

HOTDOGS FROM THE SUN

By Guy Crittenden



While researching an article ten years ago I visited the Stuart Energy plant in Mississauga, Ontario. The company is named after founder Alexander Stuart who invented the "electrolyser" in 1905 – a technology that uses electricity to separate hydrogen from water. What struck me most was a homespun contraption the owners had set up on the roof of the building: a barbecue fuelled by hydrogen supplied by a small electrolyser unit, itself fuelled by water from a rain barrel and electricity from solar panels.

"We can cook you a hot dog," my host Andrew Stuart said, "using energy taken directly from the sun and rain."

Like an adherent to some cargo cult, over the years the image of a barbecue powered by heavenly forces transfixed me. At the time the technology was most appropriate for use in remote locations where oil and gas are scarce. Yet within a decade Stuart Energy finds itself among a small breed of world leaders in the alternative energy field, at a time when fuel cells and hydrogen are poised to become mainstream. (See article, next page)

Until recently these things might have made an entertaining display at Disney's futuristic EPCOT Centre, nothing more. Yet there's real evidence that the way we power our home and office climate-control systems, our cars, and even small appliances and hand-held devices, is about to change. Best of all, Canadian companies are leading the innovation.

Stuart Energy, for instance, has entered the stationary power market, supplying large fuel cells that do for homes and offices what the rooftop contraption did for hotdogs. The company is joint-venturing with billionaire investor Li Ka-shing to install units in many of the more than 80,000 buildings in Hong Kong that are legally required to have backup power on hand (currently supplied by smoke-belching diesel generators).

Stuart also manufactures fuelling stations for the hydrogen "gas" stations of the future (in fuelling plazas or homes). Fuel-cell cars are moving rapidly from the prototype to commercial phase, with Honda and Toyota each supplying fuel-cell cars to Los Angeles and Tokyo to demonstrate their viability. Many people have heard of the "Freedom Car" – a billion-dollar program of the U.S. Energy Department rooted in the call of President Bush's National Energy Program to reduce American reliance on foreign oil. Fewer people perhaps are aware that in April 2002, Michigan's then-Governor John Engler announced a plan to make his

state a world leader in the development of fuel cells and hydrogen-based technologies. The plan offers a NextEnergy Centre that includes a 700-acre state-owned, tax-free "Renaissance Zone" for high-tech energy innovation.

GM, Ford and Daimler-Chrysler all have prototype fuel-cell cars and hybrids in various stages of design and production. These companies are working with another well-known Canadian company, Ballard Power Systems (based in Vancouver, B.C.), to develop Kyoto-friendly fuel-cell cars that emit no harmful emissions and operate via software that eliminates most of the mechanical systems in today's automobiles (including the engine). Ballard acquired the assets of Coleman-Powermate and, like Stuart Energy, has entered the portable and stationary power generation markets, too.

According to Ron Britton, president of Vancouver-based industry association Fuel Cell Canada, development is expanding rapidly in both macro and micro directions. Some fuel cells will be built for 250-megawatt (or larger) power plants like the one being

installing refrigerator-size equipment in a house, office or factory will make sense soon simply because the units – when equipped with computerized meters – can make hydrogen from electricity when rates are low (e.g., at night), then convert it back for daytime use when rates are high. If enough people do this the "peaks" disappear, fewer new power plants are needed, and everyone's costs go down.

So, hydrogen and fuel cells bring to the power debate the fact that we needn't focus entirely on whether energy comes from hydro dams, nuclear plants, coal-fired stations, gas turbines, wind towers, solar panels or geothermal systems. We can use whatever

"Expert opinions differ over when we're going to run out of oil and natural gas (at least, the easy-to-get stuff)."

demonstrated at the University of Toronto by Kinectrics (spun off from the old Ontario Hydro) that uses solid oxide technology fed by natural gas.

"Large stationary plants can now be built in increments," says Britton, "adding 250 megawatts at a time. This improves the efficiency of the use of capital."

At the other extreme Britton points out that companies such as Casio, Panasonic and Sony will roll out portable products next year that use fuel cells in place of conventional batteries. (Imagine your laptop computer not shutting down after only a couple of hours!)

