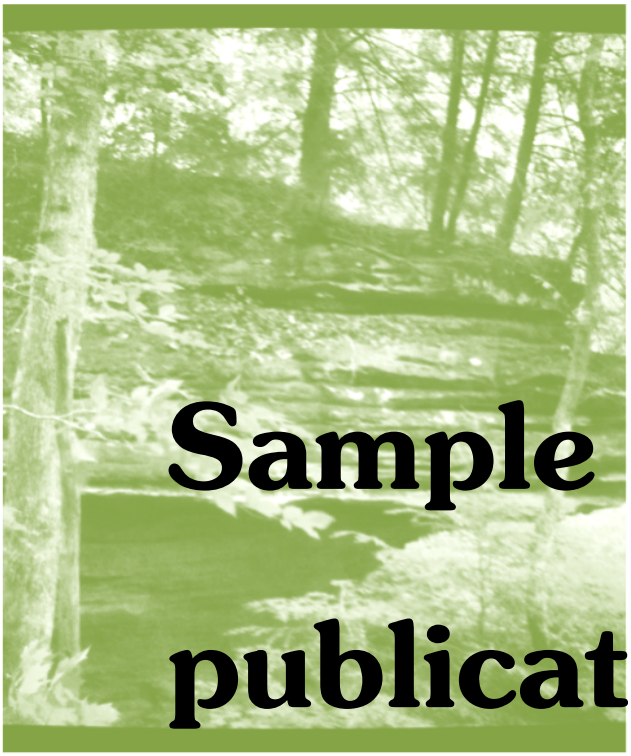


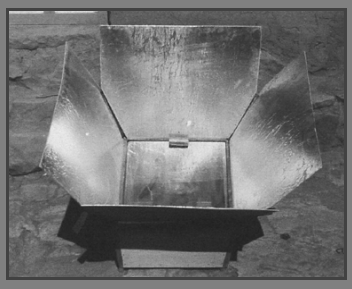
Sample publications

Since 1977, ASPI has published technical papers, manuals, fact sheets, and books pertinent to our mission. The following documents are excerpts of several publications to illustrate the diversity, relevance, and applicability. Enjoy!










The Kentucky Solar Energy Guide

by

Andy McDonald and Joshua Bills

A publication of

Appalachia– Science in the Public Interest

and the Kentucky Solar Partnership

February 2005





Chapter One
Introduction

Solar energy is an abundant, renewable resource that can meet many of our energy needs here in Kentucky. It can be used to generate electricity; to heat water for bathing, washing, space heating, and other purposes; to cook and dry food; and to purify water. Through passive solar building strategies, the sun's energy can heat and cool buildings and provide daylighting. Solar energy can meet a substantial portion or even all of a home's energy needs, greatly reducing monthly utility bills. For the Commonwealth and our nation, investing in solar energy could increase our independence from foreign energy sources and polluting forms of energy.

The need to develop clean, sustainable energy sources is imperative. The use of conventional energy sources, especially fossil fuels and nuclear power, incurs widespread environmental and human health costs. Disruptions to the global climate, international conflict, and the spread of nuclear materials that could be used as weapons are among the results of our dependence on these conventional fuels. Freeing ourselves from this dependence will give us cleaner air and water, healthier families, communities, and environments, and increased security from nuclear accidents and terrorist attacks.

Solar energy is one of the key components of a safer, healthier, more sustainable energy economy. It provides greater independence and energy security, protecting its users from interruptions to the power grid and fluctuating fuel prices. On a regional and national level, solar energy systems could become part of a "distributed energy network" in which many thousands of smaller and decentralized energy producers would make the whole system less vulnerable to interruption. By developing the use of solar and other renewable resources, our nation becomes less dependent upon foreign sources of energy. This reduces the justification for using the military to protect our fuel supplies in foreign lands, allowing all of our resources to be used more wisely and profitably.

Solar energy is widely used around the world in climates as diverse as northern Europe and southern California. Solar photovoltaic technology has developed rapidly over the past four decades, with prices falling dramatically and global installations growing at a rate of 30 percent per year over the past five years.[1] Solar water heating technologies have been in widespread use for the past century. Countries such as Israel and Japan have witnessed a consistently increasing use of the technology. Tokyo had over 1.5 million solar water heaters in use in 1991 and Israel now requires solar water heaters in all new buildings.[2] Global experience has shown that the use of solar is not limited to the sunniest climates, and that it is capable of making a significant contribution to meeting the world's energy needs.

Despite its many advantages, solar energy is still in competition with very cheap energy in places such as Kentucky. For most people, solar photovoltaics (PV) remain the most expensive option for providing electricity. Solar water heating systems, which usually produce substantial long-term financial savings, have a higher up-front cost than conventional water heaters. These economic realities have hindered the growth of the solar industry and the use of these technologies in Kentucky. However, higher energy prices or the availability of financial incentives to off-set solar's higher up-front costs can shift the economics enough to make solar economically competitive. These forces have helped drive the growth of the solar industry in California and Europe, and as the industry has expanded, prices have come down, making solar even more competitive.

Even in Kentucky the economic comparison can favor solar. Solar electricity is often the least-costly option at sites more than $\frac{1}{4}$ mile from the nearest utility line. In these situations the cost of running a new power line can exceed the cost of installing a solar electric system. In the case of solar water heaters, the energy savings they produce can pay for the cost of the system in as little as five to ten years. The economic returns are even better for homes and facilities that use high volumes of hot water. Once a solar water heater is paid for, its energy savings are like tax-free income and can amount to hundreds of dollars per year. Solar energy systems also insulate their owners from rising fuel prices for decades to come, while providing greater independence and self-sufficiency.

The Importance of Energy Efficiency and Conservation

The development of a clean, sustainable energy system depends as much on energy efficiency and conservation as on the development of renewable energy sources such as solar. Improved efficiency enables us to do the same or more work while using less

energy. Through conservation, we find alternate ways of doing things that reduce our energy demands. Efficiency and conservation allow us to meet our needs at a lower cost and with less pollution. This principle applies nationally and at the personal level. Nationally, investing in energy efficiency is like building power plants that don't pollute, at a fraction of the cost. For example, a report from the Alliance to Save Energy states that if all homes in America used the most energy efficient refrigerators available, the electricity savings would eliminate the need for about 30 power plants.[3] Those energy savings would translate into pollution not produced and money saved by American families.

