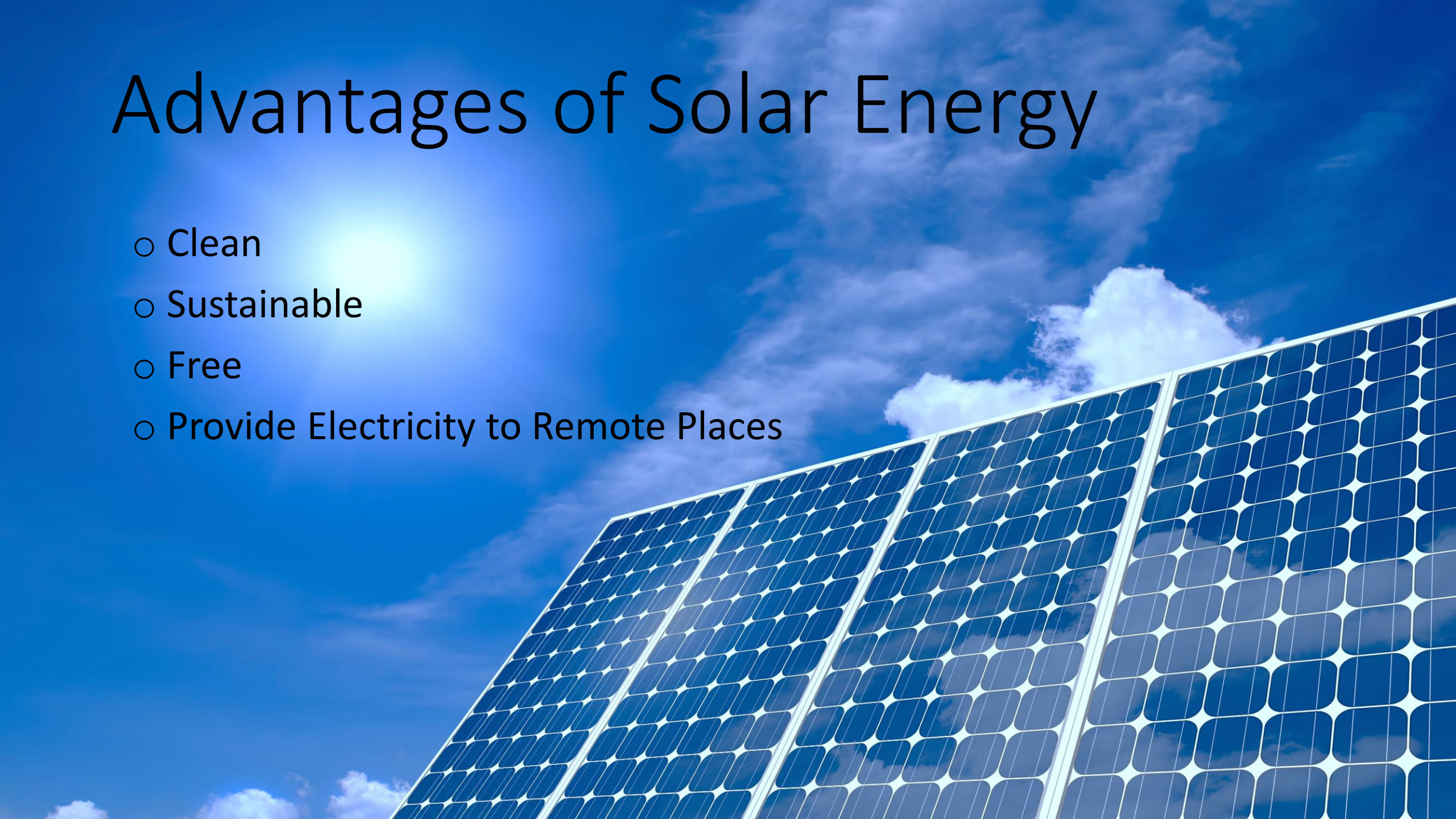
