams at all to divert a portion of a stream or river to a turbine. Low-impact hydropower sources usually produce 30 megawatts or less of electricity. High-impact hydropower facilities produce more than 30 megawatts of electricity and often result in negative impacts to the surrounding environment.

Both large and small hydropower systems are used in the United States. Hydropower represents the largest portion of renewable energy used in Pennsylvania, responsible for close to one percent of Pennsylvania's total electricity consumption. Hydropower generation requires not only a large volume of flowing water, but also a significant change in elevation. Pennsylvania has the second highest mileage of rivers and streams in the entire United States, behind Alaska. Therefore, the potential for further hydropower development in the state is high.

Costs and Benefits of Hydropower

The use of hydropower eliminates much of the air, water and land pollution associated with traditional fossil fuel electricity generation. In almost all cases, hydropower development is more cost effective than wind or solar power because much of the associated technology is proven effective and has been actively used to generate electricity for decades. Hydropower use, however, has the potential to cause more negative environmental impacts than wind or solar power, depending upon the size of the facility and its location.



Changes in the river conditions and in the land and vegetation bordering the river, caused by dams and powerhouse operations, may impact fish populations and other wildlife. Even smaller, low-impact hydropower facilities have the ability to impact regional fish populations if not designed or located properly. The occurrence and severity of these negative environmental impacts depends upon the location and design of the facility, the sensitivity of the local environment to effects of the hydropower facility, and the steps taken to modify the design and/or operation of each facility to reduce potential impacts.

The Low-Impact Hydropower Institute (LIHI) certification program attempts to identify facilities that have little negative impact to the surrounding environment. In addition to LIHI, other programs exist which certify hydropower and other electric power generation technologies according to life cycle analysis principles, such as ISO 14040 certification. Hydropower production facilities have the potential to:

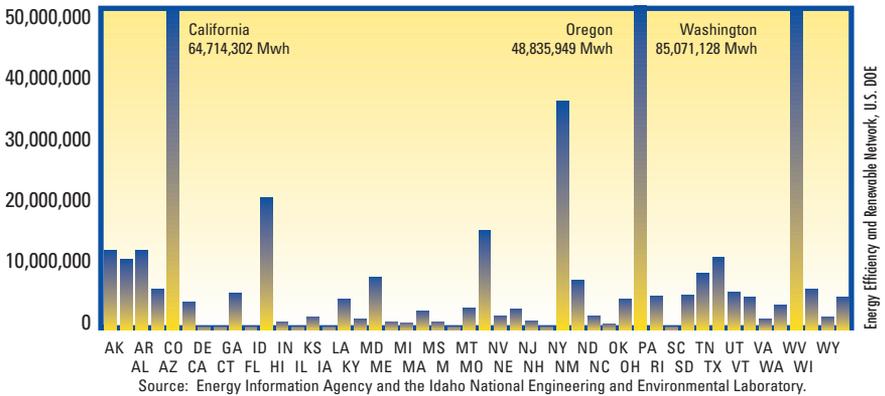
- **Disrupt the natural flow of the river** – fluctuations in flow, from either too little water or strong surges of water, can cause erosion, flooding, and dramatic changes in reservoir water levels by up to 40 feet;
- **Alter river and riverside habitat** – the effects of changes in river flow mentioned above can flood riverside habitats and destroy others;
- **Alter water quality** – variations in water temperature and/or the amount of dissolved gases in the river water may impact the habitat, growth rate, and even the survival of sensitive fish populations;
- **Create obstacles to fish migration** – the use of ladders, lifts and trucks to allow fish to pass around dams can minimize this impact; however, these methods cause stress and long-term damage to fish populations; and
- **Impede the natural flow of sediments** – flowing water transports sediment; however, with the decrease in water velocity associated with hydropower facilities, more sediment can drop out and collect in river and reservoir bottoms.



Residential Hydropower Systems

Residential properties with on-site stream resources have the option of generating electricity from a micro-hydropower system – typically producing less than 300 kilowatts of electricity. Because of their small size, these systems do not require significant alteration by dams and other heavy equipment. In a micro-hydropower system, water pressure is used to move a turbine, which in turn drives a generator to produce electricity. The head and flow of the stream determine the potential of electricity. The stream’s head – the vertical distance that the water falls from the point of intake to the turbine – and flow – the volume of water – can either be measured by the resident or by a dealer. The stream’s flow is much more difficult to measure than the head because the volume of water varies from season to season and from year to year. The efficiency of the chosen equipment plays a large role in determining the amount of power the system can generate.

Hydropower Resource by State





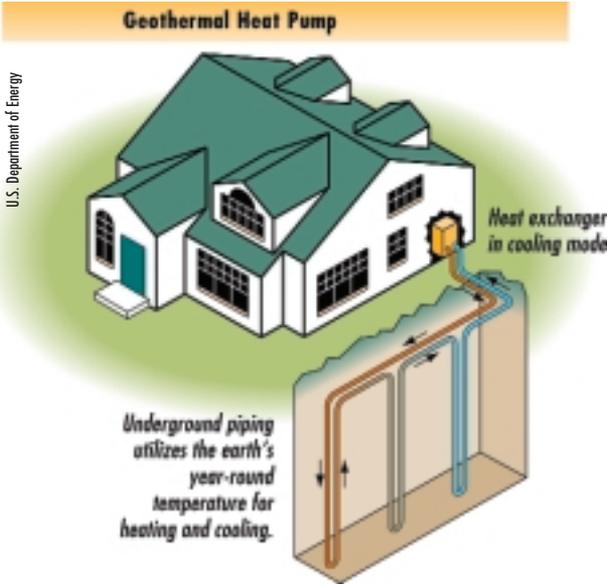
Geothermal Energy

Geothermal energy is energy derived from reservoirs of hot water below the earth's surface. Geothermal heat, generated from the high-temperature, liquid rock (magma) of the earth's core, is transferred to underground reservoirs of water that circulate beneath the earth's crust. The limitless amounts of magma and continuous transfer of heat make this resource renewable. Historically, geothermal heat, in the form of natural hot springs, was used for cooking and bathing. Today, innovations in geothermal technologies enable this resource to generate electricity as well as heat space and water for both residential and commercial settings.

Geothermal Energy Applications

In total, the United States generates 2,700 megawatts of geothermal electricity, meeting the electricity needs of well over two million U.S. citizens. The Pacific Northwest has the potential to generate more than 11,000 megawatts of electricity through geothermal power. Areas of the country that are locations of recent volcanic activity are the most viable for geothermal power. These areas are mostly in the western United States and include southeast Oregon, Washington and northern California. Virtually all geothermal electricity generation takes place in California, Utah, Nevada and the island of Hawaii. In fact, Hawaii generates 25 percent of its total power by means of geothermal power.

Pennsylvania does not have sufficient geothermal resources to generate electricity, but has low to moderate temperature resources that could be tapped for direct heat or for geothermal heat pumps.



Geothermal Heat Pumps

Ground-source or geoExchange heat pumps, commonly referred to as geothermal heat pumps, offer an efficient and cost-effective way to both heat a home and/or provide hot water. Geothermal heat pumps do not draw upon the same steam or heat from deep under the earth's surface as do other applications of geothermal energy. Instead, residential geothermal heat pumps draw on the relatively stable temperatures of the ground surrounding the home in order to provide heat in the winter months and cooling in the summer months.

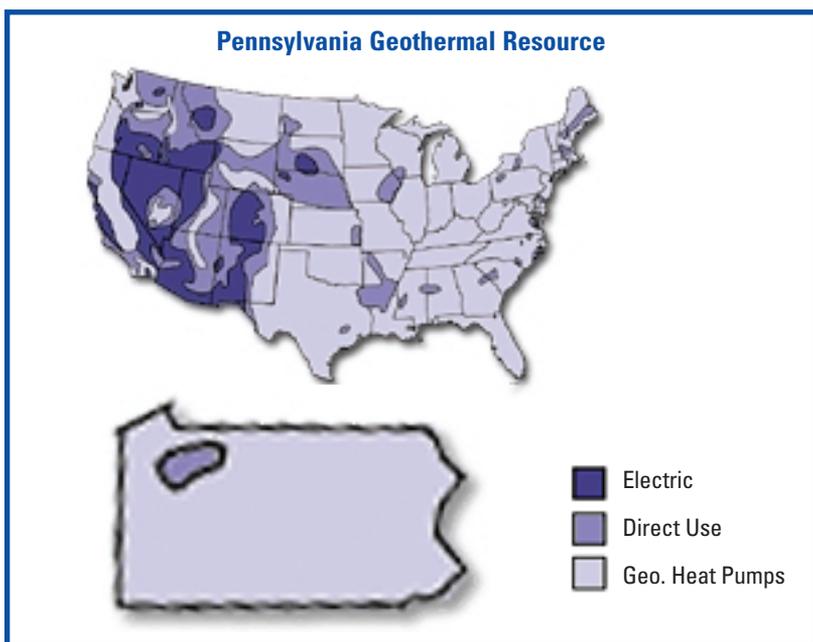
While homes can be retrofitted for geothermal heating and cooling, pumps are normally installed when a building is constructed because they require a large loop of tubing, typically several feet under the surface. Residential geothermal energy is normally used to heat water for the home, eliminating the need for a separate water heater (saving money) and performing more efficiently (saving energy). Geothermal heat pumps have dual functions – during the winter months, heat is drawn from the earth and released into the home, and during the summer months, heat from within the home is collected and released into the cooler earth. Geothermal heat pumps are both clean and efficient because they simply move heat from the home to the earth and vice versa – no heat is created.



