



UBC & NRC-IFCI

From Research Partners to 'Living Laboratory'

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September 27, 2010



National Research
Council Canada

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Canada



The seeds of collaboration...





Evolving to meet industry needs

1987

BC Research



Tribology & Mechanics, Machinery Research, Sensors & Control Technology, Integrated Manufacturing Technologies

1998

East Mall



Innovation Centre: NRC sparks HFC cluster formation

2011



UBC-CIRS: deploying & evaluating integrated clean energy solutions in a 'living laboratory'

2006



UBC-CERC: collaborating to advance technology in the energy sector

2006

Wesbrook Mall

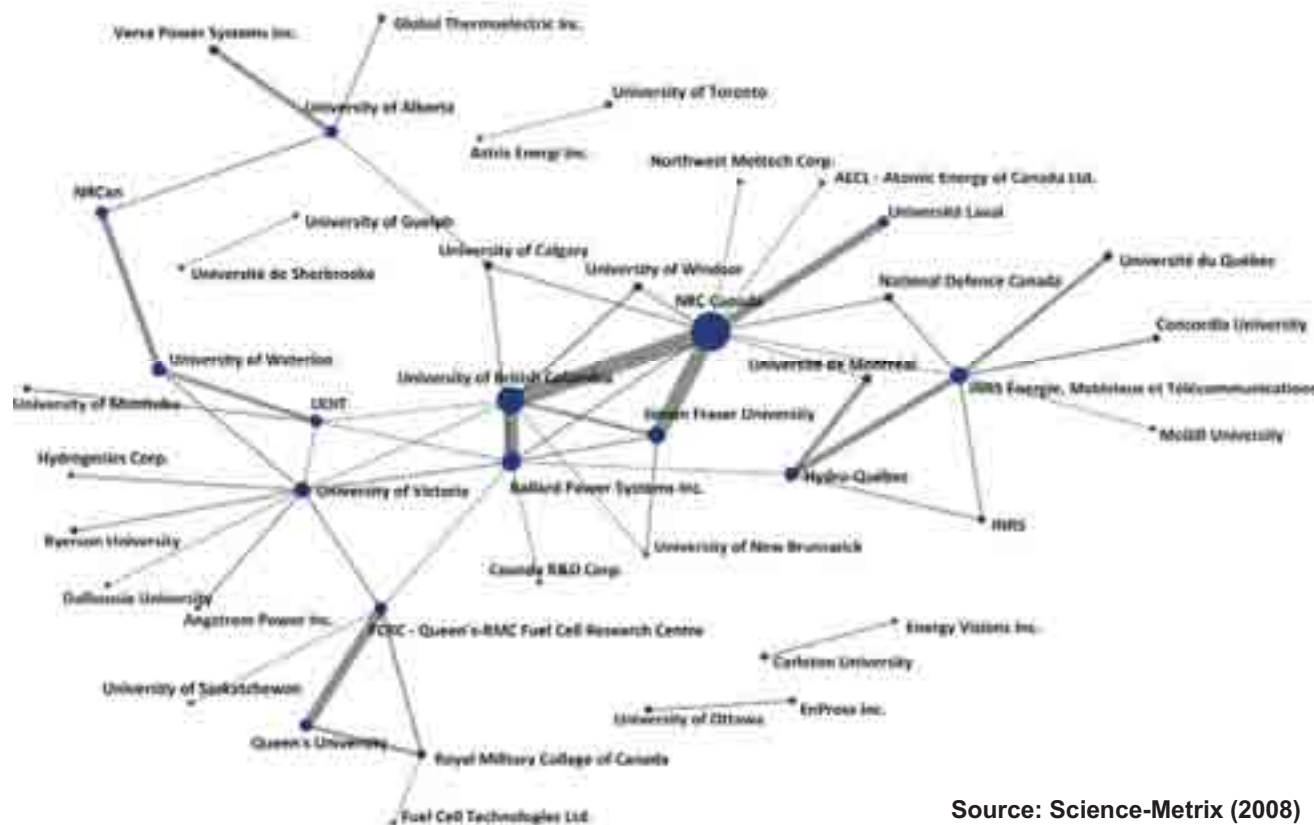


IFCI: sustainable architecture design, H₂-safe labs, Advanced Testing & Validation Centre, incubation space for SMEs



