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UTILISATION OF SOLAR ENERGY

AT the present rate of fuel consumption it has been estimated that the world's supply of readily available fuels such as coal, oil and gas will be exhausted in less than 100 years. Nuclear fuels too, are likely to last only for about another two centuries. As a long-range problem, therefore, researches on methods of utilizing solar energy are of vital importance, particularly in countries like India, which are fortunately situated in regard to the supply of solar radiation. In this connection, the deliberations of a recent symposium* on the utilization of solar energy, sponsored by the National Science Foundation and the University of Wisconsin, U.S.A., will be read with much interest.

The first general discussion at the symposium

centered round the storage and utilisation of solar energy for house heating, water heating and cooking. The discussion indicated that knowledge of absorbents of solar energy was well advanced, but that considerable improvement was still necessary before solar house heating could be achieved without the use of auxiliary fossil fuels. One of the major problems in this connection is the storage of energy through the night, and during long periods of overcast or stormy weather. Probably, improvements in house design would make possible better use of the sun's heat in both summer and winter.

Regarding the generation of solar power, it was felt that small power units could be got up in certain parts of the world, though at from 2-3 times the current cost of power production

* Held at the University of Wisconsin in September 1953, reported in *Science*, 1954, 119, 82.

from coal and oil. The chief disadvantage here is that the power would be intermittent because it can be produced only during the hours of sunlight.

Closely allied to the power problem is the solar evaporation of sea-water. Some progress in this regard has been made by dissolving dyes in salt water in order to improve the absorption of energy. One part per million of dye may increase absorption by as much as 30 per cent. in the evaporation of water to yield salt.

But it is obvious that for any widespread use of solar energy, there must be a better understanding of the meteorological implications. If improved methods for protecting crops against frost could be devised, and the growing season thus lengthened, the food supply in certain areas of the world could be increased appreciably. Conversely, if absorption could be induced on snow surfaces so that melting would be speeded up the ground would be made available for planting sooner in the spring. Meteorology could thus make an important contribution to the advancement of solar energy by developing an improved method for specifying the amount of solar radiation at any given point on the globe.

The Conference gave special attention to those areas that show the greatest promise of making major contributions to the utilization of solar energy as a source of power and felt that chemists should be urged to search for a suitable solar compound which will absorb sunlight through photochemical reactions, store up the energy and then release it in a way suitable for practical use. To discover such a compound presents a real challenge, but basic research on the question should be encouraged; for the use of sunlight in photochemical reactions offers many theoretical advantages over its use as heat in engines. However, one of the difficulties likely to be met with is that the products of such photochemical reactions may immediately react, and reverse the reaction.

An example of a possibly useful photochemical reaction is the production of hydrogen and oxygen from water, using cerium salts as the absorbent to transfer the energy needed to make the water dissociate. The hydrogen and oxygen could be stored and later recombined to give back the stored energy. Another possibility is the absorption of energy by one side

of a photovoltaic cell or an electrical battery, while the second side of the cell is kept in darkness. The side absorbing the energy from the sun would transmit the energy through an electric circuit to the side which is kept in darkness.

In addition to studies of the kind mentioned above, considerably more work should be done on the thermo-element method, in which two different electric conductors are connected, with one junction heated by the sun and the other junction kept cold. The resulting current could be made to do work; however, it will be necessary to find metals or alloys which, when connected together in this way, will produce substantially higher voltages than any produced so far.

Nature's own method of utilizing solar energy in growing plants through photosynthesis is a remarkable phenomenon which can also guide us in our approach to the collection of solar energy. We are just beginning to understand photosynthesis, but perhaps eventually the same series of reactions may be produced artificially without any requirement of the growing plant or good soil conditions.

Considerable attention was devoted at the symposium to the possibilities of a 'poor man's solar engine'. Although such engines would be inefficient thermodynamically and economically in comparison with modern engines, it was felt that they might find extensive use, particularly in countries which are not industrialised. The night interruption of power would not be a disadvantage in operations such as the pumping of water for irrigation.

No great achievements of practical value were reported in this attack on the problem of utilizing solar energy, and it was generally agreed that no new era of direct utilisation of solar energy is yet in sight. However, many of the participants of the Conference, including architects, engineers, chemists and meteorologists, were pleased to find that substantial progress is being made in the preliminary development of solar house heating, solar power production, evaporation of sea-water, and in the application of meteorology. They were also interested to discover that there are many areas of physical chemistry, physics and engineering where fundamental research may well lead to significant advances in this direction.
