NC STATE UNIVERSITY The Forum for Family and Consumer Issues (FFCI)

The Forum for Family and Consumer Issues (FFCI)
Carolyn L. Bird, Ph.D., AFC - Editor In Chief
TheForumJournal.org | ISSN 1540-5273 | info@theforumjournal.org

Energy Conservation Tips for Individuals and Families

Vann, J.
Ahmadi, R.
Friesen, C.

Abstract

Conservation of energy reduces stress on the energy generation and distribution system, saves consumers money, and reduces toxic air pollutants and the depletion of non-renewable resources, thus improving the quality of life in the present and enhancing the availability of resources into the future. The recent East Coast "black out" has forced people to think about the impact of their usage — or over-usage — of electricity on their lives. Extension Specialists are equipped to teach consumers how to select the most energy efficient systems and, to the limits imposed by the systems, how to operate the systems using the most energy-efficient behaviors possible. This paper outlines six dimensions of individuals' lives where energy consumption can be reduced through better system choices and more energy-efficient behaviors. By teaching people to select energy-efficient systems and to adopt energy-conserving behaviors, Extension Specialists will have taken yet another step toward ensuring our future.

Keywords: Energy use, energy conservation, sustainability, energy-efficient behavior, household energy use

Introduction

Sustainability of the earth's resources is a civic responsibility. Educating consumers about the many ways to foster sustainability is an appropriate activity for family and consumer Extension Specialists. For generations, family and consumer sciences professionals have emphasized individual, family, and community well-being (Nickols 2004). The recent East Coast "blackout" and last year's rolling blackouts in California have forced people to think about the impact of electricity on the quality of their lives and the impact of their usage on the communities in which they live or work. More than ever, it is imperative that people reduce their consumption of energy to reduce the stressors on our electrical grid system. Energy use in housing systems

embraces the life cycle of a house from the design, selection of materials, specification of systems, use of the home, and ultimately the final disposition of the materials and systems at the end of the house's useful life. Energy usage while the home is occupied involves impacts on electricity, oil, and/or gas usage. While most electricity in the United States is generated through coal combustion (Lawrence Livermore National Laboratory 2004), the use of oil and gas to generate electricity and as a direct energy source in the home are also relevant. All three fuels are non-renewable and all are polluting.

Is there any doubt that Ellen Swallow Richards, the pioneer of home economics (Hunt 1942), would be on the front line teaching consumers energy conservation tips? Extension Specialists around the country can have a tremendous impact on the collective energy utilization in this country if they can effectively teach consumers to conserve energy. Recognition of this opportunity is exemplified by the recently formed partnership between the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension and the U.S. Environmental Protection Agency to educate consumers about Energy Star programs (Atiles, Wysocki, and Tremblay 2004). Extension services in 17 states are currently participating in this program and materials are available at the Web site hosted by the University of Georgia College of Family and Consumer Sciences (2004).

This paper will outline six household systems where energy consumption can be reduced through better choices and more efficient use. Links to current Web sites are provided to give the reader additional information and resources.

Statement of the problem

For too long the concept of "energy availability" has been taken for granted. At the turn of a knob, a flip a switch, or even a clap of our hands, electricity has been readily available. Most energy-related discussions have centered on ways to increase the *supply* of energy through new production facilities, alternative energy sources, and improved distribution networks. In this article, however, we would like to address steps that individuals can take to reduce the *consumption* of energy. Reducing energy consumption has positive economic and environmental benefits through financial savings and reduced pollution.

Maximizing efficiency

Since at least the 1970s, behavior and technology have been recognized as determinants of energy consumption (Eagan 2001). Both are included in the National Energy Modeling System (NEMS), which was designed and implemented by the Energy Information Administration (EIA) of the U.S. Department of Energy (DOE) (Energy Information Administration 2004). Energy efficiency is determined jointly by the household systems within which we operate (i.e.,

structure/setting of a home; heating, ventilation, and air conditioning (HVAC); plumbing; lighting; landscaping; and appliances) and our behaviors in using the systems. Efficiencies can be gained by changing the systems, behaviors, or both (see the table below). Once a system is chosen and installed, its user is constrained in terms of what its maximum efficiency can be, regardless of behavior. Nevertheless, behavioral improvements can maximize the efficiency of the existing system immediately. The possibilities are shown in the table below.

