Energy from the Sun...

Solar energy runs the engines of the earth. It heats its atmosphere and its lands, generates its winds, drives the water cycle, warms its oceans, grows its plants, feeds its animals, and even (over the long haul) produces its fossil fuels. This energy can be converted into heat and cold, driving force and electricity. Solar energy can be converted to useful energy also indirectly, through other energy forms like biomass, wind or hydropower. Solar energy drives the earth?s weather. A large fraction of the incident radiation is absorbed by the oceans and the seas, which are warmed, then evaporate and give the power to the rains which feed hydro power plants. Winds which are harnessed by wind turbines are getting their power due to uneven heating of the air. Another category of solar-derived renewable energy sources is biomass. Green plants absorb sunlight and convert it through photosynthesis into organic matter which can be used to produce heat and electricity as well. Thus wind, hydropower and biomass are all indirect forms of solar energy.

How much solar energy strikes the earth?

The sun generates an enormous amount of energy - approximately 1.1 x 10 E20 kilowatt-hours every second. (A kilowatt-hour is the amount of energy needed to power a 100 watt light bulb for ten hours.) The earth?s outer atmosphere intercepts about one two-billionth of the energy generated by the sun, or about 1500 quadrillion (1.5 x 10 E18) kilowatt-hours per year. Because of reflection, scattering, and absorption by gases and aerosols in the atmosphere, however, only 47% of this, or approximately 700 quadrillion (7 x 10 E17) kilowatt-hours, reaches the surface of the earth.

Solar Energy Utilisation

In most places of the world much more solar energy hits a home?s roof and walls than is used by its occupants over a year?s time. Harnessing this sun?s light and heat is a clean, simple, and natural way to provide all forms of energy we need. It can be absorbed in solar collectors to provide hot water or space heating in households and commercial buildings. It can be concentrated by parabolic mirrors to provide heat at up to several thousand degrees Celsius. This heat can be used either for heating purposes or to generate electricity. There is also another way to produce power from the sun?through photovoltaics. Photovoltaic cells are

devices which convert solar radiation directly into electricity.

Solar radiation can be converted into useful energy using active systems and passive solar design. Active systems are generally those that are very visible like solar collectors or photovoltaic cells. Passive systems are defined as those where the heat moves by natural means due to house design which entails the arrangement of basic building materials to maximize the sun?s energy.

Passive Solar Energy Use

Passive solar design, or climate responsive buildings use existing technologies and materials to heat, cool and light buildings. They integrate traditional building elements like insulation, south-facing glass, and massive floors with the climate to achieve sustainable results. These living spaces can be built for no extra cost while increasing affordability through lower energy payments. In many countries they also keep investment in the local building industry rather than transferring them to short term energy imports. Passive solar buildings are better for the environment while contributing to an energy independent, sustainable energy future.

Passive solar systems use the building structure as a collector, storage and transfer mechanical equipment. This definition fits most of the more simple systems where heat is stored in the basic structure: walls, ceiling or floor. There are also systems that have heat storage as a permanent element within the building structure, such as bins of rocks, or water-filled drums or bottles. These are also classified as passive solar energy systems. Passive solar homes are ideal places in which to live. They provide beautiful connections to the outdoors, give plenty of natural light, and save energy throughout the year.

History

Building design has historically borrowed its inspiration from the local environment and available building materials. More recently, humankind has designed itself out of nature, taking a path of dominance and control which led to one style of building for nearly any situation. In 100 A.D., Pliny the Younger, a historical writer, built a summer home in Northern Italy featuring thin sheets of mica windows on one room. The room got hotter than the others and saved on short supplies of wood. The famous Roman bath houses in the first to fourth centuries A.D. had large south

facing windows to let in the sun?s warmth. By the sixth century, sunrooms on houses and public buildings were so common that the Justinian Code initiated ?sun rights? to ensure individual access to the sun. Conservatories were very popular in the 1800?s creating spaces for guests to walk through warm greenhouses with lush foliage.

Passive solar buildings in the United States were in such demand by 1947, as a result of scarce energy during the prolonged Second World War, that Libbey-Owens-Ford Glass Company published a book entitled Your Solar House, which profiled forty-nine of the nation?s greatest solar architects.

In the mid-1950?s, architect Frank Bridgers designed the world?s first commercial office building using solar water heating and passive design. This solar system has been continuously operating since that time and the Bridgers-Paxton Building is now in the National Historic Register as the world?s first solar heated office building.

Low oil prices following World War II helped keep attention away from solar designs and efficiency. Beginning in the mid-1990s market pressures are driving a movement to redesign our building systems to be more in line with nature.

Photovoltaics

Photovoltaics (PV) is the term derived from Greek word for light - photos- and the name for units of electromotive force - volt. Photovoltaic means direct generation of electricity from light. Recently this process is utilised by means of solar cells. The solar cells, made from semiconductor materials such as silicon, produce electric currents when exposed to sunlight. By manufacturing modules which contain dozens of such solar cells and connecting the modules, large power stations can be built. The largest photovoltaic power station that has yet been constructed is the 5 MW system at Carrisa Plain, California. The efficiency of photovoltaic power stations is presently about 10% but individual solar cells have been fabricated with efficiencies exceeding 20%.

History Of Photovoltaics

Photovoltaics dates back to 1839 and major developments evolved as follows:

- In 1839 Edmund Becquerel, a French physicist observed the photovoltaic effect.
- In 1883 Selenium PV cells were built by Charles Edgar Fritts, a New York electrician.
- Cells converted light in the visible spectrum into electricity and were 1% to 2% efficient (light sensors for cameras are still made from selenium today).
- In the early 1950?s the Czochralski meter was developed for producing highly pure crystalline silicon.
- In 1954 Bell Telephone Laboratories produced a silicon PV cell with 4% efficiency and later achieved 11% efficiency.
- In 1958 the US Vanguard space satellite used a small (less than one watt) array to power its radio.
- The space program has played an important role in the development of PV?s ever since.
- During the 1973-74 oil price shock several countries launched photovoltaic utilization programmes, resulting in the installation and testing of over 3,100 PV systems in USA alone, many of which are in operation today.