By Heather Kent

Canadian engineers are finding innovative and commercially realistic technologies for saving energy and greenhouse gas emissions. The government's SDTC program provides support funds.

Future Promise

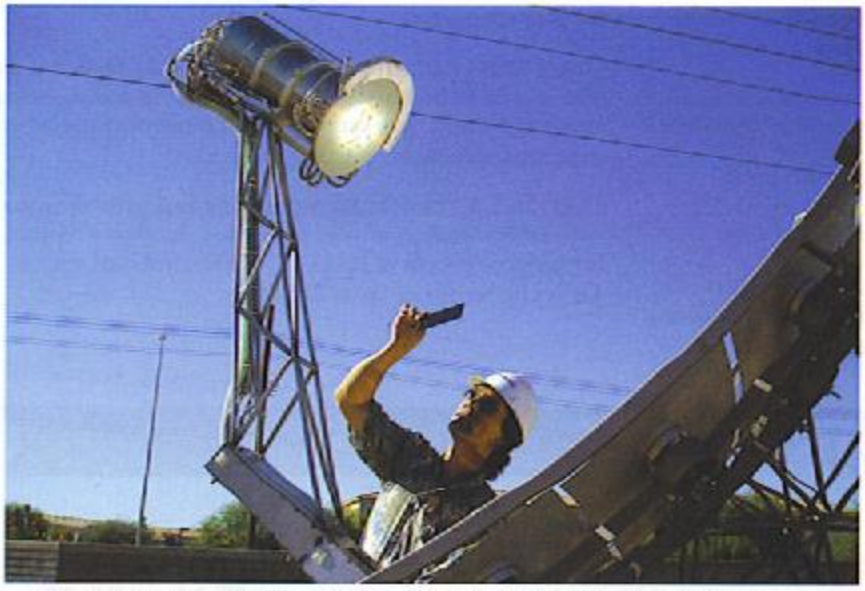
Sustainable Development Technology Canada (SDTC), a federal government agency, was launched in 2001. Its mandate reflects its name. "There is a need in Canada to have technological solutions to environmental problems and, when doing that, to make sure there is an economic return," says Dr. Vicky Sharpe, the agency's chief executive officer. "We de-risk these technologies and take them to market," she adds.

For clean technologies, there is a "pre-commercial gap," a lack of both understanding and funding to bring them to a point where the private sector will become involved in their financing. "It's a valley of death, so entrepreneurs develop these ideas and we fund the testing to determine the performance of these technologies in real world environments," says Sharpe.

SDTC has 57 technology groupings dealing with every sector of the economy. Entrepreneurs approach the agency with a wide range of expertise and many receive help to develop a business plan. "We are now becoming a funder of first resort," says Sharpe. Funding per project ranges from about $250,000 to $8 million.

The agency deals with consortiums. On average, it takes them three years to work through SDTC's evaluation process. "We are very market-oriented," says Sharpe, explaining that the agency wants to know whether the market is niche or global, how the technology performs and the nature of its environmental impact. An end-user is engaged in the process to determine whether the project meets their needs. Funded projects are tracked for three years.

Following are just three of the projects that have received preliminary approvals for SDTC funding recently and are undergoing final contract negotiations. These projects relate to saving energy and greenhouse gases.



Above: SHEC Labs' solar hydrogen generator uses concentrated sunlight at 5,000 times the intensity of the sun in its thermochemical hydrogen production process.

SHEC LABS, generating hydrogen from landfill gas

Landfills account for 33% of methane emissions in Canada and hydrogen is often seen as the fuel of the future. A project using solar-power to convert landfill methane into hydrogen is therefore a "very significant" alternative to the current method of steam reformation of fossil fuels to generate hydrogen, says Tom Beck, president of SHEC LABS/Solar Hydrogen Energy Corporation of Saskatoon. Its partners in the project are Giffels Associates (Ingenium) and Clean 16 Environmental Technologies, in conjunction with the University of Toronto Department of Chemical Engineering and Applied Chemistry.

The "SHEC Station #1" project, which is now in the design phase, will be constructed at the Regina Fleet Street landfill. It will have the capacity of producing 1.2 million kilograms of renewable hydrogen per year and will prevent 81,000 tonnes of CO_2-equivalent emissions from entering the atmosphere every year.

