

HYBRID FUEL CELL BUS DEMONSTRATION

Advanced Technology Moves Bus Forward



MANITOBA SHOWCASES FUEL CELL HYBRID BUS

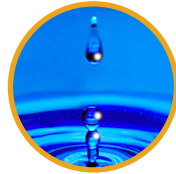
An advanced fuel cell bus is on the move in Winnipeg, Manitoba. This “bus of the future” is powered by fuel cells that run on pure hydrogen.

This bus demonstration, led by Hydrogenics and the Province of Manitoba, features a series of operations in Winnipeg during August and September, 2006.

Winnipeg, Manitoba was chosen by Hydrogenics Corporation as an ideal demonstration site to showcase the capabilities of fuel cell hybrid bus technology. Manitoba, home of New Flyer Industries, is a major bus manufacturing centre in North America. Manitoba is also a leader in hydrogen and home to innovative, hydrogen-technology companies such as Kraus Global Inc. Our province has a rich source of hydroelectric and wind power to produce emissions-free, renewable hydrogen fuel.

Fuel cell technology good for environment

When hydrogen is transformed in a fuel cell, it produces electricity without harmful emissions. In fact, all that comes out of the tailpipe is a small amount of water vapour. This is in contrast to the conventional vehicles we ride today. Because conventional vehicles are fuelled by petroleum and powered by internal combustion engines, they contribute significantly to the greenhouse gases and other noxious substances being emitted into our atmosphere daily.



Local organizations support bus demonstration

Red River College (RRC) staff are operating the fuel cell hybrid bus and providing additional support, such as refuelling. A temporary refuelling station is located at RRC's Heavy Equipment Transportation Centre. It includes a portable electrolysis unit leased from Hydrogenics to produce the hydrogen. Winnipeg-based Kraus Global Inc., a leading manufacturer of gaseous fuel equipment, is the supplier of the hydrogen dispenser used for refuelling the bus.

What is a fuel cell and how does it power a vehicle?

A fuel cell is an advanced, energy-conversion technology that produces electricity from hydrogen fuel. Fuel cell powered vehicles, like the demonstration bus, are really electric vehicles. Like a conventional battery, a fuel cell has an anode and a cathode, and produces direct current (DC) electricity. Also, similar to a conventional battery, a fuel cell converts chemical energy (in this case, hydrogen) into electrical energy.

Hydrogen storage tanks and hybrid fuel cell equipment are stored on top of the bus (shown with roof covers removed).

Hydrogenics takes the lead

Hydrogenics Corporation, based in Mississauga, Ontario, coordinated the overall conversion of the bus and installed three fuel cell modules that make up the bus' propulsion power system. The company worked with Winnipeg-based New Flyer Industries – the leading manufacturer of transit buses in Canada and the United States – to convert New Flyer's Invero model so that it would support a hybrid fuel cell system.



Three fuel cell modules are part of main power system.

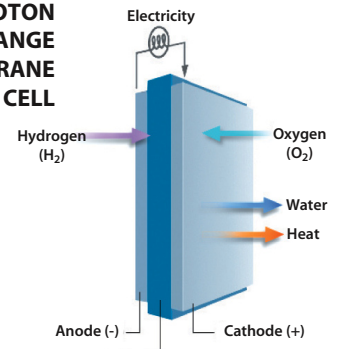


How it works... (cont'd)

However, unlike a conventional battery, a fuel cell uses a continuous flow of hydrogen fuel from storage tanks. Therefore, theoretically, a fuel cell could produce electricity indefinitely, as long as hydrogen fuel is being supplied.

As efficient as it is, some of the chemical energy of the hydrogen fuel is lost as heat. Still, when compared to a conventional internal combustion engine, a fuel cell is about twice as efficient – a huge improvement over existing technology.

PROTON EXCHANGE MEMBRANE FUEL CELL



TECHNICAL DETAILS

Building the bus

Hydrogenics Corporation installed a series of three HyPM® 65 Fuel Cell Power Modules as the bus' main power system. ISE Corporation of California designed and installed the hybrid drive system, which includes wheel-mounted electric motors, regenerative brakes and electrical energy storage to enable the recovery and reuse of energy.

Maxwell Technologies of California supplied the ultra-capacitors used for the electrical storage. A bank of lightweight, composite, high-pressure hydrogen storage tanks was installed in the modified roof structure by Dynetek Industries of Calgary. These tanks provide the fuel storage for the bus.

The 40-foot, low-floor bus was built in Winnipeg by New Flyer Industries. The contemporary Invero design is well-suited to this bus of the future. It is sleek, modern and incorporates aerodynamic styling, panoramic frameless windows, and composite materials in the body.

Transportation of the future

The bus uses three HyPM® 65 Fuel Cell Power Modules capable of providing a total of 180 kilowatts (kW) of power. A 720-volt bank of ultra-capacitors provides the remaining power needed to reach the peak power requirement of 350 kW.

While the dominant power source comes from fuel cells, the bus' efficient, hybrid-power construction represents an attractive solution for future fuel cell powered buses. This is mainly because a hybrid configuration enables the system to readily provide instantaneous full power, with reduced capital cost and increased fuel efficiency. The anticipated cost reduction is seen as a pathway that could speed up the commercialization of fuel cell technology.

DETAILED VEHICLE SPECIFICATIONS

POWER SUPPLY/ SOLUTION	
Power Train Configuration	Siemens 170kW dual drive motor unit combined with a Flender 550Nm gearbox
Fuel Cell Power Module	3 x HyPM® 65
Continuous Net Rated Power	180kW
Peak Power	350kW (via 9 Farad @ 720V Ultracapacitor)
Hydrogen Storage	45 kg @ 350bar
VEHICLE	
Bus Configuration	New Flyer Invero Low Floor Bus
Seating Capacity	39 seats
Dimensions	L=12.5m x W=2.6m x H=3.8m
Range	4h @ full power or 6-8h average (estimated)
Top Speed	90 km/h (est.)

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 Vehicle Technology Centre Inc.



The Winnipeg demonstration showcases zero-emission, fuel cell hybrid bus technology in an urban environment. The bus is powered by Hydrogenics' efficient HyPM® Fuel Cell Power Modules.



Natural Resources Canada

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