THE POTENTIAL FOR SOLAR ENERGY IN MONTANA

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ABSTRACT

Solar Energy is clean, self-sustaining and is the most abundant source of energy on earth. However, it also is difficult to collect and store, using today's technology, it is of low intensity, and it is not dependable. Solar radiation is only available in significant quantities during daylight hours and its intensity varies from hour to hour, day to day, season to season, and place to place on the earth. Montana receives the equivalent of 1,300 to 1,500 Btu per square foot per day from the sun.

Solar processes are classified as heliochemical, helioelectrical, or helicthermal.

The heliochemical process is a process by which the solar radiation is utilized directly by plants (photosynthesis) and indirectly by animals -- a vital process in an agricultural state.

The helioelectrical process converts solar radiation directly to electricity, utilizing solid state devices such as photovoltaic cells. The application of this technology has been limited because of the high cost and low efficiency of the collector system. Also, adequate large-scale power storage systems have not been developed.

The heliothermal process absorbs incident solar radiation on a surface and utilizes the energy in the form of heat. Systems employing this process are further classified as high-temperature systems.

High-temperature systems employ a focusing collector that must track the sun and that concentrates the solar energy on a surface located at the focal point of the collector. These systems are in the research and development stage.

Low-temperature systems utilize a flat plate collector oriented in an optimum fixed position. To date, systems have been developed for providing hot water, space heating, and air-conditioning.

Hot water systems are the only solar systems sold commercially anywhere in the world today. Markets exist primarily in Australia and Israel but are increasing rapidly in other developing countries.

In Australia, a solar hot water system costs about $300 and will provide between 60 percent and 90 percent of the hot water needs of a family of four with an efficiency of 40 percent.

Markets have not developed in the United States in the past because of the low cost of energy and the high standard of wages.

Space heating systems are not as well developed as water heating systems; however, there are several demonstration projects in the United States and throughout the world.

Air-conditioning systems are in the research and development stage and are still very costly.

The cost of solar energy today is about $3 to $4 per million Btu for hot water and space heating systems. The cost of energy to the residential sector in Montana is as follows (dollars per million Btu): natural gas - $.93, oil - $2.59, electricity - $3.96, LPG - $3.60. Space heating requires 53 percent of the energy used in the home. In Montana, 70 percent of the homes use natural gas for space heating, 14 percent use oil, and 8 percent use LPG. Hot water heating requires 12 percent of the energy used in the home. In Montana, 62 percent of the homes use natural gas for hot water heating and 30 percent use electricity. Obviously, because of the current low price of natural gas, the market for solar hot water heating systems in Montana would be quite limited. However, a drastic increase in the price of natural gas imported from Canada could increase the market potential.

The market in the United States for solar energy should improve in the near future. Both the cost and the consumption of energy are continuing to increase. There is also increasing environmental pressure for cleaner systems and a greater concern for energy conservation. Moreover, the federal government has significantly increased the research and development budget to improve solar energy technology.

With a vigorous research and development effort in this country, solar space heating systems and hot water heating systems are expected to see first use by 1978 and extensive use by 1988. Solar power generation systems are expected to see first use by 1985 and extensive use by 1995. By 1990 solar energy is expected to provide 4 percent of the energy required in this country; whereas, by 2020 it should provide 26 percent. The initial demand for these systems will probably be greatest in the southwestern states where solar intensity is about 1,840 Btu per square foot per day.

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