



E³A: Solar Electricity for the Home, Farm or Ranch

Steps in the Solar Electricity Series

Building and Site Assessment

Conservation and Efficiency

System Options

System Components

System Sizing

Costs

Installation

Operation and Maintenance

Electricity Use Worksheet

Conservation and efficiency

When you or a contractor sizes a solar electric system, it is based on the amount of electricity used. The less you use the smaller, more efficient and affordable the system will be. Therefore, energy conservation and efficiency provide the foundation for a smaller, more efficient and affordable solar electric system.

It is often cheaper to reduce energy use than to buy a larger renewable energy system. Replacing inefficient lights, appliances, equipment and machinery can significantly reduce your electricity use, thereby reducing the size and cost of a solar electric system. In addition to saving money on a solar electric system, the energy-efficient lights, appliances and equipment continue to save money on utility bills. You or a system installer can review past utility bills to determine your electrical load to properly size your system.

Use the *Electricity Use Worksheet* to list everything that uses electricity and how much electricity it uses. The worksheet has instructions to help you calculate how much electricity an appliance or machine uses. This exercise will create an awareness of what will be powered by your solar electric system, how electricity use changes throughout a day, month, or a season, and it will help you find ways to reduce your electrical load. This information can be used to calculate system size in *System Sizing*.

Home electricity loads in Missouri

The top three residential electricity loads in typical Missouri homes — those that use natural gas for space and water heating — are refrigerators, clothes dryers and lighting.

Refrigerators

Conservation tips

- Keep air filters and grates clean.
- Keep the refrigerator as full as possible; less open air means less air to cool.
- Clean door seals to prevent air leakage.
- Keep frequently used items near the front for easy access.

Efficiency tips

- Buy an energy-efficient Energy Star-rated refrigerator.

Clothes dryers

Conservation tips

- Air-dry clothes on a drying rack or on a clothesline outside during warmer months.
- Use the moisture sensor setting, if available.
- Use the washer's high spin selection to remove more moisture.
- Clean lint screen frequently.
- Don't overload a dryer; air circulation aids quicker drying.
- Keep external air exhaust connections clean.
- Dry light and heavy clothes separately.
- Use the cool-down cycle to take advantage of existing heat to dry clothes.

Efficiency tips

- The EPA added clothes dryers to the Energy Star program. When purchasing a new dryer or washing machine, look for the Energy Star rating to choose an energy-efficient appliance.

Lighting

Conservation tips

- Turn off lights when you're not using them.
- Take advantage of natural light when possible.
- Dim lights if you have dimmer switches.
- Use motion sensors for outdoor lights normally left on at night.
- Remove bulbs from unused recessed fixtures.
- Use task lighting, such as desk lamps or under-counter lights, instead of ceiling lights.

Efficiency tips

- Install Energy Star-rated compact fluorescent lights (CFL) or other energy-efficient bulbs or tubes.
- Use outdoor solar lights for mood or pathway lighting.
- Install dimmer switches.
- Install skylights and solar tubes for natural daylight.

Upgrading to efficient lighting is one of the easiest ways to save money and reduce electricity use in a home, farm or ranch. If you use standard incandescent bulbs in lights typically turned on for 15 minutes or longer, consider replacing them with CFL bulbs. CFLs use 75 percent less energy and last 10 times longer than incandescent bulbs. They also produce 75 percent less heat than incandescent bulbs, which makes them safer to operate and cuts cooling costs.

CFLs have a higher upfront cost, but they have a lower operational cost. They use less electricity, so you can save money on utility bills and help reduce the size of a potential solar electric system. Table 1 compares a 23-watt CFL and 100-watt incandescent bulb, which provide the same level of brightness in lumens.

Add the value of the time it takes to replace burned-out incandescent bulbs nine times.

CFLs can replace incandescent bulbs for most of a building's lighting needs. They work most efficiently when left on for at least 15 minutes because less than that shortens their lifespan. Halogen and light-emitting diodes (LEDs) are also more energy efficient than incandescent bulbs. Large agricultural-based buildings can be retrofitted to use T-8 fluorescent tube lighting and other efficient lights.

Other efficiency measures for the farm or ranch include modifying irrigation systems by switching to low-pressure sprinkler systems and using variable speed drives for pumps, fans and other equipment. A farm can reduce electricity use by as much as 35 percent with variable speed drives alone. If energy and water resources are a concern, planting crops with lower water requirements reduces water use and the electricity needed for pumping.

Converting to drip irrigation or a linear/pivot system also saves both energy and water.

Table 1. Compact fluorescent lamp (CFL) and incandescent cost and energy use comparison

	CFL	Incandescent
Equivalent light output wattage	23 watts	100 watts
Bulb cost	\$7.00	\$0.25
Bulb lifespan	10,000 hours	1,000 hours
Bulb cost for 10,000 hours	\$7.00	$\$0.25 \times 10 = \mathbf{\$2.50}$ (takes 10 bulbs to get 10,000 hours)
Energy used in kWh	10,000 hours of light at 23 watts = 230,000 watt-hours. $230,000 \div 1,000 \text{ watts} = \mathbf{230 \text{ kilowatt-hours (kWh)}}$	10,000 hours of light at 100 watts = 1,000,000 watt-hours. $1,000,000 \div 1,000 \text{ watts} = \mathbf{1,000 \text{ kilowatt-hours (kWh)}}$
Utility electricity cost for 10,000 hours of light at \$0.08/kWh	$230 \text{ kWh} \times \$0.08 = \mathbf{\$18.40}$	$1,000 \text{ kWh} \times \$0.08 = \mathbf{\$80.00}$
Store purchase cost + electricity or operation cost = total cost	$\$7.00 + \$18.40 = \mathbf{\$25.40}$	$\$2.50 + \$80.00 = \mathbf{\$82.50^*}$

Additional information

The U.S. Department of Energy offers resources on how to save money and energy in *Energy Savers Booklet: Tips on Saving Energy & Money at Home*, available at http://www.energysavers.gov/pdfs/energy_savers.pdf.

If you hire a business to conduct an energy or water use assessment, select one that has trained and certified employees. The Building Performance Institute (BPI) and Residential Energy Services Network (RESNET) are two certification programs for homes that use the Home Energy Rating System (HERS). Your utility company might provide a free or low-cost assessment. The Missouri Department of Natural Resources provides training for home-energy auditors and provides a list of trained auditors.



References

- Sustainable Agriculture Research and Education (SARE). (2008, February). *Clean Energy Farming: Cutting Costs, Improving Efficiencies, Harnessing Renewables*. Retrieved April 30, 2011, from <http://www.sare.org/Learning-Center/Bulletins/National-SARE-Bulletins/Clean-Energy-Farming>

U.S. Environmental Protection Agency.
Find Energy Star Products. (2011). Retrieved April 11, 2011, from http://www.energystar.gov/index.cfm?c=products.pr_find_es_products
Light Bulbs (CFLs) for Consumers. (2011). Retrieved April 11, 2011, from http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=LB



