STORY

Life is a (hydrogen) highway…

And we might ride it all life long

By Glenda Bartosh
Photos by Leanne Pedersen

Few close to the hydrogen fuel cell industry will venture a prediction,
but this gas that you can't see, smell, or taste, and burns with no visible flame is looking more and more like one of the big tickets to a more sustainable future.
In the meantime, the ride around here is looking good: the Lower Mainland just happens to be the leader in the hydrogen economy, while Whistler, with its compass pointed to sustainability, just happens to be a hub in the hydrogen highway.

If you're cruising Highway 99 this coming Sunday afternoon and spot a fleet of shiny vehicles sporting logos like "BCHydroGen", "Green Power" and "H2" you've just caught a glimpse of the future.

It's all part of a road rally that's helping to kick off a big hydrogen fuel cell convention and trade show in Vancouver April 29 through May 2. At the same time, the rally is providing a real-time demo of the latest hydrogen fuel cell vehicles and the technology surrounding them, while showcasing Whistler as the anchor for the hydrogen highway.

The rally, which kicks off at Vancouver's Convention Centre at 1 p.m., features six fuel cell vehicles — two Ford Focuses and a DaimlerChrysler F-Cell, which are powered by Ballard fuel cells; a GM Hydrogen 3 Zafira; a Toyota Highlander; and a Nissan X-Trail — plus a GMC Sierra pickup truck which has been converted to run on hydrogen but has an internal combustion engine.

In Vancouver, the vehicles will fuel up at a portable hydrogen station that's been set up by Powertech Labs, a Surrey-based subsidiary wholly-owned by B.C. Hydro that is hosting the event. It's a leader in providing hydrogen fuelling technology and vehicle testing expertise.

"We've got a number of years of experience with natural gas fuel storage systems," says Angela Nanalal, rally organizer and a Powertech project engineer who designs hydrogen fuelling stations.

"Natural gas is considered similar to hydrogen in that both are gaseous fuels that can be treated the same way — they're both compressed gases that can be used to fuel vehicles."

Powertech is also setting up a portable hydrogen fuelling station at the B.C. Hydro Rainbow sub-station to service the vehicles once they reach Whistler. Even the fuel source for the rally has a nice "green" angle: it's all Green Certified Power.

By 3:30 p.m., the rally will swing up to Whistler, where the vehicles will be displayed at the Telus Conference Centre for Whistler's mayor, council members and other guests. Unfortunately, the event is closed to the public for security reasons, but if you're keen to see the vehicles, stop by the conference centre between 3:30 and 4 p.m. when they'll be washed and prepped for display. On Monday morning, they will head back to Vancouver.

Not only is the rally an amazing display of fuel cell technology in motion, it's also a see-me, touch-me manifestation of something that people may have heard about, but don't fully understand — the hydrogen highway.

Part real, part virtual

The hydrogen highway is a lot of things: it's a trademarked name; it's a metaphor; it's a virtual highway; it's a real highway; and it's a real project that's about more than vehicles.

The idea of a hydrogen highway for Canada was officially launched by Prime Minister Paul Martin in 2004 at Globe, a major environmental conference and trade show held in Vancouver. The announcement was the culmination of a joint industry/government vision spawned several years before, one that led to B.C.'s hydrogen and fuel cell strategy.

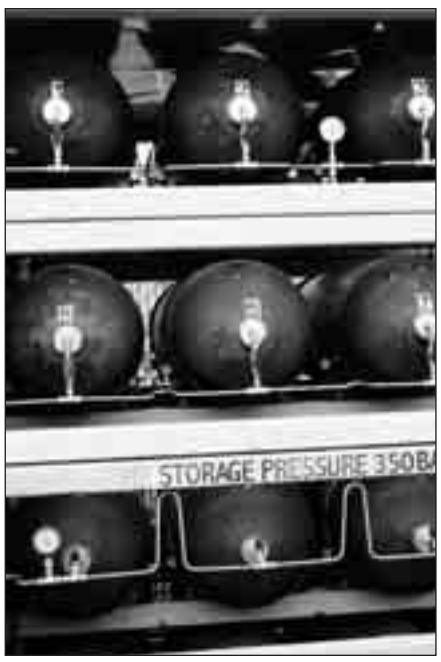
While strategizing is fine, hydrogen and fuel cell technology is big — so big that something more substantial was needed.

