

The Greenhouse

Effect

*Solar energy hasn't been forgotten,
by Pamela Young at least not by
Solar Nova Scotia*

"**T**HAT'S IT, I'M AFRAID," says Dr. John Young.

It is four feet wide and seven feet tall — a rectangle of looped-up black rubber tubing nailed to the wall like some Minimalist art statement.

We are in a narrow lean-to greenhouse, a recent addition to a Spryfield home. Today, anemic March sunlight reaches the black rubber rectangle through large, sloping windows on the opposite wall. In one corner, a compact device called a multiplexer silently registers inscrutable peaks and valleys on graph paper. This is the site of Young's prototype solar energy collection system.

Pipes connect the black rectangle, a wooden box containing an experimental heat-storing medium and a small pump in a continuous loop. During the day, radiant energy is collected in the rectangle's rubber tubing and converted into heat. This heat is transmitted to water that cycles up through the collector and down into the heat-storing medium. The harnessed heat is used to even out the greenhouse's dramatic day-to-night temperature swing.

"This is only a test case," says Young, a professor of physical chemistry at St. Mary's University. "We deliberately undersized the collector just to see what it could do. But the system's been operating like a dream since we put in in last June."

Young's "active" solar collection and heat storage/distribution system assists the structure's "passive" solar-receptive design in supplying the greenhouse with nearly all of the heat needed for year-round plant growth.

Young's work at this greenhouse is typical of Atlantic Canada's innovative approach to solar technology. Interest in alternative energy may be on the wane elsewhere, but it remains strong in the

Atlantic provinces, where conventional energy costs have always been comparatively high.

As of January, 43 per cent of all Canadian solar energy projects in the industrial and commercial sector were located in the Atlantic provinces. Nova Scotia accounts for less than four per cent of Canada's population, but is responsible for 11.8 per cent of the country's sales of domestic solar water heating systems.

John Young founded Solar Nova Scotia, a small chapter of the 15,000 member Solar Energy Society of Canada, more than a decade ago. Today, Solar Nova Scotia brings together 30 to 40 researchers, designers, manufacturers and government officials to collaborate on various solar projects and share the gospel of solar with the general public.

Three years ago, they produced a

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"build-your-own solar green house" course with funding from the federal and provincial governments. Last year, more than 200 prospective greenhouse builders took this course and Solar Nova Scotia is now in the process of expanding and updating the greenhouse program.

"There have been dramatic changes in solar energy since 1980," says Vaughn Munroe, a project officer with Energy, Mines and Resources Canada and a Solar Nova Scotia Member. "In 1980, solar products weren't being made anywhere in Canada. Now we manufacture most of our own systems."

One such manufacturer is Solar Nova

Scotia member Dr. Peter Allen, a professor in the mechanical Engineering Department at the Technical University of Nova Scotia. His Dartmouth-based firm, Thermodynamics, is the only company producing pre-fabricated solar hardware east of Montreal.

Allen's interest in solar energy dates back to his undergraduate years at Mount Allison University in the early 1970s, but he only began building solar collectors – at first in his own basement – in 1981. Thermodynamics now employs five workers fulltime. In addition to residential sales, the company has sold solar water pre-heating units to business operations ranging from laundromats to a photolab.

"You can use solar thermal wherever you have a demand for hot water," says Allen. "Textile mills, for example, use gallons of hot water. Pre-heating water with solar makes a lot of sense in a situation like that."

A solar water-heating system operates on a beautifully simple principle known as the "greenhouse effect." The sun shines on a "collector" – usually a black plate positioned an inch or so beneath a sheet of transparent glazing. Short wave-length solar radiation passes through the glazing, strikes the black absorber plate, and is transformed into long wave-length thermal energy. Most of this heat energy is trapped in the collector because long wave-length radiation cannot pass through the glazed surface as easily as short wave radiation can. The trapped thermal energy raises the temperature of the absorber plate.

Water pumped through the tubing on the underside of the absorber plate carries away some of the heat, and then relays this heat to a storage tank. Water constantly cycles up through the collector and back down into the tank, raising the temperature inside the tank a slight amount with each revolution.

Allen says technological refinements have significantly improved the performance of solar heating systems in the last few years. Many collectors are now made with a low-iron glass that transmits more solar radiation onto the absorber plate. Improved selective finishes – coatings that absorb a lot of energy and re-radiate little of it – have improved the performance of absorber plates. The mechanical pumps that force water through the system are smaller, much cheaper and more efficient than they were five years ago.

John Young is experimenting at the Spryfield greenhouse with an unconventional heat-storing medium – a salt called calcium chloride hexahydrate. Early results indicate that it can store up to six times as much heat as water, the most

POEM FOR A SUMMER EVENING'S CELEBRATION (two versions)

I

wait world wait world wait world wait

just long enough for me
to catch you

II

wait wait wait wait world

just for me
you

Paul Keen

commonly used storage medium.

Gadgetry alone, however, doesn't ensure effective use of solar energy. Peter Allen says nothing adds more to a solar heating system's usefulness than a "cooperative consumer."

"I've got the worst solar system I've ever put in," he laughs. "It's a prototype and it looks like hell, but it supplies about 80 per cent of our hot water needs for a family of five. It works well for us because we time our consumption. My wife will postpone the laundry if the day is cloudy and wait for a sunny one. I do the same thing when I wash the car."

