



# E<sup>3</sup>A: Solar Electricity for the Home, Farm, or Ranch

## Steps in the Solar Electricity Series

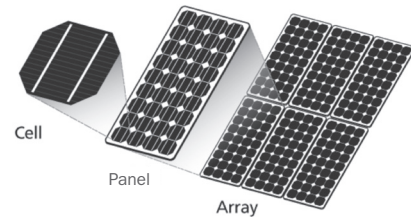
1. Building and Site Assessment
2. Conservation and Efficiency
3. System Options
4. System Components
5. System Sizing
6. Costs
7. Installation
8. Operation and Maintenance
9. Electricity Use Worksheet

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### Introduction

Most of Montana and Wyoming's electricity is generated by coal-fired power plants. An alternative is to use the sun's energy as the fuel to produce electricity. This is accomplished using photovoltaic (PV) technology. The letters PV stand for "Photo" = light and "Voltaics" = electricity. PV technology can potentially be used anywhere the sun shines.

Solar electricity is produced through the PV Effect: when sunlight hits a solar cell, electrons are released and flow as electricity through wires to your building or equipment. Solar cells are connected together to form a panel (also called a module). Panels are wired together to form an array.



*Courtesy of Namasté Solar*

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

In addition to the PV panels, a solar electric system (also called a PV system) includes an inverter, meter, and safety equipment. It may include batteries and a charge controller. These systems contain no moving parts, are silent, very durable and reliable, and are low maintenance. Once installed, they only use the sun's energy and their operation produces no emissions. Solar electric systems can produce all or a portion of the electricity needed. PV panels can be added to an existing system over time.

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. This includes installation costs. Utility rebates and government tax incentives can significantly reduce the final system cost.



*Courtesy of DOE/NREL*

### Dispelling the myth

There is a myth that it takes more energy to make a PV system than it produces over its lifetime. "Energy payback" is the term used to describe the amount of energy it takes to develop/manufacture a system versus the amount of energy it generates. How long does a PV system have to operate to recover the energy that went into making it? The energy payback for rooftop PV systems ranges from 1 to 4 years depending on the type of PV panel. A properly designed, installed, and maintained system can produce energy for and last 30-plus years.



*Courtesy of DOE/NREL*

People invest in solar electric systems for a variety of reasons: they want a clean, reliable source of electricity, they want independence from a utility company and price increases, and they want to leave a smaller environmental footprint. Investing in a system also helps



Courtesy of Solar Plexus, LLC

support local renewable energy companies and their employees. Montana and Wyoming have and continue to build an infrastructure of qualified and certified companies and independent contractors who install and service solar electric systems.

Montana and Wyoming have an excellent solar resource that makes solar electric systems worth considering. You do not need to be an electrician or PV installer to understand how solar electricity systems work. The factsheets provide basic information that can help you decide if a solar electric system will work for you and help you discuss the topic knowledgeably with an installer. The sheets can be used separately or together for a step-by-step decision-making process.

1. **Building & Site Assessment:** Building and site conditions to consider.
2. **Conservation & Efficiency:** Conserving and using energy more efficiently can reduce the system size and cost.
3. **System Options:** There are four system options to consider.
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 various factors. Rebates and incentives lower the cost.
7. **Installation:** What to consider when deciding whether to hire a contractor/installer or do-it-yourself.
8. **Operation & Maintenance:** Routine inspections and maintenance keep systems working efficiently and longer.
9. **Electricity Use Worksheet**

## Notes

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## References

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