Achievements of the Federal Energy Management Program (FEMP) illustrate the enormous potential of energy efficiency. According to the Alliance to Save Energy, the FEMP has saved taxpayers more than $8 billion through energy efficiency in government buildings. The further installation of currently-available, cost-effective technologies could save U.S. taxpayers an additional $1 billion per year.[4]

Energy efficiency offers tremendous opportunities at the personal level, as well. Compact fluorescent light bulb's (CFL) produce the same amount of light as standard incandescent bulbs, but use 25 percent as much energy (see Table 1.1).[5] High-efficiency models are now available for most appliances, and can be identified by the Energy Star label. The benefits to consumers from the move to efficiency are illustrated by the air conditioner efficiency standards approved in 2004, which are expected to save American consumers $5 billion in energy costs over the next 25 years.[6]

To minimize the up-front costs of solar energy systems, begin with energy efficiency and conservation. It is much less expensive to invest in energy efficiency than to buy an over-sized solar system, so spend your first energy dollars on efficiency and conservation. Start by reviewing all the ways you use energy. Figure out how you can reduce your demand or find alternate ways to meet your energy needs before selecting a system. A good rule of thumb before installing a solar system is to first cut energy consumption by two or three times. For instance, when considering solar lighting, use as much daylighting as possible during the day, then use only fluorescent lighting at night, since fluorescent lighting usually uses 1/3 or 1/4 as much electricity as incandescent lighting. When solar-powering computers, switch first from desktop units to notebook models, since laptops usually use 1/4 to 1/8 as much electricity.

Also consider what you need the energy for. This will guide you to the appropriate type of solar technology and will help you use your resources most wisely. For example, to heat your home, electric resistance heaters powered by solar photovoltaic panels would be a very poor and expensive choice. This is because electricity is the least efficient means of generating heat, and photovoltaic panels convert only 10 to 15 percent of the sun's energy into electricity. Solar water heater collectors, meanwhile, capture and transfer the sun's heat energy efficiently and cost-effectively, and are well-suited for use in home heating systems. Therefore, if you're considering how best to heat your home, look instead into solar water heaters, passive solar design strategies, and active solar space heaters. This approach will help you get the most from your solar system and the money you invest in your energy needs.

Passive Solar Building Design

Solar energy can be used effectively and economically to provide space heating, cooling, and lighting for homes and other building types. Through passive solar building design, buildings capitalize upon the freely available solar resources at a given site,

Table 1.1: Comparing Incandescent and Compact Fluorescent Light (CFL) Bulbs

Bulb Type	100W Incandescent	23W Compact Fluorescent
Purchase Price	$0.75	$11.00
Lumens (light output)	1,690	1,500
Life of Bulb	750 hours	10,000 hours
Number of Hours on Per Day	4 hours	4 hours
Number of Bulbs Needed	5.84 (6) over 3 years	1 over 6.85 years
Total Cost of Bulbs	$4.50	$11.00
Total Cost of Electricity over 3 Years (@ 6.5 Cents/kWh)	$28.47	$6.55
Total Cost over 3 Years	$32.97	$17.55
Total Cost Savings over Three Years using a CFL in place of an Incandescent Bulbs- $15.42		
Total Cost Savings over Three Years if Five Incandescents are replaced with CFLs- $77.10		

Power$mart, by the Alliance to Save Energy and U.S. Department of Energy, Energy Information Administration.

Steps to Choosing a Solar Energy System

The following chapters illustrate that there are many ways to utilize solar energy. To choose the appropriate type of solar energy system, ask yourself the following questions:

1. What do I need the energy for? Heating, lighting, water heating, powering appliances, or other needs?

2. How will the energy be used, specifically? Study your patterns of energy use. The way you use energy and the appliances you use will influence the type of solar technology you should employ. For example, if you need light in a workshop where you mainly work during the day, maybe a well-placed window to provide daylight would work just as well- and be cheaper- than a solar electric system to power electric lights.

3. How can I reduce my energy demand through efficiency, conservation, and behavior changes? When you study how you use energy, you begin to discover many opportunities for reducing waste and doing things more efficiently. Applying efficiency and conservation measures will reduce your energy demand, while still enabling you to do the things you need to do. This will save you money right from the start, while also reducing the cost of whichever solar energy systems you choose to use.

4. What solar technologies and strategies will best meet my energy needs?

Now you are ready to choose among the various solar systems and design strategies.

reducing the need for external heat sources. Proper design can also substantially reduce the need for electric lighting during the day, through the use of natural daylight.

These design strategies are part of a broader approach known as *climate responsive design*, which understands buildings within their local context. Through this approach, buildings are designed to suit the local climate and utilize the resources available on-site. These resources include wind, vegetation, topography, water, soil, the earth's capacity to moderate temperatures, and solar energy. Integrating all of these resources into the building design can effectively assist with heating, cooling, and lighting, reducing the need for external energy sources. This approach can also produce a more functional and beautiful home.

A complete discussion of daylighting and passive solar building design is beyond the scope of this Guide and numerous resources already exist to assist with the design of passive solar buildings. For new building construction and many renovation projects, passive solar design makes enormous sense. Whether you are planning to build a new home or commercial building, or trying to improve the energy efficiency and comfort of an existing building, we encourage you to learn more about passive solar design and apply its principles on your projects. Please refer to the Resources section on page five to learn more about this topic.

Layout of the Guide

The first two sections of *The Kentucky Solar Energy Guide* provide an introduction to solar energy technologies. Section One addresses solar electric (photovoltaic) systems, including general information related to solar system design, relevant to many solar energy technologies, including photovoltaic systems (see Chapter Five, Designing Solar Electric Systems). Section Two, Solar Thermal Technologies, discusses many of the ways the sun's heat energy can be harnessed to do useful work. This section emphasizes solar water heating systems (including solar swimming pool heaters), and also includes active solar air heating, solar cooking and food drying, and solar water purification. Both sections are interspersed with case studies of solar energy systems in use in Kentucky.