The technology involves 12m x 12m unique solar concentrators that provide concentrated solar energy to Dry Fuel Reformation solar reactors and Direct Water Splitting technologies. It is the first of its kind in the world for commercial use. The first modules will be in place in 2007 and eventually the landfill site will have 30 reactors. The production from the landfill is based on a conservative average of 20% solar availalability. This means the system will work at

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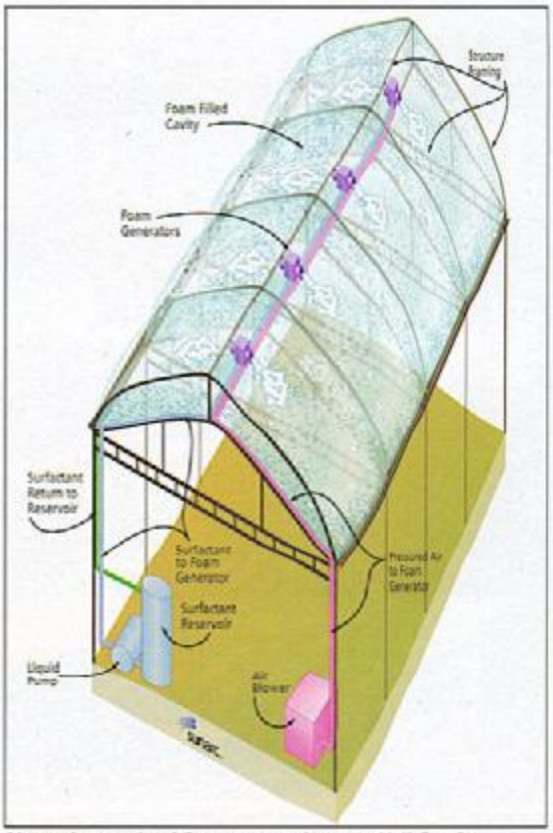
capacity with an average of 4.8 hours of sunlight per day.

Beck says there is world-wide interest and anticipates a very large market by 2010. He projects that 57 million kilograms of hydrogen capacity could be available. Other applications for the hydrogen technology include solar thermal heating and air conditioning, wastewater sterilization and groundwater remediation.

Sunarc's on-demand insulation systems

Montreal-based Sunarc of Canada is installing demonstration units of its insulation systems on vegetable-growing greenhouses in Quebec and Ontario. The "L-Foam" technology, which has been developed with Laval University, can reduce the use of fossil fuels for heating greenhouses by up to 60%, says John Dinsmore, an engineer, and Sunarc's Chief Operating Officer. The technology is not used anywhere else in the world at this time.

North American greenhouses are typically covered with two layers of polyethylene with poor insulating properties, explains Dinsmore. The Sunarc system inserts liquid foam between the layers using a specially formulated surfactant, boosting its insulating qualities at least 10-fold or more to R15-20. Using a gravity-feed mechanism, the foam is injected at the roof peaks (roofs account for 80% of a large-scale greenhouse farm surface area). As the foam breaks down naturally, the liquid that composed it is recovered and re-used to make replacement foam. The product will be market-ready in late 2006. Other possible applications are atriums, swimming pools and waste treatment plants.



Above: isometric of Sunarc greenhouse with "L-Foam" insulation system.

SAIC's solar and underground thermal energy storage

In Alberta, SAIC Canada (Science Applications International Corporation) is developing two projects that are among the first of their kind in North America. The concept is to use the earth as a thermal energy storage medium for heating and cooling, integrated with a solar energy resource.

In Okotoks, SAIC has partnered with the municipality on a demonstration project to develop underground borehole thermal energy storage that will provide heating to 52 homes in a new subdivision.

The solar energy is harnessed from collectors mounted on the garages and converted to hot water, which is then piped to 144 vertical bore holes that are 37 metres deep. The energy is stored underground in summer and used in the winter to heat the homes.

The technology is also being used in an aquifer thermal energy storage project under development in Medicine Hat. The project incorporates two wells, approximately 100 metres apart, that access a deep aquifer. Cold water is pumped from one well to the other to power air conditioning in the summer. That water warms up during the cooling process and accumulates in the second well during the summer for use in the winter, when the flow is reversed. The system will be used in a new condominium development of approximately 140 homes.

"We are ... learning from earlier research in Canada and from the Europeans. But we are pushing it further, adapting it to the Canadian climate," says Bill Wong, Program Manager for SAIC.

SAIC's partners are Town of Okotoks, Sterling Homes, United Communities, ATCO Gas, City of Medicine Hat, Enerworks and IF Technology. CCE

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Above: computer generated view of the SAIC project subdivision combining solar energy panels with underground thermal energy storage.