From the Office of Public Relations
Massachusetts Institute of Technology
Cambridge 39, Mass.
Telephone: UNiversity 4-6900, ext. 2702

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Solar House IV

Sunshine hitting its roof can at present provide a three-bedroom suburban house in New England with two-thirds of the energy required for heating and domestic hot water supply.

To do better than this would be feasible, but to attain total solar heating in the random weather of New England requires more storage space than is convenient in a small house. And, under present market conditions, the cost of mechanical equipment required for solar heating remains higher than can be justified by fuel savings.

These are some of the conclusions reached after three years of operation of Solar House IV, in Lexington, Mass., by the Massachusetts Institute of Technology. They were reported by Professor Albert G. H. Dietz at the United Nations Conference on New (Non-nuclear) Energy Sources being held (Aug. 21-31) in Rome, Italy. Dr. Dietz is professor of civil engineering and a member of the Space Heating Committee of the M.I.T. Solar Energy Conversion Project.

Built in 1958 specifically for experimental work in solar energy, the house (at 4 Russell Road, Lexington) has yielded all the scientific information it can provide and will now be converted into a conventional home and sold, Professor Dietz said.

The most valuable contribution of the house, he reported, was the engineering knowledge gained in constructing and operating a complex solar heating plant. "Somewhere and sometime this knowledge will be a resource," he said."In countries where conventional

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fuels are abundant, the use of solar energy for heating is economically attractive only where the climate permits an unusually high yield of sunshine per square foot."

A modern and complete two-story residence, the Lexington Solar House was the outgrowth of 20 years of solar energy research at M.I.T. and continued a program of accumulating experience in the technology of solar heating and its relation to architectural design.

Architecturally, the most striking feature of the house was the solar energy collector which formed all of the combined roof and wall of the south side of the building. Set at an angle of 60 degrees, the 16-by-40-foot collector consisted of two layers of glass over an identical area of thin aluminum sheet painted black. Water pumped through copper tubes attached to the aluminum sheet was heated by trapped solar energy and then stored in a 1500-gallon tank in the basement. Hot water from the tank was pumped through a heat exchanger to transfer heat from the water to air. The warm air was forced through ducts to heat the house, as in conventional heating systems. Incoming cold water from the public water system was heated for domestic hot water supply by being pumped through coils in the storage tank.

In operation, temperatures within the house were very strictly maintained and the occupants at no time accepted any compromise with the comfort levels or volume of hot water use that Americans have come to expect, Professor Dietz said. The house was occupied by the chief engineer of the project, Claremont D. Engebretson, former M.I.T. research associate in mechanincal engineering, and his family.

During the three-year period, Engebretson kept a detailed record of performance of the system and gradually improved the installation until, in the 1960-61 winter, the heating plant operated at peak efficiency and satisfied the predictions of its designers.

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Professor Dietz noted that the flow of controlled energy in the Solar House system was distributed on a fully automatic basis. Regulating devices instructed the system exactly when energy could be picked up from the sun at the collector-roof and told the auxiliary fuel-burning heater precisely how long to wait before coming to the aid of a depleted store of solar energy.

To accomplish this required a greater complexity of piping, valves, pumps and especially control devices than is ordinarily found in a small building, and maintenance of such a system is also an economic factor in solar heating. The experience gained in coordinating these elements into a complete system capable of the most careful custody of small amounts of energy is the most profitable result of building and operating the house, Professor Dietz reported.

Although the Lexington house is the first complete suburban house built by M.I.T., it is officially M.I.T. Solar House IV -- the fourth in a series constructed since 1938. The first was a two-room office and laboratory building built on the Institute's campus to establish the principles of design of the flat plate collector of the type used in the Lexington house.

The second M.I.T. solar house was a small laboratory building, also on campus, which was later extensively remodeled into a home for a married student and his family. Completed in 1948, Solar House III was occupied by a succession of M.I.T. student families for nearly a decade and yielded much of the information used in designing the solar heating plant of the Lexington house.

Two problems that can be studied without experimenting with a full scale house are the next research projects of the M.I.T. Solar Energy Conversion Project, according to Prof. Lawrence B. Anderson, professor of architecture and chairman of the project's

Space Heating Committee. The first involves investigating new combinations of materials for the construction of less expensive collectors able to withstand stresses of temperature and weather. The research group will also try to devise cooling equipment, operating on solar energy, so that summer sunshine can be used for air conditioning.

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