Costs and Benefits of Geothermal Energy

As a type of renewable energy, geothermal energy production and use eliminates the traditional air, water and land pollution associated with conventional electricity generation technologies.

According to the United States Environmental Protection Agency (EPA), geothermal heat pump systems are the most energy-efficient, environmentally clean, and cost-effective space conditioning systems available. Residential geothermal heat pumps may cost more to install initially (“first cost”) than conventional heating and cooling systems, but the additional investment can be recouped within a few years. For commercial installation, first cost is often comparable to conventional systems, and energy and maintenance costs will be lower.







Biomass, Landfill Gas and Municipal Solid Waste

Biomass, landfill gas and municipal solid waste are perhaps the most controversial of the resources being proposed as alternatives to fossil fuel use. Much debate still exists as to whether or not these resources are indeed renewable, and even more so, whether or not they are clean. While these questions and many more remain unanswered, the applications of these resources, as well as their environmental and economic costs and benefits, give some insight into their viability as alternative energy sources. Biomass, landfill gas and municipal solid waste are all typically used to generate electricity or are converted into fuel for the utility, industrial, transportation and commercial sectors. With the exception of fireplaces, wood-burning stoves and other wood-burning applications, these resources are not typically used for self-generating electricity at the residential level.

Biomass

Applications

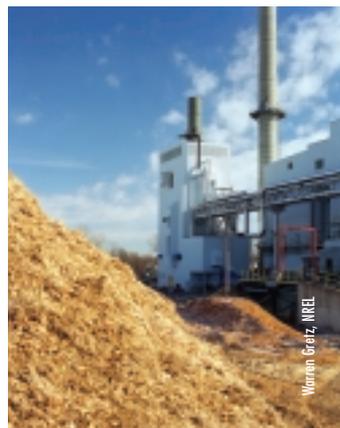
A diverse set of fuels, ranging from timber, agriculture, animal waste, and food processing wastes to fuel crops specifically grown or reserved for electricity generation, constitute the biomass resource. Biomass resources can also be converted into fuel for space heating, transportation and other end uses.



Sewage sludge and animal manure are also often considered biomass fuel sources. Although often disputed, many categorize biomass resources as “renewable” – trees can naturally regenerate, while crop residues, sewage, animal manure and other wastes are continually regenerated by society. Presently, the majority of biomass power plants burn lumber, agricultural or construction/demolition wood wastes.

There are two standard applications of the biomass resource – direct combustion and biomass gasification. Direct combustion power plants burn biomass fuel directly in boilers that supply steam for the same kind of steam-electric generators used to burn fossil fuels. Biomass gasification plants convert crops and other fuels into flammable methane gas, which can fuel generators, combustion turbines, combined cycle technologies and/or fuel cells. Several non-combustion methods (including thermochemical, biochemical and chemical processes) can be used to convert raw biomass materials into energy, all of which involve breaking down the carbohydrates found in raw biomass.

Biomass accounts for over three percent of U.S. energy consumption, supplying approximately 4.5 million people with energy. The industrial sector accounts for 80 percent of the biomass used in the United States, with industries in the northeast contributing greatly to this percentage. In Pennsylvania, an estimated 10.8 billion kilowatt-hours of electricity could be generated using renewable biomass sources. This would be enough to supply the annual electricity needs of approximately 1,080,000 average homes or about 25 percent of the residential electricity use in Pennsylvania. Furthermore, Pennsylvania farms carry the potential to convert animal waste into fuel through digester technology, which varies from farm to farm, adding yet another application of biomass technology.

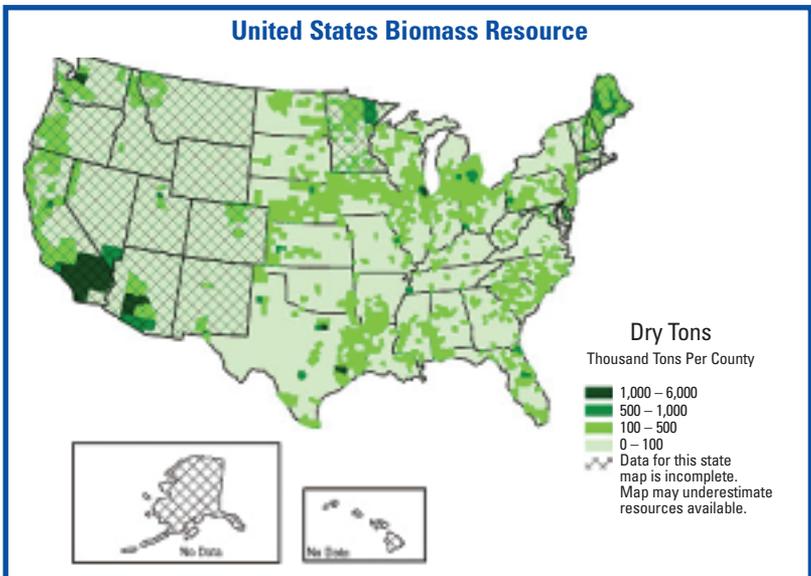


Costs and Benefits

Because there are numerous, and often very diverse, types of biomass resources, it is necessary to consider each on a case-by-case basis when evaluating environmental, economic and human health consequences. The largest problem with biomass fuels used to generate electricity is their associated air emissions. The quantity and type of emissions is largely dependent upon the precise fuel and technology used. Nitrogen oxide emissions, while one of the top air quality concerns of biomass, are dependent upon the particular facility's design and emissions control measures, as well as the nitrogen content of the biomass fuel.



Other air pollution problems associated with biomass combustion include sulfur dioxide, carbon monoxide, carbon dioxide and particulate matter. Wood gives off fairly low sulfur dioxide emissions in comparison with traditional fossil fuel sources. However, biomass combustion plants sometimes emit carbon monoxide at a rate higher than that of fossil fuel plants. The cycle of growing, processing and burning biomass leaves little or no net gain in atmospheric carbon dioxide, the leading greenhouse gas. Particulate matter pollution can often be controlled through conventional technologies. Other environmental and public health issues include toxic air emissions resulting from the combustion of contaminated/treated woods and pollution of local water resources as a result of agricultural wastes.



Landfill Gas

Applications

Large municipal or industrial landfills produce gas that can be tapped for electricity generation. Microorganisms that live within the organic materials sent to a landfill, such as food wastes, paper and yard clippings, cause these materials to decompose, emitting a gas which is approximately 60 percent methane and 40 percent carbon dioxide. Landfill gas can be collected by drilling “wells” into the landfill and funneling the gas up through a pipe. Once processed, landfill gas can be combined with natural gas to fuel

conventional combustion, small combustion or combined cycle turbines. Currently, the U.S. Environmental Protection Agency requires all large landfills to install collection systems at sites to minimize the release of methane gas, which contributes to global climate change or global warming. As with biomass, there is still much debate as to whether or not landfill gas should be considered a renewable resource and even more question as to whether it is a clean source of energy.



Philip Shepherd

Costs and Benefits

The impacts of landfill gas begin with the impacts of landfills themselves, mainly their effect on land and on surface and groundwater resources. Capturing landfill gas and converting it into electricity can have positive impacts on air quality where landfills already exist or where the decision to build a landfill has already been finalized. A landfill gas power plant burns the waste gas (methane) that would otherwise be released into the atmosphere or burned off in a flaring process. However, advocating landfill gas as a renewable energy resource across the board could, in many instances, discourage more environmentally preferred waste management techniques such as reduction, reuse and recycling.

The main component of landfill gas is methane, the global warming effects of which are 23 times that of carbon dioxide. This property of methane makes the control of methane emissions essential. As with the combustion of biomass, landfill gas generators produce nitrogen oxides, the amount depending upon the type of generator and the extent to which pollution control measures have been taken at the site. Combustion of landfill gas also releases organic compounds and trace amounts of toxic materials (mercury and dioxins).

Municipal Solid Waste

Applications

Burning municipal solid waste (MSW), often referred to as waste-to-energy (WTE), is the process of disposing of waste through incineration and producing electricity as a byproduct. MSW consists of everyday trash from residential, commercial and institutional buildings. Items range from packaging and furniture to paint and batteries. MSW does not include medical, commercial or industrial hazardous, or radioactive wastes, as they are treated separately. According to the U.S. Environmental Protection



Agency, in 1998, 17 percent of the MSW in the United States was burned for electricity, 55% was disposed of in landfills, and 28 percent was recovered for reuse. Of the 17 percent that was burned, 14 percent occurred in Pennsylvania.

There are two WTE facility designs used in the United States – mass burn and refuse-derived fuel. Mass burn facilities, which are most common in the United States, combust MSW in much the same way as fossil fuels are used in other direct combustion technologies. Burning MSW converts water to steam, which drives a turbine connected to an electricity generator. Refuse-derived fuel designs process the MSW prior to combustion, shredding the MSW and removing metals and other bulky items. The MSW is then combusted in the same manner as in mass burn plants.

