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Work is currently going on in a contract research and development laboratory in Cambridge to utilise the sun's rays as a source of energy for industrial and domestic purposes. The laboratory is staffed by about 120 scientists and technicians, 70 of whom have Ph.Ds covering multiple scientific disciplines. The research aspect of the work is now complete, and the products are currently being developed for production.

THERMAL PANELS The sun's rays carry heat rays at the infra red end of the spectrum. These rays heat up the earth's atmosphere or surface at the instant of contact. A device called a thermal panel has been developed to extract heat from the ambient air temperature caused by this phenomenon.

In effect a flat panel measuring 1 metre square and being two centimetres thick is heated by direct thermal rays from the sun and also by the temperature of the air surrounding it. Heat can be extracted by the panel from its immediate environment, and stored in a low cost heat sink. The temperature of this store can be further raised to near boiling point by a highly efficient low cost heat pump, similar in techniques, but the reverse of a normal refrigeration process, but the net effect is that a four bedroomed house in the United Kingdom can be supplied with all its hot water requirements for central heating and domestic applications from a panel measuring 5x4 metres, at a one off cost currently estimated to be about £500, and annual running costs would be negligible.

The manufacturing process is now being developed, but will not include any exotic materials or sophisticated techniques. Life time of the product, under normal circumstances, should be that of the building. Applications currently under consideration are homes, schools, hospitals, factories etc. One County Council Authority has asked that one of their new primary schools be heated by this technique, and this is being used on an experimental basis for the laboratory work. Full production is planned to begin by the end of 1975 for United Kingdom markets.

A further development currently in hand is for the design of a low temperature turbine built to work at these set temperatures for the generation of electricity for industrial and domestic appliance use. This source would be insufficient for cooker requirements, machine tools etc. Present calculations show that this aspect of the product is feasible, in which case the heating, hot water and electricity need of a building could be independently generated.

SOLAR CELLS Solar Cells provide a means of directly converting the visible spectrum part of the sun's rays into electricity. The process has been well known for many years and highly developed by the Americans in the last decade for their space exploration



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programme. To date most research and development effort has been directed towards high efficiency units to operate within limited space and weight constraints. Whilst this has been achieved the units have proved highly expensive and therefore beyond normal domestic and industrial application.

The same Cambridge laboratory mentioned above has developed a continuous process for the manufacture of solar cells trading off low efficiency factors against the low manufacturing cost. Where space and weight are not constrained, as for example on the roof of a house, or in a field, then this approach has considerable merit, and is economically viable for domestic and industrial use, especially in tropical and equatorial climates.

In tropical regions the sun's rays develop about 2 megawatt hours of electricity per year on a 100% efficiency unit measuring 1 square metre. The low cost process described here will generate 1/20th of this, that is 100 kilowatt hours per year. In the United Kingdom about half of this amount would be generated, but on a seasonal adjusted basis.

The life time of the cells has been estimated conservatively at 7 years. The manufacturing process, which is now demonstrable in the form of laboratory made samples, is very simple to make and requires no exotic materials in its manufacturing process. A full feasibility proposal for the construction of a pilot plant has been compiled; the costs would total about £300,000, and take 12 to 18 months to establish and prove. A full production unit could then be built at an estimated cost of 3 million pounds, which would include the necessary working capital.

The storage of electricity so generated could be through all the existing techniques, including batteries. A new highly efficient storage system, for up to 100 kilowatt hours, is currently under investigation by the laboratory.