UTILIZATION OF SOLAR ENERGY IN THE PHILIPPINES

By

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Introduction

The current energy situation in the Philippines is in a sad state of affairs. The 1975 energy consumption (in Billion Kilowatt-hours) is 117.2. The yearly estimated maximum assured indigenous energy resources (from Hydro, Coal and Geothermal) spread over a period of fifty years total 57 Billion Kw-hrs. It is evident that even the full exploitation of these potential resources can provide only about 50% of the 1975 level of energy consumption. The discovery of oil commercial quantity (300,000 to 500,000 barrels per day) would ease the current energy situation in the Philippines 10 to 15 years following production. This again is depletable in the long term. Most experts estimate that the total world reserve is about 2,000 billion barrels. On the basis of present rate of consumption, this supply will be exhausted before the middle of the 21st century.

Medium and long term energy programs should therefore aim at all possible alternative energy systems. Probably the brightest prospect (no pan intended) is solar energy. Solar energy is inexhaustible. The theoretically available supply of energy from the sun dwarfs the demand. It has no critical mass, it is generally not a health hazard, it is clean with no waste products to worry about and above all the supply is free. If one assumes a conservative figure of 10% efficiency in utilizing solar energy it is estimated that the required area to furnish the equivalent energy content of petroleum fuel the Philippines is currently importing is about 300 square kilometers of collector area.

In the past, the availability of cheap fuel oil discouraged research and development on utilization of solar energy. Presently with increasing cost of fuel oils, its projected depletion in 50 to 75 years, environmental concerns and increased consciousness in conservation, there is renewed interest in utilization of solar energy.

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Solar Energy Systems

Though technical feasibility of solar energy systems has been established, money is still expended on solar energy technology to solve problems related to economics and reliability. The first relates to the diffused nature of solar radiation. This necessitates large capital investments requiring long operating life-time (about 20 years) for amortization purposes. The problem relates to the intermittent nature of solar energy. This necessitates development work on energy storage. Consequently, solar energy systems inherently have a low reliability of operation as compared to conventional energy systems.

Solar Desalination

The main objective of utilizing solar enemy for distillation is to conserve on fuel oils. Theoretically 5 x 109 calories per day incident on an area of 100 m^2 can generate heat to vaporize about 1000 kg of water. Solar distillation is considered the cheapest means of producing fresh water from seawater on a small scale. In the long run it is anticipated that large scale distillation will be the cheapest means of producing fresh water. It has been demonstrated in experiments conducted in the U.P. College of Engineering that a solar still could produce about 3 liters of fresh water per square meter of collector surface over a period of about 12 hours. Basically the still is a basin type with ordinary window glass tilted at an angle to serve as condensing surface.

Refrigeration and Airconditioning

One of the most attractive prospects in utilizing solar energy is for household refrigeration and airconditioning. The potential market for refrigerators and house cooling is tremendous. The standard absorption type refrigeration system, which is probably simpler and more efficient than the conventional vapor compression mechanical system is adaptable to the use of solar energy.

Mechanical Power from Solar Energy

Higher temperature than what is needed for, say, solar stills and household refrigeration systems is needed for solar engines. This higher temperatures may be achieved using solar concentrating collectors.

Electrical Power from Solar Energy

Any long range program on the utilization of solar energy is to direct attention on research in photo-chemistry to find a suitable

process (Photochemical) which allows absorption of solar energy and to reverse this process in the dark accompanied by a release of the absorbed energy. The problem is admittedly a very difficult one.

Perhaps one of the most hopeful prospects in the long-range program of finding devices for the utilization of solar energy is in the area of photo electricity—solar battery. The emphasis of the investigation in this area should be to find less expensive substitute to the very expensive single crystals of silicon which form the battery.

Photochemistry and Photovoltaic

There were initial economic studies on the possibilities of photosynthesis. Based on just .7% solar energy conversion, studies have shown that use of forest for energy is five times less than photothermal systems using directly solar-energy. This merits very serious thinking. The idea is simple. A thermal plant is located within a forest.

Solar Collectors

Except for direct conversion to electricity utilization of solar energy necessitates the use of solar collectors to harness the energy of the sun to heat working fluid (air, water, refrigerants, etc). Solar collectors may be classified into flat plate collectors for low to medium temperature and concentrating types (tracking or non-tracking) for high temperature collection.

Experimental work has been done in the College of Engineering on performance of flat plate collectors under natural conditions. Test results show that locally fabricated collectors perform fairly well and generally follow performance trends. Probably one significant aspect of the experiments is in assessing various weaknesses of locally designed and locally fabricated collectors.

Concentrating collectors (non-tracking type) are presently being installed and performance test should start very soon.

Storage of Energy

Present-day systems have conversion efficiencies of 5 to 10 percent. The technology, therefore, will have to be developed to improve these efficiencies. One aspect that needs to be looked into is the problem of thermal storage. The intermittent nature of solar energy necessitates development work on devices for storage of energy. Various media for storing solar energy should be investigat-

ed. The conventional method is to store energy in insulated hot water tanks. Other media such as fused materials, and salts should be researched on.

Other potential storage system such as electrolysis of water and subsequent storage of the hydrogen and oxygen in underground bottle should be considered seriously. The gases may be recombined to operate a gas turbine, or to operate a "hydrogenoxygen" fuel cell.

Economic competitiveness, assuming that the technical difficulties are not insurmountable, is attained once a conversion efficiency of 20 percent is realized.