

NRC Technology Clusters

COMMUNITY INNOVATION, ECONOMIC GAIN

Through dynamic and rapidly growing technology clusters, the National Research Council advances world-class R&D in collaboration with Canadian communities. Using its research facilities as hubs for community innovation, NRC partners with universities and industry to inject local drive into the Canadian economy.

Vancouver—Fuel cells

NRC's Vancouver-based technology cluster is the world's fastest growing and most sophisticated grouping of companies and organizations focused on fuel cell and hydrogen-energy technologies. A study by a leading American market-research company, predicts Canadian fuel cell industries—most of which reside in Vancouver—will seize nearly 30 percent of an estimated US\$2.4 billion share of the world fuel cell market in 2007. By 2017—when experts say the global industry will be worth trillions of dollars annually—NRC's early strategic investments will have primed the Vancouver cluster for a significant market share.

Strategically positioned players

While pockets of fuel cell research exist in other locations across Canada, Vancouver remains the national hub for groundbreaking R&D, accounting for nearly 70 percent of 1,405 Canadian jobs in the field.

This concentration of activity coincides with an aggressive development strategy launched by NRC in 1998 to position the region as an

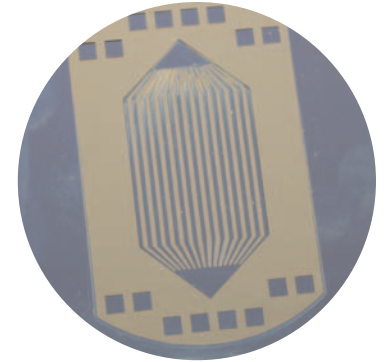


important player in the highly competitive global fuel cell marketplace. A key part of NRC's approach was the creation of a task force that determined how best to conduct fuel cell R&D in Canada with Vancouver serving as the focal point. The plan sparked a number of important initiatives:

- construction of a state-of-the-art fuel cell research facility at the NRC Institute for Fuel Cell

Innovation, and building local hydrogen and fuel cell expertise

- creation of Fuel Cells Canada, a national association dedicated to accelerating Canada's hydrogen and fuel cell industry
- development of the Fuel Cell Program, a national research initiative that taps into the talent of NRC's best minds from six of its major research facilities across Canada.



Partnering to commercialize research

The strategic focus of NRC's cluster is to maintain Canada's early leadership in the emerging field of fuel cell R&D. To reach this goal, NRC supported Canada's Fuel Cell Commercialization Roadmap, a federal government initiative that assembled 40 stakeholders to identify opportunities in fuel cell R&D and map a strategy for technology commercialization. The strategy has been a resounding success. The number of organizations partnered with NRC to bring pioneering technologies to market has doubled over five years, bringing the total to 19 industrial collaborations, 14 university partnerships and eight international projects.

NRC has strengthened its relationships with three local universities to help develop highly qualified personnel for local industry, establish hydrogen and fuel cell consortiums and leverage resources. And, NRC has recently added 20 senior researchers to its 115-strong team of experts as well as extending training in hydrogen and fuel cell technologies.

Transforming technology into business

NRC offers strategic services to businesses that wish to take their innovations to market—easing the transition from small start-up company to bona fide industrial presence.

ASSISTING WITH INDUSTRIAL RESEARCH

The NRC Industrial Research Assistance Program provides a range of financial and advisory services to Canadian hydrogen and fuel cell SMEs. Through its extensive network of professional advisors, the program links these companies to appropriate sources of technical and business expertise, market information and local financing. It also facilitates international connections via technology trade missions to regions such as China and Europe.

This NRC program has developed close relationships with the majority of the fuel cell firms in B.C., supporting early R&D and pre-commercialization of fuel cell products.

Over the two-year period from 2003 to 2005, it funded 30 projects for a total contribution of \$1.5 million to 13 B.C. firms.