NRC-UBC: most important HFC collaboration hub in Canada

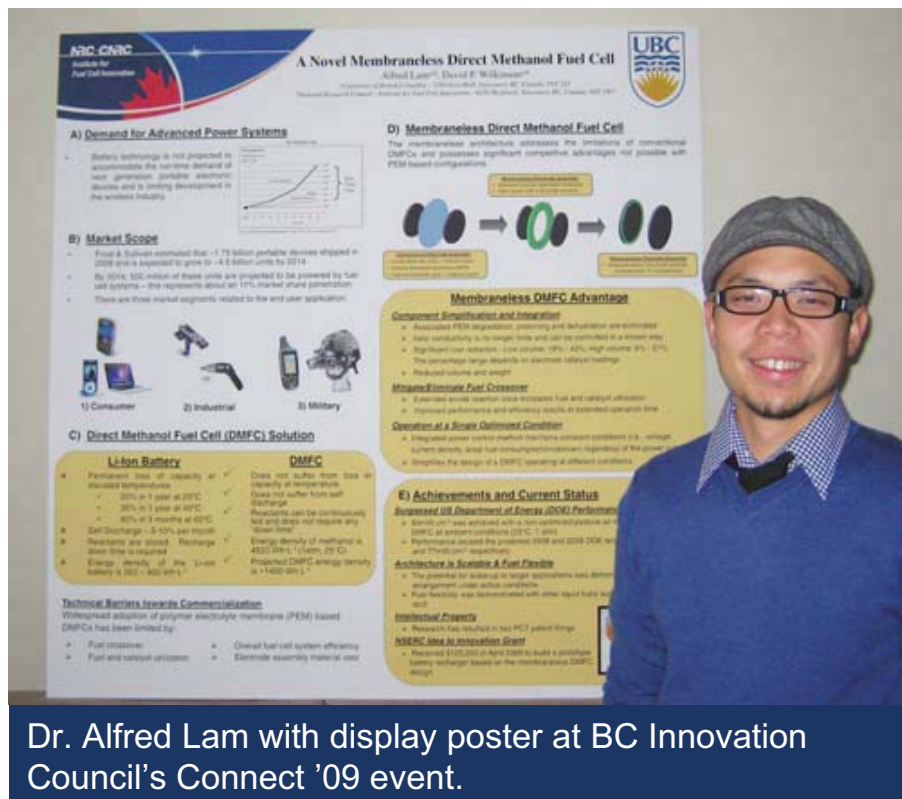
Fuel Cell Research Collaboration Networks between Leading Canadian Institutions, 1996-2007



Source: Science-Metrix (2008)