The upper left-hand corner of the table represents a situation in which both systems efficiencies (e.g., a refrigerator) and behavioral efficiencies (e.g., use of the refrigerator) are optimized. An example of this scenario would be an ENERGYSTAR® (Energy Star 2004a) refrigerator that the owner opens infrequently and in which all stored liquids are covered, the freezer compartment is kept relatively full, the recommended temperature setting is maintained, and the coils are cleaned frequently. In the upper right-hand corner, on the other hand, the owner may have an ENERGY STAR® refrigerator, but violate the key energy-saving principles outlined above. In the bottom left-hand corner of the table, the owner may have a refrigerator purchased in the mid-70‘s that is approximately half as energy-efficient as a modern ENERGY STAR® refrigerator. Even though maximum energy efficiency is limited by the outdated refrigeration system in this case, efficient behaviors can maximize the performance of that system to save both energy and money. The scenario in the bottom right-hand corner would be an energy inefficient refrigerator whose owner exhibits wasteful behaviors (the worst case).

Potential impact of household systems and human behavior on energy consumption.

System	**Behavior**	
	Energy-efficient (+)	**Energy-wasteful (-)**
Energy efficient (+)	+ + **Best case scenario**	+ - **Constrained by behavior**
Energy inefficient (-)	- + **Constrained by system**	- - **Worst case scenario**

Systems of a home

In this article, six systems of a home (i.e., structure/setting of a home, HVAC, plumbing, lighting, landscaping, and appliances) will be examined. We will present both system and behavioral opportunities for energy conservation in each of the six systems. The reader will be provided with some best management practices for reducing energy consumption.

Structure/setting system

The design of a home can have a tremendous impact on its long-term energy consumption (Energy Efficiency and Renewable Energy2004a). Most of the opportunities for structural/setting energy efficiency are related to systems options while most of the behavioral opportunities for energy conservation in the home consist of the maintenance and operation of the home's sub-systems, which will be discussed separately below.

Structure/setting system options

- Purchase low-e, triple-pane, insulated windows with argon or krypton gas inside and a thermal break on the edges (Energy Efficiency and Renewable Energy 2004b).
- Purchase re-used (first) or recycled (second) materials whenever possible unless modern materials have an energy-use advantage (Northeast Sustainable Energy Association [NESEA] 2004).
- Orient your home to maximize solar gains in the winter and avoid them in the summer.
- Include large south-facing windows with long, over-hanging eaves that block the sun in the summer and allow the sun to enter in the winter when it is lower in the sky.
- Insulate your home to the levels recommended for your region (Oak Ridge National Laboratory 2004; Energy Efficiency and Renewable Energy 2004c; Lawrence Berkeley National Laboratory 2004a).
- Minimize openings around foundations, utilities and plumbing entries, doors and windows, that allow air intrusion into the home as these can create a chimney effect that draws outside air in and heated or cooled air out (INFILTEC 2004).

Structure/setting behavioral options

- Weatherize your home (Energy Efficiency and Renewable Energy 2004c; Union of Concerned Scientists 2004).
- Contact your local utility companies to determine if they offer free home energy audits, providing the consumer with a variety of specific energy-conservation recommendations (Energy Efficiency and Renewable Energy 2004d).
- Conduct your own Web-based energy audit (Lawrence Berkeley National Laboratory 2004a).
- Have a contractor test your home for air leakage/infiltration by conducting a blower door test to assess overall leakage and to identify sources (INFILTEC 2004).
- See specific sub-systems below (e.g., lighting, landscaping).

Heating, ventilation, and air conditioning (HVAC) system

The opportunities for HVAC energy conservation are straightforward and limited in number, but the opportunities for savings are great (Energy Efficiency and Renewable Energy 2004e). Total efficiencies are determined by other elements discussed in this article, including the structure and orientation of the home and landscaping issues.

