

# FACT SHEET

## Photovoltaics (solar electricity)



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### *Photovoltaics (solar electricity)*

The purpose of this fact sheet is to provide consumers, producers, lawmakers, educators, and municipalities with current information pertaining to photovoltaics (PV) in Montana.

#### **DESCRIPTION**

PV modules are made up of solar cells that convert light energy directly into DC electricity. PV modules don't store energy, so batteries or the power grid are necessary for night use or for when there is no sunshine. Other related components may include: batteries, charge controller, inverter, mounting racks, meters, and wiring.

#### **Types of PV Systems**

**Grid-Intertie or Utility-Connected:** Renewable power system in which excess electricity may be sold back to the power grid.

**Stand-Alone:** Independent of utility; uses inverter to change DC to AC; battery storage

**PV-Direct:** PV modules wired directly to a load

**Hybrid System:** Integrating PV with other power sources such as wind turbine or generator

The word "photovoltaic" comes from the term "photo" meaning light and "volt" from the name of Alessandro Volta (1745 –1827), a pioneer in the study of electricity. So "photovoltaics" could literally mean "light-electricity". In the United States there are more than 10,000 homes that are now entirely powered by solar energy and 200,000 homes that use some type of photovoltaic solar technology. Photovoltaic systems convert clean, reliable electrical energy directly from sunlight without consuming any fossil fuels. Many utilities have recently installed large PV arrays to provide consumers with solar generated electricity or as backup systems for "critical" equipment. PV systems are currently being used for:

- |                          |                            |                 |
|--------------------------|----------------------------|-----------------|
| homes and business       | water pumping for cattle   | gate openers    |
| environmental monitoring | communications             | electric fences |
| trailers and RVs         | marine and air navigation  | health care     |
| lighting                 | utility power              | roof shingles   |
| commercial applications  | water purification         | awnings         |
| aeration and de-icing    | compressors for fish farms | crop irrigation |
| powering sprayers        | cathodic protection        | calculators     |
| space exploration        | fire ant control           | watches         |

Our conventional fuel sources have created many environmental problems, such as global warming, acid rain, increasing smog concentrations, water pollution, rapidly filling waste disposal, and loss of scenic resources. PV systems can provide relief from much of this environmental degradation. With proper design, installation and training, PV systems can be reliable anywhere in the world. The driving factors in home PV installation are environmental responsibility and energy independence.

## Advantages of PV systems

Reliability  
Durability  
Low Maintenance Cost  
No Fuel Cost  
Reduced Sound Pollution  
PV Modularity – can add on to system  
Safety – no combustible fuels  
Independence – from utilities  
Electrical Grid Decentralization  
Good High Altitude Performance

## Disadvantages of PV Systems

High Initial Cost  
Solar Radiation Varies with Weather  
Energy Storage – system more complex  
Education – new technology for user

## Economics

Over the lifetime of a PV system, the lower maintenance costs and nonexistent fuel costs make PV more economical than other fuels in off-grid (stand alone) applications when power lines are more than ¼ mile away. When the cost to extend electric power lines from the electric grid averages from \$20,000 to \$80,000 per mile, the cost savings can pay for the PV system and the homeowner would never again have to pay another electric bill.

**When is residential solar electricity practical and affordable?** The answer is (1) when you design your house and utilities (water, heat, power) for low energy use, (2) when you carefully select efficient lights and appliances, and (3) when you eliminate energy waste by appliances or human carelessness. It is not practical to operate major heating appliances with solar electricity. They account for 80% of typical monthly electric bills. Instead, use wood, propane or gas. Propane refrigerators or special electric refrigerators and freezers designed for solar powered homes are highly insulated saving 75% of the energy consumed by ordinary refrigerators. Instead of air conditioning try a swamp cooler that works well for all except humid areas.

Now on the market are building-integrated products such as solar roof shingles for homes and opaque glass PV facades that are aesthetically pleasing and effectively reduce the cost of PV installation. PV and passive solar are being incorporated into factory-built modular homes.

How much will it cost for a solar electric family home? The cost varies with the amount of power need and with the average daily sunshine hours for your location and climate. It could cost anywhere from \$2,500 to \$28,000, but most often comes between \$4,500 and \$15,000.

Much depends on the number of people living there and their habits of using electricity.

## Resource List/Bibliography

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