There is even more controversy over whether or not MSW is a renewable resource than with biomass and landfill gas. According to Power Scorecard, an on-line rating system for electricity products, MSW is not a renewable resource because it includes materials made from fossil fuel resources, the amount of plant material within the MSW stream is unpredictable and the MSW stream could be reduced through other waste management techniques. The U.S. Environmental Protection Agency and many state governments do consider MSW a renewable resource because MSW is abundant and contains significant amounts of biomass.

Costs and Benefits

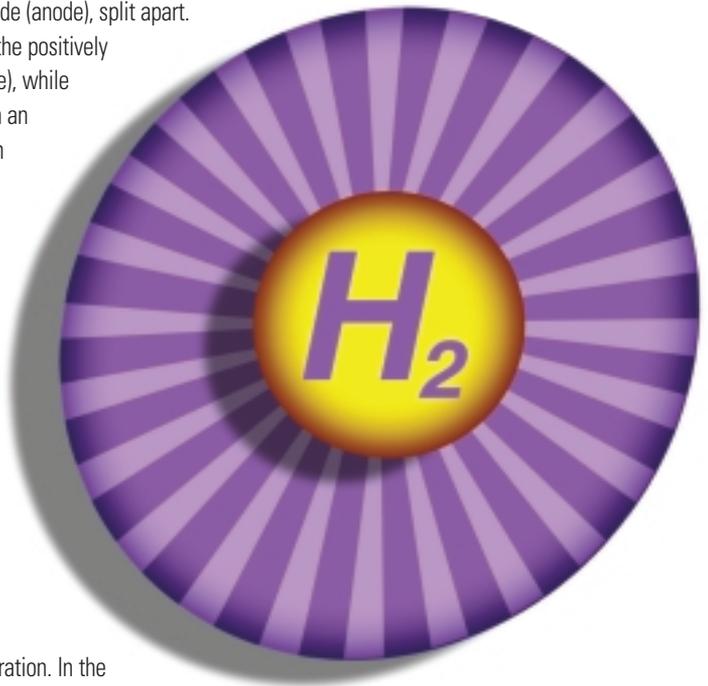
Ash disposal and air pollution are the largest environmental and public health problems associated with the burning of MSW. The MSW stream is diverse, containing both items that are benign and those that are extremely toxic to human health. If mechanisms were put in place to better eliminate toxic materials from entering the waste stream at these facilities, these air emissions could be reduced. Toxic air pollution resulting from MSW combustion includes trace metals (lead, cadmium, and mercury) and trace organics (dioxins and furans), both of which negatively impact public health and the environment by entering into ground water and into the air. Refuse-derived fuel WTE facility designs have the potential to remove a portion of these highly toxic metals and other items prior to combustion. MSW combustion also has comparatively high nitrogen oxide and carbon dioxide emissions. The net climate change impact of the carbon dioxide emissions associated with WTE facilities is argued to be less than if the MSW was left in the landfill to decompose.

Powering the Future With Fuel Cells

Like batteries, fuel cells convert energy into power through a chemical reaction. While fuel cells do not need to be recharged, they do require an external fuel source – typically hydrogen gas. Each cell contains two electrodes, between which lies an electrolyte (a substance through which hydrogen can pass freely). The hydrogen molecules, when forced against the negatively charged electrode (anode), split apart.

The protons are pulled to the positively charged electrode (cathode), while the electrons pass through an external circuit, forming an electrical current. Finally, the protons and electrons rejoin in the cathode and, when exposed to oxygen, form only water and heat as byproducts.

By producing electricity through chemical reactions rather than through combustion, the use of fuel cells eliminates much of the air pollution associated with traditional electricity generation. In the near future, hydrogen is most likely to come from natural gas. However, with further research and development, a combination of renewable energy (such as solar energy) and water can provide hydrogen for use in fuel cells. Added benefits of fuel cells include a reduction in the United States' dependence on foreign oil, higher levels of efficiency, and the ability to store and distribute energy in the form of a fuel (hydrogen). Fuel cells can be applied in the transportation, utility, residential and commercial sectors.





Pennsylvania Electric Choice

Prior to deregulation (or restructuring) of the electric utility industry in 1996, Pennsylvania consumers did not have the option to choose their electricity supplier. Rather, consumers were assigned an electricity provider based on where they lived. Eleven electric utilities currently operate across

PURCHASING

CLEANER ELECTRICITY IN PENNSYLVANIA

Pennsylvania and were the only option for electricity generation, transmission and distribution in Pennsylvania.

Many factors led to the deregulation of the electricity industry, which began in the early 1990s. Regional disparities in electricity pricing left some areas of the country, including Pennsylvania, with electricity prices well over the national average. In theory, deregulation would create a competitive marketplace for electricity, forcing prices down for all customers.

Pennsylvania Electric Utility Service Territories



- Allegheeny Power
- Citizens Electric Company
- Duquesne Light Company
- Met-Ed (Formerly GPU Energy)
- RECO Energy
- Penelec (Formerly GPU Energy)
- Penn Power
- Pike County Light and Power
- PPL Electric Utilities
- UGI
- Wellsboro Electric Company

Generation, Transmission and Distribution

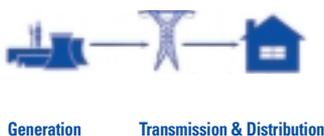
Generation– Generation is the production of electricity using either renewable or non-renewable energy as a fuel source.

Transmission – Transmission refers to the regional inter-connection of electric lines that move electricity from generation facilities to the distribution lines of an electric distribution company.

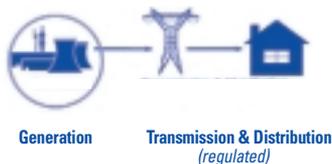
Distribution – Distribution refers to the local wires, transformers, substations and other equipment used to deliver electricity locally to customers from the transmission lines.

Source: Pennsylvania Public Utility Commission

Before Deregulation



After Deregulation



Sustainable Energy Education Program
Clean Air Council



In a deregulated electricity market, electricity generation is open for competition, separating it from the transmission and distribution stages. In other words, customers keep the same utility company for transmission and distribution of electricity to their home and/or office, but have the option to choose a different electricity generation company. This enables customers to “shop around” for a better product

and allows customers to base their decision on price and on environmental factors. The utility that currently delivers electricity to homes and businesses will continue to be responsible for resolving any billing problems, downed lines and power outages.

In Pennsylvania, former Governor Tom Ridge signed the Electricity Generation Customer Choice and Competition Act (HB 1509) into law in 1996, eliminating the traditional regulated monopoly system for the electricity industry and creating opportunities for other electric suppliers to offer products and services to Pennsylvania consumers. Pennsylvanians now have the opportunity to choose an electricity supplier.



Renewable Portfolio Standards

A renewable portfolio standard (RPS) requires each utility company that generates electricity to obtain a portion of that electricity from renewable resources. The company has the option of either generating that electricity itself from renewable energy or buying credits or electricity from a different renewable energy generator. RPS programs are flexible and market-friendly because they allow companies to buy, trade and/or generate electricity from renewable energy in a way that is most efficient and economical for them.

According to the ideal estimates of the Union of Concerned Scientists, establishing and implementing an RPS would allow renewable energy to go from accounting for three percent of total U.S. electricity generation to 10 percent by the year 2010. For this to happen, the PJM region, composed of the states of Pennsylvania, New Jersey and Maryland, would have to install approximately 5,500 megawatts of capacity by means of wind power and biomass. Renewable energy would have to account for about 10.5 percent of the electricity consumption in the PJM region.

RPS programs are established at the state level, thus the standard varies throughout the country. Pennsylvania's RPS, rather than applying one universal standard across the state like most other states have done, has different standards for each service territory. Most service territories, however, have established an RPS of two percent, which went into effect in 2001 and increases 0.5 percent annually. In Pennsylvania, eligible renewable resources vary depending upon the service territory and can include photovoltaics, solar thermal, wind, low head hydro, geothermal, landfill and mine-based methane gas, waste-to-energy and sustainable biomass.

Identifying Clean Energy Options in Pennsylvania

Electricity deregulation gives customers the opportunity to switch to a cleaner, renewable electricity supplier. Pennsylvania has the nation's most active green energy market – thus far, more than 80,000 customers have switched to a cleaner electricity supplier. As more customers in Pennsylvania sign up for green power products, more clean energy facilities will be built to meet this need.

When a customer purchases green power from a supplier, that generator must supply enough green power to the grid to equal the green power commitments made to customers. Tools such as the Green-e standard and Power Scorecard help consumers to identify and learn more about their clean energy options.

Green-e

The Green-e program is a voluntary certification program for renewable electricity products. By establishing a consumer protection and environmental standard for products, the Green-e program provides a way for consumers to quickly identify and make informed decisions about environmentally friendly products within a deregulated electricity market. All electricity products that meet the Green-e standard are marked by a logo. Green-e certifies a variety of electricity product offerings for the residential, commercial and wholesale markets. In 2002, Green-e began certifying certificates or "green tag" products, which allow customers to buy renewable power without having to switch suppliers. The Green-e logo has helped to establish consumer confidence in retail renewable energy products. Green-e is administered by the non-profit Center for Resource Solutions, and within each state where Green-e is active, a regional advisory committee made up of a diverse set of stakeholders oversees the program.