HVAC system options

- Choose ENERGY STAR® HVAC systems when building a new home (Energy Star 2004b).
- Purchase programmable thermostats at home improvement center (approximately $100 or less).
- Replace old, inefficient systems.

HVAC behavioral options

- Clean/replace filters frequently (see manufacturer's recommendation). Filters are usually located in the central air handling unit. There will be a trade-off between particle filtration efficiency and air resistance. Increasing air resistance increases the energy costs for the system's fan. High particle efficiency filters with the greatest depth and pleating are the most energy efficient. (Lawrence Berkeley National Laboratory 2004b).

- Use conservative temperature settings in both the summer (e.g., 75ºF) and winter (e.g., 65ºF). Each degree lower in the winter corresponds to a 3 percent savings on your heating bill (Alliance to SaveEnergy 1998, 10; see also Alliance to Save Energy 2004).

- Set your programmable thermostat to reflect your needs throughout the day and when you go on vacation. Don't override the settings except in extreme circumstances.

- Don't heat or cool unused rooms with zoned heating/cooling. However, don't block airflow to rooms by using magnetic or other vent covers because this can be detrimental to the system.

- Have your ducts tested for leakage and efficiency.

- Lower window shades or curtains on the south side of the house to block the sun in the summer and raise them to allow solar gains in the winter.

Appliance systems

The typical household spends $1,400 per year on energy bills (Energy Star 2004d). However, modern appliances are much more efficient than those manufactured just 10 years ago. For example, appliances that meet the Environmental Protection Agency (EPA) requirements for ENERGY STAR® designation can save consumers up to 50 percent off of their energy bills compared to standard models (Energy Star 2004e; Energy Efficiency and Renewable Energy 2004h; American Council for an Energy Efficient Economy 2004). In addition, appropriate behaviors associated with appliance use can maximize their efficiencies.

Appliance systems options

- Purchase a front-loading washing machine to conserve water and its associated energy costs.
- Choose energy efficient (e.g., ENERGY STAR®) appliances.
- Use the EnergyGuide label to determine the annual energy usage, estimated annual energy costs, and a comparison of the model under consideration with the most and least efficient models in that class of appliance (Energy Efficiency and Renewable Energy 2004i; Maryland Energy Administration 2004).
- Check free directories from the Association of Home Appliance Manufacturers for refrigerator or freezer ratings before purchasing (AHAM 2004).
- Choose smallest refrigerator or freezer that meets your needs.
- Minimize redundant appliances in the home (e.g., second refrigerator, third television).
- Purchase appliances that can be upgraded rather than disposed of (e.g., a computer to which you can add more memory rather than having to buy another computer).
- Retrofit appliances to delay disposal (e.g., add memory chips to your computer).

Appliance behavioral options

- Wash only full loads in the dishwasher and clothes washing machine.
- Wash clothes in cold water.
- Clean the refrigerator coils frequently.
- Switch off stereos and televisions when you leave the house.
- Cover liquids in the refrigerator to reduce frequency of defrosting cycles that would otherwise occur with excessive evaporation.
- Use the smallest possible cooking appliance (e.g., microwave, toaster oven, table-top grill) rather than a full-sized oven to cook foods.
- Minimize time refrigerator or freezer doors are open.
- Turn off all appliances when they are not in use (e.g., TV, computer, stereo).

- To avoid use of "phantom energy" that is consumed even when items are turned off (Energy Solutions Alberta 2004), plug your television, computers, monitors, printers, and entertainment systems into power strips and turn them off at the power strip.

Plumbing system

Energy use for plumbing is tied directly to the use of warm or hot water and indirectly to the energy required pumping and purifying water and to pump and purify sewerage. Controlling flows and temperature are the primary avenues for energy conservation. Energy use can be limited both by the system (e.g., running a 3/8" pipe between the water heater and the water outlet to reduce the amount of hot water "held" in the pipe and thereby dissipated from the pipe) and by human behavior. Use of water is influenced by other household sub-systems, e.g., type of washing machine, dishwasher, and landscaping, and the energy-efficiency of related behaviors (Regional Water Providers Consortium 2004a).

