# How can we best use solar energy?
# The unregulated sun

**Use of solar energy for heating homes is feasible. NRC investigations at the Division of Building Research aim to find out to what extent we can rely on the sun for our heating requirements and to determine the most suitable systems for collection and storage of this "free" energy.**

Solar energy is a resource receiving increasing attention in many countries as supplies of conventional non-renewable energy dwindle. Energy from sunlight offers the prospect of supplementing conventional sources for heating homes and offices. The size of this supplement will depend upon a number of variables — the cost and availability of conventional energy sources, the availability of standardized collector units which can be incorporated into a building without the necessity for specialized techniques, and the cost of long-term heat storage systems.

To study these variables, the National Research Council's Division of Building Research has initiated a research program that forms part of NRC's involvement in the interdepartmental program on energy research and development. The objectives are not only to establish when and where solar heating will be economically viable in Canada, but also to prepare for the eventual introduction of solar heating by demonstrating it in appropriate regions of Canada and by assisting industry in the development of solar heating hardware.

Extraction of low grade heat from the sun's rays does not depend upon sophisticated equipment. In essence, a solar collector panel consists of a darkened absorber (backed with insulating material to minimize heat loss) through which is circulated a heat transport fluid (generally air or water); a covering of glass or transparent plastic transmits the visible light energy from the sun, but does not transmit the infrared, or heat energy re-radiated from the absorber. The circulating fluid transfers heat to a storage unit (water in the case of a water circulating system, or rock in the case of an air system) from which heat is extracted when needed.

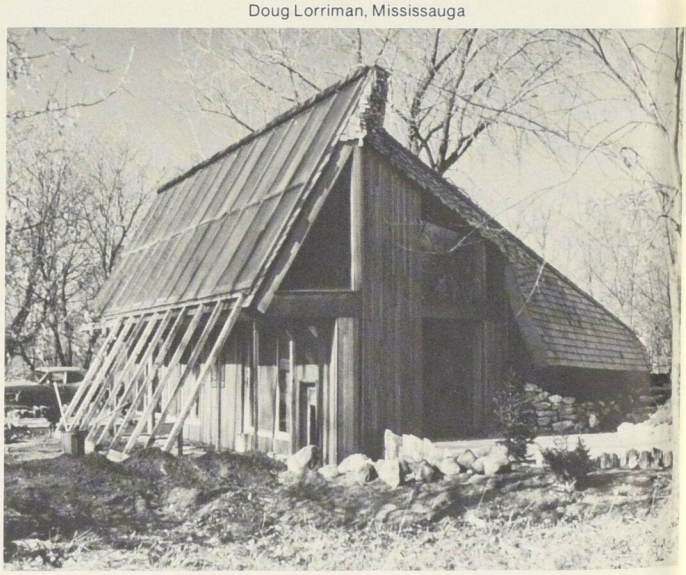
The drawback lies in the size of the collecting equipment — and hence its capital cost. Sunlight, like wind, is a dilute energy source and very large collector areas are required. For example, in a well-insulated, detached house, solar collectors of a total surface area of about 540 square feet (50 $m^2$) would be required to supply about half the home's heat load and would cost about $5000 at present-day prices. Assuming that the solar input was replacing electric heating, a maximum cost saving of about $240 would result (again at present-day prices), which represents an annual return of four per cent of invested capital. (This cost calculation, of course, excludes installation and storage system costs.)

Does this mean then that solar heating is just not economically competitive? Certainly, using current cost figures there appears to be little immediate economic inducement to install solar heating systems, but it must be remembered that, first, conventional energy costs are increasing and can be expected to continue increasing over the lifetime of a house, and second, that as the manufacture of solar heating components develops, capital costs should fall due to economies of volume production.

The development of systems which will be practical and economic for large-scale application is, according to Mr. J.R. Sasaki of the Division of Building Research's solar energy group, a long-term objective of the research program. "Looking ahead," he says, "we want to see a situation where solar collector units can be incorporated into house construction in the same way as other standardized items such as doors and windows. Ideally, solar heating systems should be installed without requiring specialized skills and should operate without requiring frequent specialized maintenance." Mr. Sasaki points out that in the long term the introduction of solar heating systems should become a significant construction-related industry if the construction industry itself can profitably integrate solar heating systems into its products. "This consideration has had a strong influence on our approach," he adds.

One part of the Division's program has been to sponsor the design, purchase and installation of solar heating systems in a small number of specially selected solar demonstration houses located across the country, "There are two features of this part of the program that should be emphasized," says Mr. Sasaki. "We are looking specifically

Doug Lorriman, Mississauga



**Completed early this year, this 1,350-square-foot home in Toronto's Mississauga suburb obtains 60 per cent of its heating from direct solar energy. The home uses 690 square feet of solar collector area, with water as the heat transport and storage medium. Supplementary heating is obtained from a heat pump which "upgrades" heat from one of the two water storage tanks. In summer, the heat pump can be reversed to provide air conditioning.**

**Achevée au début de l'année, cette maison de 1 350 pieds carrés, à Mississauga dans la banlieue de Toronto, est chauffée à 60% par l'énergie solaire. Elle utilise une surface de captage solaire de 690 pieds carrés, l'eau étant l'agent de transport et de stockage de la chaleur. Le chauffage supplémentaire est obtenu à l'aide d'une pompe à chaleur qui "enrichit" la chaleur provenant de l'un des deux réservoirs d'eau. En été, la pompe à chaleur peut être inversée pour la climatisation.**