



Steps in the Solar Electricity Series

STEP 3

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

For more energy information, go to <http://energy.tennessee.edu>.

System Options

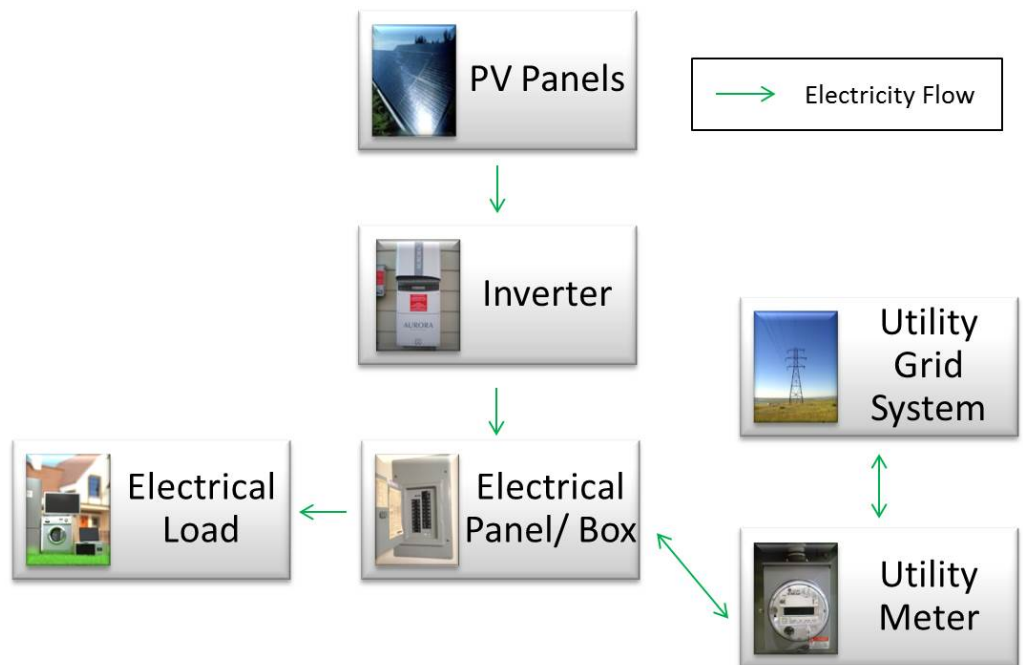
This factsheet provides flow charts for the four most common solar electric system options. Each system is designed based on whether it includes batteries, whether it is connected to the utility grid, and the electrical load. The term “grid” refers to a utility company’s system of transmission and distribution lines that carry and deliver power plant-generated electricity to your home or business. The Step 4: System Components fact sheet provides information about each major component.



Courtesy of DOE/NREL

Grid-Connected Systems

Grid-connected, or grid-tied, systems are connected to the utility power grid. Grid-connected systems without batteries are currently the most common/popular system type for residences and businesses. PV panels produce electricity when the sun is shining during the day. If the PV panels are producing more electricity than needed by the building’s electrical loads, the extra electricity is fed into the utility grid. If the building or equipment needs more electricity than the PV panels are producing, electricity is provided by the utility grid to meet the demand. At night, electricity comes from the utility grid. If there is a power outage, the PV system automatically shuts down (does not supply electricity) for utility worker safety, and the building will have no electrical power during the utility outage.

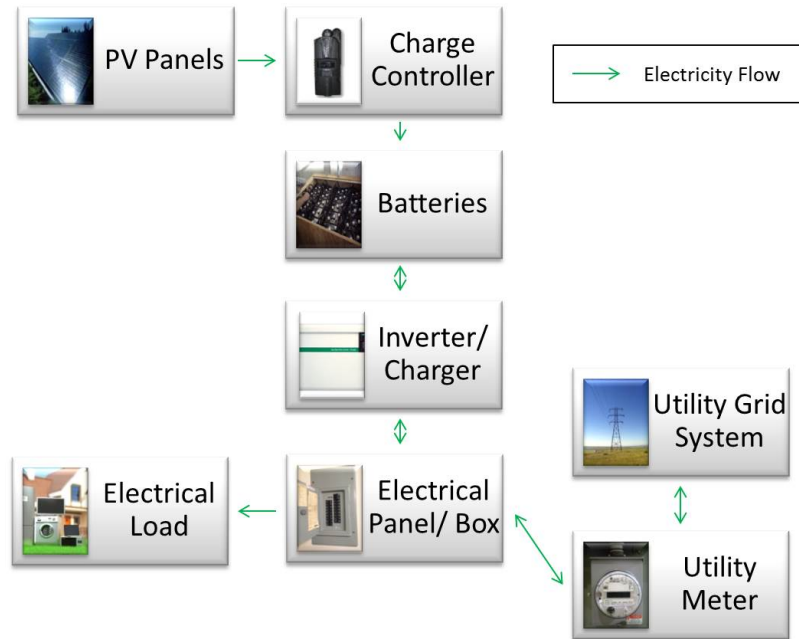


PV Panels, Inverter, Utility Meter, Utility Grid-

Pictures courtesy of DOE/NREL

Grid-Connected Systems with Batteries

Grid-connected systems with batteries work exactly the same way as grid-connected systems except electricity is stored in batteries for use during a utility power outage. Homes/buildings can have dedicated “critical” electrical loads powered by the batteries. These loads might include a refrigerator, water- and heat-related pumps, furnace fans, medical equipment or a computer for a home-based business. Note that the Tennessee Valley Authority Green Power Provider contracts do not permit transfer switches, but dedicated outlets can be powered by the PV systems to run electrical loads.