"It's not just a matter of putting in a few dollars or doing a couple of demos," says Alison Setton, from her office near UBC. She's the manager of the Hydrogen Highway and the Vancouver Fuel Cell Vehicle programs for Hydrogen & Fuel Cells Canada, a non-profit industry association accelerating Canada's world-leading hydrogen and fuel cell industry.

"It's such a transformative technology that slices across all aspects of life — energy is just one of those things — that it really took the federal and provincial governments and industry aligning under a common vision, and that included having a large-scale demo and deployment.

"Without that step it's almost impossible to jump from the lab to commercial products on the shelf."

In terms of developing new products and technologies, demonstrations are more at the R&D — research and development — end, while deployment means moving



CLOCKWISE FROM TOP LEFT: *BC Hydro's Ford Focus fuel cell vehicle (one of five in the Vancouver Fuel Cell Vehicle Program) beside the Hydrogen Highway station at Powertech Labs (Surrey). A close up of the fuelling receptacle on a hydrogen fuel cell powered Ford Focus. This is similar to natural gas vehicles. Carbon fiber and aluminum cylinders, made by Dynetek, safely store compressed hydrogen for use at a filling station.*

more into commercial products.

As you might guess, with a technology as transformative as hydrogen and fuel cells, you can't just put them out there without a variety of supporting infrastructure. That includes everything from fuel supplies, to things like safety and public acceptance, so it requires many different groups working together to assemble the whole puzzle.

And that's when the Hydrogen Highway as a project was born. (While Canada has trademarked the name in this context, there are other hydrogen highways in California and Europe, as the term is loosely applied to any road or transportation system based on hydrogen.)

"The Hydrogen Highway is not just about vehicles. It's a route to our future, a way we get from R&D and technology in the lab to form a commercial hydrogen fuel cell industry," says Setton.

The Hydrogen Highway project in the Lower Mainland has six hubs of hydrogen and fuel cell technology and fuelling infrastructure. These include North Vancouver, where engineering company Sacré-Davey is capturing and purifying hydrogen from an industrial waste source; it's then used to power a car wash in North Vancouver. UBC and the National Research Council site there comprise another hub, with the Pacific Spirit hydrogen fuelling station and a variety of "green" fuel cell projects including residential ones.

Victoria has a hydrogen fuelling station at B.C. Transit's Langford facility and the university has used fuel-cell powered flashlights. Vancouver is another hub, with projects like four Translink hydrogen/natural gas hybrid buses, and the airport is one with its baggage carriers powered by fuel cells. Surrey is home to Powertech Labs, and their hydrogen fueling and testing facilities.

And then there's the Whistler hub: home to far more than Sunday's hydrogen fuel cell road rally terminus and a temporary fuelling station.

In keeping with its 2020 sustainability vision, the Resort Municipality of Whistler will be the home of an $89-million deployment of 20 fuel-cell powered municipal buses and supporting infrastructure, in time for the 2010 Winter Games. (The RFP to build these busses is currently circulating.) As well, some