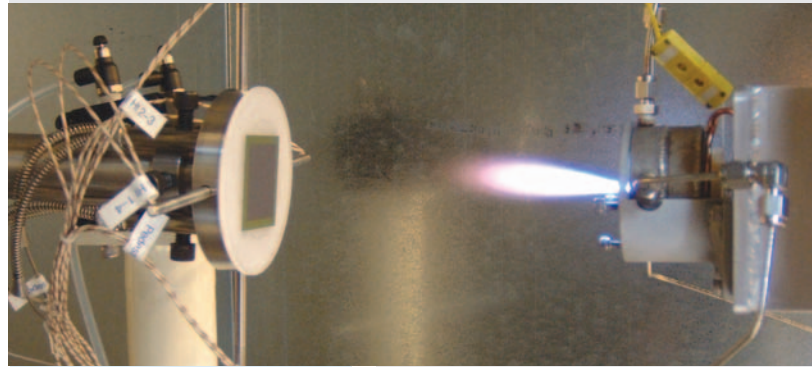
Best available science and technology literature

NRC maintains full-time information specialists to supply researchers and external clients with leading-edge scientific and technical documents, and business-related services. Users can take advantage of:

- pioneering technical information
- literature searches
- cutting-edge industry and market information
- patent information
- rapid delivery of up-to-date full text articles from online sources
- referrals to industry experts or organizations

COMMUNITY ENGAGEMENT

- 1998—NRC sparks cluster formation with task force
- 1999—NRC establishes a fuel cell lab at its Vancouver Innovation Centre
- 2000—NRC helps establish Fuel Cells Canada, a national industry association
- 2002—planning begins for NRC research institute
- 2003—NRC and Western Economic Diversification announce \$1.5 million for Hydrogen Technology Environmental Chamber, unique in North America
- 2003—NRC drives the launch of a Canadian Fuel Cell Commercialization Roadmap, a multi-stakeholder initiative
- 2004—Prime Minister unveils Hydrogen Highway™ at Globe 2004 conference
- 2004—NRC receives \$15 million in new federal funding for NRC Institute for Fuel Cell Innovation



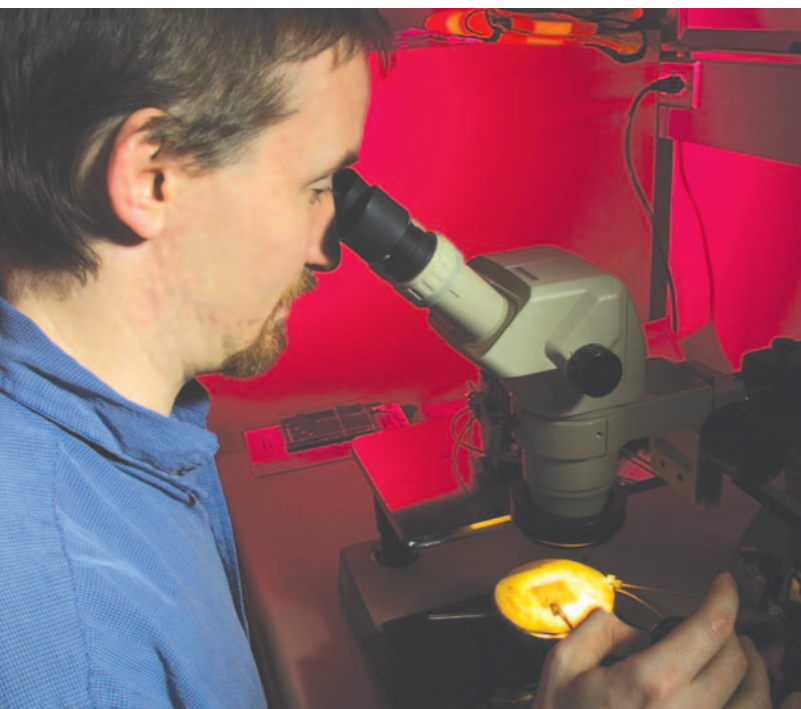
DEMONSTRATING FUEL CELL POTENTIAL

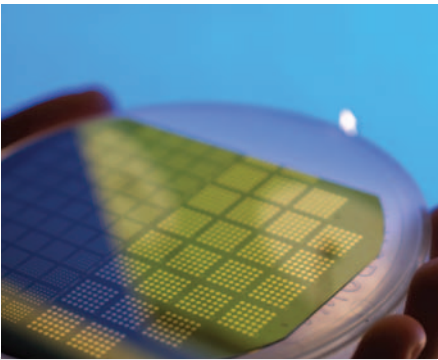
To nurture its Vancouver cluster, overcome technical and non-technical barriers to technological deployment, and attract the top minds in fuel cell R&D, NRC showcases groundbreaking technologies and companies through a series of demonstration projects. Demonstrations include:

