

# Ontario Fuel Cell Research and Innovation Network

*Realising the Full Benefits of Fuel  
Cell Power in Ontario*

Brant Peppley  
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# Introducing OFCRIN



- The Ontario Fuel Cell Research and Innovation Network (OFCRIN) is a partnership between industry and university researchers that is working towards overcoming the technical roadblocks to realising the full economic and environmental benefits of implementing (stationary and portable) fuel cell power technologies.

# Goals of the Research and Potential Impacts



- Address the technical barriers to fuel cell commercialisation with world-class research.
- Support the growth and success of fuel cell related commercial activities in Ontario.
- Bring together a multidisciplinary, highly motivated team of world-class scientists and engineers.
- Ensure that Ontario continues to be a leader in the development of fuel cell related technologies.
- Develop a pool of highly trained individuals for the growing fuel cell industry.

# Goals of the Research and Potential Impacts

- Annual reduction of GHG emissions in Ontario by an estimated 9000 tonnes of CO<sub>2</sub> per year through the installation of 2000 kW of off-grid and distributed fuel cell power products.
- Creation of 800 to 1,000 new skilled jobs for the design and manufacture of fuel cell systems and components.
- Creation of 15 to 20 new businesses in the fuel cell sector.
- Creation of 80 to 100 highly qualified personnel at the M.Sc. or Doctoral level.

# Goals of the Research and Potential Impacts



- The fundamental mission of the OFCRIN is to generate knowledge that leads to innovation.
- Intellectual property is one of the most important metrics.
- Proof that companies are using OFCRIN knowledge in their business is important.
- Creating new business and businesses in Ontario is also a measure of success

# OFCRIN Team

(17 researchers/8 universities)

## Ottawa

- Javier Giorgi
- Marten Ternan

## RMC

- Nicolas.Cunningham
- Chris Thurgood

## Queen's

- Boyd Davis
- Kunal Karan
- Kim McAuley
- Patrick Oosthuizen
- Jon Pharoah

## UOIT

- Peter Berg

## Toronto

- Charles Mims

## McMaster

- Anthony Petric
- Gu Xu

## Waterloo

- Michael Fowler

## Western

- Jin Jiang
- Andy Sun

# OFCRIN Private Sector Partners

## Energy Systems and Technologies

Enbridge Gas

Ballard Power.

Hydrogenics Corporation

UNENE (University Network of Excellence in Nuclear Eng.)

## Emerging Technologies

Ballard Power

Hydrogenics Corporation

QuestAir Industries

REB Research

## Materials and Advanced Manufacturing

DaimlerChrysler

Dana Corporation

E.I. du Pont of Canada

INCO

Kingston Process Metallurgy

## Other

Enpross

# OFCRIN and the other ORF fuel cell proposal

- There was a second unsuccessful fuel cell proposal in the Round 1 RE program.
- The other proposal was led by Xianguo Li and focused on transportation-related fuel cell research and development.
- OFCRIN has been asked to allocate \$50K to \$100K to work toward consolidating the two groups into a single network by the end of the five year project.

# Themes in OFCRIN



- Theme A: fuel storage and supply
- Theme B: reliability and durability issues
- Theme C: fuel cell design
- Theme D: materials development
- Theme E: systems analysis.

Projects were defined in each Theme area based on either directed private sector funding or opportunities for productive collaboration.

Since the application was submitted, some projects have been changed due to changes in private sector support

# Theme A Projects



- A-1: The Development of Advanced Hydride Systems for Hydrogen Storage (Davis – Queen’s, Peppley – RMC, DaimlerChrysler)
- A-2: Development of Autothermal Reformer for Fuel Cell Systems (Peppley and Thurgood – RMC, QuestAir Industries)
- A-3: Fuel Processor Component Development (Karan – Queen’s, Peppley – RMC, Dana Corp)

# Theme B Projects



- B-1: Reliability and Durability of PEM Fuel Cell Components (Fowler – Waterloo, Peppley – RMC, Hydrogenics Corporation, E.I. du Pont Canada)

# Theme C Projects



- C-1: Modelling of Autothermal Reformer for Design Optimisation (Oosthuizen – Queen's, Thurgood – RMC, QuestAir Industries)
- C-2: Fundamental Modelling of PEM Fuel Cells (Pharoah, Karan, McAuley – Queen's, E.I. du Pont Canada)
- C-3: Modeling of MCFC Systems (Berg – UOIT, Thurgood – RMC, Enbridge)

# Theme D Projects (pg 1)



- D-1: Alternative Cathode Materials for Bio-Fuel Cells (Petric and Xu – McMaster, INCO)
- D-2: SOFC cathode fundamentals using stable isotope techniques (Mims – Toronto, Karan – Queen's)
- D-3: High Conductivity Zebra Cell Membrane (Petric and Xu – McMaster, INCO)
- D-4: Flow-Field Plate Composite Material Development and Processing (Cunningham – RMC, Karan – Queen's, E.I. du Pont Canada)

# Theme D Projects (pg 2)



- D-6: Direct Hydrocarbon Low Temperature Fuel Cell Development (Ternan and Giorgi – Ottawa, Peppley – RMC, EnPross, Enbridge)
  - D-7: Nano-Materials for PEM Fuel Cells (Sun – Western, INCO)
  - D-8: SOFC Anode Development (Giorgi – Ottawa, Karan – Queen's, EnPross)
- \* Project D-5 was eliminated due to withdrawal of private sector partner since submission of proposal

# Theme E Projects



- E-1: Development of a Controllable Power Interface for a Fuel Cell Power Module (Jiang – Western, UNENE)
- E-2: Systems Analysis of Hybrid Turbine - Fuel Cell Power Systems (Oosthuizen – Queen's, Peppley – RMC, Berg – UOIT, Enbridge)
- E-3: Performance Analysis and Impact Evaluation of MCFC-Turbine System (Peppley – RMC, Enbridge)

# OFCRIN Budget

Total institutional contribution: cash	\$ 4,712,299	
Total institutional contribution: in-kind	\$ 1,642,400	
<b>Total institutional contribution: (see note 1)</b>	<b>\$ 6,354,699</b>	<b>38.6%</b>
Total private sector contribution: cash	\$ 2,202,127	
Total private sector contribution: in-kind	\$ 2,422,500	
<b>Total private sector contribution: (see note 1)</b>	<b>\$ 4,624,627</b>	<b>28.1%</b>
Total funding requested from ORF Research Excellence	<b>\$ 5,483,607</b>	<b>33.3%</b>
<b>Total project cash</b>	\$ 12,398,033	
<b>Total project in-kind</b>	\$ 4,064,900	
<b>TOTAL PROJECT VALUE (cash and in-kind)</b>	<b>\$ 16,462,934</b>	

Note 1: The combined institutional and private sector contributions represent two-thirds of the total budget for the project,

# Funding Process



- The Government of Ontario will permit OFCRIN to submit funding requests semiannually.
- An initial amount will be provided shortly to start work.
- Proof of industrial matching support is submitted at next funding request and next installment is provided.
- Funding is also dependent on reporting being completed.



# Summary

- OFCRIN provides a flexible funding envelope for fuel cell research in Ontario
- OFCRIN projects can be altered to address immediate needs of the fuel cell industry
- OFCRIN will provide stability and continuity for five years