In order to carry the Green-e logo, products must meet the following criteria:

- Fifty percent or more of the electricity supply must come from one or more eligible renewable resources, as defined by Green-e (tradable renewable energy certificate products or "green tag" products must contain 100 percent new renewables to be eligible for Green-e certification);
- If a portion of the electricity supply is non-renewable, air emissions must be equal to or less than those produced by conventional sources;
- No specific purchases of nuclear energy (meaning that the percentage of the product that is non-renewable must not be generated from nuclear power); and
- Meets the Green-e new renewable requirement – defined as renewable energy generated from solar electric, wind, biomass and geothermal facilities that have come online since 1997. The product must contain specific percentages of new renewable sources.

For a complete listing of Green-e certified products available in Pennsylvania, visit www.green-e.org.



Power Scorecard

The Power Scorecard is a tool that provides customers with information on the environmental impacts of electricity products. Power Scorecard differs from the Green-e logo in that it uses a grading system to rate all electricity products based on their overall environmental impact and their new renewable content. Green-e is a pass-fail certification and Power Scorecard uses many ratings to approve products.

Power Scorecard grades the environmental quality of electricity products in two ways. First, the scorecard attaches a score to the impact that a product has in eight different environmental areas – global climate change; acid rain; smog (ozone) and fine particulates; toxic mercury emissions; consumption of water resources; pollution of water bodies; on-site land impacts; and off-site land impacts. Second, the scorecard grades the product according to the percentage of electricity obtained from new renewable resources (newly built technologies that use renewable sources of power to produce electricity).

To find out how various electricity products rate in Pennsylvania, visit www.powerscorecard.org. By simply selecting a state and service territory, this easy-to-use website allows visitors to obtain a detailed rating of the environmental impact of all available electricity products, as well as their cost per kilowatt-hour. Additional information on clean energy options available in Pennsylvania and the rest of the mid-Atlantic region is available at www.cleanyourair.org.



For a FREE presentation on electric choice or for more information on the clean, renewable energy options available in your area, contact Clean Air Council's Sustainable Energy Education Program (SEEP) at (215) 567-4004 or visit www.cleanair.org.

Tradable Renewable Energy Certificates

A tradable renewable energy certificate (TRC, or often referred to as a “green tag”) is a new way to purchase renewable electric generation that divides the generation into two separate products: the commodity energy and the renewable attributes. The TRC represents the renewable attributes of a specific quantity of renewable energy. TRCs serve two primary roles. The first is to provide an accurate and reliable tracking mechanism for renewable energy products, reducing fraudulent claims made by marketers. The second is to help facilitate the trade and sales of such renewable energy products. In this role, the TRC acts like currency that represents the non-energy attributes of renewable generation. The TRC allows the environmental, social and economic development attributes of renewable energy generation to be separated from the electricity and to be represented as a separate product.

For more information on purchasing TRCs in Pennsylvania, visit the Green-e website at www.green-e.org.





Energy Efficiency for Buildings

Home Energy Audits

A home energy audit is the first step in identifying ways to increase energy efficiency in the home. An audit will show areas within the home that are currently operating inefficiently and once corrected, offer the opportunity to save money on energy bills. Simple audits can be performed without a professional auditor; however, in some cases, a more comprehensive assessment performed by a professional auditor can reveal important savings.

Do-it-yourself home audits can be as simple as conducting a basic walk-through of your home.

ENERGY EFFICIENCY

FOR HOMES AND BUSINESSES

Locating air leaks, or drafts, is one of the most important steps in the audit process. Air leaks are most often found by windows and doors, but also can be found along baseboards, floor edges, electrical outlets, fireplace dampers, and gaps in pipes and wiring. In cases where it is difficult to locate air leaks, incense sticks or a damp hand can be used – moving air will cause smoke to waver and drafty air will cool a damp hand. Caulking and weather stripping can often be used to prevent air leaks. In other instances, replacement of doors and windows with more efficient ones makes more sense.

In addition to air leaks, it is important to evaluate the quality of insulation used in the attic and walls of a home. The U.S. Department of Energy's R-value scale, updated regularly, rates different types of insulation by its insulating properties. While a home's original insulation may have been adequate at the time of construction, higher energy prices may warrant replacement with more efficient insulation. A do-it-yourself home audit should also include an evaluation of heating and cooling equipment, replacing filters, insulating ducts and pipes, and replacing units with more efficient ones as necessary. Finally, every home audit should inspect lighting, examining the wattage size of light bulbs and considering replacing traditional light bulbs with compact fluorescent ones.

Professional home energy audits include a more detailed, room-by-room walk-through of the home, as well as a blower door test, thermographic scan and an examination of past energy bills. In a blower door test, a powerful fan is mounted into the frame of an exterior door. The fan pulls air out of the house, lowering the air pressure inside the home. Professional auditors will then note locations where the higher, outside air pressure flows through gaps into the home. Professional auditors can also use thermography, or infrared scanning, to determine air leaks in the building envelope. Thermography produces an image that illustrates temperature variations throughout the building's skin, helping to determine the effectiveness of a home's insulation. The image records these temperature variations using a range from white for warm regions to black for cooler regions. Thermography can be used on both the interior and exterior walls of a building. Professional energy audits normally take between four and eight hours. Local professional energy auditing services can be found by contacting the Pennsylvania Department of Environmental Protection, your local electric or gas utility, or through the yellow pages of a local telephone book under "energy service" or "electricity service."

Energy Use in the Home



44% Heating and Cooling



33% Lighting, Cooking and other Appliances



14% Water Heating



9% Refrigerator

U.S. Department of Energy

Calculate Your Savings Online!

www.homeenergysaver.lbl.gov

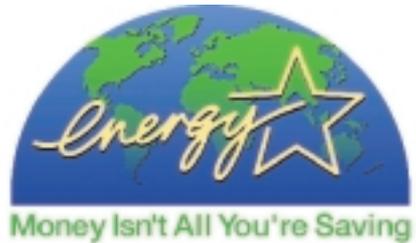
Calculate your potential energy and cost savings online using the Home Energy Saver, an online energy advisor that assesses the positive impacts that energy efficiency could bring to your home! By simply entering your zip code, the Home Energy Saver displays a typical home energy bill (based on the area of the country that you live in and the energy prices in that area) and how much that bill could be reduced with a more efficient home. This online energy advisor breaks down each bill by what the power is used for (i.e., heating, cooling, lighting, etc.) and gives detailed tips on how to achieve both energy and cost savings in each category.





Building Envelope

One way to create an energy efficient residential and/or commercial building is to improve the efficiency or design of the building envelope. The building envelope refers to everything that separates the interior walls of a building from the outdoors. Windows, walls, ceilings, foundations, basement slabs, roofs and insulation are all considered part of a building's envelope. Efficient windows can provide added energy and cost savings. Windows are often rated on the solar heat gain coefficient (the amount of solar radiation admitted through a window), the U-value (how well the window insulates), and/or the visible transmittance (how well light passes through the window). Energy efficient windows can be identified by the Energy Star logo. White and/or reflective roofing helps to reflect heat and keep buildings naturally cool. Proper insulation in walls, ceilings and foundations, as well as alternative building materials such as adobe, straw bale and recycled materials, improve the energy efficiency of the building envelope.



What is Energy Star?

Energy Star is a labeling program administered by the U.S. Environmental Protection Agency and the U.S. Department of Energy that identifies and promotes energy efficient products in homes and businesses with the goal of reducing carbon dioxide. For information on the Energy Star program, visit www.energystar.gov.

Space Heating and Cooling

Energy efficient furnaces and boilers, air conditioners, dehumidifiers, and air-source heat pumps, often labeled with the Energy Star logo, can improve the efficiency of a building's heating and cooling system. Natural ventilation and fans are considered amongst the cheapest and most energy efficient ways to ventilate a building. A building's temperature can also be regulated through installing a setback thermostat. Setback thermostats are automatic thermostats designed for central heating and/or cooling systems that allow the building's temperature to be programmed in advance and in relation to the particular time of day. Diligent upkeep of heating and cooling ducts through regular testing and repair also add to the efficiency of space heating and cooling systems. Strategic planting of trees and bushes and other efficient landscaping techniques can provide natural cooling for buildings and protection from prevailing winds. Air-source heat pumps are more efficient than standard electric or gas water heaters. Improving the efficiency and insulation of water heater tanks is another way to reduce energy use and costs. Tankless water heaters, which exhibit less heat loss, are also an energy efficient option for buildings.

Lighting

According to the U.S. Department of Energy and U.S. Environmental Protection Agency, the typical household spends approximately \$110 per year on lighting, which amounts to about 10 percent of an average household's annual energy budget. Light fixtures labeled with the Energy Star logo use 50-75 percent less energy than the conventional incandescent or halogen fixtures. Compact fluorescent lighting is the most common technology used to reduce electricity use and save money on energy bills. Over a lifetime, one compact fluorescent bulb can equal up to 13 standard bulbs. For more information on energy efficient lighting, visit the U.S Department of Energy's Energy Efficiency and Renewable Energy Network at www.eren.doe.gov/EE/buildings_lighting.html or Energy Star at www.energystar.gov.