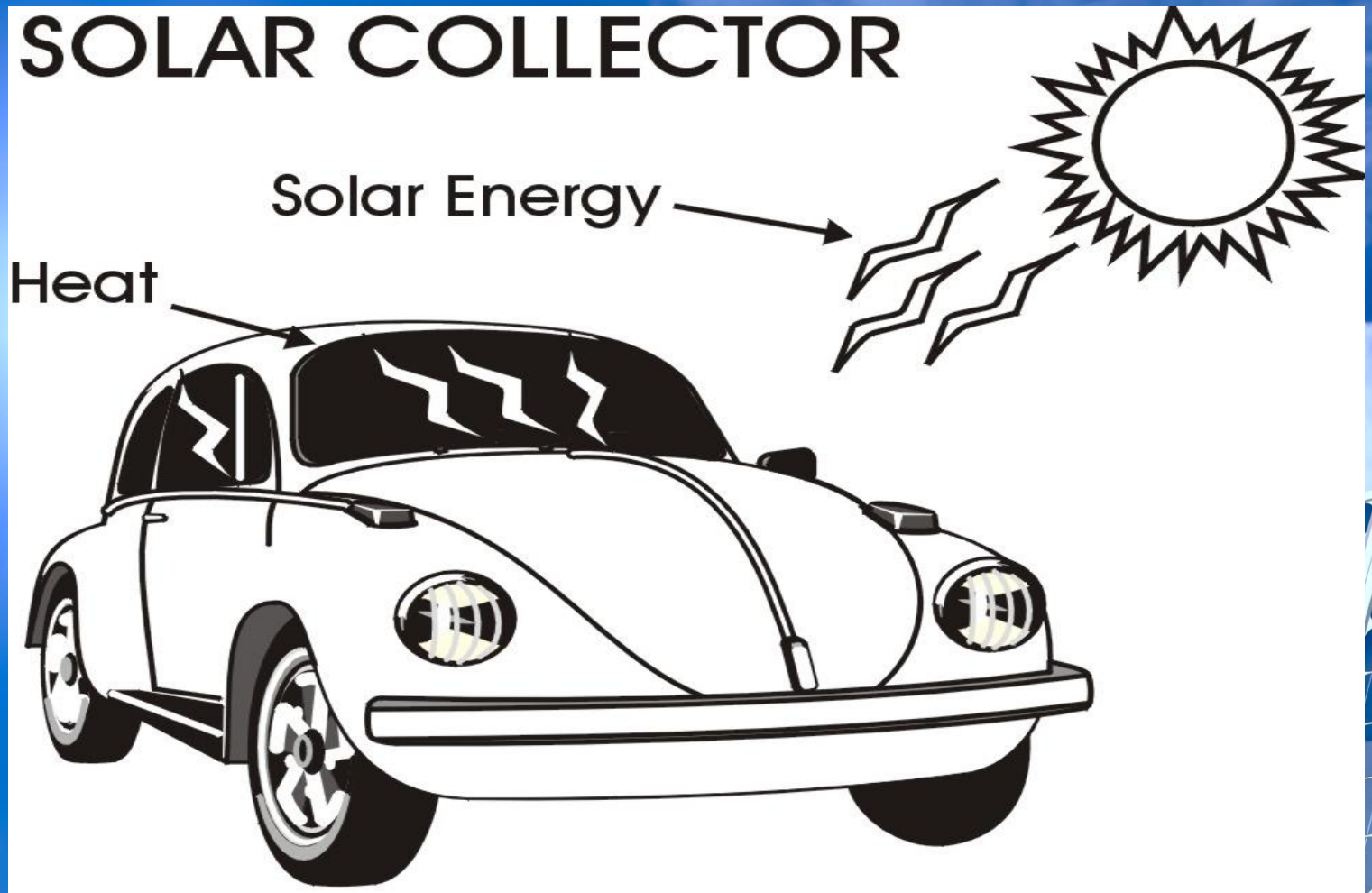
Solar Energy

