Zeolite possibility for solar heat

Imagine making a potent fuel using the sun's energy through a process that takes not millions of years like coal or oil, but only days or even hours, writes Joseph Szostak in the September issue of *Canadian Renewable Energy News.*

Imagine further that this fuel did not create waste or pollution when exhausted, but could simply be recharged and used again and again.

These are some of the hopes in a new technology being researched by scientists at Carleton University in Ottawa. Working under National Research Council grants, they are investigating the storage of solar energy in a safe, clay-like substance called zeolite.

If their work is successful it would mean a major breakthrough for solar technology.

Storage has been one of the problems connected with solar heating. Because most solar systems cannot provide heat during consecutive sunless days, some form of heat storage is necessary, as well as a backup system for winter months.

Rocks and water have commonly been used. They are cheap and available, but their energy density is low – they cannot hold more than one or two days' heat reserve without becoming impractical because of size and costs.

Glauber's is a eutectic salt that stores heat as it changes from solid to a liquid. Commercial eutectic systems are just beginning to appear on the market.

Recently, a team of scientists at Carleton, including Ronald Shigeishi, Cooper Langford and Bryan Hollebone, began investigating the absorption-desorption cycle of zeolites.

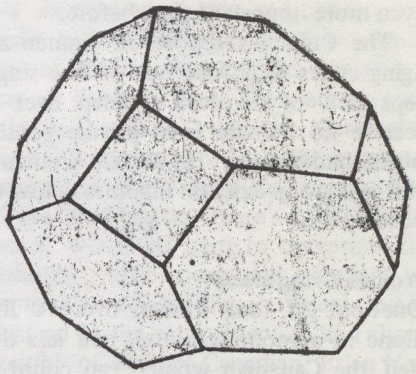
Crystal substance

Zeolite is a crystalline substance composed of silicon, oxygen and aluminum. Synthetic zeolite is commonly used as a catalyst in petroleum processing.

Its structure is an open lattice with holes that attract moisture. For years, zeolite has been used by industry as a drying agent, and carries a warning label, because when it absorbs moisture, it releases heat.

"A natural twist would be to think of using it not as a drying agent, but as a heat exchange," Mr. Langford said.

In the absorption-desorption cycle, heat dries zeolite by driving water molecules out of the lattice, but to do so it must overcome the forces binding the water there in the first place. The energy it takes to do this is stored as potential.



A type of zeolite crystal

"It's like pumping water uphill. Since it wants to come back down, it has potential energy," Mr. Langford said.

Similarly, as soon as the temperature of the zeolite bed returns to normal, it wants to reabsorb the water it has lost. When it does so, or is allowed to do so, it releases heat.

If the bed is cut off from a source of moisture, the reversal cannot take place.

Because humidity rather than temperature controls the reversal, the temperature of the bed no longer matters. There is no need for insulation and no problem of thermal loss.

Stores heat

This means zeolite does what previously only fuels have done: stores heat indefinitely as chemical potential.

"The importance of this in a northern climate cannot be over-emphasized," Mr. Hollebone said. "Zeolite storage could make solar (energy storage) viable by allowing you to store heat during the good months to use in the bad winter months, and in so doing eliminate the need for an expensive backup system."

And because zeolite's energy density is extremely high, almost one million BTUs *per* cubic metre, it may be able to outperform eutectic salts systems by as much as two to one.

Mr. Langford said that research was still in an early stage. The scientific parameters for zeolite look very good, but a system must be engineered and tested. But the research completed to date is encouraging.

Because blocks of zeolite would be as easily transportable as oil, solar energy could become a moveable commodity.

Large solar collectors could gather heat to be used throughout an entire district. With zeolite, blocks could be charged at the central collector and then delivered to households instead of oil.

When their energy is exhausted, they would be taken back to the collector to be recharged.

Another approach being considered is the use of industrial waste heat, rather than solar heat, to charge zeolite blocks.

Office serves elderly

McMaster University in Hamilton, Ontario, recently opened its Office on Aging, which will deal with questions concerning the rapidly-growing part of the population made up by the elderly.

Dr. Arthur N. Bourns, MacMaster president, noted that Canadians were only just beginning to appreciate the future dimensions of the problems associated with the growth of the percentage of aged in the population. Because of the breadth of the expertise that will be drawn together through the help of the Office of Aging, he said, that office will be central in coping with the problems associated with this growth.

Up to now, Canada has had a smaller percentage of elderly because of a relatively high birth rate and immigration. The population over 65 will double in the next 20 years and then double again by the year 2020, when the elderly will constitute close to 15 per cent of the whole, said Dr. Ronald Bayne, clinical professor of medicine and medical director of St. Peter's Hospital in Hamilton.

This, he said, would have a major impact on the Canadian life style, not necessarily as an intolerable burden, but as a requirement for changes in economics, recreation, health and social services, to name a few. There were major implications for universities, he continued, among them that students must gain an understanding of aging in themselves and in others. Increased survival would provide great opportunities for lifetime learning and service to others. Graduates in the service professions would need a high level of competence and interest in the elderly, said Dr. Bayne. Specialists in geriatrics, medicine, nursing, rehabilitation, social work, recrealogy and also gerontologists in social sciences, sociology, geography, education, psychology and other fields were required.