Section Three provides a guide to resources that can help you find the support you need to use solar energy at your home, farm, or business. Chapter Thirteen discusses incentives that support investments in renewable energy and energy efficiency within Kentucky. Chapter Fourteen presents guidelines for choosing a solar energy installer, offering advice for making wise decisions when contracting professionals to work on your home. Chapter Fifteen presents the

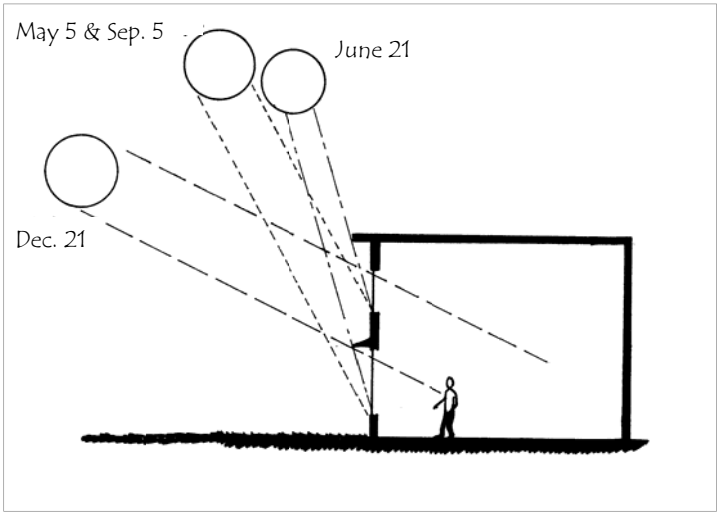


Figure 1.1: Awnings and roof overhangs can be used to control the sunlight that enters a building, an important element in passive solar design, *Andy McDonald*

Kentucky Sun Pages, a directory of renewable energy and green building businesses and professionals serving Kentucky. The Sun Pages connects those seeking to install solar systems or build with environmental protection in mind to installers, professionals, and businesses skilled in these fields. In Chapter Sixteen you will find a list of suppliers, manufacturers, and retailers of renewable energy products and equipment.

Each Section includes lists of references to publications, websites, and organizations where you can learn more about each of the topics discussed in this Guide.

End Notes

1. Joel Makower, Ron Pernick, and Clint Wilder, "Clean Energy Trends 2004," Clean Edge, March 2004. Available at: www.cleanedge.com/reportstrends2004.php
2. Daniel M. Berman and John T. O'Connor, *Who Owns the Sun? People, Politics, and the Struggle for a Solar Economy*, 1996, Chelsea Green Publishing Company, White River Junction, Vermont.
3. *Power$mart*, 2002, Alliance to Save Energy, Washington, DC.
4. Alliance to Save Energy, Washington, DC. On-line fact sheet available at: www.ase.org/programs/federal/femp.htm
5. Adapted from *PowerSmart.*
6. American Council for an Energy-Efficient Economy, Washington, DC. On-line fact sheet. URL: www.aceee.org

RESOURCES:
Energy Efficiency and Conservation

Publications

Consumer Guide to Home Energy Savings, A. Wilson, J. Thorne, and J. Morrill, ACEEE, Washington, DC, 2003. The Consumer Guide will help you find energy-saving products and show you how to use them most effectively. From light bulbs to furnaces, air conditioners to washing machines, windows to refrigerators, all are covered in this guide for consumers who care about the environment and about their budget. Can be purchased on-line at: www.aceee.org

"Home Energy Briefs," Rocky Mountain Institute, Snowmass, Colorado, 2004. These nine reports address energy efficiency and conservation in the following areas: building envelope, lighting, space cooling, space heating, water heating, cleaning appliances, electronics, kitchen appliances, and whole system design. Free downloads available on-line at: www.rmi.org/sitepages/pid194.php

Home Energy Magazine, see below for contact info.

The Most Energy Efficient Appliances 2004, ACEEE Washington, DC, 2004. A listing of appliances based on product directories and manufacturers' data regarding energy performance. Available at www.aceee.org

Southface "Fact Sheets" and "Technical Bulletins," Southface Energy Institute. These Fact Sheets and Technical Bulletins cover a wide range of topics and provide extensive information related to energy efficient, environmentally-sound, high performance home building. They can be downloaded for free from their website, www.southface.org

"What You Can Do to Save Energy and Money: A Checklist for Action," ACEEE, Washington, DC. Available on-line at www.aceee.org

Organizations

American Council for an Energy-Efficient Economy
1001 Connecticut Avenue, NW
Suite 801
Washington, DC 20036
(202) 429-8873
www.aceee.org

The American Council for an Energy-Efficient Economy is a nonprofit organization dedicated to advancing energy efficiency as a means of promoting both economic prosperity and environmental protection. Publishers of the *Consumer's Guide to Home Energy Savings* and *The Most Energy Efficient Appliances 2004*.

Energy Efficiency and Renewable Energy Network
(800)DOE-3732
www.eren.doe.gov

EREN provides an enormous database and search engine on all aspects of energy efficiency and renewable energy. The web site provides access to a wealth of information about renewable energy and energy efficient technologies.

Energy Star Products and Programs
(888)STAR-YES
www.energystar.gov/

The U.S. Environmental Protection Agency and the Department of Energy promote the purchase and use of energy-efficient appliances and equipment by awarding the Energy Star label. Their web site includes program descriptions, product specifications, lists of qualifying products and manufacturers, news and updates.

Home Energy Magazine
2124 Kittredge St., #95
Berkeley, CA 94704
(510) 524-5405
www.homeenergy.org

Home Energy Magazine is dedicated to housing quality, comfort, and energy efficiency. The Home Energy web site includes an index to all feature articles, some full articles, and energy links.

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, CO 81654-9199
(970)927-3851
www.rmi.org

RMI is a national leader in the field of energy efficiency. Among their many excellent publications are their *Home Energy Briefs* (see Publications list above).

Southface Energy Institute
241 Pine St. NE
Atlanta, GA 30308
(404)872-3549
www.southface.org

The Southface Energy Institute works to promote environmentally sustainable homes, workplaces and communities through education, research, advocacy and technical assistance. Their *Fact Sheets* provide extensive information related to energy efficient, environmentally-sound, high performance home building, and can be downloaded for free from their website.

RESOURCES: Passive Solar Heating, Cooling, and Daylighting

Publications

Direct Use of the Sun's Energy, F. Daniels, Yale University Press, New Haven, 1964.

Heating, Cooling, Lighting: Design Methods for Architects, N. Lechner, Wiley Publishers, 2000.

