TRANSPORTATION ENERGY TECHNOLOGIES PROGRAM

The Transportation Energy Technologies Program (TETP), managed by CANMET's Alternative Energy Division, supports efforts by Canadian industry to develop and commercialize technologies and fuels that permit a cleaner, more sustainable energy mix for our roadways.

TETP has been designed to assist industry in responding to a growing worldwide demand for more environmentally responsible transportation alternatives. By supporting R&D toward innovative new technologies, TETP is improving Canada's competitive edge in the changing transportation market place.

The development of vehicle and refuelling infrastructure hardware for alternative fuels, including natural gas, propane, methanol, ethanol, and hydrogen, along with electric vehicles, is a key activity. As well as emitting fewer hazardous emissions compared to gasoline or diesel, these fuels are available in enormous supply in Canada. For example, reserves of natural gas, a proven transportation fuel and an inexpensive feedstock for the production of propane and methanol, are estimated at 30 times our annual use. And technologies to produce ethanol from biomass, including wood waste, and hydrogen from a variety of sources — even water — are approaching commercialization.

Conventional vehicle technology is another target for improvement under TETP, specifically through increasing efficiency without detracting from performance. The potential for technologies that boost fuel economy and reduce tailpipe emissions is enormous, ranging from modifications to vehicle hardware to the investigation of "smart roadways" which are specially designed to efficiently accommodate high volume traffic patterns.

Funding for TETP is provided by the Green Plan and the federal Program on Energy Research and Development.

Some Facts about Canada's Changing Transportation System

- The most fuel-efficient vehicles on the market today are approximately five per cent more efficient in city driving — and 20 per cent more efficient on the highway — than the vehicles with the best fuel performance five years ago.
- Approximately 140,000 propane and 35,000 natural gas vehicles are on the road in Canada, most of them after-market conversions. Original Equipment Manufactured (OEM) natural gas vehicles are now being produced in Canada, and the world's premier dedicated natural gas bus manufacturing facility has been established in Mississauga, Ont.
- Canadian sales of ethanol-blended gasoline reached over 256 million litres in 1992, and are forecasted to increase dramatically in the next few years.
- Prototype variable-fuel methanol vehicles, which can run on gasoline, "M85" (85 per cent methanol with gasoline) or a combination of the two, are being field-tested at 11 sites across the country. Some of the world's first OEM M85 vehicles are now being manufactured in Canada.
- The world's first hydrogen-powered fuel cell transit bus is operating in Vancouver, B.C.

City bus in Regina, Saskatchewan.

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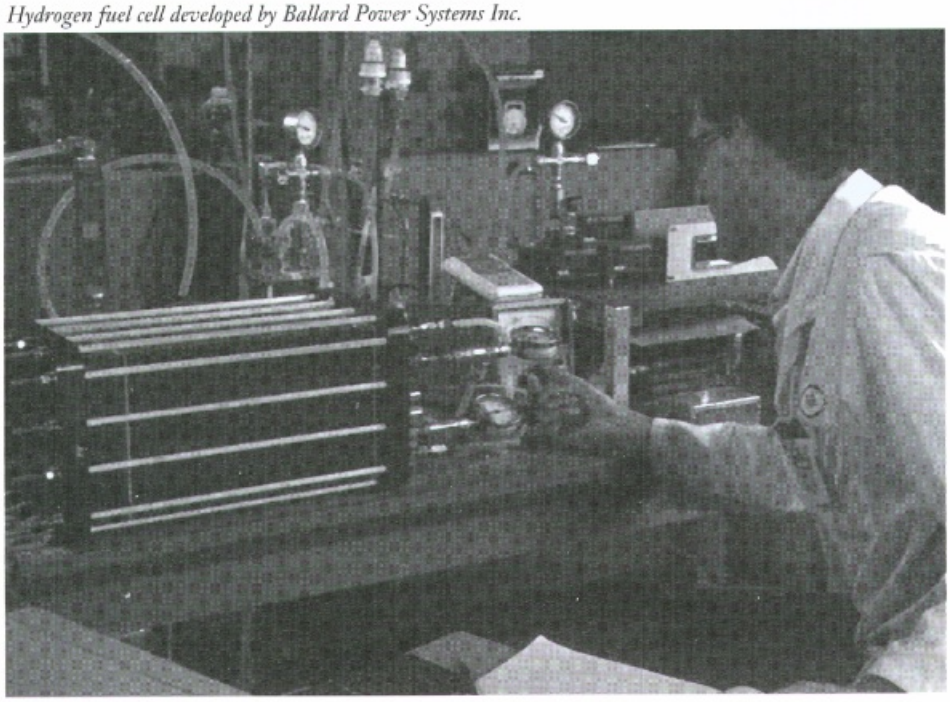
Hydrogen fuel cell developed by Ballard Power Systems Inc.



