

APPLYING KNOWLEDGE, DELIVERING RESULTS



HYDROGEN INITIATIVES in MANITOBA

Hydrogen Sub-Group

Canada-Brazil Science Technology & Innovation Forum

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Purpose

- Renewable energy in Manitoba
- Hydrogen activities in Manitoba
- Red River College (RRC)
 - Hydrogen-related projects
 - Sustainable infrastructure
- Insights in Manitoba's hydrogen experiences
- Collaborative opportunities with RRC

NOTE: *Presentation content includes information from the Province of Manitoba, not all activities described involved Red River College.*



The McGraw-Hill Companies

BusinessWeek

DECEMBER 12, 2005

www.businessweek.com

#1 Regional Government
For Action On Climate Change

GLOBAL AWARD WINNER:

The Province of Manitoba, Canada



Red River College and AR&C

- MB's 2nd largest post-secondary institution
 - Comprehensive college - ~110 programs
- Serve 9,900 FT and 21,500 PT learners annually
- \$117 Million annual budget (06/07)
- 1,100 employees
- Applied Research & Commercialization Growth
 - '03-04 FY - ~\$50,000 (SSARF)
 - '04-'05 FY - ~\$150,000 (NSERC)
 - '05-'06 FY - ~\$300,000 (HHICE and MCI)
 - '06-'07 FY - ~\$900,000 (Manitoba Hydro and H2FC)
 - *Does not include WD support for AR&C establishment, nor pre-existing relationships (such as the Lawson Foundation)*



Renewable Energy Priorities (MB)

- Energy focus within Province of Manitoba is **only renewable energy resources**
 - Economic as well as environmental drivers
- Manitoba's renewable energy-related priorities
 - New-Generation Hydroelectricity
 - Low flood, First-Nation partnership
 - Wind power development
 - Biofuels
 - including ethanol, biodiesel, and methane from anaerobic digestion
 - Ground-source heat pumps
 - Hydrogen and other emerging renewable technologies (eg. PHEV's)
 - aimed at longer-term



Hydroelectricity in Manitoba



New Wuskwatim Project



- ❑ Three new-generation projects now proposed representing 2000+ MW
- ❑ Wuskwatim (left) is most advanced – 200 MW
- ❑ Low-head design selected by Manitoba Hydro and NCN to minimize flooding
- ❑ Flooded area (0.37 km²) smaller than the store area of “Mall of America” in Minneapolis