Technology breakthroughs

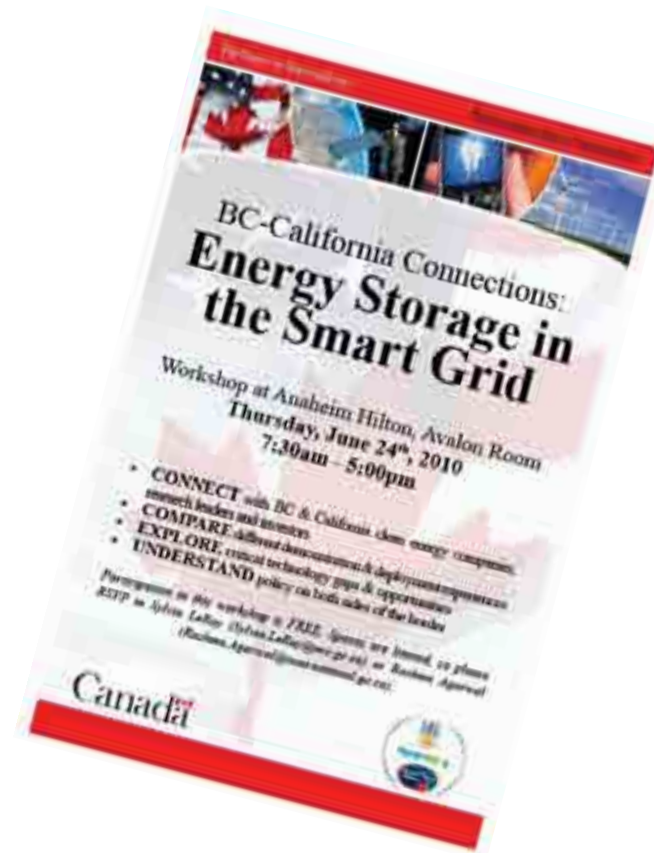
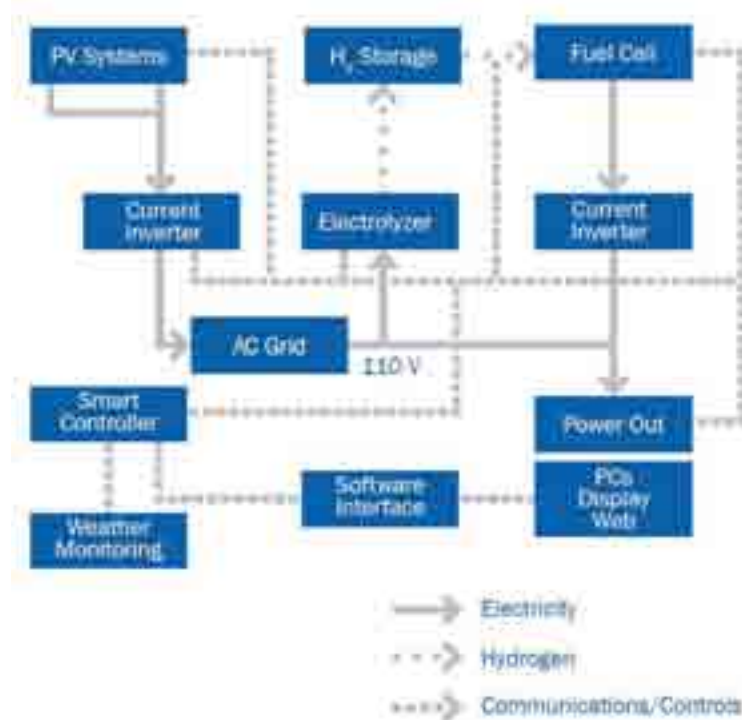


- 9 inventions & 5 patents pending
- **Commercialization opportunity:** membraneless direct methanol fuel cell (DMFC)
 - Building prototype battery recharger based on the new technology with support of NSERC Idea to Innovation (I2I) grant
 - **Market applications:** alternative to battery technology in electronic and portable devices



Building & linking technology clusters

Multiple Technologies for Integrated Clean Energy Solutions





Our 'living laboratory' is growing!



- NRC & UBC partnership is key to meeting societal aspirations:
 - **National:** world leaders in clean energy
 - **Provincial:** becoming a clean energy powerhouse
 - **Municipal:** the “greenest city in the world”
 - **UBC:** net zero campus by 2050

NRC-IFCI is proud to join UBC 'living laboratory' and help bring these aspirations to life



Opportunities in Clean Energy R&D

at the National Research Council Canada

Dan Wayner
Vice-President, Physical Sciences
September 27, 2010



National Research
Council Canada

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Canada



Solving Tomorrow's Problems Today



Transportation Safety



Medical technology



Disease prevention



Environment



Clean Energy



Safety



Sustainable infrastructure



CLEAN ENERGY RESEARCH

at the National Research Council of Canada

Energy Generation:

- Fuel Cells
- Photovoltaics

Energy Storage:

- Hydrogen
- Batteries

Applications:

- Aerospace “Green” Roadmap Initiative
- “Green” Building Initiative
- National Bioproducts Program
- Hydrogen and Fuel Cell National Program



National Program on Hydrogen and Fuel Cells





Lithium-ion battery research

Stats and accomplishments:

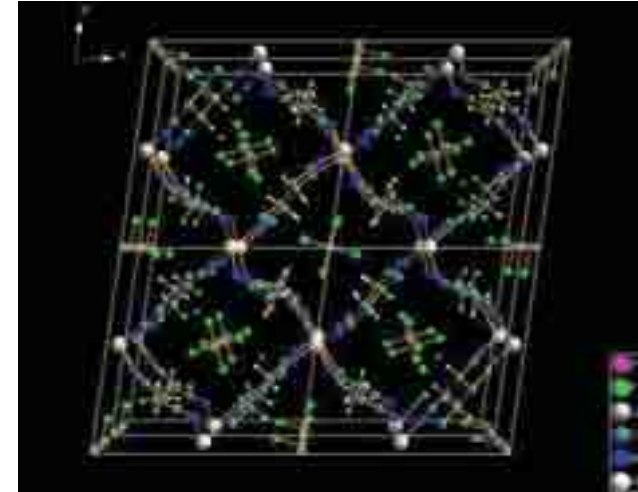
- 25 years of li-ion battery research
- Hundreds of published papers and conference presentations
- 10 li-ion technology patents

Battery materials research to develop:

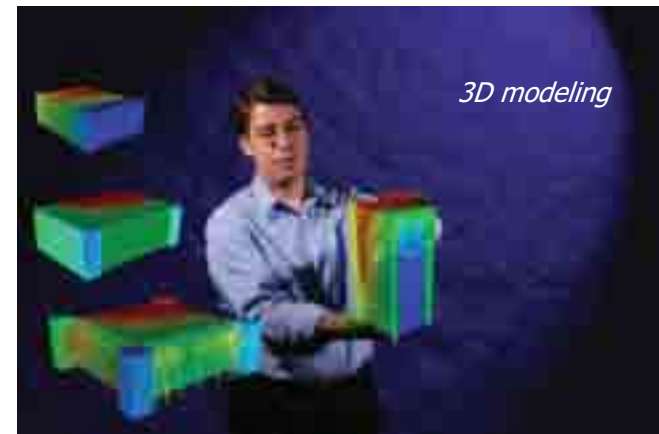
- Higher power densities
- Longer cycle and calendar life
- Broader operating temperature
- Enhanced reliability and safety, even under abusive conditions
- Specific solutions using electrolytes, anodes and cathodes

Battery modeling and simulation capabilities:

- Thermal effects modeling
- Overlay of battery aging behaviour
- Thermal management strategies and battery management methods



Crystal structure of novel battery electrolyte



3D modeling



Photovoltaics

- Printable organic
- Semiconductor

- Collaborations with industry, universities and government leading to advancements

NRC holds the world record for photo-efficiency with a conversion efficiency of 6.2% for an organic photovoltaic cell





CLEAN TECHNOLOGY

research programs

New revenue streams for the
forestry and agriculture industries

“Eco-materials” for light-weight cars and planes

Renewable gas from waste sites

Biofuels from marine algae



Alternative/Clean Energy-Integrated Solutions

Biofuels from marine algae

Institute for
Marine Biosciences

Plant Biotechnology
Institute

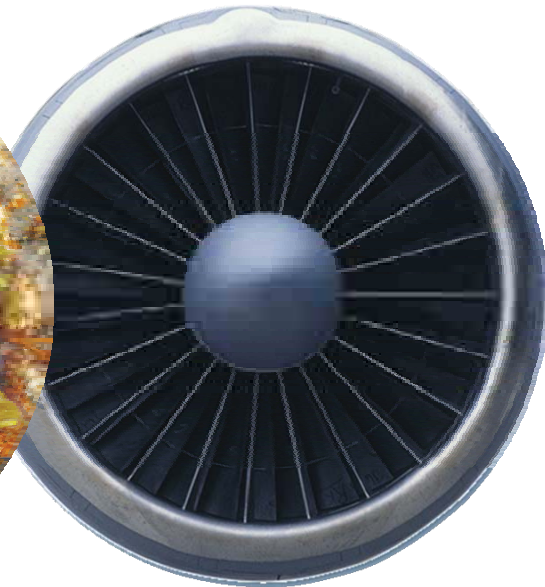
Institute for
Aerospace Research



Identify most suitable
strains and growing
conditions



Genetically enhance
needed properties
of algae



Ensure fuel produced
from algae can power
jet engines



Productive Partnerships

2008-2009

Canadian Collaborations: \$372M

International Agreements: \$179M



Industry



Academia



Federal organizations



Provincial governments



International partners



Thank you



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