Advantages of Solar Energy

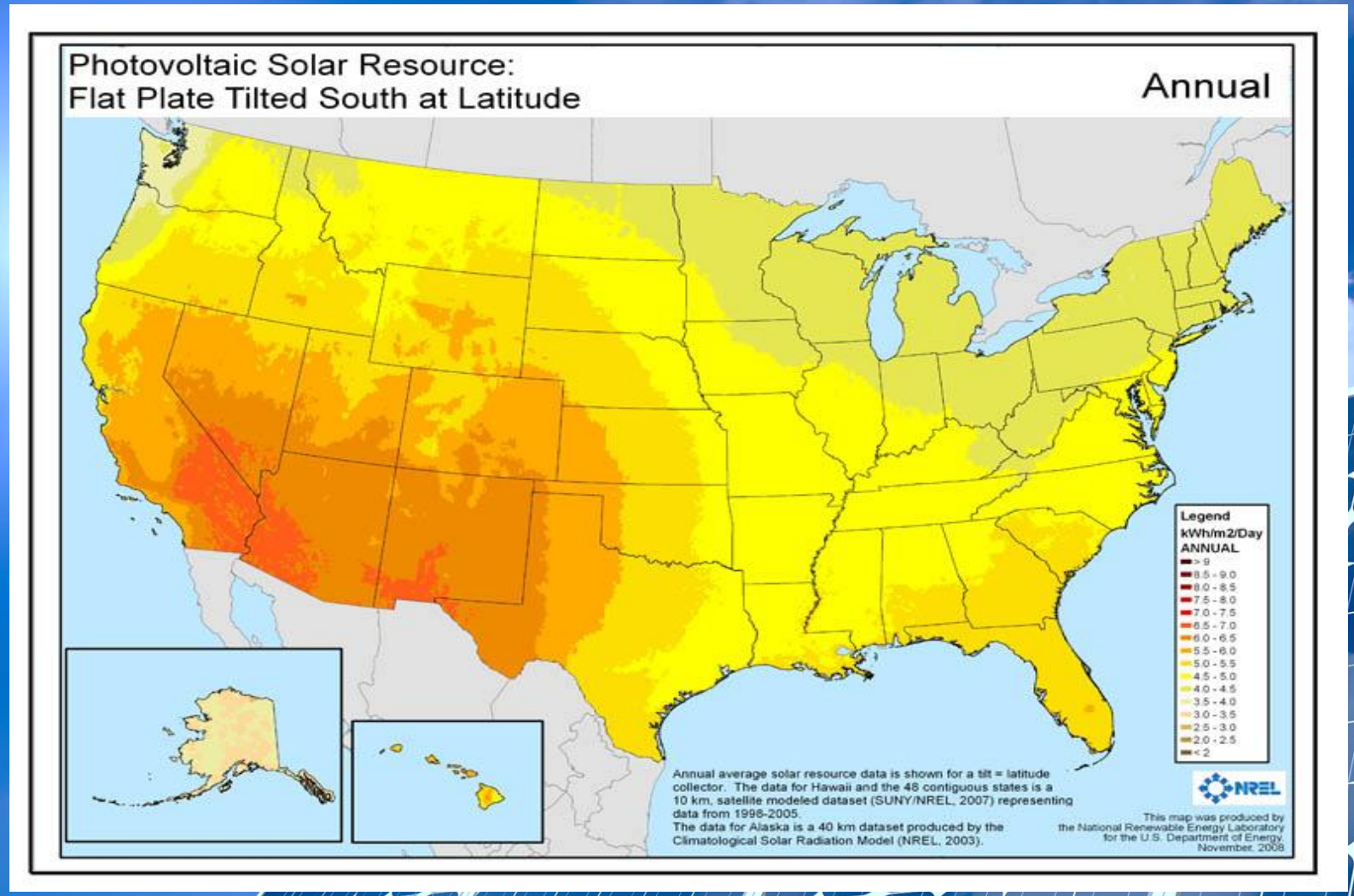
- Clean
- Sustainable
- Free
- Provide Electricity to Remote Places



SOLAR COLLECTOR



On a sunny day, a closed car is a solar collector.
Solar energy passes through the glass,
hits the inside of the car and changes into heat.
The heat gets trapped inside.