"Passive Solar Design," Technical Bulletin published by Southface Energy Institute and the Office of Building Technology, State and Community Programs, U.S. Department of Energy. No date. Available on-line at: http://www.southface.org/web/resources&services/publications/factsheets/sf_factsheet-menu.htm

The Passive Solar Design and Construction Handboook, Michael J. Crosbie (ed.), Wiley Publishers, 1997.

The Passive Solar Energy Book: A Complete Guide to Passive Solar Homes, Greenhouses, and Building Design, Edward Mazria, Rodale Press, 1979.

The Passive Solar House, James Kachadorian, Chelsea Green Publishing Company, 1997.

The Solar House: Passive Heating and Cooling, Daniel Chiras, PhD., Chelsea Green Publishing Company, 2002.

Sun, Wind & Light: Architectural Design Strategies, G. Z. Brown and M. DeKay, Wiley Publishers, 2000.

Organizations

North Carolina Solar Center
Box 7401
North Carolina State University,
Raleigh, NC 27695-7401
(919)515-5666
www.ncsc.ncsu.edu/

The North Carolina Solar Center offers numerous publications addressing passive and active solar energy. These documents can be downloaded for free from their web site (follow the link for "Information Resources"). They will also mail printed copies upon request. A sample of the titles available include:

- "Sunbook: A Guide to Solar Energy in North Carolina"
- "Passive Solar Options for North Carolina Homes"
- "Passive Solar Design Checklist"
- "Selecting a Site for Your Passive Solar Home"
- "Passive Cooling for Your North Carolina Home"

Appalachian Ginseng Foundation (AGF)

a project of

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presents

A MANUAL FOR GINSENG GROWERS AND TRAINERS

How to Grow Virtually Wild Ginseng

By

Albert J. Fritsch & Sherman Bamford

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DISCLAIMER: ASPI makes no claims as to the health effects of ginseng. We can only say that many people testify to the good effects of ginseng and that it is renowned for its healing characteristics in Asia and North America alike. We know of no instances of ginseng hurting anyone, and we know that it is used for a wide variety of ailments and for the maintenance of strong general health. We are confident that with continuing, serious research, scientists may support these health claims, but there is no conclusive evidence at this time.

Likewise, the information in this book does not constitute investment advice. The potential grower should consider existing risks, markets, regulatory climate, and local factors before beginning to grow "virtually wild" ginseng (VWG) for sale. The potential grower should decide for himself or herself how large a role VWG should play among a mix of other crops, investments, and income sources.

INTRODUCTION

Do you own or hold a small woodlot? Do you want to retain some land as future forest cover for hunting, fishing stream cover, recreation, or simply to pass onto your children or grandchildren? Do you also want to grow a steady, productive crop in the forest? Many woodlot owners and farmers are planting "virtually wild" ginseng (VWG), a valuable root that generates profits in a shorter time period than typical rotation rates for timber. Ginseng has been a major medicinal herb in Asia for over 5,000 years, and demand for it is likely to remain strong, as long as growers continue to produce high quality roots. Ginseng is the same herb that traditional 'sang hunters (ginseng hunters) have harvested from the wild for generations in Appalachia. Although slight fluctuations in the export market can occur, as with any product, high quality wild ginseng has been selling for hundreds of dollars per pound in recent years, and experts expect it to sell for a high price for years to come.

Today, growers working with ASPI and others have developed methods for growing "virtually wild" ginseng plants - plants that are essentially of the same high quality as "wild" roots. This "virtually wild" method of growing allows the land-owner to grow ginseng roots that are far superior to intensively cultivated field or woods-grown ginseng and with less maintenance.

This manual is meant to be a practical guide for those who wish to grow ginseng in a manner which closely resembles the wild condition. In fact, it is called "virtually wild" because it mimics nature in many ways: the seeds are sown far apart; the land is not tilled in any way and only slightly disturbed; soil amendments are not added or added only minimally; surrounding trees are not cut but remain as natural cover; and chemical fungicides are not applied because disease only rarely strikes the widely-spaced VWG. The VWG grower thus produces a plant with a wild look and quality that increases market value. The grower need only sow the seed properly, protect the crop in the course of the growing years, properly harvest and dry the crop, and seek a good market to recover investment and additional funds.

We have selected pertinent information for both beginning and advanced growers who seek to be VWG growers. Most VWG growers are forest landholders who want to grow and sell wild ginseng for supplemental income in the future. When well protected, ginseng can provide needed income, supplemental retirement funds, funds for land-ownership related expenses, or rainy day funds. The VWG grower has much to be optimistic about: highly prized wild and virtually wild ginseng has been in demand in Asia for thousands of years and has nearly always brought a consistently high price in the Asian market; ginseng is not perishable like most fruits and vegetables and, if properly stored, can retain much of its value for a length of time; and ginseng is a healthy medicinal herb with few, if any, known side effects and has a number of claimed uses as a medicine. We do not pass judgment on these health claims, but note that ginseng has been one of the most revered medicinal plants in China and vicinity since the dawn of Chinese civilization. Finally,it is important to note that there are hurdles to overcome if the individual VWG grower (and the larger ginseng-growing community) is to be successful. However, in the discussion that follows, we address the risks involved and show how these challenges may be met.

Personal Testimony (Albert Fritsch) - As an ex-tobacco grower, my primary motivation is to make amends for my part in the cultivation of tobacco. Think what you may, tobacco is a substance that has sapped the life and health from millions of people. I am now determined to assist tobacco growers and other farmers in the conversion to a more healthful, wholesome product - American ginseng. In addition to its purported health benefits, VWG is an agricultural commodity that helps save our region's dwindling mixed mesophytic forests (scientifically, the oldest and most diverse type of hardwood forests in the entire world). I want to make it clear that my goal is not to promote ginseng use. As of this writing, I am not a ginseng user and I take the least amount of medicine possible. This may change with time. Most growers also use ginseng on occasion. But I do see ginseng as a valuable cash crop with many positive benefits to offer. So, read on.

ASPI
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CORDWOOD BUILDINGS

ASPI Technical Series

INTRODUCTION

No one knows who first built a stackwood or cordwood log building (CWB) back in the hazy past, but some of these structures have withstood the elements in northern Greece for at least a thousand years. Northern Europe has a sizeable number of such buildings and the construction zone extends into Siberia and the frigid climates of Canada. This author saw one such structure used in Saskatchewan Province. It requires very little fuel wood to heat the building, even though outside temperatures reach as low as 40° below zero (Fahrenheit) -- yet it is most comfortable in winter.