Appliances

In 1987, Congress passed the National Appliance Energy Conservation Act (NAECA), which established efficiency standards for a dozen standard household appliances. The Act has since been amended to include fluorescent lighting ballasts, commercial and industrial products, and plumbing fixtures. Currently, the U.S. Department of Energy has the authority to upgrade appliance efficiency standards to the “maximum level of energy efficiency that is technically feasible and economically justified.”

As of the year 2000, current appliance efficiency standards saved approximately enough electricity to equal the output of 31 large (500-megawatt) power plants, according to the Appliance Standards Awareness Project (ASAP), a project that advocates the upgrading of appliance efficiency standards. As consumers replace older appliances with newer, more efficient ones, this savings will increase to the equivalent of 90 large power plants by 2015. As of the year 2000, existing appliance efficiency standards have already cut U.S. carbon emissions by 29 million metric tons and nitrous oxide emissions by 286,000 tons per year.

In Pennsylvania alone, utility bill savings could amount to \$478.3 million by 2020 with basic upgrades of the current appliance energy efficiency standards, according to a 2000 study conducted by ASAP. Many appliances, including refrigerators, freezers, clothes washers, televisions and VCRs, and office and building equipment, such as computers, can be purchased with the Energy Star logo, indicating that they are energy efficient.



NAECA

Pennsylvania Building Codes

Mandatory energy conservation codes for buildings have been in effect in Pennsylvania since 1981, when the Pennsylvania legislature passed the Building Energy Conservation Law (P.L. 1203 Act 222). BECA: Act 222 regulates the energy-related aspects of new construction, additions and major renovations of all new buildings designed after July 1, 1981. The Act gives government the authority to oversee both commercial and residential building construction to ensure that construction is performed using materials and techniques that provide for energy conservation in the future operation and maintenance of the buildings. Since it was enacted, residential standards have been updated three times, the last time being in 1986. Commercial standards were updated once, in 1983.

In 1999, former Governor Tom Ridge signed into law the new mandatory statewide Uniform Construction Code, which adopts the 1999 Building Officials and Code Administrators (BOCA) codes and mandates that the Pennsylvania code be updated whenever a new BOCA code edition is published. Current commercial and residential standards are based upon codes established by the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE).

The Pennsylvania Department of Labor and Industry (DLI) is responsible for administering, as well as promulgating and upgrading, commercial energy standards. The Pennsylvania Department of Community and Economic Development (DCED) is responsible for residential energy standards.

The Governor's Green Government Council

The Governor's Green Government Council (GGGC), established in 1998, aims to help the Pennsylvania state government adopt environmentally friendly policies and practices. Thus far, the GGGC has focused on energy efficiency in areas such as building design and management, procurement of environmentally friendly commodities and services, vehicle purchasing and recycling. The Pennsylvania state government's first green building initiative was the Pennsylvania Department of Environmental Protection's Southcentral Regional Office building. In an attempt to pursue an integrated design approach for the facility, a "green team" was assembled to focus primarily on maximizing the use of sustainable building materials, reducing energy consumption and operational costs through the use of high-performance technologies, minimizing negative air quality impacts, and improving the health and productivity of building users.

For more information on green buildings in Pennsylvania, visit the GGGC website at www.gggc.state.pa.us.



Whole Building Design

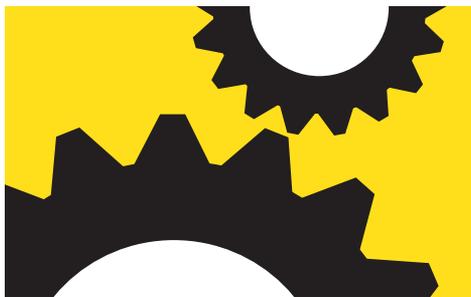
The whole building design approach stands in contrast to the traditional approach to energy efficiency, which views a building as a collection of independent parts. Innovative architects and builders see the whole building approach as a holistic solution to improving not only the overall energy efficiency of a building, but also its indoor air quality, lighting and overall comfort.

Whole building design considers, from the start, all the elements of a building that help achieve optimal energy performance. This "climate-responsive architecture" focuses on how a building interacts effectively with the outdoor environment. These building techniques are not only environmentally sound, but also result in energy cost savings for the consumer. For more information on whole building design, visit the Sustainable Buildings Industry Council at www.sbicouncil.org or the U.S. Department of Energy's Energy Efficiency and Renewable Energy Network at www.eren.doe.gov/EE/buildings.html.

EFFICIENCY



Energy Efficiency for Industries



The making of industrial products is highly energy intensive; thus, optimizing the efficiency of industrial equipment and improving the overall maintenance of equipment can result in energy, cost and pollution savings. Using boilers and furnaces that operate at higher temperatures while requiring less energy, as well as increasing the

efficiency of industrial motors, can increase industrial energy efficiency; however, many of these efficiency-optimizing methods are industry-specific. The greatest savings can often be found in the most energy-intensive industries, such as the aluminum, agricultural, chemical, forest products, glass, metalcasting, mining, petroleum and steel industries. More information on industry-specific energy efficient technology can be found through the U.S. Department of Energy's Energy Efficiency and Renewable Energy Network at www.eren.doe.gov/EE/industry.html.

Cogeneration

Producing electricity on site is often of interest to industries that can make use of waste heat. Combined heat and power systems, often referred to as cogeneration systems, achieve a higher level of efficiency than stand-alone power plants. Cogeneration power production technologies include gas turbines, microturbines and fuel cells. Cogeneration is a form of distributed generation (i.e., power that is generated close to where it will eventually be used). Distributed generation reduces the strain on power transmission and distribution systems. It is important for facilities with on-site cogeneration systems to secure a market in order to sell their excess power to other entities, such as electric utilities.



Motors

Motor-operated equipment accounts for approximately 64 percent of the overall electricity consumed by industries in the United States. More efficient motors have the potential to cut energy use by at least 12 percent. Most commonly, industries use motors to run pumps, fans, blowers and air compressors. There are various types of technology that can be used to increase the efficiency of industrial motors. Controllers oversee the start-up of the motor and match the motor's output to the energy needed. Variable-speed drives help match the motor energy output to the overall energy needed. Super-conducting materials show no resistance to the flow of electricity at low temperatures and the use of these materials for motor coils can reduce energy loss in motors. The U.S. Department of Energy's Motor Challenge, a voluntary industry-government partnership that is part of the U.S. DOE's BestPractices Strategy, is just one way in which industries can improve motor efficiency. Motor Challenge helps industries capture electricity savings by providing technical expertise and knowledge necessary for managing motor systems and purchasing energy efficient motors.

Steam Systems

Additional efficiency improvements within the industrial sector can be sought through improving steam systems. Over 45 percent of all fuel burned by manufacturers in the United States is consumed to raise steam. By improving steam systems, industrial facilities can realize steam savings of 20 percent. Energy performance in steam systems can be improved by insulating steam and condensate return lines, stopping steam leaks and maintaining steam traps. The U.S. Department of Energy's Steam Challenge, similar to the Motor Challenge, is a public-private partnership initiative that promotes the comprehensive upgrade of industrial steam systems.

Compressed Air Systems

A majority of industries use compressed air systems to power equipment and tools for pressurizing, atomizing, agitating and mixing applications. Optimizing compressed air systems can be as simple as detecting and fixing air leaks, or can involve something more complex like the use of compressors with variable-speed drives.

Pennsylvania's Industries for the Future Initiative

Pennsylvania's Industries of the Future Initiative aims to help targeted Pennsylvania industries, among other things, improve competitiveness and profitability by improving energy efficiency, environmental performance and productivity of industrial facilities, processes and operations. For more information on this initiative, visit www.dep.state.pa.us/dep/deputate/pollprev/techservices/paiof.

Demand Side Management

Demand side management (DSM) programs are initiatives, typically taken by electric utilities, to plan, implement and monitor activities that are designed to encourage consumers to modify their level and pattern of electricity use. Utility DSM programs offer a variety of measures that can reduce energy consumption and consumer energy expenses. DSM programs initiated by electric utilities often have the goal of maximizing end-use efficiency to avoid or postpone the construction of new generating plants. Current DSM programs, particularly in the deregulated marketplace, are beginning to focus more on enhancing customer service than averting the need for new power sources.

There are two types of technology that can be used to reduce electricity demand – load reduction and load leveling. Load reduction technologies are energy conservation technologies that are used to reduce the total amount of energy used, typically through energy efficient lighting, appliances, building equipment, etc. Load leveling technologies are technologies used to smooth out the peaks and dips in energy demand. These technologies, which include energy management control systems that switch electricity equipment on and off for load control and energy storage devices that are located on the customer's side of the meter and help to switch the timing of energy consumption, are increasingly focused on reducing consumption at peak demand times or shifting electricity demand from peak to off-peak hours.