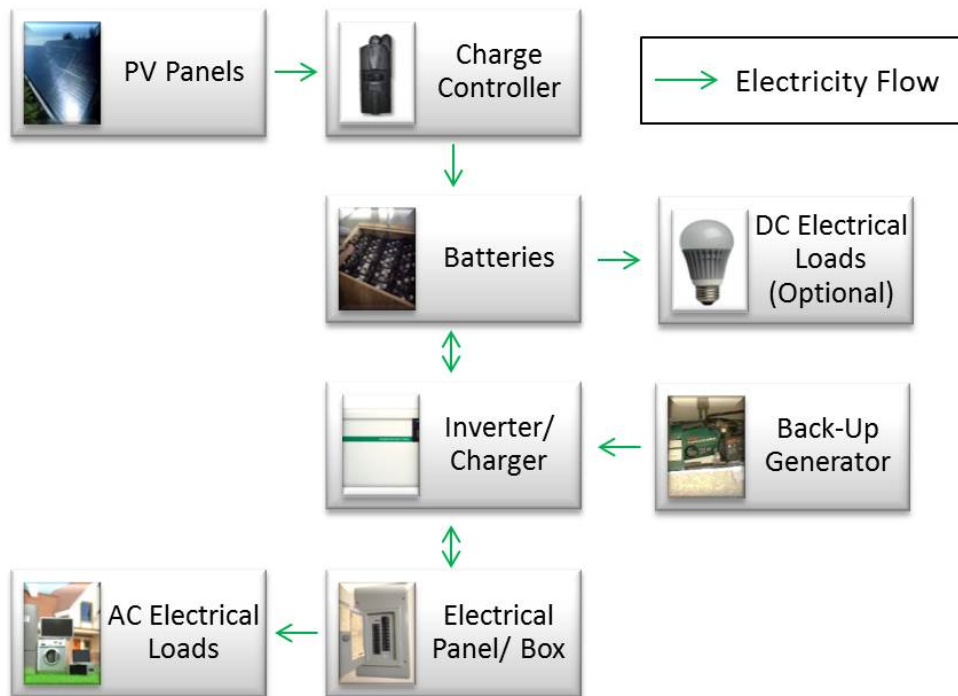


PV Panels, Batteries, Inverter/Charger, Utility Meter, Utility Grid-

Pictures courtesy of DOE/NREL

Off-Grid Systems

Off-grid systems are not connected to the utility grid. They are also called stand-alone systems. PV-generated electricity is stored and used from batteries. These systems are typically installed in remote areas where connecting to the utility grid costs more than an off-grid system. Off-grid solar electric systems typically have supplemental and back-up power from a fossil-fueled generator to meet electrical needs during cloudy periods or times of higher-than-expected electrical demand.

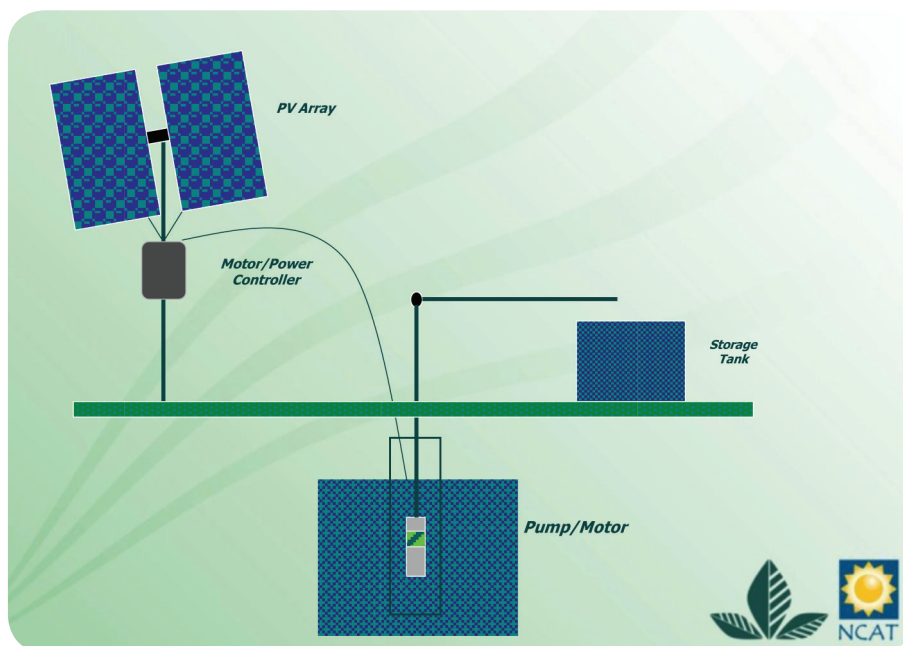


PV Panels, Batteries, DC Load, Inverter, Generator-

Pictures courtesy of DOE/NREL

PV-Direct Systems

PV-direct systems do not use batteries and are not tied to the utility grid. Thus, they only power the load when the sun shines. These systems have the fewest components and are used with DC-powered appliances or equipment. Applications include water pumping, building ventilation, etc.



PV-powered water-pumping system illustration. Courtesy NCAT

Simple, DC-powered systems can have batteries for applications for applications such as electric fences that need to be powered at night.



Courtesy DOE/NREL

Whether from the ground or a river, water can be pumped for crops or livestock using photovoltaics.

References

Morris, Mike, and Vicki Lynne/ National Center for Appropriate Technology (NCAT). (2002, October). Solar-Powered Livestock Watering Systems. IP 217. <https://attra.ncat.org/attra-pub/solarlswater.html>.

Sanchez, Justine. (2011, Aug./Sept.). PV Systems Simplified. Home Power, 144, 70-78.

U.S. Dept. of Energy. (2011, Feb.). Equipment Required for Stand-Alone Systemsu Retrieved February 16, 2011, from http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10620.