Plumbing system options

- Purchase an energy efficient water heater (Energy Efficiency and Renewable Energy 2004f; American Council for an Energy Efficient Economy 2004).
- Compare efficiencies of electric, natural gas, and heat pump water heaters in your geographic area (Energy Efficiency and Renewable Energy 2004f).
- Consider adding a solar hot water collector to your current hot water system which could save 40-90 percent on the electrical costs for water heating (Northeast Sustainable Energy Association 2004).
- Retrofit your home with a low-flush toilet.
- Retrofit your home with low-flow shower heads.
- Install aerators on kitchen and bathroom faucets.
- Install a cistern to capture rainwater for sanitary and landscaping uses.
- Insulate hot water pipes.

Plumbing behavioral options

- Place a water dam or a water-filled milk jug in your non-low flow toilet's water tank (City of Desoto, TX 2004).
- Take short showers (e.g., aim for 5 minutes or less).
- Minimize use of hot and warm water for showers and hand washing.
- Turn shower off while lathering.
- Fix leaking faucets (Energy Efficiency and Renewable Energy 2004g).
- Don't run water while brushing your teeth.
- Set water heater no higher than 120ºF (Wilson, Thorne, and Morrill 1999, 135).

- If you have an older, inefficient water heater, wrap it with additional insulation.

Lighting system

Lighting consumes much of the electricity used in a home. While good lighting enables people to work safely, effectively, and efficiently, it should be as energy-efficient as possible. There are opportunities for energy conservation both in the design and in the operation of the system.

Lighting system options

- Use occupancy sensors.
- Purchase compact fluorescent lamps (CFL) for both indoor and outdoor use, as they use about one-third the energy of a standard light bulb to produce the same level of illumination (Energy Star 2004c).
- Avoid using halogen torchieres (floor lamps with halogen bulbs) as they use excessive electricity; consider replacing them with compact fluorescent torchieres which use low wattage bulbs.
- Look for the ENERGY STAR® label when purchasing lighting products.
- Maximize use of daylighting (Daylighting 2004).
- Use specialized low-wattage fixtures (e.g., light emitting diode (LED) technology or CFL).
- Use minimum wattage necessary for the task at hand.
- Install task lighting (e.g., use desk-top or under-cabinet lighting).
- Use photocells, motion detectors, or a timer to control outside lighting.
- Use light-colored surfaces and furnishings indoors to reflect light.

Lighting behavioral options

- Turn off lights when you leave a room.
- Use task lighting rather than lighting an entire room.
- Dust bulbs and shades.

Landscaping system

Landscaping maintenance requires energy use. For example, fertilizer requires energy for its manufacture and water requires energy for its pumping and purification. On the other hand, proper landscaping can reduce the energy requirements of the home by minimizing maintenance requirements and managing home energy gains and losses from the sun and wind.

Landscaping system options

- Optimize use of natural shade from trees.
- Minimize use of outdoor lighting (for lights that are necessary, follow the guidelines found in Lighting listed above).
- Plant deciduous trees to shade the house in the summer and allow sunlight in winter.
- Plant evergreen windbreaks on the northwest side of the house to protect the house from chilling winds in the winter.
- Apply the concept of xeriscaping (e.g., use only plants that require natural levels of moisture) to minimize maintenance and watering (Xeriscape Council of New Mexico 2004).
- Plant native species to minimize water use.
- Minimize grassy areas that would require watering (e.g., plant wild flowers or prairie grasses).

Landscaping behavioral options

- Lower frequency of mowing and fertilizing.
- Minimize watering (Regional Water Providers Consortium 2004b).

