

# **Harnessing the Sun's Energy: Solar Power for Homes**

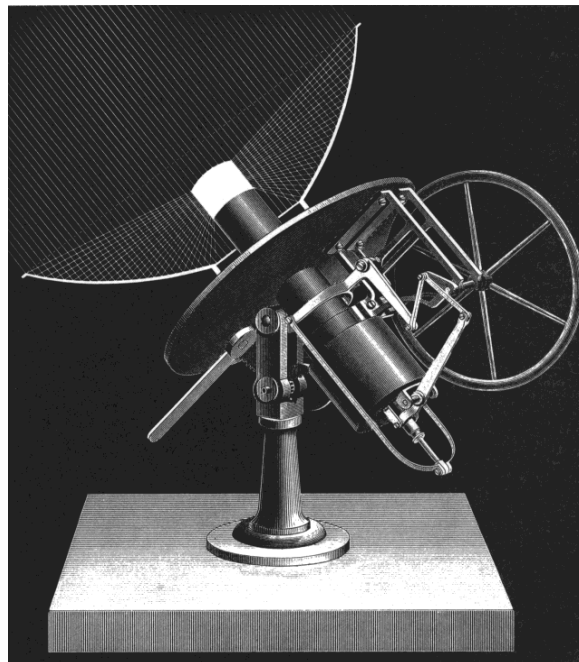
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## **Harnessing the Sun's Energy: Solar Power for Homes**

The use of solar power is all around us. Calculators, roadside emergency telephones, and street-side speed radars all utilize the sun's limitless rays to provide power for their simple functions. As simple as these functions may be, solar power is nonetheless capable of powering much greater things. The technology and motivation for this exists; all the planet needs is time and funding before it becomes a planet powered solely by the luminous rays of the great sun. But before this universal shift towards solar power happens, citizens have the choice and ability to install their own personal solar power system for their private homes. After weighing the advantages against the disadvantages, the correct choice should be clear.

The sun has been a candidate for a universal power source for centuries. Since as early as 1839, scientists have been researching the concept of photovoltaic cells, in an effort to effectively collect electrical power from the sun's rays. According to a professor at the University of Oregon, the entire surface of the earth receives an average of approximately 84 Terawatts of power from the sun in a 24-hour day (University of Oregon, 2001). Research done by the Energy Information Association shows that the annual worldwide power consumption in the year 2004 was 15 Terawatts (EIA, 2006). Clearly, the sun provides us with much more energy than we need. Moreover, this energy does not produce waste and is overly available, as shown by the fact that the planet earth intercepts more energy from the sun than is used in an entire year through the burning of fossil fuels (EIA, 2006). The question at hand is, what is keeping us from converting into a civilization that relies entirely and solely on the sun for power? Unfortunately, despite all the positive aspects of solar power, there are realities that must be addressed, such as the fact that not all parts of the world receive abundant sunlight, and that no power can be collected during the night or on overcast days. Throughout history, scientists and engineers have been trying to defeat these realities with technological advancements.

Numerous methods of sunlight collection have been devised. One of the first successful machines was created in 1878 by an Englishman by the name of William Adams, who managed to heat a container of water enough to produce steam to power a small engine by using mirrors to focus a large area of the sun's rays into a small point (Southface, 2005, para. 12). Not too long after, John Ericsson from Sweden improved on Adams' machine (Southface, 2005, para. 13) by utilizing concave mirrors and a more accurate focus point (Figure 1).



*Figure 1.* An early drawing of John Ericsson's "Sun Motor". (Sterling Engines, 2006)

Unfortunately, further research on solar power came to a temporary halt due to economical conditions and a certain civil war. Later, in 1921, Einstein bridged the gap from simple physical manipulations of the sun's rays to chemically withdrawing power from sunlight by discovering the photoelectric effect, opening the gateway to the development of solar cells. The breakthrough came around in 1953. Scientists from Bell Laboratories, now known as AT&T Labs, developed silicon solar cells that were able to

produce a measurable amount of electrical power. Although the device was deemed revolutionary, it was impractical as the costs of utilization hovered around \$300 per Watt (Southface, 2005, para. 11). It was not until the early 1990s that the prices of newly developed photovoltaic cells dropped to an economically practical range. Since then, the market for PV cells has been growing steadily, at an average rate of 30% per year (Southface, 2005, para. 15), especially in major cities such as Japan, who alone installed a record number of 25,000 solar rooftops in the year 2002. Certain states in the United States have begun to construct solar power plants (Figure 2) in an effort to preserve the environment as well; however, the cost of energy obtained from solar power plants continue to greatly outweigh that of energy from other more conventional sources, such as the burning of fossil fuels or nuclear power.