Why so few CWB's in non-frigid parts of the world? Maybe the lack of accessible, long-lasting supplies of wood has something to do with it. Granted, there is a loss of insulating ability in the end direction of wood as opposed to laying materials lengthwise, but this is compensated for by using thicker logs and cradling insulation within the interior of the CWB walls. Curiously, the insulating ability of a cordwood wall is actually far superior to that of a conventional log building. A 16 inch thick cordwood wall would have an insulating value of R-16, or a factor of resistance to heat loss of R-1 per inch of wood. Unfortunately, many do not want novel ideas for building and thus refrain from this CWB approach to low-cost housing, although CWB's have several advantages. Where building codes may restrict or impede the construction of cordwood houses, the technique can still be used for garages, workshops, studios, storage sheds, barns, or other buildings.

Parts of the world build for hot summers and other parts for cold winters, but in a temperate zone band, building spaces experience both hot and cold temperatures -- and few structures serve both extremes better than CWB's. Furthermore, these are "solar" buildings which have captured the sun's rays in the form of wood, a renewable resource and do not take as much maintenance and care as do more conventional solar houses.

ADVANTAGES

* Saves fuel in both summer and winter. ASPI's CWB uses only about one cord of firewood a year. Therefore, extra wood required for initial construction can be recovered as fuel savings in less than one decade.

* Very low cost. On a per square foot basis this is one of the most economic houses to build, in areas where plentiful wood supplies are present.

* Uses recycled materials. The short length of each cordwood log (12-16inches) allows use of scrap wood and log ends.

* Extremely attractive. Virtually all who see these buildings comment on their aesthetically pleasing lines, rustic charm and character.

* Easy to construct. Full-length logs are heavy and cumbersome, difficult to transport, and need draft animals or machinery and several people for construction. A CWB can be built by a single person with moderate stamina and strength. Care is the only special skill required.

* Easy to maintain. The CWB needs an application of linseed oil on the log ends every two or so years and one or two repointings (filling the masonry joints with mortar, and smoothing with a spoon) as the walls season.

* Low fire-hazard. It is almost impossible to burn down the walls of a CWB. The roof may burn out, but the walls are protected by the surrounding cement from doing more than singeing under ordinary circumstances.

ASPI's CORDWOOD BUILDING

This 1000-square foot building is made from 16 inch lengths of White oak cut from already down timber on U.S. Forest Service land about a mile from this site. The structure was erected in 1983 and has served as the ASPI office since 1985. It is cool in summer and warm in winter, using little cooling energy in summer or heating in winter. The cordwood building cost less than $8,000 for materials, or $8.00 per square foot.

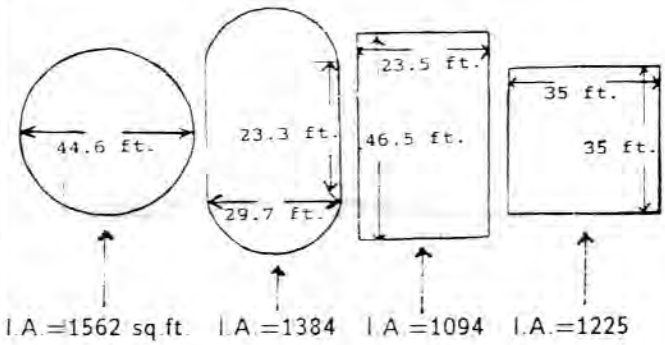
HOW TO BUILD A CWB

The classic books by Robert L. Roy (references 2 and 3) describe the construction of a CWB in great detail. For the sake of emphasis, we will review some of the steps:

Choosing the Site

Site selection is important for the total comfort, lifetime, and economy of the building. Remember, having a southern exposure is most important for including passive design considerations. Building on a shaded hillside away from the prevailing wind but with winter exposure to the sun is ideal. However, very few locations fit all one's expectations. In level areas in suburbs or sub-divisions, one might be highly restricted as to what can be done--as important for CWB's as for other kinds of housing. Often, wind barriers can be constructed with the proper types of evergreens (hemlocks, white pines, blue spruce, etc.) that can cut winter space-heating losses.

INTERNAL AREAS OF VARIOUS BUILDING SHAPES



Each figure has a perimeter of 140 feet.

Selecting the Design

CWB's come in a variety of building designs, (e.g., post-and-beam, stack wall, curved--round or oblong). As Roy points out, a 120-running foot wall building could have a variety of internal areas so the selection of shape has much to do with building material economy. One should remember that curved wall buildings require some novel ways of economizing interior space because of the customary shape of commonly purchased furniture and appliances.

Economy of building materials is not the only design consideration. One must remember that curved walls are far less difficult to construct, but the roofs are somewhat harder to design and build. However, the self-supporting nature of the curved walls, along with the fact that log ends need not be as uniform in size as is necessary for the angled corners of stackwall buildings are significant factors to be considered. A post-and-beam structure is beautiful but takes far more time to construct if individual mortising is performed. The technique is an art and the resulting handiwork could last for centuries.

Choosing and Preparing Wood

The type of wood one selects for the CWB is most important. The typical type of wood in northern climates is Eastern red cedar (Juniperus virginiana), which is known for its durability and resistance to rotting. Where plentiful, this is an ideal CWB construction material because many of the trees are of small girth and make good logs.

For its CWB ASPI used White oak (Quercus alba), which is the most common tree of the central Appalachian climax forest. The U.S. Forest Service had clear cut a number of acres of its nearby land because of '74 tornado damage; this wood was dried and cut for our building after being deadened for three years. Another common tree, the Yellow poplar or Tulip tree (Liriodendron tulipfera), has been known to remain solid and sturdy in two-hundred year-old log cabins.

The selected trees are cut into double lengths for drying. (Walls may be 12 or 16 inches thick; thus the lengths could be 24 or 32 inches). The cordwood is placed on stovewood type ricks and allowed to dry. Cutting in winter before the sap rises reduces drying time required. At a minimum, wood should be cut, split, stacked and dried out of the weather for at least one year prior to construction. Pieces of tin roof over the rick will keep rainwater from adding moisture during the drying period.

Timing is important in removing bark from the logs and will vary with different types of wood. Common sense and some knowledge of timber will help to determine when your variety of logs can be stripped of bark most easily. For some logs peeling is best done when the trees are freshly cut, while the bark on others is more easily cut away after they are seasoned and thoroughly dry (sometimes six months or more depending on when cut).