DSM programs, in the deregulated marketplace, are often supported through a system benefit charge (SBC), a small surcharge on utility bills. Utilities will also manipulate rate structures in order to encourage modification of energy use. For example, utilities will impose a time-of-use rate, charging higher prices for peak electricity use than off-peak use. For more information on local DMS programs, contact your area utility.



There are several opportunities to apply for financial support for both residential and business investment in renewable energy, energy efficiency and energy conservation. Deregulation of the electric utility industry in Pennsylvania created a unique opportunity to set aside funds to support clean energy investments in the different utility service territories. For the most part,

FINANCING

OPPORTUNITIES

these sustainable energy funds are supported by a system benefits charge. Electric

utility companies also contribute to these funds. Additional funding for energy efficiency and pollution prevention is provided by the state government, primarily through the Pennsylvania Department of Environmental Protection.

System Benefits Charge

A system benefits charge (SBC) is a charge imposed on utility customers to fund various public benefits, including renewable energy, energy efficiency and low-income assistance programs. Many states have chosen to include an SBC as a regulatory mechanism within the broader electric restructuring process, to ensure that renewable energy, energy efficiency and other public programs remain a focus of the electric industry in the deregulated marketplace. An SBC is normally applied in the form of a charge per kilowatt-hour to all utility customers, and, in many cases, accompanies other fees that help provide utility services.

In Pennsylvania, HB 1509 (The Electricity Generation Customer Choice and Competition Act of 1996) offered only limited guidance on how SBCs were to fund renewable energy and energy efficiency programs and left the details to be ironed out by the Pennsylvania Public Utilities Commission

(PUC). The PUC established different sustainable energy funds for each of the major utility distribution companies, through which revenues from SBCs are to be funneled. Sustainable energy funds now exist in the PECO Energy, PP&L, GPU Energy (MetEd and Penelec regions) and West Penn Power service territories.

Sustainable Development Fund (PECO Energy)

The Sustainable Development Fund (SDF) was created by the PUC in a final order in the PECO Energy electric utility restructuring proceedings. Environmental and consumer advocates rallied for the creation of this fund in order to ensure investments in clean, renewable energy infrastructure in southeastern Pennsylvania. As a result of the PECO Energy/Unicorn merger settlement, additional funding was acquired, making the total value of the SDF approximately \$32 million. The Reinvestment Fund, located in Philadelphia, manages the fund.

The mission of the SDF is to promote renewable energy and advanced clean energy technologies; to promote energy conservation and energy efficiency; and to promote the start-up, attraction, expansion, and retention of sustainable energy businesses. The SDF is most interested in funding companies and ventures that generate electricity using renewable energy sources; manufacturers, distributors, and installers of renewable energy, advanced clean energy and energy-conserving products and technologies; and companies and organizations that are end-users of renewable energy, advanced clean energy and energy-conserving products and technologies. Grant amounts typically average at \$25,000.

For more information, contact:

Mr. Rob Sanders, Fund Manager
The Reinvestment Fund
Tel: (215) 925-1130 ext. 252
Email: sanders@trifund.com
Website: www.trifund.com/sdf



Sustainable Energy Fund of Central Eastern Pennsylvania (PP&L)

The Sustainable Energy Fund (SEF) of Central Eastern Pennsylvania was established as part of the joint settlement between the PUC and PP&L, Inc. during the electric utility restructuring proceedings. The SEF amounts to approximately \$20.5 million, and will be granted over a six-year period. The goal of the SEF is to finance the start-up, expansion and attraction of businesses and projects within the PP&L service territory that focus on renewable energy, clean energy technology, energy efficiency and energy conservation. Grant amounts typically range from \$10,000 to \$25,000.

For more information, contact:

Mr. Thomas J. Tuffey, Executive Director
Sustainable Energy Fund
Tel: (610) 740-3182
Email: ppltsef@aol.com
Website: www.sustainableenergyfund.org

GPU Energy Sustainable Energy Fund (Metropolitan Edison Region)

GPU Energy established an initial Sustainable Energy Fund of \$5,700,000 for the Metropolitan Edison (Met-Ed) region of its service territory through the Berks County Community Foundation, located in Reading. The purpose of the fund is to promote the development and use of renewable energy and clean energy technologies; to promote energy efficiency and conservation; to promote sustainable energy businesses; and to promote projects that improve the environment within the Met-Ed region of GPU Energy's service territory.

For more information, contact:

Mr. Kevin K. Murphy, President
Berks County Community Foundation
Tel: (610) 685-2223
Email: kevinm@bccf.org
Website: www.bccf.org/pages/gr.energy.html

GPU Energy Sustainable Energy Fund (Pennsylvania Electric Company Region)

GPU Energy also established a companion Sustainable Energy Fund for the Pennsylvania Electric Company (Penelec) region of its service territory through the Community Foundation for the Alleghenies, in the amount of \$8.3 million. The fund supports businesses and projects in the Penelec region with the same focus as those supported by its companion fund in the Med-Ed region.

For more information, contact:

Mr. Michael Kane, Executive Director
Community Foundation for the Alleghenies
Tel: (814) 536-7741
Email: cfdnbc@aol.com
Website: www.cfalleghenies.org/gpusef.htm

West Penn Power Sustainable Energy Fund

The West Penn Power Sustainable Energy Fund will provide approximately \$12 million in funding for renewable energy, clean energy technology, energy conservation and efficiency, and sustainable energy business projects between 1999 and 2006.

For more information, contact:

Mr. Joel Morrison
The Energy Institute, Penn State University
Tel: (814) 865-4802
Email: jlm9@psu.edu
Website: www.wppsef.org



State Financial Assistance Programs

Funding for energy efficiency and pollution prevention projects, both for individuals and for businesses, can be acquired through the Pennsylvania Department of Environmental Protection (DEP). DEP also offers a number of free benefits to businesses interested in energy efficiency and pollution prevention, particularly smaller businesses. A number of these funding opportunities and free benefits are highlighted below. For more information on all financial assistance programs offered through DEP or for contact information, visit the DEP website (www.dep.state.pa.us) or Pennsylvania's state energy website (www.paenergy.state.pa.us).

Pennsylvania Environmental and Energy Challenge (PEEC) Grant Program

PEEC is a new grant program that provides grant funds to address pollution prevention (P2) and reduction, and energy efficiency (E2), with an emphasis on renewable and alternative energy and technology projects that address P2 and/or E2. New and innovative projects are preferred. For more information on the program and information on how to apply, visit www.dep.state.pa.us/dep/deputate/pollprev/PEEC/default.htm.

Weatherization Program

Pennsylvania's Weatherization Program is aimed at low-income, elderly and/or handicapped Pennsylvanians who need assistance because of high energy costs. This program provides education and weatherization services such as heating system modifications and replacement, air leak reduction, and attic insulation and venting installation. For more information, visit www.paenergystate.pa.us or contact the Pennsylvania Department of Community and Economic Development, which administers the Weatherization Program, at (717) 787-3003 or via its website at www.inventpa.com.

Pollution Prevention and Energy Efficiency Site Visits and Grant Program

DEP's Office of Pollution Prevention and Compliance Assistance offers voluntary, non-regulatory visits to both small and large Pennsylvania businesses to assess opportunities to conserve energy and resources, prevent product loss, and avoid waste and emissions. Between 1995 and July 2002, DEP conducted 343 free pollution prevention and energy efficiency (P2/E2) site visits, and has made more than 3,000 P2/E2 suggestions to businesses across the state. For more information, visit www.dep.state.pa.us/dep/deputate/pollprev/SiteVisit/SiteVisit.html.

P2/E2 grants are also available under Act 190, which can fund 80 percent of the total cost of a P2/E2 site assessment. For small businesses with less than 100 employees, up to \$5,000 is available toward a P2/E2 site assessment. A maximum of \$15,000 is available for businesses that hold qualifying DEP permits. Experienced environmental consultants are hired to conduct the site assessments. For more information, visit www.dep.state.pa.us/dep/deputate/pollprev/Act190/act190.html.

EnviroHELP

DEP's EnviroHELP program provides free help to small businesses seeking to comply with local, state and federal environmental regulations. Pollution prevention and energy efficiency are both focuses of the program. Site visits and a quarterly newsletter help small businesses identify opportunities to decrease waste and spending. For more information on EnviroHELP, visit www.pa-envirohelp.org.

Small Business Pollution Prevention Assistance Account

The Small Business Pollution Prevention Assistance Account, administered by DEP and the Pennsylvania Department of Community and Economic Development, is a low-interest loan program that helps Pennsylvania small businesses implement pollution prevention and energy efficiency projects. For more information, visit www.dep.state.pa.us/dep/deputate/pollprev/Ombudsman/loanfund.htm.



Small Business Ombudsman

The Small Business Ombudsman is the small business advocate at DEP. Among other things, the Ombudsman helps small businesses recognize the potential cost savings of pollution prevention and helps develop financing programs for small businesses within DEP. For more information, contact the Small Business Ombudsman, Mr. Bruce McLanahan, at (717) 772-5942 or at bmclanahan@state.pa.us.