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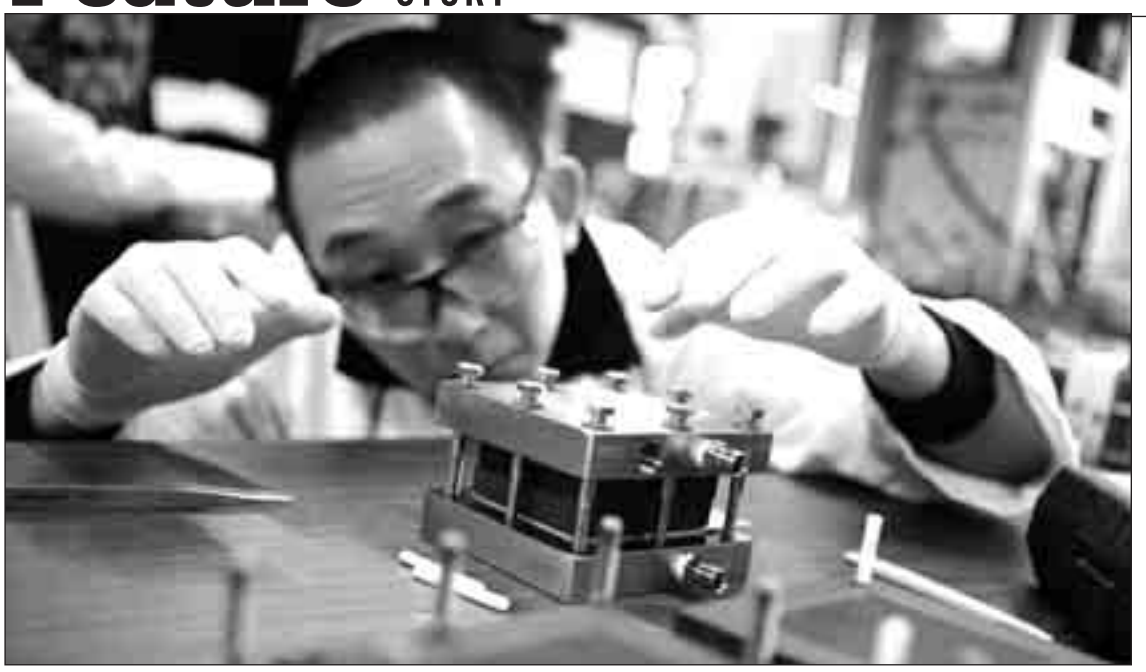

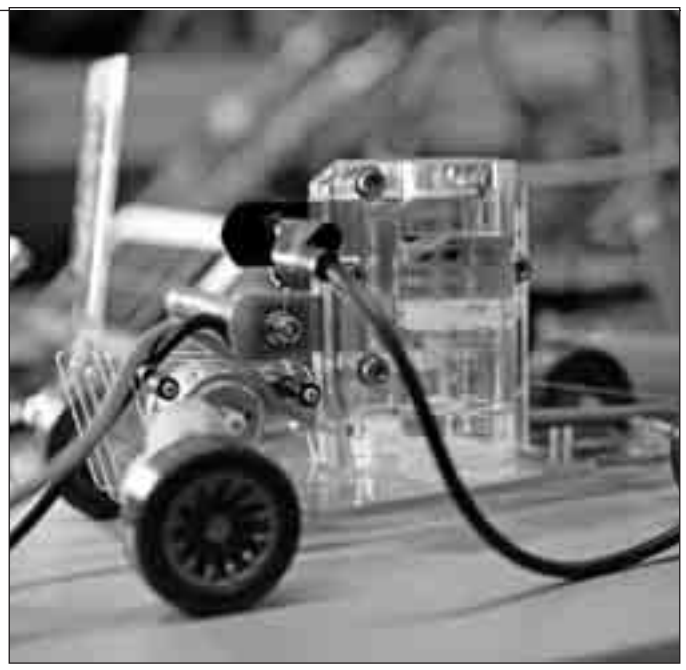

FROM LEFT TO RIGHT: *A hydrogen research laboratory at the National Research Council of Canada Institute for Fuel Cell Innovation in Vancouver. A model car demonstrates how an electric current generated by on board solar cells can be used to make hydrogen to power the fuel cell. A hydrogen research laboratory at the National Research Council of Canada Institute for Fuel Cell Innovation in Vancouver*

envision Whistler as the northern terminus of a real hydrogen highway stretching from B.C. to California along Highway 99 that one day will be dotted with hydrogen fuel pumps right beside the gasoline, propane and diesel pumps, complete with fuel cell vehicles driving along the way.