Photovoltaic Solar Resource:
Flat Plate Tilted South at Latitude
Annual
Legend
kWh/m2/Day
ANNUAL
> 9
8.5 - 9.0
8.0 - 8.5
7.5 - 8.0
7.0 - 7.5
6.5 - 7.0
6.0 - 6.5
5.5 - 6.0
5.0 - 5.5
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
< 2
Annual average solar resource data is shown for a tilt = latitude collector. The data for Hawaii and the 48 contiguous states is a 10 km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.
The data for Alaska is a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).
NREL
This map was produced by the National Renewable Energy Laboratory for the U.S. Department of Energy.
November, 2008

Passive Solar

Daylighting

Active Solar: Two Main Categories

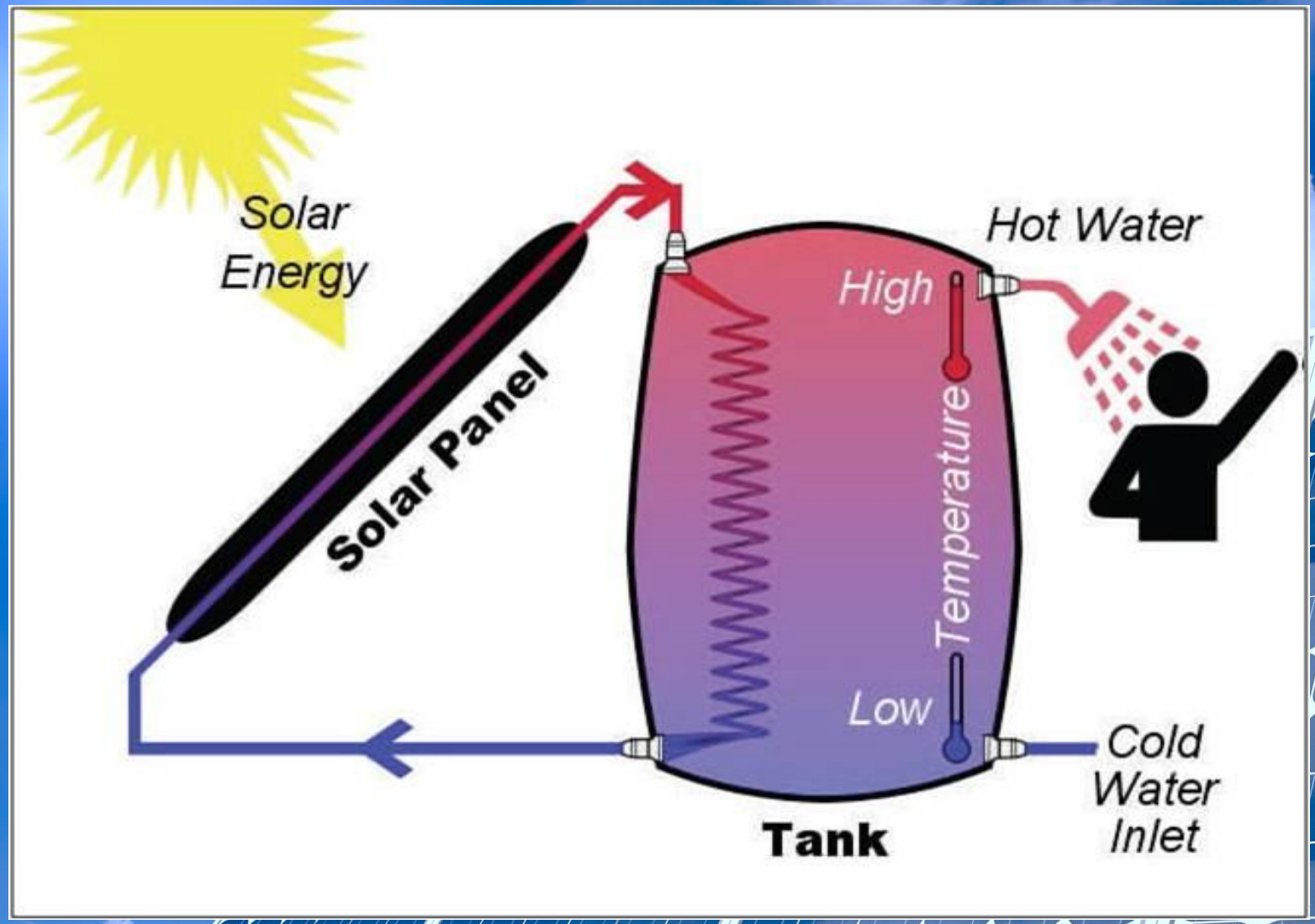
Solar Thermal

Water heating and cooking

Solar Photovoltaic (PV)