Expert opinions differ over when we're going to run out of oil and natural gas (at least, the easy-to-get-at stuff). Fossil fuels may peak in 20 years, or maybe not for two hundred, depending on who you talk to. In any case,

combination we prefer of all these, but do so more efficiently using equipment that is already tested and proven. Such ideas, fanciful until now, are only a few years away – in some cases only months.

Don't believe me? Here's a hotdog from the sun, available right now.

GUY CRITTENDEN is Editor-in-Chief of this supplement, a function he also performs for environmental trade magazines **Hazardous Materials Management** and **Solid Waste & Recycling** published by Hollinger's EcoLog Group based in Don Mills, Ontario.



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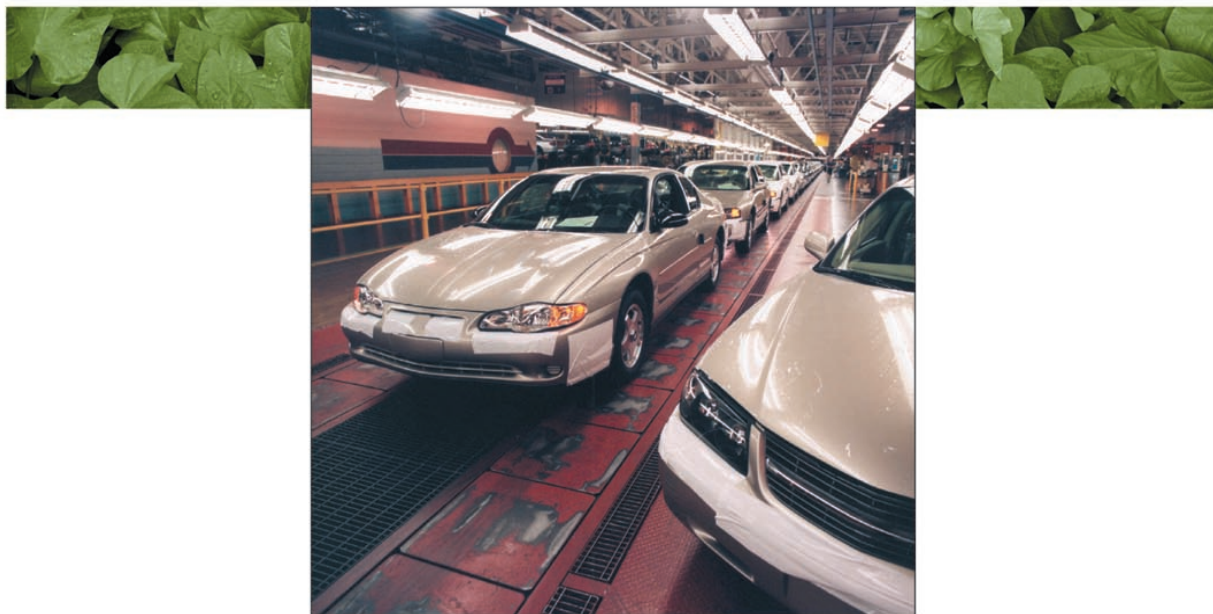


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TIMETOSHINE

MADE-IN-CANADA CLIMATE CHANGE STRATEGIES AND TECHNOLOGIES

By Connie Vitello



The Canadian federal government's vote to ratify the Kyoto Protocol on Climate Change commits the country to cut its greenhouse gas (GHG) emissions to six per cent below 1990 levels (on average) in the period between 2008 and 2012. This initiative upset several industries in Canada, especially oil and gas – but not the environmental protection industry, for which Kyoto spells opportunity. Several innovative made-in-Canada technologies are scrambling to provide solutions.

In its 2003 budget, the feds designated \$2-billion for the Kyoto kitty to support new environmental technologies, renewable energy and alternative fuels. Included in this is the \$250-million Sustainable Development Technology Canada (SDTC) fund.

One company that is already benefiting from these funds is Suncor Energy Inc., the biggest Canadian player in the Alberta oil sands.

Canada's oil sands industry has perhaps the most to lose under Kyoto. The energy-intensive melting and processing of bitumen in the sands to make crude oil uses natural gas and generates a lot of carbon dioxide (CO₂) and other global-warming gases. Suncor has a new technology that captures CO₂ emissions, then injects and sequesters them into a local subsurface coal reservoir to produce enhanced volumes of coal-bed methane. So, while other oil sands stakeholders such as TrueNorth Energy defer plans and rethink spending, Suncor has bucked the trend. (TrueNorth recently deferred construction of its Fort Hills Oil Sands Project, closed its Fort McMurray office and reduced its Calgary office.)