So how real is the B.C.-to-California hydrogen highway?

"Our premier, Gordon Campbell, and (California Governor Arnold) Schwarzenegger met to talk about the hydrogen highway, and I know there are plans for the governor to come up to B.C. as well, so there are plans to make it a reality," says Nanalal. "California has a number of hydrogen fuelling stations and, of course, B.C. does as well, so it's just a matter of filling in the gaps in Washington and Oregon."

Tanking up hydrogen's capabilities

There's no doubt that Canada, specifically the Lower Mainland, is a world leader in hydrogen and fuel cell technology. Some have even called the area the "Silicon Valley" of the hydrogen world. At the hub lies Burnaby-based Ballard Power Systems, with its powerful alliances with companies like Ford and DaimlerChrysler.

"On the automotive side, given initial commercialization isn't until around 2015, our primary focus is to continue to develop the technology so we will be ready for commercialization. Our goal is to meet targets announced by the U.S. Department of Energy for automotive applications by 2010," says Ballard's chief customer officer, Noordin Nanji.

"That will give our customers time to

It's a Fact

• Together with fuel cells, hydrogen can help address issues related to air pollution, climate change and energy security.

• Hydrogen can be extracted from a variety of sources, including water and other renewable resources such as solar, wind, hydroelectricity and biomass.

• Fuel cell vehicles produce no tailpipe emissions. Rather than burning gas, these vehicles are propelled by electric motors that get their energy from fuel cells, which extract electricity from hydrogen fuel quietly, efficiently and without combustion.

• Hydrogen is neither more nor less inherently hazardous than gasoline, propane, or methane. Hydrogen has been safely produced, stored and used in large amounts in industry for the past 50 years.

— Source: Hydrogen & Fuel Cells Canada, and Hydrogen Highway

take that technology and put it into vehicles that you and I can buy at a dealership."

Ford and DaimlerChrysler have already deployed the largest fleet of fuel cell vehicles in the world — about 130 vehicles: buses, cars and vans — all of them using Ballard fuel cells.

"And all are collecting tons of very, very valuable information so that we can continue to develop the technology the right way," Nanji says.

In the bigger picture, both the hydrogen economy and culture are solidifying. For instance, the federal government is using the fuel efficiencies and other data from hydrogen/fuel cells to validate their greenhouse gas model. And while some would argue that, until the recent financial support for the fuel cell bus program in time for the Olympics, government has not been overly supportive of Canada's young hydrogen economy, the private sector has been pouring in money.

"Canada's private sector is investing more than $200 million per year in hydrogen and fuel cell R&D," says John Tak, president and CEO of Hydrogen & Fuel Cells Canada. "This represents 30 per cent of Canada's entire energy R&D investment by the private sector." And it's totalled $1 billion over five years.

Right now, Canadian employees in the hydrogen sector number nearly 2,000, 57 per cent of them clustered in Western Canada; sector revenues increased by 39 per cent from 2001 to 2005, growing from $97 million to $135 million.

So despite the growth and optimism lining the hydrogen highway, there's no

doubt that the industry is still in its early stages, far from having the energy future secured in its clutches.

"Ultimately, in the future, hydrogen will be the way to go for vehicles, but it's a long way off. In the meantime, renewables like biodiesel are here and now, and can bridge that transition," says Mike Vanstone, operations manager for Delta-based Green Machine Biofuels Ltd.

Ballard's Nanji also sees a multi-facetted progression toward sustainable energy.