State Energy Program Funding

The U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy makes grants available to states for special projects. In fiscal year 2001, approximately \$15 million was made available in awards. The grant money is administered through the State Energy Program and in Pennsylvania, the Department of Environmental Protection administers special project money. Special project money is directed toward accelerating deployment of energy efficiency and renewable energy technologies, as well as facilitating the acceptance of these emerging technologies. Past special project funded programs in Pennsylvania include an energy efficient schools initiative and the installation of solar water pumps on dairy farms.

Formula grants are a second type of U.S. Department of Energy funding available to states through the State Energy Program. Formula funds are congressionally appropriated funds that are distributed based on a given formula that considers a state's size, population and other factors. For more information on the State Energy Program and special project funding, contact the Pennsylvania Department of Environmental Protection or the U.S. Department of Energy.

The opportunities to invest in cleaner energy, both at home and in the workplace, are ever growing in Pennsylvania. The recent restructuring of the electricity industry opened the markets for new and cleaner forms of electricity production, such as wind and solar power. An increase in the use of these renewable energy resources will lead to greater energy independence, as well as a reduction in the depletion of our natural resources. Both residential and

CONCLUSION

commercial customers now have the option to choose their electricity supplier and conse-

quently have helped to spur demand for these alternative energy forms. In fact, Pennsylvania's wind farms have been built purely in response to customer demand. Renewable energy technologies, such as photovoltaic panels and small wind turbines, can help power homes and businesses, allowing them to meet a portion, or in some cases all of their electricity needs without relying on the electric grid.

The opportunities to use energy more efficiently are even more prevalent and cost saving. Everything from home appliances, including refrigerators, air conditioners, and personal computers, to industrial equipment and lighting are available in energy efficient models. Energy efficiency and conservation can save consumers money on electric bills, reduce electricity demand, and improve the environment and public health by reducing pollution.

Taking advantage of these cost-effective, clean energy opportunities is no longer science fiction and is now easier than ever! Your choices make a difference. The more residents and businesses take advantage of their clean energy options, the more secure Pennsylvania's role as a leader in the movement toward a sustainable energy future becomes. Educating and enabling individuals, as well as businesses, to make smarter energy choices will ensure environmental sustainability, public health, and economic prosperity for Pennsylvania.



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Sustainable Development Fund. www.trifund.com/sdf.

Sustainable Energy Fund of Central Eastern Pennsylvania. www.sustainableenergyfund.org.

West Penn Power. Sustainable Energy Fund. www.wppsef.org.



ONLINE RESOURCES

Appliance Standards Awareness Project

www.standardsasap.org

The Appliance Standards Awareness Project (ASAP) is a project aimed at increasing awareness of and support for national appliance and equipment energy efficiency standards. ASAP is coordinated by a steering committee of national energy efficiency experts and its website provides detailed reports and updates on appliance efficiency standards and their associated environmental and cost savings.

American Council for an Energy-Efficient Economy

www.aceee.org

The American Council for an Energy-Efficient Economy (ACEEE) is dedicated to advancing energy efficiency as a means of promoting economic prosperity and environmental protection. The ACEEE website provides in-depth and technical information and analyses on energy efficiency in the industrial, residential, commercial and transportation sectors.

American Wind Energy Association

www.awea.org

The American Wind Energy Association (AWEA) advocates the development of wind energy as a reliable, environmentally superior energy alternative in the United States and around the world. The AWEA website includes a wide variety of information on wind energy for both small and utility scale applications, energy policy and recent news events. AWEA also provides Pennsylvania-specific information on wind energy.

Citizens for Pennsylvania's Future

www.pennfuture.org

The goal of Penn Future's Green Power- Turn it On! program is to have 10 percent of the total electricity consumed in Pennsylvania generated from renewable energy sources by 2010.

Clean Air Council

www.cleanair.org

Clean Air Council's Energy Program website includes fact sheets and other useful materials on electric choice in Pennsylvania and on renewable energy options for residential and commercial customers. Clean Air Council coordinates the statewide Sustainable Energy Education Program and Solar Schools Program.

Clean Your Air

www.cleanyourair.org

Clean Your Air (CYA) is a public education initiative of the Mid-Atlantic Renewable Energy Coalition (MAREC). The CYA campaign's website includes information on purchasing and producing clean energy in the mid-Atlantic region.

Clear the Air: The National Campaign Against Dirty Power

www.cleartheair.org

Clear the Air is a national public education campaign to improve air quality by reducing emissions from coal-burning power plants. The campaign's website includes fact sheets, reports, and other action alerts concerning the environmental and public health effects of fossil fuel combustion.

Community Energy, Inc.

www.newwindenergy.com

Community Energy, Inc. offers the only option to purchase 100 percent new wind in the State of Pennsylvania. One hundred kilowatt blocks of wind energy are available for purchase, by both residential and commercial customers, on Community Energy's user-friendly website. Community Energy's wind farms are located in Somerset and Mill Run, Pennsylvania.

Database of State Incentives for Renewable Energy

www.dsireusa.org

The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on state, local and utility incentives that promote renewable energy. DSIRE's website provides state specific information for Pennsylvania, including information on rules and regulations, financial incentives and renewable energy pilot projects.

Energy Cooperative Association of Pennsylvania

www.theenergyco-op.com

The Energy Cooperative is a nonprofit, member-owned cooperative with over 6,500 members throughout Southeastern Pennsylvania. In 1998, the Energy Cooperative became a licensed electrical supplier, upholding the belief that the best way for residential consumers and small businesses to benefit from electric deregulation is to combine their buying power. Their mission includes promoting energy efficiency and renewable energy. Visit the Energy Cooperative's website for more information on their new initiative to purchase excess solar power, generated through a residential system, at premium pricing.

Energy Coordinating Agency

www.ecasavesenergy.org

The Energy Coordinating Agency (ECA) is a nonprofit corporation dedicated to ensuring that low and moderate-income people have access to safe, affordable and reliable sources of energy. ECA works to promote a sustainable energy future for the region by encouraging renewable energy and energy efficiency.

Electric Power Research Institute

www.epri.com

The Electric Power Research Institute (EPRI) is a nonprofit research organization that provides information on different types of electricity generation and technologies, mainly for the utility industry. Much of EPRI's research, reporting and data is available on their website.

Energy Efficiency and Renewable Energy Network (U.S. Department of Energy)

www.eren.doe.gov

The Energy Efficiency and Renewable Energy Network (EREN) of the U.S. Department of Energy is a comprehensive resource for information on energy efficiency and renewable energy, including access to over 600 website links and 80,000 documents. The EREN website contains renewable energy resource maps, as well as detailed descriptions of renewable energy technology applications and different types of energy efficiency measures for all sectors.

Energy in Pennsylvania (State of Pennsylvania)

www.paenergy.state.pa.us

The State of Pennsylvania hosts an Energy in Pennsylvania website, which contains Pennsylvania-specific information on energy efficiency, renewable energy, and business and individual financial assistance programs, as well as tips to save energy and costs.

Energy Information Administration (U.S. Department of Energy)

www.eia.doe.gov

The U.S. Department of Energy's Energy Information Administration (EIA) website provides detailed energy information, searchable by categories such as geographic region, fuel type and sector. The EIA website also contains forecasts for short-term and long-term energy production and use.

Energy Star

www.energystar.gov

The Energy Star labeling program, co-facilitated by the U.S. Environmental Protection Agency and the U.S. Department of Energy, identifies and promotes energy efficient products with the goal of reducing carbon dioxide emissions. The Energy Star logo covers everything from energy efficient homes and buildings to lighting, appliances, and heating and cooling devices.

Fuel Cells 2000

www.fuelcells.org

Fuel Cells 2000 is an online fuel cell information center that includes information on fuel cell basics, current news, a fuel cell library, and links to other fuel cell websites.

GPU Energy Sustainable Energy Fund (Metropolitan Edison Region)

www.bccf.org/pages/gr.energy.html

GPU Energy established the Metropolitan Edison Company Sustainable Energy Fund (Met-Ed Region) within the Berks County Community Foundation in 2000 with an initial contribution of \$5,700,000. The fund invests in renewable energy, energy efficiency and energy conservation projects. Fund application and other project information can be found on this website.

GPU Energy Sustainable Energy Fund (Pennsylvania Electric Company Region)

www.cfalleghenies.org/gpusef.htm

In June 2000, GPU Energy established the GPU Energy Sustainable Energy Fund at the Community Foundation for the Alleghenies in the amount of \$8.3 million. The fund invests in renewable energy, energy efficiency and energy conservation projects. Fund application and other project information can be found on this website.

Green Mountain Energy

www.greenmountain.com/pa

Green Mountain Energy was the first "green power" supplier in Pennsylvania. Green Mountain has constructed a wind farm in Garrett, Pennsylvania and solar arrays on business rooftops outside of both Philadelphia and Pittsburgh, Pennsylvania. Green Mountain's construction of both new wind and new solar is in response to strong customer demand for clean energy in Pennsylvania following electricity deregulation.

Green Power Network

www.eren.doe.gov/greenpower

The Green Power Network, administered by the U.S. Department of Energy, provides critical information on green power markets and utility green pricing programs. Detailed, up-to-date information is available, through the Green Power Network, on green power providers, product offerings and consumer issues.

Green-e

www.green-e.org

The Green-e program is a voluntary certification program for renewable energy products. Green-e's website includes a Pennsylvania-specific section that outlines renewable energy product choices for Pennsylvania business and residential customers that meet the Green-e standard.