"It's simple, really. All you need is a \$10 timer to have the clothes washer go on at noon when the collector has had enough time to heat it up."

Don Roscoe, a graduate architect who has been designing and building solar homes for more than 10 years, goes far beyond Peter Allen's notion of a "cooperative consumer." "The one thing I can do for myself is shelter myself," he says. "I can live very comfortably on six grand a year."

A stylized graphic of the sun takes up nearly half of his business card. Printed neatly at the bottom of the card is the motto: "Better this world." He is, it goes

without saying, a member of Solar Nova Scotia.

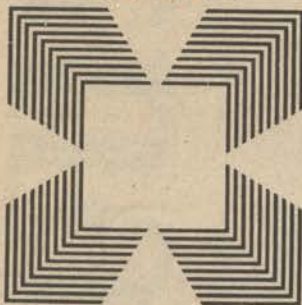
For the past eight years, he has lived without running water in one of his own solar-designed homes. The back-up heating system in his West Dover home is a \$40 trash burner, and his one luxury is a composting toilet.

Roscoe designed the Spryfield greenhouse that houses John Young's experimental solar heating system. Young and Roscoe will collaborate on at least two more greenhouse projects this summer. One of them will be a two-storey greenhouse addition to Roscoe's own home.

"Once this greenhouse is running, I'll be even more of a back-to-the-lander than I am now," says Roscoe. "I can't wait."

The basic principles behind the passive solar architecture that Roscoe practices are as easy to understand as the mechanics of an active solar heating system. A solar home is designed to collect, store, and distribute energy from the sun. The sun's rays pass through large south-facing windows and the energy is stored in the buildings' foundation. At night, this stored energy is slowly released into the building in the

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"The mid-seventies were right in the prime of the back-to-the-land movement. Now I feel like I should be doing American Traditional Post-Modernist houses or something."

form of heat. In cool weather, a ventilation system carries heat to where it is needed within the building; in warmer weather, excess heat is diverted outside.

Roscoe's approach to designing a house sounds almost haphazard. "A lot of times we put the foundation in and have no idea what the rooflines are going to be," he admits cheerfully. But Roscoe has won two Nova Scotia Energy Awards — one for his elegantly spare solar designs and one for his work on Solar Nova Scotia's greenhouse course. He also did the technical detailing for a recent Harrowsmith book on solar additions. Roscoe knows what he's doing. It's just that he takes the dictum, "form follows function" more literally than most. Energy efficiency matters more to him than any other design aspect.

ROSCOE is quick to point out that solar architecture is still in an experimental stage. "Each of our clients benefits from our previous projects, and each of them takes a small risk to help push solar design forward," he says.

But given the recent phenomenon of plummeting oil prices, there may be fewer people wanting to invest in solar-designed homes.

"It's an exceedingly difficult time for solar planners," says Vaughn Munroe of Energy, Mines and Resources. "Sheik Yamani won't keep oil prices down any longer than it will take to raise them and keep them up for good, but that could take months or years."

As Peter Allen sees it, the irony of the campaign to decrease dependence on conventional sources of energy is that it has succeeded all too well. "My hypothesis is that conservation and the use of renewables dropped the demand for oil and resulted in a slight oversupply. When that happens, the government gets off the bandwagon and says energy is no longer an issue. What did Mulroney do when he came into power? He chopped funding for renewables and conservation and supported nuclear. Reagan did the same thing in the States a few years earlier."

Allen says research grants for the study of alternative energy are still available, but they're becoming more difficult to find.

During the depth of the energy crisis in the mid-1970s, sun power and other alternative energy forms were expected to come to the rescue of Western society. When it became apparent that the fledgling technologies were not even

close to being ready to substitute for conventional energy sources, the public lost interest.

"I feel like a dinosaur," admits Roscoe. "I'm out of my era. The mid-seventies were right in the prime of the back-to-the-land movement. Now I feel like I should be doing American Traditional Post-Modernist houses or something."

Roscoe worries that today's architecture students — the ones who are learning to build American Traditional Post Modernist houses — aren't being taught about alternative energy designing. "I think it's important that they at least get exposed to the possibility that there are other types of architectural practices that service the community, where they can make a living doing something that's fun to do."

All things considered, however, John Young still believes the solar energy industry is in reasonably good shape. "I'm pleasantly surprised how well interest in alternative energy has survived, given that it's a substitute for an established product whose price suddenly halved," he says.

"The idea of alternative energy is really good," says Young. "Given half a chance in a real market, or even in the game as conventionally played with heavily subsidized oil prices, alternative energy is still pretty good in a number of areas."

As Young sees it, the biggest drawback to solar energy is the start-up cost. "Solar is up-front capital intensive," he says. "Its cost effectiveness has a lot to do with interest rates and the inflation rate as well as oil prices. Even a one per cent change in the interest rate can blow your payback in solar."

Young and Allen agree that the slump in world oil prices is only temporary. They believe alternative energy will look more attractive when oil prices begin climbing upward once again.

"All Jed Clampett had to do was shoot at possum and 'up came the bubbling crude,' but look at what they have to do to get it now," says Allen. "They're prepared to spend as much as \$100 million to get oil out of a single well in Hibernia. It can't go on forever."

In the meantime, the members of Solar Nova Scotia are quietly improving the productivity of an energy source that has a lot going for it. "Solar energy is totally benign," Peter Allen says. "It effects the environment in no way whatsoever. And we're not going to run out of it."