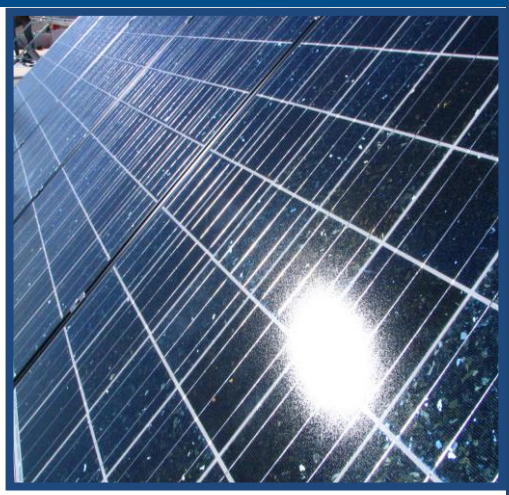
Solar Basics



Solar Photovoltaic (Solar PV) systems use semiconductor technology to convert sunlight directly into electricity. Photovoltaic technology is well established and field proven, and many sizes and types of modules are commercially available from a various companies.

Solar PV panels are typically made from solar cells combined into "modules," or "panels," that hold about 40 cells. Combining many solar panels together is referred to as a "solar array." For large electric utility or industrial applications, hundreds of solar arrays are interconnected to form a large utility-scale PV system.

- **System Orientation:** Solar PV panels can either be roof-mounted, ground-mounted, or pole-mounted; they can be mounted at a fixed angle or mounted on a tracking device that follows the sun. Solar PV systems are typically oriented within 30 degrees of due south.
- **Types of PV:**
  - Traditional solar cells are made from silicon, are usually flat-plate, and generally are the most efficient.
  - Second-generation solar cells are called thin-film solar cells because they are made from amorphous silicon or non-silicon materials such as cadmium telluride. Thin film solar cells use layers of semiconductor materials only a few micrometers thick. Because of their flexibility, thin film solar cells can double as rooftop shingles and tiles, building facades, or the glazing for skylights.
  - Third-generation solar cells are being made from variety of new materials, including solar inks, solar dyes, and conductive plastics.
    Source: National Renewable Energy Laboratory

Solar PV roof shingles provide a unique alternative to traditional roof-mounted solar. Photo credit: NREL

Photo credit: NREL

Solar Thermal, also known as solar hot water, systems use the sun's light to directly heat water and/or space for homes and businesses. There are several solar-thermal system configurations which employ the sun's energy to heat water; the most appropriate for Utah's climate, where freezing temperatures are common, is a closed-loop, active, solar hot water system.

Closed-loop solar thermal systems use the sun to heat a heat-transfer fluid in the collector. Heated fluid is pumped from the collector in the bottom of the solar storage tank into a heat exchanger where heat energy is transferred from the fluid to potable water. Heated water is then held in the storage tank ready for use, with a conventional system or electric element providing additional heating as necessary. For more information on Solar Thermal, visit Utah Clean Energy, the Utah State Energy Program, and the National Renewable Energy Laboratory.

Passive Solar employs strategic building design, building orientation, specific materials for walls and floors, highly efficient windows, shading mechanisms, and architectural features to enable a building to collect, store and distribute solar energy in the form of heat in the winter and reject solar heat in the summer. Passive solar design can reduce heat and energy bills by as much as 50%, utilizing the sun directly or indirectly to heat, light or cool a home or building. Many Passive Solar elements must be done at the planning stage, but there may also be some retrofits you can do to increase the energy efficiency of an existing home. Passive solar design incorporates the following elements:

- orienting a building east to west
- incorporating large south facing windows with adequate overhangs and shading to keep the sun out during the summer months
- tight building envelope

For more information, visit the U.S. Department of Energy, Energy Savers Program.