Electricity production

Solar Water Heating



Active Solar Heating

Concentrating Solar Power

Power Tower

Photovoltaics

Solar Electric Systems

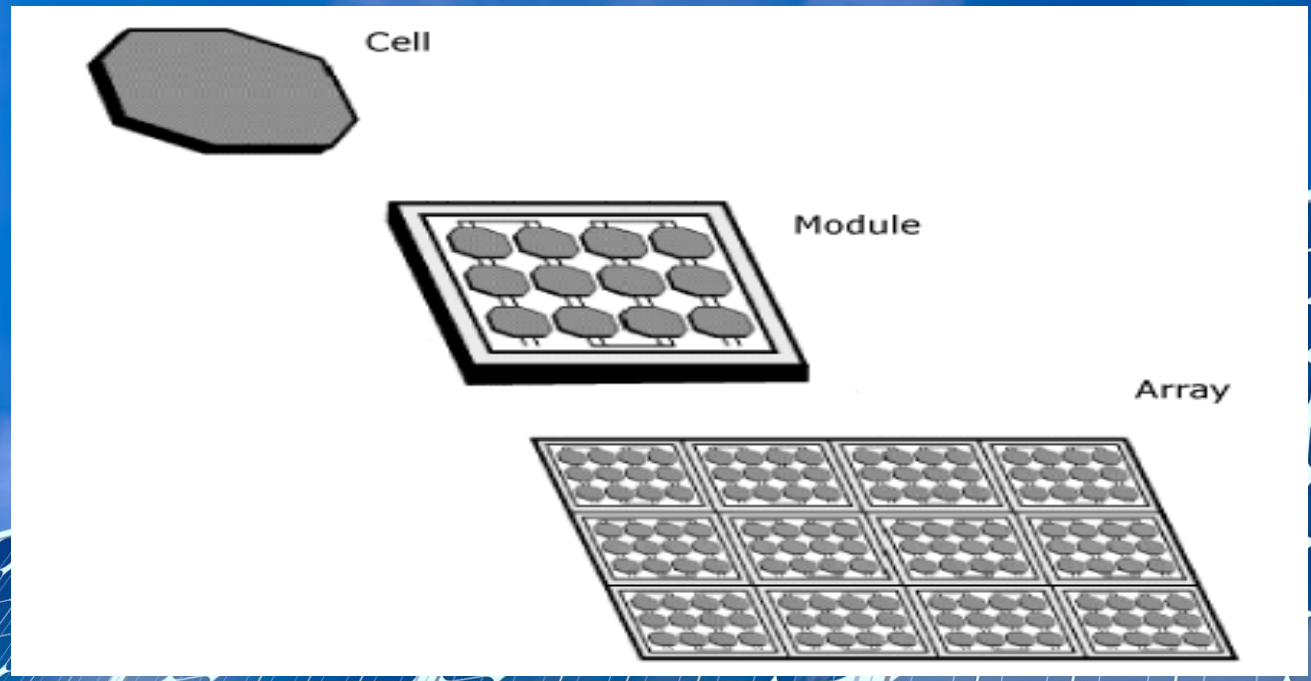
- **Photovoltaic (PV) systems convert light energy directly into electricity.**
- **Commonly known as “solar cells.”**
- **The simplest systems power the small calculators we use every day. More complicated systems will provide a large portion of the electricity in the near future.**
- **PV represents one of the most promising means of maintaining our energy intensive standard of living while not contributing to global warming and pollution.**

How Does it Work?

Sunlight is composed of **photons**, or bundles of radiant energy. When photons strike a PV cell, they may be reflected or absorbed (transmitted through the cell). Only the absorbed photons generate electricity. When the photons are absorbed, the energy of the photons is transferred to electrons in the atoms of the solar cell.