It is better to split larger logs (above 10 inches diameter) for faster drying, and to prevent checking starring or cracking after the wall is laid. This last factor is mostly an appearance problem because the cracked logs can easily be caulked during an annual inspection. In addition fewer logs are needed in construction when large logs are split into several individual segments, each to be used as small logs.

TOOLS TO USE FOR THE CWB CONSTRUCTION

Foundation tools (pick, spades, etc.)
Chainsaw for wood cutting
Axe and hatchet (or peeling spud) for debarking
Splitting maul or go-devil
(or sledge hammer with splitting wedges)
Masonry mixing tools and container
Tarp for covering wet walls
Trowel & pointing tools
(a large spoon is sufficient)
Hammer, saws, drills, square, level
Caulking gun and caulk
Painting equipment.

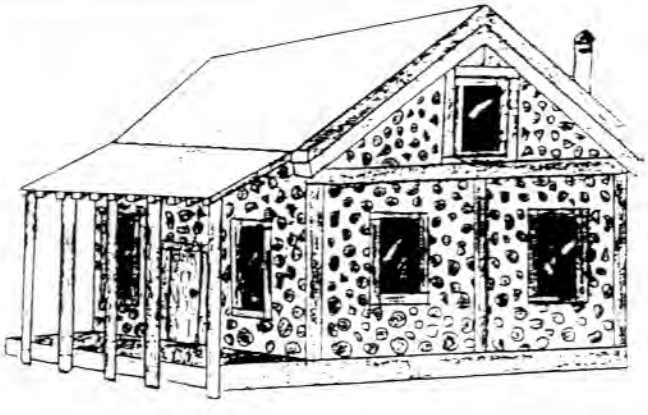
Wood Protection

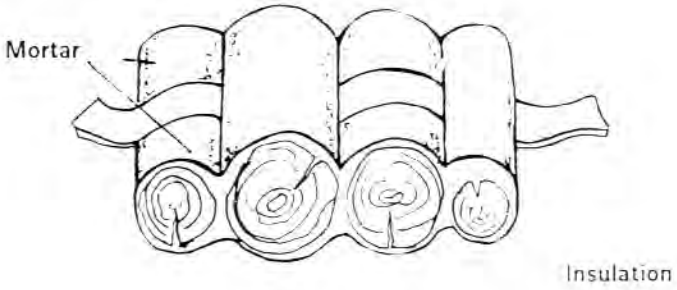
A masonry or slab concrete floor will retard the action of termites and other wood–eating insects. Precautions taken for preserving and preventing such damage in other houses apply here. Stacking of the cordwood should begin at least 12 –18 inches above the grade, with rocks, block, or other masonry forming the foundation. Aluminum flashing should be applied between the masonry foundation and the cordwood with ample caulking and sealing to prevent air infiltration. The first course of stacked wood should be treated with Thompson's Water Seal brand Water Proofing Formula or other non–toxic wood preservative to deter insects and prevent rot from splash action, which results from normal rainfall and runoff from the roof. Due to the removal of many toxic wood preservatives from the market, wood preservation is more difficult for the do–it–yourselfer. We suggest raw linseed oil as a good CWB preservative. The discontinuous nature of the cemented individual logs makes it more difficult for termite damage to occur in CWB houses.

Cementing Mixture Composition

There is no firm mixing composition of the masonry materials due to the amount of shrinkage still to occur, the type of wood used, the weather conditions of the construction period, the time length allowed for drying the cement, and the weather conditions of the first year curing time. Because slower drying time is necessary to prevent severe shrinkage and breaking away from the wood, some sawdust is inserted into the masonry mixture. In the ASPI building a composition of almost equal sand and sawdust was used. The resulting cement wall is soft and will easily crumble for a year or so –– and no nails or excess hammering should occur to shake up the wall in any fashion. A Brixment/yellow sand mix which is so helpful in tuck–pointing (See MAINTAINING THE CORDWOOD BUILDING) could be used in the log laying process as well.

If you are using a type of wood that has no previous CWB history, a helpful procedure for gaining hands–on experience is to build a smaller free–standing storage building in the model of the anticipated house, and see how well the various masonry types hold up after recording conditions at each of the sides during and after construction. Use the mixture of the best–preserved side.





Insulating the Walls

The CWB at ASPI was built using insulation scrap that was free for the cost of hauling. Check at local lumber yards and building supply outlets for free or low–cost fiberglass, rock wool or foam insulation scraps. Shredded and fire–proof (boron treated) newsprint and other cellulose materials also prove good insulating materials. There is a need for a thermal–break between exterior and interior mortar to prevent excessive heat loss. (The outer and inner masonry walls should not be connected and the space between should be about one–third the width of the wall.) See diagram. The more insulation between the mortar joints, the greater the overall efficiency of the building.

At the top of the building's walls some space will exist between the last row of logs and the plate holding the roof. This can be plugged with scrap insulation, by using a trowel to firm the material into place and protected with masonry both on the exterior and interior.

NOTE: In warmer climates heat gain, rather than loss may be the more serious problem.

Pointing Practices

Veteran builders know the value of tuck–pointing the walls, but this is a step many amateurs will omit or consider superfluous. If inexperienced, talk to a builder before beginning the masonry process to understand the importance of this operation. It firms the walls and adds to the life of the materials. Since sawdust is inserted in most mixtures, and this dries very slowly, additional pointing can be done the second day, the second week and even after a month in many climates.

Finishing the CWB

The completion of the house follows standard practice. Interior walls, plumbing, electrical work, roofing and chimney are done in the usual manner. One should remember that a curve–walled building may require some special fitting and more scrap wood. We would suggest making a regular rectangular roof of hip or gable design, for it takes the same amount of wood and adds overhangs to the ends for weather protection. In any case, a minimum eave or roof overhang of 30 inches will protect the exterior walls from weather damage, and will also help to shade the building to prevent overheating during the hot summer months.

MAINTAINING THE CORDWOOD BUILDING

Even though the CWB is built to last for centuries some maintenance is necessary.

* Walls will normally require repointing with some cementing material mix. We strongly suggest a mix of yellow sand and masonry cement (We used BRIXMENT brand type–N Coplary Cement, ESSROC Materials, Inc. Speed, IN 47172), recommended by expert log cabin builder, Albert Baldwin of Pittsburg, Kentucky. For the ASPI house this material has proven to be excellent. It sticks very well to the wood and will not develop cracks provided hammering and violent vibrations do not occur.