- a hydrogen refueling station and storage tower that power Ford Focus fuel cell vehicles
- photovoltaic panels that transform solar energy into hydrogen to power fuel cells
- a five-kilowatt solid-oxide fuel cell generator that provides heat and power to buildings

CLUSTER FACTS AT A GLANCE

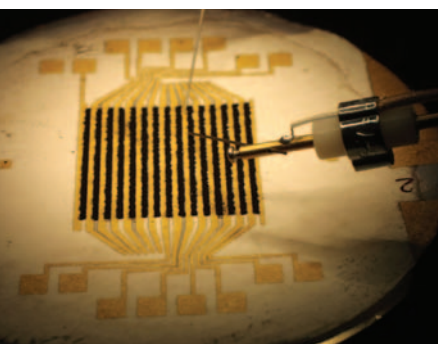
- International fuel cell market will be worth US\$2.6 trillion by 2021.
- In 2004, Canadian fuel cell companies generated revenues of \$133 million.
- Vancouver is home to more than 70 percent of the 1,405 people employed in fuel cell R&D in Canada.
- R&D expenditures increased from \$218 million in 2003 to \$237 million in 2004—an increase of 8%.
- Hydrogen Highway to be operational by 2010 Winter Olympics.





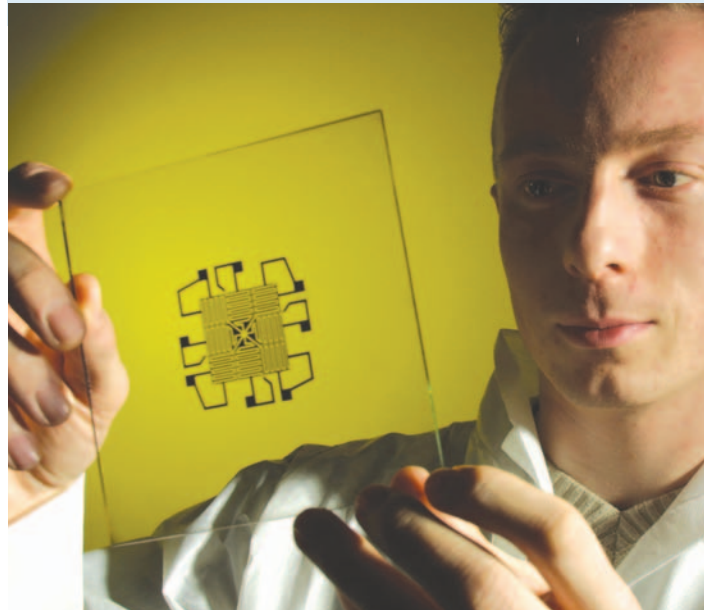
BLAZING A TRAIL

British Columbia's Hydrogen Highway™—led by Fuel Cells Canada and NRC's Canadian Transportation Fuel Cell Alliance—is an integral component of NRC's fuel cell cluster strategy. Envisioned as a key attraction at the 2010 Winter Olympic Games, the highway will extend north from the Vancouver airport to the Resort Municipality of Whistler. A new NRC research facility will be one of seven hydrogen centres along the highway featuring hydrogen refueling infrastructure and a variety of transportation, micro and stationary fuel cell demonstrations.



UNIQUE OPPORTUNITY FOR SMEs

As part of its strategic investment in fuel cell research, NRC operates a cutting-edge, public testing facility unique in North America. Called the Hydrogen Technology Environmental Chamber, the facility—which can simulate the climactic extremes of the Northern Territories, Winnipeg, or Mexico City—enables SMEs to test pioneering fuel cell ideas, and prepare their innovations for commercial markets.



RESPONDING TO INDUSTRY NEEDS

To meet the evolving needs of Vancouver's fuel cell cluster, NRC relocated in 2006 to a new, \$19 million research facility on the grounds of the University of British Columbia. At its new facility NRC focuses on three key research areas:

- proton-exchange membrane technologies
- solid-oxide fuel cell technologies
- new materials development to advance hydrogen generation, compression and purification technologies

NRC'S CLUSTER PARTNERS

- Fuel Cells Canada
- Simon Fraser University
- University of British Columbia
- University of Victoria
- Government of British Columbia
- Western Economic Diversification
- Natural Resources Canada
- Industry Canada
- Environment Canada
- National Defence Canada
- International Trade Canada
- Transport Canada

“NRC-IRAP has been the strongest of all government programs in research that Angstrom has been involved with. They understand their mission, contribute in more ways than money and are a valued contributor to Angstrom's R&D program. In addition they have tried to link Angstrom with other research groups within NRC with the aim of accelerating development and reducing costs. The support has been extensive.”