PV Array Components

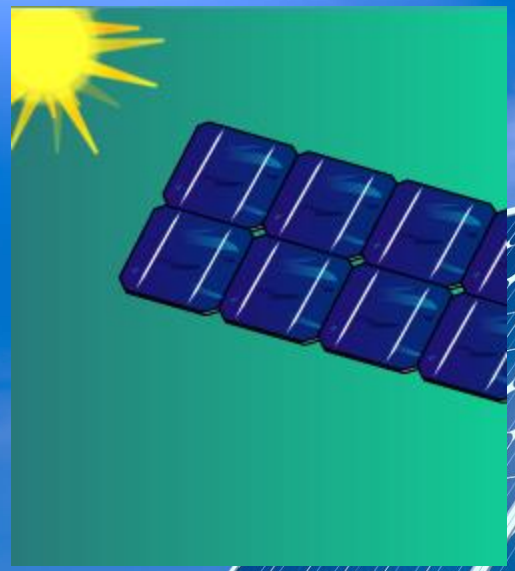
- PV Cells
- Modules
- Arrays

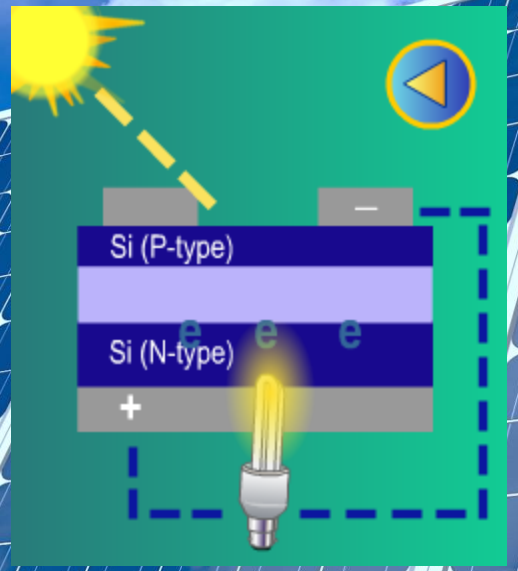


Helpful PV Animations

http://www1.eere.energy.gov/solar/animations.html

http://www.managenergy.net/kidscorner/animations/solar_an.html

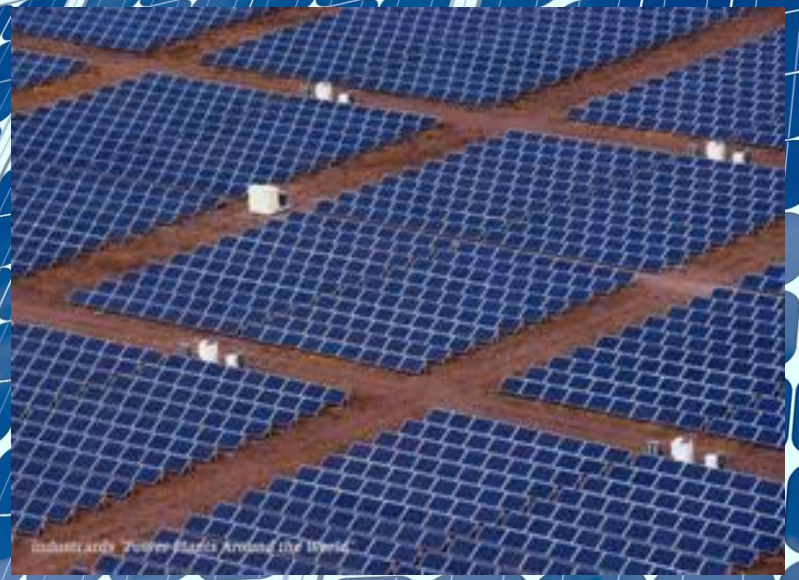




PV Array Fields

Large Scale PV Power Plants

Prescott Airport
Location: AZ
Operator: Arizona Public Service
Configuration: 1,450 kWp



SGS Solar
Location: AZ
Operator: Tucson Electric Power Co
Configuration: 3,200 kWp

Solar Concentrators

- These 20-kW Solar Systems dishes dwarf visitors in Alice Springs, Australia.
- The concentrators use an array of mirrors to focus sunlight onto high-efficiency solar cells.
- Four supports hold the cells in front of the mirrors
- The supports also supply cooling water and electrical connections