* The wood surface should be re–coated with linseed oil depending on the amount of weathering. The inside surface of the log ends can last for four or five years between applications, but parts of the outside should be done every other year. The applications should be quite light and the linseed oil should not be allowed to touch the mortar, so apply with a small paint brush.

* At times larger logs will "star" or check. If this is severe apply a caulking material to match the color of the logs.

* If ample overhangs have not been built, any re–roofing of the house should take this into consideration. Porches and other protective roofing can also help preserve the logs. Guttering is more difficult but not impossible with rounded varieties.

* Use a water sealer on the bottom layer of logs if moisture becomes a problem. Thompson's Water Seal brand Water Proofing Formula works well.

* Often wasps and other stinging insects are attracted to log buildings and periodically throughout the warmer months an effort should be made to remove the nests and gathering places. Kerosene is an excellent low–toxic substance for such extermination operations. Sealing cracks at the top of the highest layer and between the plate and roofing area will discourage many of these insects.

* When attaching items such as pictures to walls on the interior, be extremely careful about hammering nails into the wood. Thumb tacks or other low vibration attaching devices are preferable.

* Doors and window frames and other parts of the building will require the same maintenance due any housing.

TYPICAL COST (Labor not included.)

Small CWB Cabin 20 X 20 feet Total 400 square feet

Cement, sand	$ 120
Chain saw fuel	30
Four windows	240
Two doors (galvanized steel) 200	
Roof –500 square feet (shingles, plywood, tar paper, nails)	300
Guttering, downspout	100
Floor (concrete, rebar) plus foundation	440
Paint, caulking	50
Insulation	120
Rafters (local cut)	150
Sheeting (sheet rock) for ceiling 160	
Electric outlet, box, wiring	200
Plumbing and pipes	120
Vents	20
Stove pipe	50
Flashing	40
Miscellaneous hardware	100
TOTAL	$ 2400

$ 6.00/ square foot

IF ...

If we had to do it again we would –

* Build the house in an open space due to moisture problems. However, ASPI sites are extremely limited;

* Insert glass bottles into the walls for beauty and light;

* Split all logs of more than eight inches in diameter, due to difficulty in placement and starring (cracking) on standing;

* Build a gabled roof over the building;

* Conduct more workshops as part of the building procedure;

* Put vertical log supports every 12 feet ––to prevent possible severe earthquake damage;

* Add two skylights to the attic area;

* Insert several more windows.

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3 Robert L. Roy, CORDWOOD MASONRY HOUSES: A PRACTICAL GUIDE FOR THE OWNER–BUILDER, Sterling Publishing Company, New York, 1982.

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Appalachian Alternatives

Appalachia - Science in the Public Interest

Winter 2012 Number 101

ASPI Celebrates 35th Anniversary

ASPI announces our 35th anniversary. Appalachia-Science in the Public Interest was founded on Earth Day in April of 1977. Our roots actually go back to 1971 with the founding of the original Center for Science in the Public Interest (CSPI) in Washington DC. Our founder, Al Fritsch was one of the three original co-founders of CSPI including James Sullivan and Michael F. Jacobson (CSPI's current executive director). Al and James had both come from Ralph Nader's Center for the Study of Responsive Law and Mr. Nader and his sister Claire remain supporters of ASPI to this day. The idea of appropriate technology was very new in the early 70's. When Al Fritsch founded ASPI he did so with the hope that other regional "Science in the Public Interest Groups" would spin off of CSPI. In Al's words however, "That was never the case." This illustrates the point that ASPI occupies a unique niche even after 35 years.

I would like to kick off our anniversary year by taking my hat off to our staff, board, former directors and our supporters. Thank you. If it wasn't for you we would not have made it this far. Not least of all, we would like thank Al, a true pioneer of conscientious and meaningful change. I am asked frequently what he's up to. He is still writing and working with Earth Healing (www.earthhealing.info). He has been pastoring Saint Elizabeth Catholic Church in Ravenna, KY. I visited him there in May of last year. He showed me around his garden and gave me a great tip for keeping the rabbits out with hot mustard plants. I had to admire his energy as he enthusiastically shared his plans to create a fruit orchard with a pond and other improvements right there beside his parish on the church grounds. That's what Al does. He's always working at creating a better world. In his honor, that's what we're going to keep doing too.

I encourage our readers to revisit Al's "ASPI Milestones." He compiled ASPI's accomplishments for our 25th anniversary in 2002 (his last year as director). You can find those milestones on our website by clicking first on "Publications" and then selecting the archives for our "Appalachian Alternatives Newsletter" issue #71, spring 2002. Recently looking at his compilation of the first 25 years, I'm excited to add the past 10 years to the list. Look for the continued "ASPI Milestones" in our spring newsletter.

Grow Appalachia & ASPI

The Appalachian Community Gardening and Food Security Project, better known as Grow Appalachia, is sponsored by John Paul DeJoria of Paul Mitchell Hair Salons and dedicated to helping Appalachian families plant a healthy future for themselves and their communities by:

- Providing them with skills and resources to grow sustainable, nutritious food.
- Teaching them how to prepare and preserve food in a healthy way.
- Empowering them to share their knowledge in the community.
- Creating programs to provide food to elderly and disabled residents in need.
- Developing local farmers markets to sell surplus food.

ASPI is proud to be one of 15 grant Grow Appalachia recipients for the year of 2012, allowing us to bring this very worthwhile project to Rockcastle County. Priority has been given to low-income and multi-generational households, though we have welcomed all interested gardeners, and/or potential gardeners. The project's goal of assisting local families to become more self-reliant in healthy, sustainable food production is an important one, made more so in this current, troubling economy.

The Grow Appalachia Project is coming along nicely. We have over 40 families who are interested in having a family garden or becoming members of a community garden. Grow Appalachia provides some of these project participants with supplies to prepare and maintain their gardens as well as inform them through monthly workshops in basic gardening and food preservation skills. Some participating families will be provided with seeds and starter plants, hand tools, fertilizer & soil amendments, as well as some canning equipment, as needed. A new project tiller purchased from Earth Tools will be available to participants. Soil testing will be done through the Extension Office and paid for with grant funds.