*Figure 2.* “Solar Two”, a solar power plant in California. (INFORSE 2006)

Despite this, many Americans still feel the need to switch to a more environmentally friendly form of energy, and so individual solar power systems for private homes have

become more popular in recent years. When describing solar power systems for private homes, there are several different systems available. The most popular is the solar panel. Solar panels are simply groups of photovoltaic cells (Figure 3), smaller rectangular panels which use electrons that have been excited by the sun's rays to produce electricity, grouped together in a large grid format.



*Figure 3.* A photovoltaic solar cell. (Department of Energy, 2005)

Solar panels are attached onto the roof or sides of a building, depending on where the most sunlight is received, and connected either directly to the home's electrical circuit or to a battery for charging for use when no sunlight is available. Some homes utilize sunlight to heat interior space and water, using a system known as a solar combisystem (Figure 4).

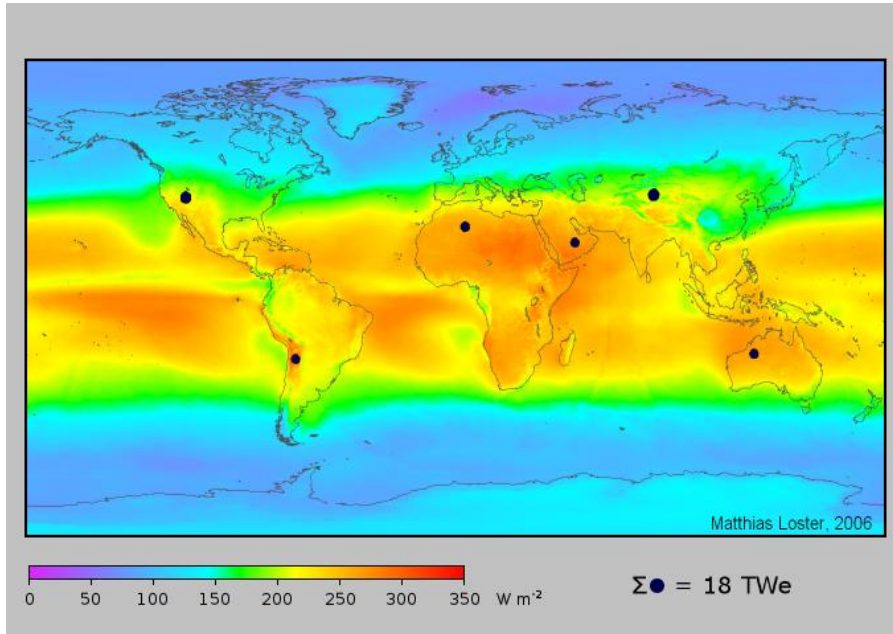


*Figure 4.* A solar combisystem on the roof of a house used to heat water. (Wikipedia, 2006)

A combisystem consists of an array of solar thermal collectors that collect sunlight and direct the energy towards heating tanks of water, usually placed on the roof or behind a building (Wikipedia, 2006). A slight variation of this method simply passes cold water through a series of parallel pipes at a slow enough rate for the sun to heat the water up by the time it reaches the exit of the pipeline. Even less popular is the solar pond, a small pool of water placed in direct sunlight (Wikipedia, 2006). The water contains 3 layers of salts in different concentrations, thus creating different densities. Heat from the sun causes convection currents that can trap heat at the bottom of the pool, which in turn can be used to heat buildings or generate electricity for other purposes. This is a comparably low-tech and low-cost form of solar power. Overall, solar panels are preferred for their low maintenance costs and their ability to produce more conventional electricity with the most efficiency.

Installing a personal solar power system in a privately owned home has many advantages. The most obvious of these is that the electricity bill will be significantly

lower, if not completely obsolete, depending on where the homeowner resides. Also, the supply of power is plentiful, as the sun provides the earth with more solar power in a day than can be used in a year (Wikipedia, 2006).



*Figure 5.* Map of average available solar energy on the earth's surface as measured in 1991 to 1993. (Wikipedia, 2006)

Unlike other conventional forms of energy, solar power does not produce any waste or pollution during use. Of course, the initial production of solar power systems produces a measurable amount of waste, but this waste can be managed using existing waste management technologies. Once installed, the system requires little to no maintenance and/or intervention. For people who reside in remote areas, where there is no nearby power source, solar power can provide a reliable one, as long as there is adequate sunlight. Furthermore, solar power systems do not make noise. Unlike the massive machines used for the drilling and pumping of oil, solar power cells operate in silence. Finally, solar power systems also provide a sense of security, as most solar power manufacturers offer a warranty for 20 years or more.