Governor's Green Government Council

www.gggc.state.pa.us

The Governor's Green Government Council (GGGC) was created in 1998 in order to help the State of Pennsylvania adopt environmentally friendly operation policies and practices. The GGGC works with various state government agencies to incorporate sustainable practices into the state government's planning, policymaking and regulatory operations. The GGGC website contains examples of green buildings in the state, tips on how to incorporate simple efficiency improvements into building architecture, design and planning.

Low-Impact Hydropower Institute

www.lowimpacthydro.org

The Low-Impact Hydropower Institute (LIHI) is an organization dedicated to reducing the impacts of hydropower generation through the certification of environmentally responsible, "low-impact" hydropower. The LIHI web site lists the hydropower facilities throughout the United States that are certified as "low-impact" by LIHI, as well as outlining the criteria that are used to certify facilities.

National Association of Energy Service Companies

www.naesco.org

The National Association of Energy Service Companies (NAESCO) provides counsel as decisions are being made by state agencies about the deployment of third parties to provide energy efficiency products and services to public facilities like schools, colleges and universities, hospitals and more. NAESCO also acts as an energy services industry advocate and represents the industry to the federal government.

National Environmental Trust

www.environment.org

National Environmental Trust (NET) is a non-profit, environmental organization that addresses issues of clean air and global warming, among others. NET's website contains information on power plant pollution, clean energy, and various opportunities to participate in these nationwide campaigns.

National Million Solar Roofs Initiative

www.eren.doe.gov/millionroofs

The Million Solar Roofs Initiative (MSR) is a federal goal of installing one million solar systems on business and residential rooftops across the United States by 2010. The MSR website highlights success stories, financing opportunities, and other resources needed to participate in the initiative.

National Renewable Energy Lab

www.nrel.gov

The National Renewable Energy Lab (NREL) is the U.S. Department of Energy's laboratory for renewable energy and energy efficiency research and development. The NREL website discusses different applications of renewable energy as well as more detailed information on renewable energy technologies, energy data and case studies.

Office of Pollution Prevention & Compliance Assistance (PA Department of Environmental Protection)

www.dep.state.pa.us/dep/deputate/pollprev/pollution_prevention.html

The Office of Pollution Prevention & Compliance Assistance is the division of the Pennsylvania Department of Environmental Protection that deals most directly with energy efficiency. Their website is a comprehensive online resource providing information on financial support available through the state government for investment in residential and commercial energy efficiency and various tips on how to use energy for efficiently.

PA Wind Map

www.pawindmap.org

The PA Wind Map website provides an interactive wind map of Pennsylvania for those interested in learning more about the wind resources available to them across the State of Pennsylvania. PA Wind Map is a project of Conservation Consultants, Inc.

Pennsylvania Department of Community and Economic Development

www.inventpa.com

The Pennsylvania Department of Community and Economic Development is responsible for administering, promulgating and upgrading residential energy efficiency standards.

Pennsylvania Department of Environmental Protection

www.dep.state.pa.us

The Pennsylvania Department of Environmental Protection (DEP) is the state agency responsible for administering Pennsylvania's environmental laws and regulations. The Office of Pollution Prevention & Compliance Assistance, within the DEP, is most closely connected with energy efficiency and conservation.

Pennsylvania Department of Labor and Industry

www.dli.state.pa.us

The Pennsylvania Department of Labor and Industry is responsible for administering, promulgating and upgrading commercial energy efficiency standards.

Pennsylvania Public Utility Commission

www.puc.paonline.com

The Pennsylvania Public Utility Commission (PUC) oversees electric, natural gas, water, telephone and transportation services in Pennsylvania. The PUC aims to ensure safe, reliable and reasonably priced service for Pennsylvania customers.

Pennsylvania Utility Choice

www.utilitychoice.org

The Utility Choice Program website, originally the Pennsylvania Electric Choice website, was created in response to the 1999 deregulation of Pennsylvania's electric industry and has recently been updated. This website provides basic information for electricity customers including details on what electric choice is, selecting an electricity supplier and recent news items.

Pennsylvania Wind Campaign

www.windenergynow.org

The goal of the Pennsylvania Wind Campaign is to encourage businesses and individuals to purchase electricity from Pennsylvania wind farms. The campaign's website contains information on Pennsylvania wind farms, press releases, and instructions as to how to sign up to purchase electricity generated from new wind in Pennsylvania.

Philadelphia Million Solar Roofs Community Partnership

www.phillysolar.org

The Philadelphia Million Solar Roofs Community Partnership (PMSR) is a collaboration of Philadelphia-area organizations and small businesses dedicated to helping southeastern Pennsylvania contribute to meeting the overall federal goal of one million solar system installations by 2010. PMSR's goal is to help install over 500 solar systems by 2010. The PMSR website contains technical information, zoning and code information, financing tips and local case studies.

PJM Interconnection, L.L.C.

www.pjm.com

PJM Interconnection, L.L.C. operates the largest wholesale electric market in the world. PJM is responsible for the operation and control of the bulk electrical power system throughout major portions of five Mid-Atlantic states and the District of Columbia.

Power Scorecard

www.powerscorecard.org

Power Scorecard is an online rating mechanism that assesses the environmental impact of different types of electricity generation. The Power Scorecard website is a user-friendly site that allows visitors that reside in areas where there is a deregulated electricity marketplace to rate the different available electricity products.

Renewable Energy Policy Project – Center for Renewable Energy and Sustainable Technology

www.repp.org

The Renewable Energy Policy Project (REPP) and the Center for Renewable Energy and Sustainable Technology (CREST) have joined together, creating an all-encompassing web-based resource (formerly known as Solstice). The new CREST website includes information on renewable energy applications, energy policy documents and analyses, discussion groups and a community calendar.

Rocky Mountain Institute

www.rmi.org

The Rocky Mountain Institute (RMI) was founded in the early 1980s by Hunter and Amory Lovins and has been a leader in the development of energy policy and in the push toward a sustainable energy future. The RMI website includes information on the environmental impacts of energy use and on renewable energy and other low and zero-emission technologies.

Solar Rating and Certification Corporation

www.solar-rating.org

The Solar Rating and Certification Corporation (SRCC) administers a certification, rating and labeling program for solar collectors and a similar program for solar water heating systems.

Sustainable Buildings Industry Council

www.sbicouncil.org

The Sustainable Buildings Industry Council (SBIC) aims to advance the design, affordability, energy performance, and environmental soundness of residential, institutional and commercial buildings nationwide. The SBIC website contains advertisements for workshops and training, software, and resources for architects, builders, and utility and energy officials.

Sustainable Development Fund

www.trfund.com/sdf

The Sustainable Development Fund (SDF) services the southeastern portion of Pennsylvania, funding renewable energy and other clean energy projects. SDF is administered by The Reinvestment Fund and the SDF website contains information for those that are interested in applying for funding through SDF.

Sustainable Energy Fund of Central Eastern Pennsylvania

www.sustainableenergyfund.org

The Sustainable Energy Fund services the PPL Electric Utilities Corporation service territory within the central eastern portion of Pennsylvania. The fund supports renewable energy, energy efficiency and energy conservation projects. Fund application information and other project information can be found on this web site.

Union of Concerned Scientists

www.ucsusa.org

The Union of Concerned Scientists (UCS) is an alliance of concerned citizens and scientists from across the country that combines scientific analysis with innovative thinking and advocacy to promote a healthy, safe environment. The clean energy section of the UCS website includes briefings, fact sheets, analyses and updates.

U.S. Department of Energy

www.energy.gov

www.eren.doe.gov/pro/ (Philadelphia Regional Office)

The U.S. Department of Energy (DOE) is the department within the federal government responsible for advancing United States energy policy and fostering new developments in science and technology. The DOE's National Renewable Energy Lab (NREL), Energy Information Administration (EIA), and Energy Efficiency and Renewable Energy Network (EREN) deal most closely with renewable energy, energy efficiency and energy conservation.

U.S. Environmental Protection Agency

www.epa.gov

www.epa.gov/region3 (EPA Region 3)

The U.S. Environmental Protection Agency (EPA) is the agency within the federal government responsible for administering federal environmental laws and regulations.

U.S. Fuel Cell Council

www.usfcc.com

The U.S. Fuel Cell Council is an industry association dedicated to fostering the commercialization of fuel cells in the United States. Members of the U.S. Fuel Cell Council include the world's leading fuel cell developers, manufacturers, suppliers and customers.

West Penn Power Sustainable Energy Fund

www.wppsef.org

The West Penn Power Sustainable Energy Fund encourages the promotion, development, and deployment of sustainable energy technologies throughout the 17 county West Penn service area in western and central Pennsylvania. Fund application and other project information can be found on this website.

Wind Powering America (U.S. Department of Energy)

www.eren.doe.gov/windpoweringamerica

Wind Powering America is a U.S. Department of Energy initiative to increase the use of wind energy in the United States. The Wind Powering America website includes resources on regional wind power activities throughout the United States, resources for specific communities, such as Native Americans, communities of color, and rural land owners and farmers, wind maps and success stories.

Clean Air Council



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