Centralized Wind-Solar Hybrid System

- **In hybrid energy systems more than a single source of energy supplies the electricity.**
- **Wind and Solar compliment one another**


WIN BIG
McDonald's
EXIT NOW
PLAY GOLD RUSH

Solar Cars

Brief history

- The first solar car was invented 60 years ago
- In 1981 Tholstrup built a solar powered race car in which he crossed Australia
- Breakthroughs through the years

Brief history

- New cars been developed…
- World Solar Challenge invented by Tholstrup, an australian solar car inventor

Advantages of solar cars

- NO AIR OR NOSIE POLLUTION
- The purchaser does not have to purchase USUAL fuel
- Cheaper and less regular maintenance service than conventional cars

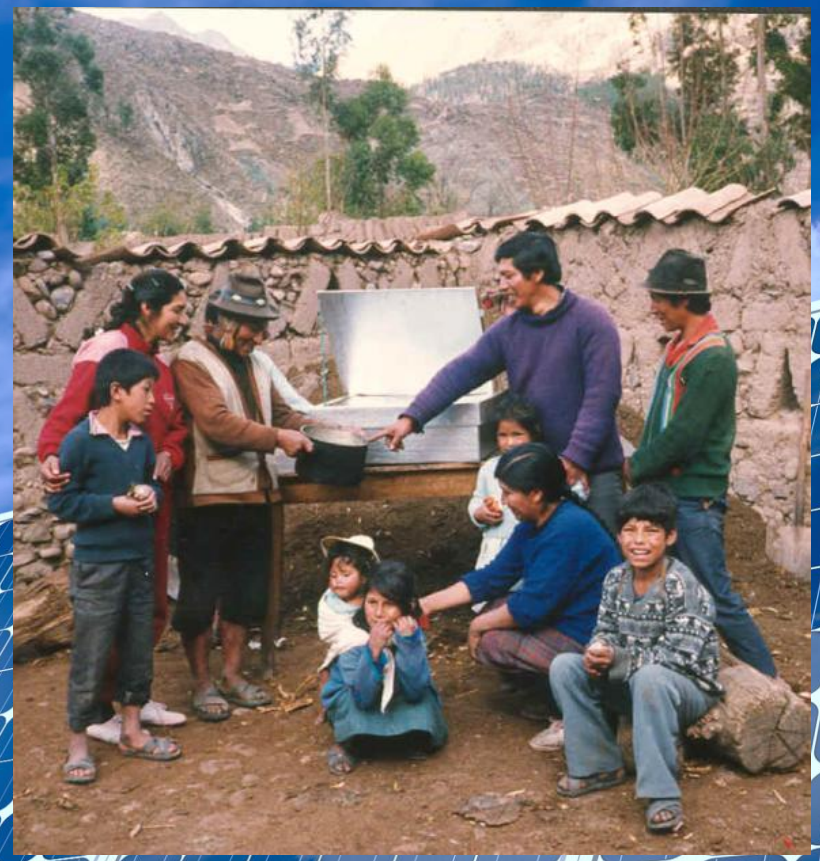
Current problems

- None commonly available in market
- Too small
- Design is not appealing to the consumer
- Not reliable, fuel problems

Solar Cooking

Benefits of Solar Cooking

- Consumes no fuels/wood
  - No loss of trees & habitat
  - Trees sequester carbon
- Generates no air pollution
- Generates no greenhouse gases
- Produces no smoke
  - Cooking smoke kills over 1.6 million people each year, mostly women & children, according to a recent report
- Eliminates fire dangers



More Benefits of Solar Cooking

- Eliminates work
  - No daily search for firewood
    - 2 Billion people rely on wood for cooking fuel!
  - No risks to women and children
  - Frees time for other activities
  - No need to stir food
  - Helps to liberate women

Even More Benefits of Solar Cooking

- Cooks foods slowly and thoroughly
- Preserves nutrients
- Foods will not burn
- Pots are easy to clean; less clean water is needed
- Use for canning vegetables
- Use for dried fruit
- Kill insects in dry grains