Summary

Conservation of energy reduces the stress on the energy generation and distribution system while concomitantly saving money for individuals and families. In addition, conservation of energy reduces the release of toxic air pollutants into the environment and depletion of non-renewable resources, thus improving the quality of life in the communities where individuals live and work, and enhancing the availability of resources into the future. Family and consumer scientists are equipped to be key players in resource development and sustainability issues (Atiles and Cude 2002). Extension Specialists can teach consumers how to select the most energy efficient systems and, to the limits imposed by the system, how to operate the systems using the most energy-efficient behaviors possible. As Anderson (2004, iii) so eloquently stated, "Today's choices affect individual, family, and community well-being as well as our children's future." By teaching people to select energy-efficient systems and to adopt energy-conserving behaviors, Extension Specialists will have taken yet another step toward ensuring our future.

References

AHAM. 2004. "Directory of Certified Refrigerators-Freezers," http://www.aham.org/products/productitem.cfm?recordID=176 (accessed September 24, 2004).

Alliance to Save Energy. 1998. *Power Smarts: Easy Tips to Save the Planet.* Washington, D.C.: Alliance to Save Energy.

Alliance to Save Energy. 2004. http://www.ase.org/consumer/index.htm (accessed September 24, 2004).

American Council for an Energy-Efficient Economy. 2004. "The Most Energy-Efficient Appliances 2002-2004," http://www.aceee.org/consumerguide/mostenef.htm (accessed September 24, 2004).

Anderson, C.L. 2004. "Sustainability-Coexisting in times of enormous change." *Journal of Family and Consumer Sciences* 95(2): iii.

Atiles, J.H., and B.J. Cude. 2002. "Expanding on the meaning of resource development for family and consumer sciences in the 21st century." *Journal of Family and Consumer Sciences* 94(2): 9-10.

Atiles, J. H., J.L. Wysocki, and K.R. Tremblay, Jr. 2004. "Energy Star: Introducing a New Cooperative Extension Partnership." *Housing and Society* 30(1).
City of Desoto, TX. 2004. "Cut your water bill! Conserving water can save you money!!!,"http://www.ci.desoto.tx.us/water_conservation.htm (accessed September 24, 2004).

Egan, Christine. 2001. *The Application of Social Science to Energy Conservation: Realizations, Models, and Findings*. Washington, D.C.: American Council for an Energy Efficient Economy.

Energy Efficiency and Renewable Energy. 2004a. "Your Home's Energy Use," http://www.eere.energy.gov/consumerinfo/energy_savers/energyuse.html (accessed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004b.
"Windows," http://www.eere.energy.gov/consumerinfo/window.html (accessed September 24, 2004).
Energy Efficiency and Renewable Energy. 2004c. "Insulation and Weatherization," http://www.eere.energy.gov/consumerinfo/energy_savers/insulation.html (acce ssed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004d. "Home Energy Audits," http://www.eere.energy.gov/consumerinfo/factsheets/ea2.htm (accessed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004e. "Heating and Cooling," http://www.eere.energy.gov/consumerinfo/energy_savers/heatcool.html (accessed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004f. "Choosing a Water Heater," http://www.eere.energy.gov/consumerinfo/heatcool/hc_choosing_water_heater.html(accessed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004g. "Energy-Efficient Water Heating," http://www.eere.energy.gov/erec/factsheets/eewtrhtr.html (accessed September 24, 2004).

Energy Efficiency and Renewable Energy. 2004h. "Appliances," http://www.eere.energy.gov/consumerinfo/saveenergy/save_appliances.html (accessed December 26, 2004).

Energy Efficiency and Renewable Energy. 2004i. "How to Read the EnergyGuide Label." http://www.eere.energy.gov/consumerinfo/energy_savers/label.html (accessed December 26, 2004).

Energy Information Administration. 2004. "The National Energy Modeling System: An Overview
2004/Introduction," http://www.eia.doe.gov/oiaf/aeo/overview/introduction.html(accessed December 26, 2004).

Energy Solutions Alberta. 2004. "Phantom Energy Losses," http://www.energysolutionsalta.com/home1.asp#phantom (accessed September 24, 2004).

