

Facts about Solar Energy: Solar Electricity

Introduction

Harnessing energy from the sun holds great promise for meeting future energy needs because the sun is a renewable and clean energy resource. Fossil fuels will eventually run out and the future of nuclear power is uncertain. For these reasons, other energy sources need to be developed. Solar energy is one of these sources.

Solar energy is produced by the sun, which is a gigantic nuclear fusion reactor running on hydrogen fuel. The sun converts five million tons of matter into energy every second. Solar energy comes to Earth in the form of visible light and infrared radiation. Scientists expect that the sun will continue to provide light and heat energy for the next five billion years.



Solar Energy Potential

The amount of solar energy that strikes Earth's surface per year is about 29,000 times greater than all of the energy used in the United States. The solar energy falling on Wisconsin each year is roughly equal to 844 quadrillion Btu of energy, which is about 550 times the amount of energy used in Wisconsin.

Although the amount of solar energy reaching Earth's surface is immense, it is spread out over a large area. There are also limits to how efficiently it can be collected and converted into electricity and stored. These factors affect the amount of solar energy that can actually be used.

Producing Solar Electricity

Solar electricity is measured in kilowatt-hours, a unit of energy. Solar cells convert sunlight directly into electricity. Most cells are made of silicon, a material that comprises 28 percent of the Earth's crust. One solar cell measuring four inches across can produce one watt of electricity on a clear, sunny day. To produce more electricity, cells are wired together into panels, and panels are wired together to form arrays.

Solar cells are reliable and quiet, and they can be installed quickly and easily. They are also mobile and easily maintained. They provide an ideal electrical power source for satellites, outdoor lighting, navigational beacons, and water pumps in remote areas. In the United States, more than 35,000 homes are powered by solar cells, and many more are planned.

Solar energy can be used to heat a fluid to produce steam that spins a turbine connected to an electrical generator. These systems are called solar thermal electric systems. One type of solar thermal-electric system, the solar power tower, uses mirrors to track and focus sunlight onto the top of a heat collection tower. An experimental 10-megawatt solar power tower called Solar Two is being tested in the desert near Barstow, California.

Another type of solar thermal-electric system uses curved, mirrored collectors shaped like troughs that focus the sun's heat on pipes running through the middle of the collectors. The largest system of this type is located in Southern California and has a generating capacity of 347 megawatts, which is equal to the capacity of a medium-sized electric power plant in Wisconsin.

Solar Electricity Production

Of the total electricity production in the United States, solar energy still provides less than one percent. In Wisconsin, a negligible amount of electricity from solar energy is currently being generated by individual homeowners and businesses.

Effects

Solar electricity has many benefits. Solar electric systems have no fuel costs, low operating and maintenance costs, and produce virtually no air emissions or waste. Solar electric systems can be built quickly and in many sizes. They are well-suited to rural areas, developing countries, and other communities that do not have access to centrally generated electricity.

Solar electricity also has limitations. It is not available at night and is less available during cloudy days, making it necessary to store the produced electricity. Backup generators can also be used to support these systems.

References:

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Large-scale solar electric systems need large amounts of land to collect solar energy. This may cause conflicts if the land is in an environmentally sensitive area or is needed for other purposes. One solution is to locate large-scale solar electric systems in deserts or marginal lands. Another idea is to place solar cells on rooftops, over parking lots, in yards, and along highways, and then connect the systems to an electric utility's power-line system. As the use of solar electric systems increases, laws may be needed to protect people's right to access the sun.

Outlook

The sun is expected to remain much as it is today for another five billion years. Because we can anticipate harvesting the sun's energy for the foreseeable future, the outlook for solar energy is optimistic. The flexibility and environmental benefits of solar electricity make it an attractive alternative to fossil and nuclear fuels. Although high costs, land issues, and the need for electricity storage or backup systems are obstacles, many experts are confident that these obstacles can be overcome.

In the near future, the use of solar electric systems will likely increase in the southern and western parts of the United States where sunshine is plentiful, in remote villages in the developing world, and in nations such as Japan that have few fossil and nuclear energy resources. Widespread use of solar electric systems is more likely to appear in Wisconsin 10 to 50 years from now, as fossil fuel supplies decline and the environmental advantages of solar electricity become increasingly important. On the other hand, a number of homeowners and businesses in Wisconsin have already demonstrated that solar electric systems can meet their needs.