- Advances in battery technology are significantly increasing the potential for cost-effective electric vehicles. Several light-weight, high-efficiency alternatives to traditional lead acid batteries, such as the lithium aluminum/iron sulphide and sodium sulphur which feature energy density and life roughly three times lead acid, are actively under development.

Breaking Down the Barriers to Commercialization

In a straight dollar per litre comparison, most alternative transportation fuels are competitive with gasoline or diesel fuel. The exceptions are hydrogen and ethanol from wood waste; however, technologies to reduce production costs are under development.

Nevertheless, there are a number of barriers to increasing the contribution of these fuels, some of which also impact the market potential of cleaner conventional vehicle technologies.

Alternative fuel technologies are each at a different proximity to full market penetration, which reflects their state of development. For example, it can cost as little as $2,000 to convert a conventional vehicle to natural gas, which retails at half the price of gasoline in some parts of Canada. While the economics of this technology are appealing, technical limitations still remain, particularly with respect to the range and weight of natural gas vehicles. Advanced technologies that address these problems are in demand to both improve the performance of after-market conversions and assist original equipment manufacturers to develop dedicated natural gas vehicles.

On the other end of the technology development spectrum, prototype hydrogen-powered vehicles are just being introduced. Significant R&D will be required before this technology can be introduced on the commercial scale of natural gas. However, technical and market potential is enormous.

The lack of a refuelling infrastructure for alternative fuels is another barrier to their progress in the market place. While this obstacle is currently being addressed through the development of variable-fuel vehicles that can also run on gasoline, economic technologies to accommodate alternative transportation fuels within our existing fuel distribution network must be identified and implemented.

Researchers concerned with efficiency improvements and emissions reductions to conventional vehicles are similarly challenged in providing cost-effective technology. However, minor modifications can have a relatively huge impact. For example, every one per cent reduction in a vehicle's weight can result in a .58 per cent decrease in fuel consumption. The search for shorter-term technical solutions, conducted in conjunction with longer-term initiatives such as fuel reformulation, can potentially result in a significant overall improvement.

Finally, information gaps exist between the developers of innovative technologies and the users who can most benefit from them, such as fleet managers and operators of high-mileage vehicles. Links must be forged between these two groups on an ongoing basis.

Strategy for Technology Development

Several activities are conducted under TETP to address technical as well as institutional barriers to the commercialization of alternative transportation fuels and more efficient conventional vehicle technologies.

Research and Development

TETP supports R&D through cost-shared agreements, frequently under multiple-partner arrangements. Program activities are oriented toward the development of technologies with short-to-medium term commercial and market potential.

Selected projects are eligible for a portion of funding based on the degree of risk, proximity to commercialization, energy potential

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and contribution to environmental objectives. R&D priorities are set by technical experts from industry and government, and proposals are generally submitted in response to requests for proposals issued by Supply and Services Canada's Science Branch.

Partners in research include a wide variety of players in the Canadian transportation industry. In the majority of cases, equipment, technical data, designs or processes resulting from a project are vested in the project proponent and remain its property.

TETP is also involved in a number of international projects, including activities under the International Energy Agency, cooperative agreements with the U.S. Department of Energy, and joint science and technology activities with countries such as Japan. These activities help raise the profile of Canadian technological achievements and capabilities on the world market place, as well as prevent duplication of R&D in a rapidly evolving field.