We have received generous support from the Rockcastle County Healthy Communities Committee as well as several businesses. The local schools are actively involved in growing starter plants and some of the high school students will also be volunteering labor to the project. The mayor's office has had us on his regular local radio show (WRVK) and the local newspaper, the Mount Vernon Signal, has run articles about the project. We are pleased to have so much local support and believe this is a great opportunity for ASPI as well as the local community. A great way for ASPI to celebrate this 35th anniversary year!

Nancy Seaberg is the project coordinator; Mark Spencer is doing the video recording of the community garden site and Jack Keiffer will be assisting in the ASPI demonstration garden plot. Thanks to director, Alan Whetsel, for getting the garden site at the ASPI office enlarged and improved to allow it to be one of two community garden sites for the project. If you would like more information about the project, or would like to contribute in some way, please contact Nancy at the ASPI office; 606-256-0077; nseaberg@a-spi.org.

2012 Sustainable Energy Training Series

The Kentucky Solar Partnership will be hosting the following workshops at the Franklin County Cooperative Extension Office in Frankfort. Who should attend: building contractors, electricians, plumbers, engineers, architects, and anyone interested in working in the solar energy field or using solar electric or solar thermal systems in their home or business.

May Classes with Instructor Chris LaForge, ISPQ Certified Master Trainer for Solar PV

Introduction to Solar Photovoltaics – May 8th & 9th. 8:30am – 5:00pm. Fee: $275
Solar Site Assessments & PV System Design – May 10th. 8:30am – 5:00pm. Fee: $140
Solar PV & the National Electrical Code – May 11th. 8:00am – 4:00pm. Fee: $140

June Classes with Instructor Bill Guiney, Johnson Controls, Inc.

Introduction to Solar Water Heating – June 5th & 6th. 8:30am – 5:00pm. Fee: $275
Status of the US Solar Industry & New Technologies – June 7th. 8:30am – 12:00pm. Fee: $100

July Classes with Instructor Chris LaForge, ISPQ Certified Master Trainer for Solar PV

Advanced Solar Photovoltaics – July 10th, 11th, & 12th. 8:30am – 5:00pm. Fee: $415

To register, visit www.kysolar.org to download a registration form or call the Kentucky Solar Partnership at 502-227-4562 to request a registration form.

Legislative Work – Working to Pass Clean Energy Legislation in Kentucky

The Kentucky Solar Partnership has been working to build support for two bills currently pending before the Kentucky Legislature that would greatly advance the use of renewable energy and energy efficiency in Kentucky. The **Clean Energy Opportunity Act (HB 167)** would establish a Renewable and Efficiency Portfolio Standard (REPS), requiring Kentucky's electric utilities to generate 12.5% of their power from renewable energy and 10.25% through energy efficiency savings by 2022. The Act would also establish Clean Contracts (or Feed In Tariffs), requiring electric utilities to purchase power from eligible renewable power generators at guaranteed rates, with long-term contracts.

The second bill, **HB 187- Expanding Net Metering**, would update the state's net metering law by changing two provisions of the existing statute. First, the bill would expand the definition of who is eligible to use net metering, making solar leases more readily available. Second, it would increase the size of eligible generators from 30 kilowatts to 2 megawatts.

KSP has been working closely with our partners at the Kentucky Sustainable Energy Alliance, Kentucky Solar Energy Society, and the Kentucky Conservation Committee to achieve a hearing for these bills. Both bills have been assigned to the House Tourism Development and Energy Committee but have not yet been assigned a hearing date.

Clean Energy Tour and Reception Held in Frankfort On February 13, KSP helped to organize a Clean Energy Tour and Legislative Reception in Frankfort to educate legislators and others about the importance and benefits of the Clean Energy Opportunity Act. The reception included a presentation by architect Kenny Stanfield about Richardsville Elementary in Bowling Green, Kentucky, the nation's first net-zero energy public school. Richardsville Elementary was designed to use 75% less energy than a typical school and uses a grid-tied solar photovoltaic system to generate as much power as the school requires each year. Significantly, the school cost 20% less to build than a typical school before adding the solar PV. Even after the PV was added, the school still cost less to build. After more than a year of operation the school is performing as-designed and has no electric bills. The architect estimates that the school district is saving about $150,000 per year on energy bills, as compared to a conventional school.

The reception attracted over 60 participants and 16 legislators and included an awards ceremony honoring those who've shown leadership and innovation in renewable energy and energy efficiency. Award recipients included Rep. Rocky Adkins, Kenny Stanfield and Warren County Public Schools (for the Richardsville Elementary School design), and Berea Municipal Utilities & City Commission for the Berea Solar Farm.

Please contact your legislators and let them know that you support clean, renewable energy and the two bills we are advocating: HB 167 and HB 187. To contact your legislators, visit www.LRC.KY.GOV or call 800-372-7181. To learn more about the Kentucky Sustainable Energy Alliance, visit www.kysea.org.

Lighten Up, Frankfort! Final Report Released

The final report for the *Lighten Up, Frankfort!* initiative was released in January, describing the results of the initiative, how the project was organized, and lessons learned through the process. The report describes how *Lighten Up, Frankfort!* motivated over 200 Franklin County households, organizations and businesses to reduce their energy use and annual greenhouse gas emissions by over 1,000 tons. The report was written by Andy McDonald for ASPI and the Frankfort Climate Action Network and is available at www.FrankfortClimateAction.net.

KSP Installs Solar Electric System on Mobile Classroom for Kentucky State University

In October 2011 KSP installed a 1.47 KW solar PV system on an environmental education trailer for Kentucky State University. The installation was performed during a five day workshop led by Chris LaForge of Great Northern Solar. Fourteen students worked together through the week to install this off-grid, battery-based system on KSU's Mobile Classroom, which travels the state teaching youngsters about Kentucky's environment. Among the students at the workshop were building contractors, electricians, people hoping to begin careers in solar energy, and homeowners interested in using solar energy at their home.

Students installing a solar photovoltaic module during the workshop at KSU

New study Shows a Renewable & Efficiency Portfolio Standard could Create 28,000 Jobs in Kentucky

A study released in January estimates that the **Clean Energy Opportunity Act (HB 167)** could create over 28,000 jobs in Kentucky while lessening the growth of electricity bills. Synapse Energy Economics produced the study, which shows that there would be powerful economic benefits throughout Kentucky if HB 167 were to pass. The bill would protect