Energy Star. 2004a. "What makes a product ENERGY STAR®?" http://www.energystar.gov/index.cfm?c=products.pr_what_makes_es (accessed September 24, 2004).
Energy Star. 2004b. "Find a Product," http://www.energystar.gov/index.cfm?c=products.pr_index (accessed September 24, 2004).

Energy Star. 2004c. "Compact Fluorescent Light Bulbs," http://www.energystar.gov/index.cfm?c=cfls.pr_cfls (accessed September 24, 2004).

Energy Star. 2004d. "Did you know?" http://www.energystar.gov/index.cfm?c=products.pr_index (accessed September 24, 2004).

Energy Star. 2004e. "Appliances," http://www.energystar.gov/index.cfm?c=appliances.pr_appliances (accessed September 24, 2004).

Green, K.B. 1990. "Our Intellectual Ecology: A treatise on home economics." *Journal of Home Economics* 82(3): 41-47.

Hunt, Caroline Louisa. 1942. *The Life of Ellen H. Richards*. Washington D.C: American Home Economics Association.

INFILTEC. 2004. "About Blower Doors," http://www.infiltec.com/inf-bd.htm (accessed December 26, 2004).

Lawrence Berkeley National Laboratory. 2004a. "The Home Energy Saver," http://HomeEnergySaver.lbl.gov (accessed December 26, 2004).

Lawrence Berkeley National Laboratory. 2004b. "Filtration for Particles/Costs of Filtration," (accessed December 27, 2004). http://eetd.lbl.gov/ied/viaq/v_filtration_2.html.

Lawrence Livermore National Laboratory. 2004. "Energy Flow Charts for the United States," http://eed.llnl.gov/flow/02flow.php (accessed December 27, 2004).

Maryland Energy Administration. 2004. "Understanding EnergyGuide Labels for Appliances," http://www.energy.state.md.us/energysources/energyefficiency/residential/energyguide.htm(accessed September 24, 2004).

Nickols, S.Y. 2004. "Point of view: The voice for family well-being." *Journal of Family and Consumer Sciences* 95(1):1.

Northeast Sustainable Energy Association. 2004. "Information about Green Buildings." http://www.nesea.org/buildings/info (accessed September 1, 2004).

Oak Ridge National Laboratory. 2004. "Insulation Fact Sheet," http://www.ornl.gov/roofs+walls/calculators/rvalue/index.html (accessed September 1, 2004).

Regional Water Providers Consortium. 2004a. "Get Started on the Road to Indoor Water Conservation," http://www.conserveh2o.org/pdf/Indoor_Brochure.pdf (accessed September 24, 2004).
Regional Water Providers Consortium. 2004b. "Lawn and Plant Care Tips," http://www.conserveh2o.org/lawncare.html (accessed September 24, 2004).

The Daylighting Collaborative. 2004. http://www.daylighting.org/ (accessed September 24, 2004).

Union of Concerned Scientists. 2004. "Weatherizing," http://www.ucsusa.org/publication.cfm?publicationID=442 (accessed September 5, 2004).

University of Georgia College of Family and Consumer Sciences. 2004. "Energy Star National Extension Partnership Web site," http://www.fcs.uga.edu/extension/housing/estar/index.html (accessed December 26, 2004).

Wilson, Alex, Jennifer Thorne, and John Morrill. 1999. *Consumer Guide to Home Energy Savings, 7th Edition.* Washington, D.C: American Council for an Energy-Efficient Economy.

Xeriscape Council of New Mexico. 2004. "Xeriscaping Info http://www.xeriscapenm.com/xeriscape_info.html (accessed September 24, 2004).

Authors

John W. Vann, Ph.D.
Associate Professor
Department of Marketing and Management
Ball State University
jvann@bsu.edu

Reza T. Ahmadi, M.Arch.
Associate Professor
Department of Family and Consumer Sciences
Ball State University
rahmadi@bsu.edu

Carol A. Friesen, Ph.D., R.D.
Associate Professor
Department of Family and Consumer Sciences

Ball State University
cfriesen@bsu.edu