Similar to the SDTC, the federal Technology Early Action Measures (TEAM) program has been a major funder and promoter of new climate change mitigation technologies in Canada, and internationally. The new large wind-power generator at the Canadian National Exhibition is one of the beneficiaries of this program. According to Wayne Richardson, director of TEAM, about 95 projects so far have been awarded \$950-million.

Traditional energy companies such as TransAlta Corporation are now banking on the idea that wind can effectively and profitably complement conventional forms of power generation. Large-scale wind energy facilities are slowly becoming competitive with fossil-fuel generators. In fact, the capital cost of wind power dropped by a third in the last decade and will continue to decrease as more "wind farms" are built. TransAlta recently purchased a major interest in Canada's largest wind energy company, VisionQuest Inc.

The Canadian Wind Energy Association estimates there are well over 3,000 megawatts (MW) of commercially viable wind energy

available for development in Ontario alone (which currently has only 15 MW of wind capacity installed).

Ontario should take a page out of Saskatchewan's book. On April 1, the feds and Saskatchewan Power Corp. (SaskPower) began a ten-year \$26-million agreement to enable the utility to reduce the price of its "GreenPower" product (electricity from green or wind power) by more than 25 per cent. The incentive value is 1.2 cents per kilowatt hour, reducing the monthly premium from \$3.50 to \$2.50. The lower price also means that the government will support enough GreenPower to meet about 20 per cent of the electrical needs in provincial buildings.

A host of other companies that have been toiling in obscurity for years are over the moon about Kyoto, the launching pad they've been waiting for. It's now their time to shine.

Turbocor Inc. of Montreal, Quebec manufactures the world's first oil-free compressor specifically designed for heating, ventilation, air conditioning and refrigeration (HVACR). Since HVACR accounts for 30 per cent of all electrical power consumed in North America, this technology could have a significant impact on decreasing GHG emissions.

Similarly BIOX Corporation of Oakville, Ontario hopes to experience a greater appreciation of "biodiesel," a renewable non-toxic, biodegradable and sulfur-free fuel replacement for petroleum diesel. It will be cost-competitive with petroleum diesel when produced from waste animal fats and recycled cooking greases, whereas other biodiesel production methods can cost significantly more than petroleum diesel.

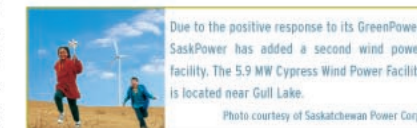
"The government's support for biodiesel is the result of environmental, agricultural and energy security drivers," says Scott Lewis, business development manager of BIOX. "The U.S. Dept. of Agriculture has stated that a two per cent blend of biodiesel made from soy bean oil will boost the value of soybean oil by about 22 per cent, which would effectively get farmers off subsidy. Similar numbers could be experienced for canola."

Meanwhile, ENRG of Burnaby, British Columbia (B.C.) is set to capitalize further on its alternative natural gas and fuel vehicle stations. The company designs, builds and operates natural gas fueling stations to provide a clean fuel option for fleet and individual vehicle owners, including the Los Angeles International Airport, SuperShuttle, and Waste Management Inc.

Alternative energy concepts like solar heating that were once considered ineffective or too expensive are being reconsidered.

According to the Canadian Solar Industry Association, the solar component of energy to the commercial and residential sectors in 2012 (the Kyoto year) could be approximately five per cent of the total market.

But critics wonder if it will ever become economically advantageous. Some estimates say that a residential system would have to run for



Due to the positive response to its GreenPower, SaskPower has added a second wind power facility. The 5.9 MW Cypress Wind Power Facility is located near Gull Lake.

Photo courtesy of Saskatchewan Power Corp.

65 years — about more than twice its guaranteed life — to pay for itself. Even so, an increasing number of people are investing in it for the environmental value alone, and the technology is improving. By substituting solar energy for conventional power over 20 years, a single residence could keep 115,000 kilograms of CO₂ out of the atmosphere. That's as much GHG emissions as a car would emit driving ten times around the world.

