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SOLAR ENERGY - CAN IT HELP TO SOLVE THE ENERGY PROBLEM ?

I. Potential and limitations of solar energy

The oil crisis of 1973 has made everyone in the Community aware of the extent to which day-to-day comforts are dependent on an adequate supply of energy. Oil, as the paramount source of energy in our society, is continually increasing in price, and world supplies cannot be regarded as inexhaustible. In order to ensure the continued existence of our technological civilization, it is necessary to find new sources of energy and to develop new processes and technologies that will allow costs to be kept within acceptable limits. In this search for substitute forms of energy, the sun offers a possible alternative. If solar energy is to cover even as little as 5-10 % of Europe's energy requirements by the beginning of the next century - when, according to current estimates, oil will have become scare - then it is high time to make a start on the necessary development work, with a budget commensurate with the importance of the objective to be attained. Notwithstanding our "fast-acting" technology, it still takes an average of ten to fifteen years for major inventions and developments to reach the stage of large-scale industrial application.

Technically speaking, our exploitation of solar energy still stands on the first rang of its evolutionary ladder. The objection that the use of direct solar radiation can be of significance only in southerly latitudes is refuted by the results of more recent studies. These show that on average central Europe receives half as much energy in a year, in the form of radiation per unit of surface area, as the desert belt of the Sahara. Since, however, large areas of Europe are frequently overcast, the potential for the technical exploitation of solar energy will differ according to climatic conditions and geographic situation.

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Apart from the solar heating of water, for which the outlook is promising even in northerly latitudes, the most hopeful techniques in this context are probably the direct conversion of radiation into electricity by means of solar batteries and, in the longer term, bioconversion or photochemistry.
South of the Alps, solar power stations with mirrors as concentrators are feasible and, given intensive research aimed at increasing their efficiency conversion, should be capable of competing economically with conventional forms of energy.
The total output of all the solar collectors at present installed in Europe does not amount even to one megawatt. Such a figure is negligible in the overall energy balance. It can be assumed, that the development work now getting under way in Europe will, in ten to fifteen years, result in a more mature technology and therefore to output figures that will be more perceptible. The market shows that there is already considerable public interest in solar water heaters and in houses heated by solar energy. Many of the developing countries in particular, with their tropical climates, offer suitable locations for experiments and trials systems developed in Europe. Owing to the different structure of the energy market in these countries - a corollary of the more favourable climatic conditions - it can already be said that solar energy should be commercially competitive there in the near future. A market already exists in such places for technical developments to which a European research programme may give rise; this makes it all the easier for European industry to adopt a long-term objective, since in the short term there is an outlet in these regions for its products.

II. The solar energy research programme of the European Community

Since the energy crisis the various member countries of the European Community have intensified their research into the use of solar energy. Here there is an opportunity for cooperation extending beyond national frontiers, since on the one hand all the Community countries have an interest in the development of solar energy, and on the other hand industry and research in this field are still seaking to establish proper structures and are receptive to the idea of concerted action.

Since taking up his post, Dr. Guido Brunner, the member of the Commission with special responsability for research, has stressed the need for alternative sources of energy. The European Community research and development programme in the field of solar energy, submitted by Dr. Brunner, was adopted in mid-1975. In the course of the four-year programme, the sum of 17,5 million units of account (DM 63 million) is to be spent in support of projects aimed at making solar energy competitive with "conventional" sources of energy. This programme is divided into the six main areas described below :

1. The heating and cooling of buildings

A considerable amount of work is already beeing carried out in the member countries on the development of solar heating systems. To some extent such systems are already commercially vailable. Consequently, as far as solar heating is concerned , the European Community supports primarily those projects which are of benefit to all manufacturers or research institutes working in this field, e.g. the computer-programmed search for the optimum working conditions for solar heating systems, or the development of new types of heat accumulator for the sunless hours, days or even weeks (the problem of economical long-term storage of solar heat remains unsolved).

2. Thermal solar power stations

Solar energy can also be used indirectly - via the generation of steam and the driving of steam turbines - to operate quite large solar power stations. For this purpose, a whole field of reflectors is oriented towards the sun in such a way that the concentrated sunlight strikes a central "boiler" and heats it.
A European group of companies recently concluded a project-definition study, commissioned by the European Community, for a 1MW solar power station. It is intended that development of the components for such a power station should be put in hand forthwith and that a start should then be made on the construction of the station, probably in Italy.

3. Photovoltaic conversion

With the aid of semiconductor cells, familiar from the technology of space-travel, sunlight can be converted directly into electricity. These cells, however, are still far too costly to compete with normal electricity production. Since the use of such solar cells would be particulary advantageous in Europe (they function even when the sky is overcast)the European Community is spending nearly half of its solar energy research budget in this field. Some thirty contracts with important industrial firms and research laboratories in the Community are at present beeing prepared or have already been concluded. Both the further development of known methods based on silicon and cadmium sulphide and completely new methods involving special materials and techniques are beeing studied.

4. Photochemistry

Solar energy is captured and converted into chemical energy by the process known as photosynthesis, which occurs naturally in plants. Knowledge of the complex processes involved in photosynthesis could lead to the

development of new artificial photochemical systems. Although the necessary basic research is hardly likely to open up an important new source of energy in the near future, the European Community has concluded contracts with nineteen institutes well known for their work in this field, with a view to promoting their current research projects, coordinating the work and making the knowledge thereby acquired as widely available as possible.

5. Bioconversion

Certain plants convert solar energy into organic matter with remarkable efficiency and therefore constitute a possible means of energy storage, i.e. as "biomasses". The Commission is currently supporting research into the cultivation and selection of particulary fast-growing tree species (poplars, etc.), which should later be able to ensure the fuel supply for power stations in Ireland previously fired by peat. In Germany, France and Denmark, the use of straw for the direct production of thermal energy is also beeing studied, and the Commission is participating in the research.
These studies are concerned not only with the purely scientific aspects and the resulting technical processes but also with the economic and environmental facets of the subject.

6. Data collection

In order to make the best use of solar energy it will in future be necessary to have more accurate information on the intensity, duration and type of insulation in the various parts of Europe and also to have access to reliable meteorological data.
To this end, methods of measurement and measuring instruments must be standardized and the requirements of the solar-energy industry, architects and users ascertained. The Commission has several projects in course of preparation. However, before the measurement values can be ascertained and collated in data banks, there is need of further work by groups of experts and harmonization with various other organizations already working on certain aspects of the problems to be solved. Only on the basis of data ascertained through these investigations will it be possible to make a reliable economic evaluation of the various ways of utilizing solar energy.

III. Organization of research

Research into solar energy is interdisciplinary. Physicists, biologists, engineers and agronomists - to mention but a few of the disciplines involved - must all contribute their experience to the common goal of harnessing solar radiation in the service of man. The projects to be carried out must be selected, supervised and aligned. To this end, the European Community calls upon the services both of researchers from its own research centres in Italy, Germany, Belgium and the Netherlands and of numerous specialists from national research institutes, universities and private industry. The European Community is linked by contracts to nearly one hundred research establishments in the nine member countries. A programme advisory committee composed of members from the various member countries is responsible for the continuous adaptation of the programme to the latest developments.

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