Renewable Energy:
Solar Energy – How it works

Factsheet 06

Facts and Figures

How solar energy works with solar thermal energy

The sun's rays hit collectors through which a carrier fluid (water + antifreeze) flows. The heated carrier fluid is pumped to the solar storage tank. The solar storage tank contains a heat exchanger in which the heat from the carrier fluid is transferred to the domestic hot water, thus heating the domestic hot water. The cooled carrier fluid passes through the heat exchanger and is fed back to the solar collector. The process starts all over again.

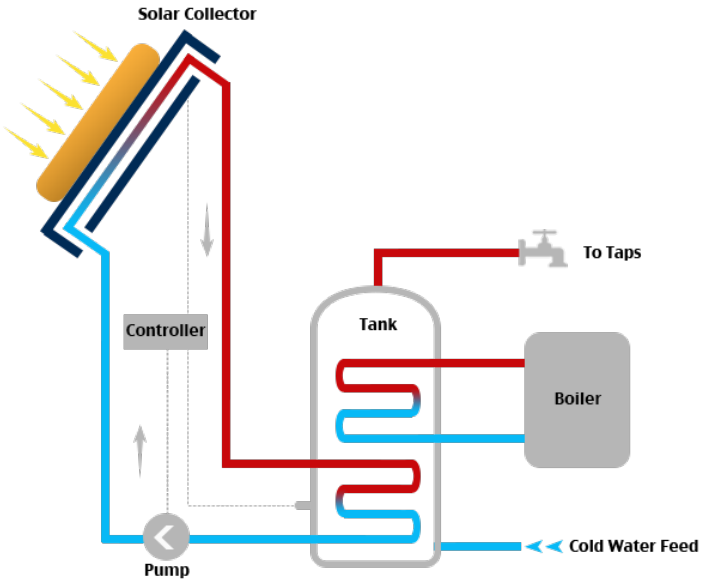

Figure 1: Source: https://www.eeweb.com/solar-thermal-energy/

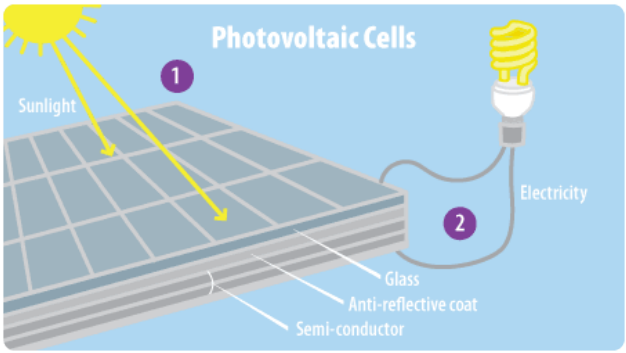

Figure 2: Source: https://archive.epa.gov/climatechange/kids/solutions/technologies/solar.html

How solar energy works in photovoltaics

Photovoltaics refers to the direct conversion of solar energy into electrical energy:

1. A solar cell captures light energy in the form of solar radiation and converts it into electrical energy. This is done by the solar cells, which are made of a semiconductor material, e.g. silicon.
2. As soon as light energy hits the solar cells, silicon can become electrically conductive and thus a charge carrier, producing electrical energy that is captured by metal contacts. The light energy is first converted into direct current, but to make the electrical energy usable, alternating current is needed. This is generated by the so-called inverter.

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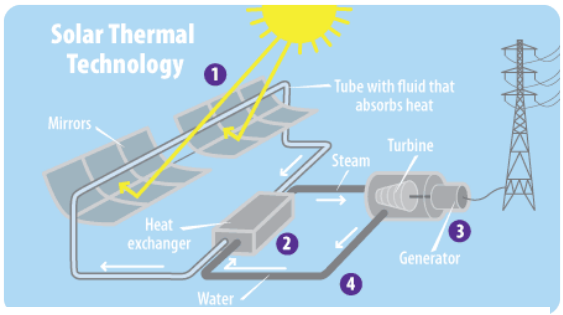

Figure 3: Source: https://archive.epa.gov/climatechange/kids/solutions/technologies/solar.html

How solar energy works in solar thermal power plants

1. Such a power plant consists of a large number of collectors with a dark tube inside. In order to capture as much solar energy as possible, the sunlight is focused onto the tube by so-called parabolic mirrors. All day long, the mirrors track the sun.
2. The tube inside heats up to 400 degrees Celsius, and the resulting heat converts water into steam via a heat exchanger.
3. The hot steam flows into a turbine, expands and thus drives the wheels in the turbine. A generator finally produces electrical energy/electricity from the kinetic energy.

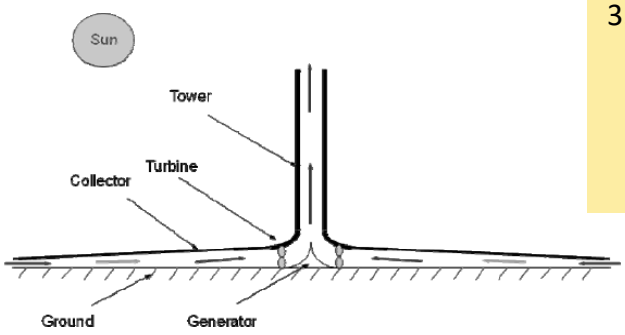

Figure 4: Source: https://www.researchgate.net/figure/Schematic-of-a-Solar-Updraft-Power-Plant_fig1_265229926

How solar energy works in updraft power plants

Updraft power plants use the property that warm air rises to the top. Under a glass roof, the collector, air is heated by the sun's rays and then rises upwards in a chimney. The solar radiation becomes the "motor" of the updraft in the chimney. The turbine installed in the chimney converts the energy of the updraft into electrical energy by means of a generator.

Using Solar Energy on a Small Scale – Solar Cooker

Solar cookers convert the energy of solar radiation into heat. The rays are bundled in the centre, at the focal point, of a parabolic mirror and absorbed by a container (pot), whose contents are then heated.

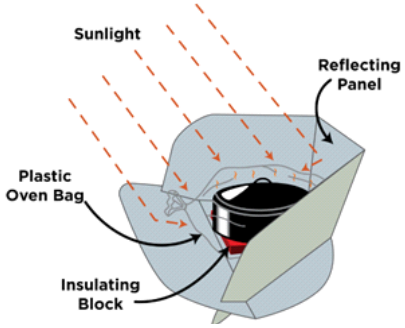

Figure 5: Source: https://energyresearch.ufc.edu/education/k-12/resources/solar-cookers/

Sources:
https://www.interconnector.de/wissen/solarenergie/

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