Another concept poised for success is geothermal energy; these systems use the constant earth temperature and heat exchangers for heating and cooling needs. One variation in particular is expected to make waves when it starts using cold water from the bottom of Lake Ontario to cool buildings in Toronto's downtown core. Toronto is working with NRCAN's Community Energy Systems to use the cool lake water as an agent in heat exchangers, thereby eliminating the need for electricity-intensive refrigerants. If the expected 90 per cent reduction in climate-control-related electricity costs is achieved during the trial, it's expected that half the city core will be serviced this way by the end of the decade.



This Mercedes-Benz Sprinter van powered by a Ballard® fuel cell engine may be ready for market soon. DaimlerChrysler unveiled it in August 2001.

Photo courtesy of Ballard Power Systems.

Then there's biomass — energy systems that use renewable sources. For instance, Dell-Point of Montreal produces a U.S. EPA-approved stove that burns wood pellets or shelled corn as a fuel source.

"It would cost me \$1,500 per year to heat my 2,500 sq. foot home with natural gas and about \$3,000 for electricity," says Mike Thomas, P. Eng., president of Efficiency Engineering Inc. of Cambridge, Ontario, which provides cost-effective energy auditing and retrofit design. "But I only pay \$900 per year for my stove and fuel sources." While a small change, it reaps significant benefits for the

TIMETOSHINE (CONTINUED)

environment as well as his pocketbook.

It seems that hydrogen energy may have the biggest potential in the new Kyoto impacted economy.

There's been a lot of hype about hydrogen, which is not an energy source but rather a storage and transmission medium made either by reforming natural gas or splitting hydrogen from water with an electrical current. If nuclear energy is the source — a concept promoted recently by no less a hydrogen fuel cell luminary than Canada's Geoffrey

Ballard—there are no fossil-fuel type emissions. But the tricky business of what to do with the nuclear waste remains. Speaking of Ballard, according to a recent report by PricewaterhouseCoopers, companies such as Ballard Power Systems Inc. of Burnaby, B.C., are part of an industry that spends about \$150-million annually on research and that could provide 108,000 direct and indirect jobs in the transportation sector by 2011.

Analysts, however, say that the industry faces enormous challenges in unseating long-established

technology such as the internal combustion engine and providing a proper infrastructure such as refueling stations.

Chris Curtis, vice president of Fuel Cells Canada, an association that represents 46 companies in the fuel-cell sector, admits Canada is not as competitive yet as other countries in this area and a concerted coordination effort is needed from the government. Even an industry leader like Ballard isn't expected to become profitable until 2007 at the earliest.

But controlling transportation emissions is critical for Kyoto compliance and could spur hydrogen and fuel cells. Studies indicate that transportation accounts for about half of Canada's GHG emissions. With an eye to the environmentally conscious consumer, companies such as Ballard are helping automakers design cleaner, more efficient vehicles.

Ballard has developed fuel cell modules and hydrogen and methanol-fueled fuel cell engines to integrate into both light and heavy-duty vehicles. As an example, DaimlerChrysler unveiled the Mercedes-Benz Sprinter powered by a Ballard fuel cell engine in August 2001. The delivery-company Hermes Versand Service is field-testing the hydrogen fuel cell vehicle under everyday conditions for two years in Hamburg, Germany.

Other fuel-cell concepts are moving forward. Siemens Westinghouse recently produced the world's largest solid-oxide fuel cell power plant. Siemens and Ontario Power Generation (OPG) are set to carry out the first pre-commercial demonstration of this technology at the University of Toronto at Mississauga (UTM) starting this fall. The proponents say the unit, which will cost-effectively produce about eight per cent of UTM's current electricity and hot water needs, is suitable for small industrial sites, universities, hospitals, or even neighborhoods.

Stuart Energy Systems Inc., another TEAM beneficiary, is also hopeful. In addition to manufacturing "electrolyser" machines that make hydrogen from water, Stuart produces an appliance to produce hydrogen for use in small installations (i.e., private homes) to refuel vehicles powered by hydrogen, and also a larger fuel-delivery system that converts water to hydrogen at commercial refueling stations. These systems can reduce the cost of hydrogen production and distribution and increase its practicality.

With the plethora of strategies and technologies now on the market, it will be interesting to see how Canada will adopt to the new Kyoto diet. Like the lure of fast food, traditional energy sources are easily accessible and cheap but alternative technologies and energy sources seem to be better for us in the long run.

"We'll never fully replace fossil fuels," concludes Mr. Thomas. "Rather, it will be a combination of sources that will allow us to meet our energy needs economically and environmentally."