"What you'll see is there will be multiple solutions in the future, of which fuel cells will be one," he says. "Today, of course, hybrid vehicles are gaining in popularity, so I don't think fuel cells will become dominant in the sense that the internal combustion engine is dominant until probably the middle of the century."

In the meantime, he's positive about the synergies that are starting to come together around projects like the hydrogen highway.

"It is exciting to see all these different threads coalesce into a vision so that you can now start to see how this could unfold, and what it could do for us," he says. "That has really only started to happen in the last year or two." ■

Good traction with hydrogen off-road

While vehicles are the most obvious symbol of hydrogen and fuel cell use, it's with other applications that the biggest inroads are being made.

"When people think about fuel cells, they do tend to think about automotive applications. It is by far the biggest, but it's also the market that's furthest from commercialization," says Noordin Nanji, vice-president and chief customer officer with Ballard Power Systems. "In our case, we've identified three much nearer-term markets, which we are starting to get very good traction on."

Ballard is currently partnering with the Ebara Corporation in Japan to provide stationary fuel cells in a co-generation application to heat water and generate electricity for individual home use.

Hundreds of Ballard fuel cell products are already in use there, including one at the prime minister's home. They all use natural gas or kerosene to source the hydrogen, but still see a 30 per cent reduction in emissions. As well, the fuel cell products are saving homeowners about $600 per year in energy costs.

Ballard expects fully commercialized residential fuel cell products will be available in Japan by 2012, and envisions similar applications in Germany, Denmark, Korea and parts of the U.S.

> ***"We're replacing batteries*** *that operators of these cell sites don't like, and the battery market is about US$2 billion a year,"*
> ***- NOORDIN NANJI***

The company is also working with Europe-based Dantherm Air Handling A/S to provide fuel cell solutions as emergency back-up power supplies for telecom and broadband applications — another golden opportunity with huge potential.

"We're replacing batteries that operators of these cell sites don't like, and the battery market is about US$2 billion a year," says Nanji.

The third near-term market for fuel cell use is light-duty mobile applications, like forklifts and mobile baggage carriers — situations where goods have to be moved, but emissions cannot be created because of the enclosed environment. Currently, such needs are met with rechargeable batteries, but they have several drawbacks.

"First of all, batteries take up a lot of space. They typically don't last for a full eight-hour shift and even when they do, just like the battery in your flashlight, as the battery runs down, so does the power," he says.

Fuel cells are ideal in such applications. Working with two other local companies, General Hydrogen and Cellex, Ballard has proven fuel cells' worth in trials at Wal-Mart and the Vancouver International Airport. As well, pricing is already competitive, "which is really exciting for us," says Nanji.

"We see it as a great opportunity." ■

Making the hometown hydrogen crowd proud

Hydrogen and Fuel Cells 2007 is an international conference and trade show taking place at the Vancouver Convention & Exhibition Centre April 29-May 2. Organized by the federal and provincial governments along with Hydrogen & Fuel Cells Canada, it's expected to attract up to a thousand delegates and attendees from around the world interested in the latest in hydrogen and fuel cell technologies.

With locally-based leaders participating, such as Ballard Power Systems, Quest Air Technologies (which does hydrogen purification), Cellex Power and Powertech Labs, the event is sure to make the hydrogen hometown crowd proud.

Hydrogen and Fuel Cells 2007 is also carbon-neutral. Toronto-based Cleanairpass.com has determined that 391 tonnes of greenhouse gases will be created to power and transport attendees. By purchasing a cleanairpass, participants are generating revenue used to buy equivalent emission-reduction credits, called "offsets", to compensate for this damage. The money goes toward energy conservation initiatives, technological improvements that lower emissions, or developing clean renewable energy technologies like wind turbines. ■

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FROM LEFT TO RIGHT: *The Angstrom Power "G2" recharging unit containing both a fuel cell and hydrogen storage, charging up a PDA's batteries using a universal connection (USB) for when you don't have access to grid power. The hydrogen-powered car wash in North Vancouver.*