Dr. Ged McLean , Founder and CTO, Angstrom Power Inc.



NRC Technology Clusters

GLOBAL REACH—LOCAL TOUCH

NRC has played a critical role in the development of emerging and mature clusters, acting as a catalyst for technological progress and economic growth in every region of Canada. Its successful clustering model encourages and supports local strengths while leveraging NRC's national and international resources, science and technology capabilities, networks and partnerships. This proven approach ensures that each cluster can develop according to its unique needs, opportunities and challenges.

Committed leadership

Successful clusters need staying power, often taking decades to mature. The building process must be community-driven and focused, and must have the support of effective networks and committed local champions.

For many years, NRC has distinguished itself as an effective catalyst for cluster development, providing not only R&D expertise, but also the leadership clusters need to move research out of the lab and put it to work for Canada's economy.

NRC stimulates the growth of world-class technology clusters, putting its leading-edge research to work in innovative communities across Canada.



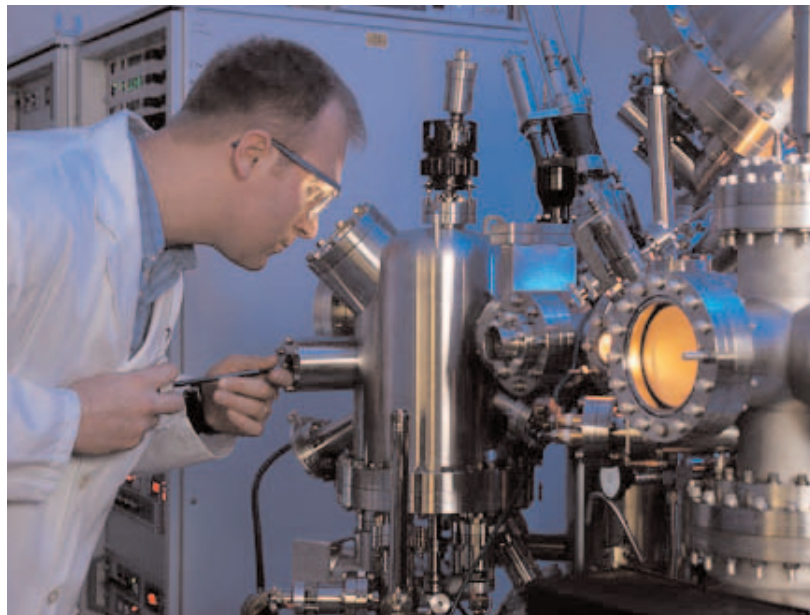
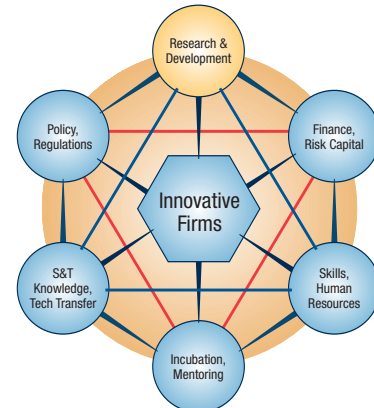
● NRC Technology Cluster Initiatives

Delivering results

Clustering is a term economists have borrowed from science to describe the significant concentration of innovative companies around a nucleus of R&D facilities in a single locale – the ideal environment for innovation to flourish.

A key ingredient is the presence of a science and technology anchor—usually a government research institution or a university—able to work with local companies, transfer technology and spin off new enterprises.

Innovative, knowledge-based firms act as a magnet, attracting others with technical and business expertise to locate and invest in the area. Over time, partners grow into a critical mass of skilled people, capital and entrepreneurial drive.



GREAT PEOPLE, GREAT MINDS

Recognized globally for cutting-edge research and innovation, the National Research Council helps Canada create a world-class, knowledge-based economy. NRC is home to nearly 4,000 creative and skilled people held in highest regard by their colleagues and collaborators worldwide. NRC employees have earned international acclaim for excellence and for winning innovations – their honours include a Nobel Prize, an Academy Award, and helping Canada capture Olympic Gold.

<http://ifci-iipc.nrc-cnrc.gc.ca>

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