CONNIE VITELLO is a magazine editor for the EcoLog Information Resources Group, a division of Hallinger's Business Information Group.

ENVIRONMENTAL FUNDS

By James Sbrolla



ARE ETHICAL INVESTMENTS REALLY HELPING CLEAN UP THE EARTH?

On the face of it, most people would assume that "environmental" investing is investing in companies with especially good environmental track records or that are part of the waste management or pollution prevention industries. One investment vehicle whose name holds such connotations is the Clean Environment Fund which is managed by the Acuity Group, based in Toronto.

The fund has a social conscience edge to its marketing strategy and has had admirable results. According to Martin Grosskopf, investment analyst with Acuity, "Recently, the Clean Environment has returned to the excellent performance which characterized it during most of the 1990's. Fundata Canada indicates that among Canadian growth equity funds, the Clean Environment Fund comes up 18th out of 574 funds for the year to April 1st."

The fund does invest in companies that are good corporate and environmental citizens and could be a good investment.

According to Ian Ilnatowycz, Acuity's President, "Clean Environment Fund invests in companies that are positioned to benefit from key trends in sustainable development."

But if you think that this translates into investments in companies that design better equipment or novel strategies to clean up oil spills, improve indoor air quality, prevent toxic muck from entering lakes and streams, or combat global warming, you're likely to be disappointed. By and large, it doesn't, and neither does anybody else. And its reluctance to do so (along with other venture capital providers) has created a severe shortage of cash among the entrepreneurs society hopes will eventually solve its most pressing ecological problems.

The top ten holdings of the Clean Environment Fund make the point. The biggest holdings include financial institutions such as The Royal Bank at 4.5 per cent, information technology provider Cognicase at 5.2 per cent, and even such companies as hardware chain Lowes that no one would normally think of as an "environmental company."

While none of these companies likely has a smokestack or wastewater pipe spewing hazardous material into the air or water, few if any fit the bill of what many folks would assume are an "environmental" business. And even going further down the list, few if any holdings are companies at the forefront of developing new technologies to serve the supposedly important environment industry.

At number seven there's Canadian Crude Separators, an oil field service provider. The four per cent interest in Headwaters Inc. sounds the most like an environmental play. Headwaters Internet home page states that the company "provides technologies and services that maximizes the value of fossil fuels." That's about it.

There are many hot environmental issues today. The federal government recently agreed to ratify the Kyoto climate change accord. After Walkerton, there's concern about clean drinking water, sewage treatment systems and polluted groundwater. Many former industrial sites are being rehabilitated and developed commercially. A recent study, "Environmental Protection in Canada", conducted by Envionics International in conjunction with trade journal *Hazardous Materials Management*, estimates the value of the products and services that tackle all these problems at more than \$4.7-billion dollars. According to the report the industry is growing rapidly.

Yet the Clean Environment Fund has little involvement with these kinds of companies and no one else is capitalizing on this either.

Confronted with this, the fund managers point out that many of these companies are not at a stage of development that allows them to invest

investment for tax motivation purposes limited to \$5,000 per individual investor, there's limit to the appeal.



The government has tried to help. For instance, Ontario's Ministry of Environment actually has a Green Industry Office that does an admirable job of

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and their market cap is too small for their investment criteria.

Says Ilnatowycz, "We have very few positions, currently three, in companies with less than \$100 million in market cap, and none with less than \$50 million."

This is a problem that plagues micro-cap companies in other industries, but it's especially troublesome for the environment industry which is highly fragmented with a few large players and many small ones.

If the name brand green and ethical funds won't or can't invest directly in the innovative environment companies, who else might?

One alternative is "labor sponsored investment funds." These are tax-driven vehicles that have generally provided lousy results with high management expenses. Some, namely the E2 Venture Fund and Venture Link Brighter Futures Fund (both based in Toronto), have an environmental focus, but with the maximum

bridging the gap between business and government. However, there's little awareness in the investment community about this agency and it hasn't been the investment magnet some had hoped.

New technology development and industry penetration take a long time and investors today are generally not patient. Let's hope that soon someone on Bay Street figures out a way for investors of all sizes and budgets to capitalize on growth in the environment business, for their own benefit and that of the companies. If they do, investors could be "cleaning up" in every sense of the word.

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