



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

Introduction

Missouri's electricity is primarily generated by coal-fired power plants. Recent data indicate coal supplies 82 percent of Missouri's net electricity generation. However, burning coal produces greenhouse gases that can be harmful to the environment. A more eco-friendly alternative is to use the sun's energy to produce electricity using photovoltaic (PV) technology, which can potentially be used anywhere the sun shines.

Solar cells produce electricity by generating electrons when exposed to sunlight. Solar cells connect to form a panel, also called a module, and multiple panels join to form an array. In addition to PV panels, a solar electric system, also called a PV system, includes an inverter, a meter and safety equipment. It might include batteries and a charge controller. These low-maintenance systems contain no moving parts and are silent, durable and reliable. Once installed, they use only the sun's energy and produce no emissions. PV panels can be added to an existing system over time.

PV technology is used to power everything from calculators and outdoor lighting fixtures to buildings and satellites. Everything powered by electricity, such as appliances and machinery, is called the electrical load. The sun can provide electricity for your home, greenhouse and barn. It can also electrify fences and pump water.

System costs depend on a variety of factors. As a general rule of thumb, a grid-tied residential system without batteries costs between \$5,000 and \$7,000 per kilowatt (kW) of electricity produced, including installation costs. Utility rebates and government tax incentives can significantly reduce the final system cost.

Dispelling myths about costs

There is a myth that it takes more energy to make a PV system than it produces over its lifetime. Energy payback describes how long a system has to operate to recover the energy that went into making it. The energy payback for rooftop systems ranges from one to four years, and depends on the type of PV panel. A properly designed, installed and maintained system can produce energy for more than 30 years.

There are several good reasons to invest in a PV system:

- They are a clean, reliable source of electricity.
- They provide independence from a utility company and price increases.
- They leave a smaller environmental footprint.
- Investing in a system helps support local renewable energy companies and their employees.

Missouri has an excellent solar resource that makes solar electric systems worth considering. The guides in this section provide information to help you decide if a solar electric system will work for you and allow you to discuss the topic knowledgeably with an installer. The guides can be used separately or together for a step-by-step decision-making process.



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1. **Building and site assessment:** Consider building and site conditions.
2. **Conservation and efficiency:** Conserve and use energy more efficiently to reduce system size and cost.
3. **System options:** The four options to consider are PV-direct, grid-connected with batteries and off-grid.
4. **System components:** Provides detailed information about system option components.
5. **System sizing:** Proper sizing is important for a resource-efficient and cost-effective system. Includes a panel and system sizing worksheet.
6. **Costs:** System costs depend on several factors, but rebates and incentives lower the cost.
7. **Installation:** Considerations when deciding whether to hire an installer or do it yourself.
8. **Operation and maintenance:** Routine inspections and maintenance keep systems working efficiently and longer.
9. **Electricity use worksheet:** An exercise to determine the energy used by your household.

References

- National Renewable Energy Laboratory (produced) for U.S. Department of Energy.
Own Your Power! A Consumer Guide to Solar Electricity for the Home. (2009, January). DOE/GO-102009-2656.
PV FAQs: What is the Energy Payback for PV? (2004, January). DOE/GO-102004-1847.
- National Renewable Energy Laboratory Engineer and Montana-based NABCEP-certified PV system installers, personal communication regarding current PV system purchase and installation costs, April 12, 2011.
- Solarbuzz: Solar Market Research and Analysis. *Solar Electricity Prices.* (2011). Retrieved April 11, 2011, from <http://www.solarbuzz.com/facts-and-figures/retail-price-environment/solar-electricity-prices>
- U.S. Department of Energy.
Photovoltaics. (2011). Retrieved February 16, 2011, from http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10490
Solar Energy Applications for Farms and Ranches. (2011, February). Retrieved March 4, 2011, from http://www.energysavers.gov/your_workplace/farms_ranches/index.cfm/mytopic=30006

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