Technology Assessments

Along with supporting the development of technologies, TETP assists industry in testing and evaluation to reveal opportunities for improvement. Assessments of technologies are conducted in the lab and through technical demonstration projects and field trials, which provide data on factors such as fuel economy, reliability, safety, environmental impacts and cost benefits.

Standards Development

Once a technology has a proven performance in the field, TETP supports the development of technical and safety standards needed to encourage acceptance in the market place. Standards development is conducted in cooperation with provincial, national and international standards writing organizations and national and provincial regulatory bodies.

Partnerships in Technology Development

TETP works in cooperation with a number of stakeholders in the domestic and international transportation industries, including:

- original equipment manufacturers (OEMs)
- industry associations such as the Canadian Gas Association, Propane Association of Canada, Canadian Oxygenated Fuels Association, Electric Vehicle Association of Canada and the Hydrogen Industry Council
- fleet managers
- transit authorities
- utilities
- provincial governments
- research organizations
- universities
- other federal departments
- U.S. Department of Energy
- International Energy Agency

Technology Transfer

Technologies are transferred through sponsorship of workshops and seminars, including the annual Windsor Workshop on Alternative Transportation Fuels held every June in Toronto. Technical reports are available, and information exchanges are maintained with the automotive manufacturing and fuel supply industries, along with industry associations, universities and other levels of governments.

Technology Highlights

- TETP has joined forces with the B.C. provincial government, Ballard Power Systems and B.C. Transit to develop and demonstrate the world's first hydrogen-powered solid polymer fuel cell transit bus. A series of 24 powerful polymer electrolyte fuel cells are replacing the diesel engine of a Vancouver transit bus.

- TETP has struck a partnership with the Canadian Petroleum Producers Institute to correlate the composition of diesel fuel with emissions, particularly with respect to suspected carcinogens Polycyclic Aromatic Hydrocarbons (PAHs) and Nitro-PAHs. Four different diesel blends are being tested in two heavy-duty truck engines, donated by Navistar Engines and Detroit Diesel Corporation. The results of the test program will be used in the development of future regulations on the composition of diesel fuel.

CANMET's variable fuelled methanol/gasoline Lumina.

Refuelling of a natural gas car.

- Electrofuel Manufacturing Company is receiving funding for the development of a high-energy-density high-efficiency lithium aluminum/iron sulphide battery for electric vehicles. The battery contains no hazardous chemicals or explosive materials, and features significantly better performance than standard lead acid batteries currently used in electric vehicles. Electrofuel has recently completed plans for a pilot plant for module production.

- Funding and technical expertise is provided to the Canadian General Standards Board toward the development of standards for alternative transportation fuels, including activities related to neat methanol and methanol/gasoline blends. In support of this effort, TETP is funding work by the Society of Automotive Engineers to assess the cold starting performance of vehicles fuelled with high-level methanol-to-gasoline blends.

- TETP supported the 1991, 1992 and 1993 Natural Gas for Vehicles (NGV) Student Challenges in partnership with the U.S. Department of Energy, General Motors and the Society of Automotive Engineers. A student design competition featuring natural gas as an automotive fuel, the NGV Challenges attracted participation by student engineers from universities and colleges across North America, introducing them to the challenges and benefits of NGVs.

- A field trial demonstrating the use of neat ethanol as a fuel for urban buses is under way in cooperation with Regina Transit and Mohawk Fuels. There are also similar programs for methanol and natural gas buses which aim to improve air quality, diversify energy sources and reduce operating costs.

About CANMET

As Natural Resources Canada's research and technology arm, CANMET is a major participant in research and development for Canada's minerals, metals and energy industries.

CANMET, formally the Canada Centre for Mineral and Energy Technology, is striving to enhance the competitiveness of its client industries through conducting and supporting R&D toward the development and use of leading-edge technologies. In keeping with the goals set out in Canada's Green Plan, CANMET emphasizes the development of technologies that are consistent with the goal of a cleaner environment.

Within CANMET, the Efficiency and Alternative Energy Technology Branch (EAETB) is accelerating the development and use of energy efficiency, and alternative and renewable energies. Technical areas include solar energy, wind, small hydro, bioenergy, alternative transportation fuels, transportation efficiency, and energy efficiency for the commercial and industrial sectors and for buildings.

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