Of course, there are negative aspects to installing a solar power system in one's home. One of the largest issues is the initial cost. The cost of obtaining and installing a solar power system can cost thousands of dollars, which, to many, is unreasonable. However, studies have shown that within 2 to 3 years of installation, a homeowner would have saved that same amount of money on his or her electric bill (Energy Efficient Homes, 2007), thus providing them with positive financial payback in the long run. Another issue with solar power is obviously the periodical absence of the sun. Solar power systems are only able to collect energy for an average of 7 hours a day, at time when the sun is high enough in the sky and without interference from clouds or overcast skies. Furthermore, some areas of the world do not even receive sunlight for more than several hours each day. Sadly, solar power is not a viable resource for those areas yet, but for those that do receive sunlight for at least 7 hours a day, a simple solution is available. While providing electricity for household utilities during the day, the system can also be used to charge batteries while sunlight is available. By storing energy collected from the sun, a house can still function when there is no sunlight available. Another minor issue is the fact that power from sunlight is collected in direct current, while the majority, if not all, of houses in the United States use an alternating current. This problem can be solved with a simple converter. Finally, weather plays a hostile figure in solar power systems. Obviously, overcast skies and rainy days in the winter seasons will prevent a system from working properly. Also, extreme weather conditions such as hail or thunderstorms may damage a solar panel, making it useless until repaired or replaced. These are some of the unavoidable realities that must be considered when installing a solar power system in one's home.

Solar power has been around for a while, and for several reasons has not expanded to global use yet. Needless to say, however, solar power is an important field to research in, as the source of power, the sun, is readily available as it has been from the beginning. At present, the largest consumers of solar power are the United States, Germany, and Japan. These countries have not been disappointed. With the promise of an unlimited, environmentally friendly power supply, solar power has a very promising future.

## References

Cardenas, D. (2007, January 22) Retrieved August 1, 2007, from

[http://en.wikipedia.org/wiki/World\\_energy\\_resources\\_and\\_consumption](http://en.wikipedia.org/wiki/World_energy_resources_and_consumption)

*Cutting Home Solar Power Costs With Discount Solar Panels.* (2007, July 12) Retrieved

August 1, 2007, from [http://www.homesolarpowerguide.com/solar-](http://www.homesolarpowerguide.com/solar-power/cutting-home-solar-power-costs-with-discount-solar-panels-36/)

[power/cutting-home-solar-power-costs-with-discount-solar-panels-36/](http://www.homesolarpowerguide.com/solar-power/cutting-home-solar-power-costs-with-discount-solar-panels-36/)

Derksen, B., & Ross, D. (2001, December 27) Retrieved August 1, 2007, from

[http://en.wikipedia.org/wiki/Solar\\_power](http://en.wikipedia.org/wiki/Solar_power)

Ericsson, J. (Artist). (1872). *Sun Motor* [Online Image], Retrieved August 1, 2007, from

<http://www.stirlingengines.org.uk/sun/sola2.html>

Gilabrand, A. (Photographer). (2006). *Solar Boiler* [Online Image], Retrieved August 1,

2007, from <http://en.wikipedia.org/wiki/Image:Solarboiler.jpg>

*History of solar.* (2005, March 2) Retrieved August 1, 2007, from

[http://www.southface.org/solar/solar-roadmap/solar\\_how-to/history-of-solar.htm](http://www.southface.org/solar/solar-roadmap/solar_how-to/history-of-solar.htm)

Knier, G. (2006, November 2) Retrieved August 1, 2007, from

<http://science.nasa.gov/headlines/y2002/solarcells.htm>

Loster, M. (Photographer). (2006). *Solar Land Area* [Online Image], Retrieved Aug 1, 2007, from [http://upload.wikimedia.org/wikipedia/commons/d/db/Solar\\_land\\_area.png](http://upload.wikimedia.org/wikipedia/commons/d/db/Solar_land_area.png)

Smith, C. (1995, July 18) Retrieved August 1, 2007, from [http://www.solarenergy.com/info\\_history.html](http://www.solarenergy.com/info_history.html)

*Solar*. (2006, June 1) Retrieved August 1, 2007, from <http://www.inforse.org/europe/dieret/Solar/solar.html>

*Solar Cell*. [Online Image]. (2005). Retrieved August 1, 2007, from [http://www1.eere.energy.gov/solar/pv\\_systems.html](http://www1.eere.energy.gov/solar/pv_systems.html)

*Solar Two* [Online Image]. (2006). Retrieved August 1, 2007, from <http://www.inforse.org/europe/dieret/Solar/solar.html>

Williams, W. (2007, August 1) Retrieved August 1, 2007, from <http://www.energyefficienthomearticles.com/Article/energy-efficient-homes---solar-power----Advantages-and-Disadvantages-of-Solar-Powered-Home-/5906>

Xiarhos, M. (2007, July 13) Retrieved August 1, 2007, from <http://www.enn.com/energy.html?id=1653>

