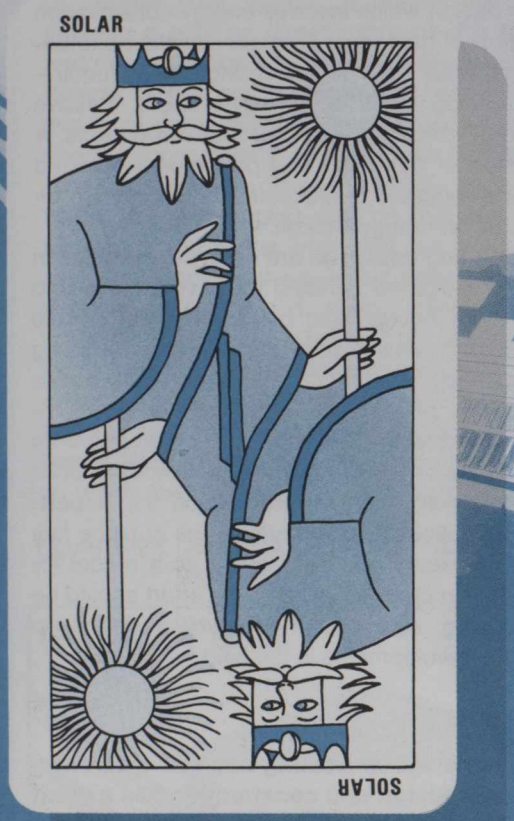
Solar Energy



1. THE NATURE OF SOLAR ENERGY

The solar radiation which man seeks to harness originates 93 million miles away in the sun, a sphere of incandescent gases with an effective surface temperature of 6,000 K (over 10,000°F). The centre of the sun is estimated to reach a temperature of some 15 million degrees Kelvin (27 million degrees Fahrenheit).

The sun is a continuously operating fusion reactor converting mass into energy at a calculated rate of about 4.5 million tonnes per second. Scientists have deduced that the principal fusion reaction taking place is one in which two hydrogen nuclei (protons) combine to produce helium. The small loss of mass which accompanies this reaction appears as energy. Virtually all of this energy is generated within the sun's core and then radiated into space.

Radiant energy is emitted from the sun at the prodigious rate of some 4×10^{23} kilowatts (nearly 1.5×10^{27} Btu) per hour but the Earth intercepts only a tiny fraction of this radiation. On the basis of data received by spacecraft at the outer edge of the Earth's atmosphere, the solar radiation crossing a perpendicular surface of one square metre every second is 1,353 watts, or 428 Btu/foot^2/hour. This value is known as the *solar constant*.

Not all of this energy reaches the Earth's surface. About 30% is directly reflected by the atmosphere back into space while an estimated 47% is absorbed as heat by the atmosphere, bodies of water and the surface of the land, becoming part of our planet's low-temperature heat budget. Almost all of the remaining solar power drives the hydrologic cycle — the evaporation, precipitation and circulation of water. Roughly speaking, one-half to two-thirds of the radiation incident on the outer