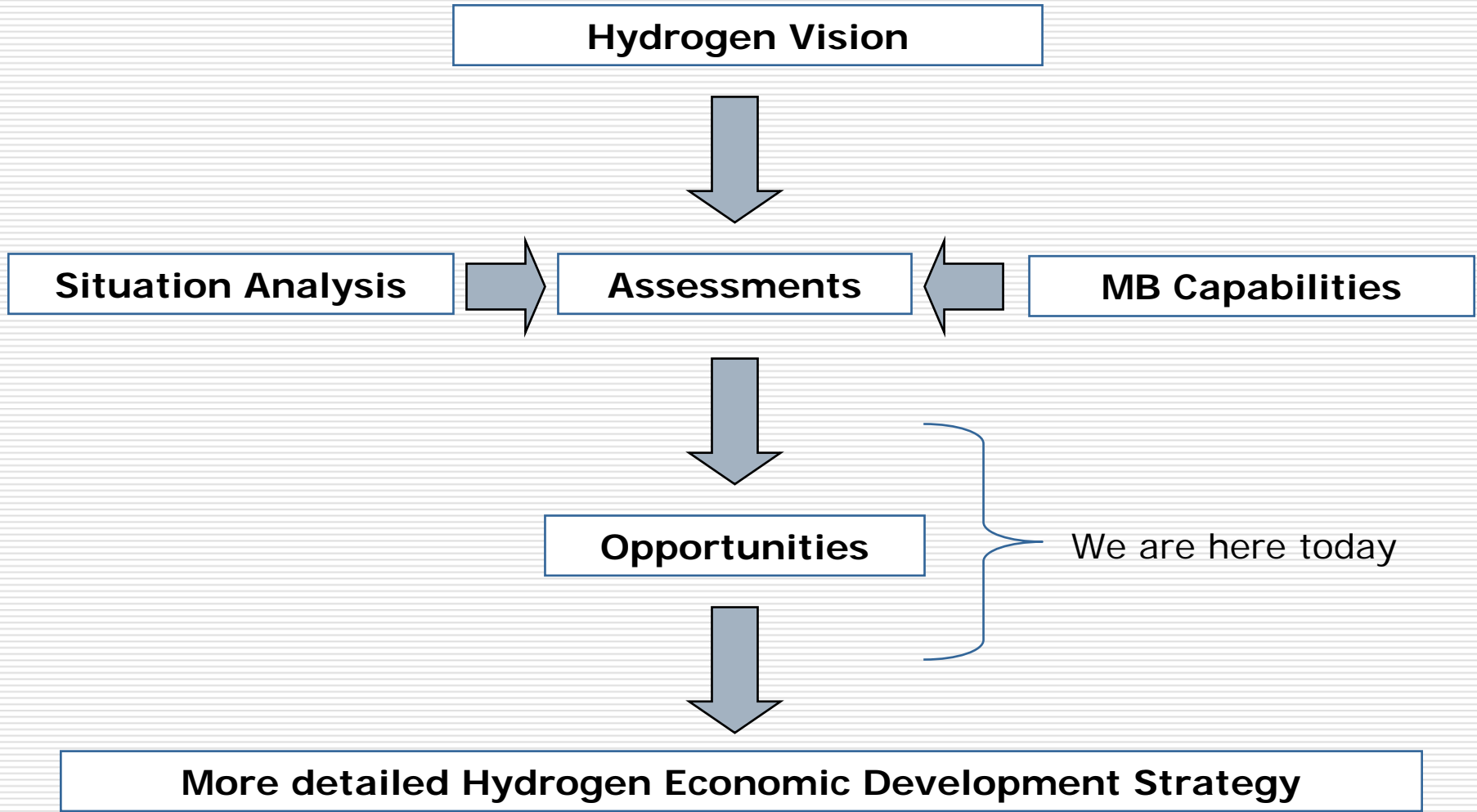
Wind in Manitoba: St. Leon



PHEV in Manitoba

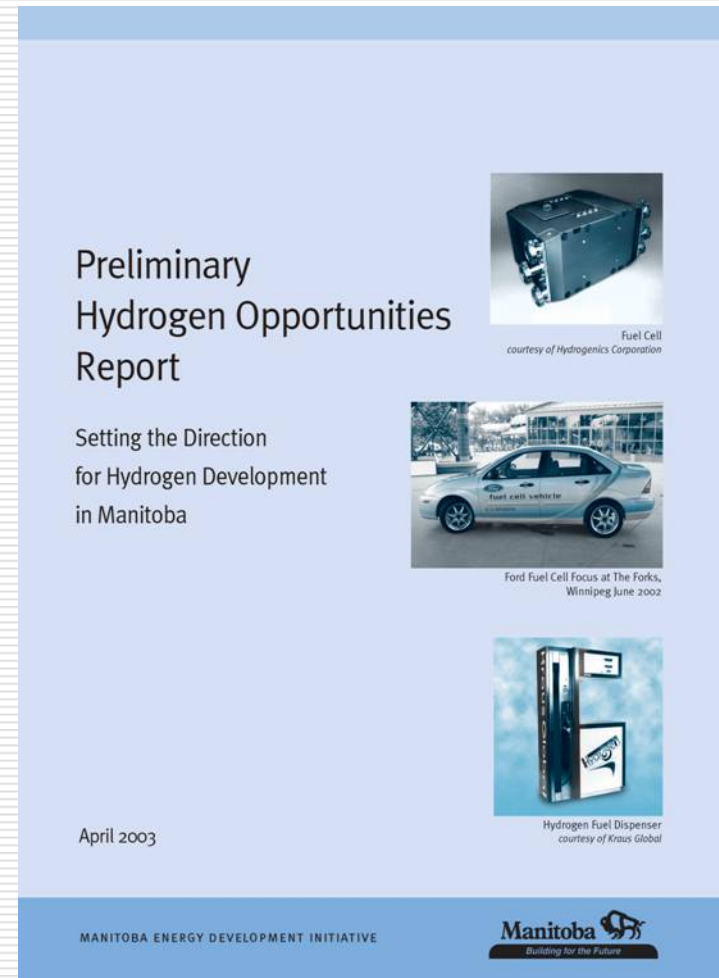


MB's Hydrogen Strategy Process



Hydrogen Opportunities Report

- ❑ Released in April 2003
- ❑ First of kind in Canada
- ❑ Identified series of priority actions for Manitoba as a whole
- ❑ Has set stage for follow-up activities



H2 Priority Actions (MB H2 Steering Committee)

- Buses and refueling demonstrations
- By-product hydrogen fuel cell demonstration
- Hydrogen Centre of Expertise
- Manitoba Hydro Dorsey on-site generator
- MOU with Iceland
- Permanent refueling station



Fuel Cell Cars in Winnipeg



Static Display
The Forks
Spring 2002



Fuel Cell Cars in Winnipeg



"Ride and Drive"
The Forks Spring
2003

RRC assisted in
marshalling:
about 150 people
in one day with
two cars



Temporary Refueling at RRC



HHICE Winter Test 2005



HHICE Bus

- Cold weather evaluation while in fare service
- 20+ project partners
 - Canada and USA
 - Private and public-sectors
 - Industry-Government-University and College
 - Faculty AND student involvement



- ***“An important factor in the success of the trial was the flexibility of Red River College as a project partner The first time a Canadian college has taken part in a major hydrogen vehicle and refuelling demonstration.”***



Hybrid H2FC Bus: 2006



- ❑ Demonstration completed September 2006
- ❑ New Flyer, Hydrogenics and other partners



Hybrid H2FC Bus Refuelling



H2 Buses and Refuelling

- Obvious hydrogen priority for Manitoba, having now completed two demonstrations
- “Bus Capital” of North America
 - New Flyer – leading transit bus manufacturer
 - Motor Coach – leading intercity bus manufacturer
- Kraus Global – leader in gaseous refueling
- Transit buses well identified as an important early niche opportunity for hydrogen and fuel cells in general



Manitoba Hydro Dorsey Station



- ❑ First priority action completed in 2004
- ❑ Advanced Hydrogenics IMET electrolysis technology implemented at Dorsey station



Hydrogen Centre of Expertise Inc.

- New non-profit entity formed in May 2006
- Focused on research and training opportunities
 - Expertise & facilities already present at Atomic Energy of Canada Limited Whiteshell Laboratories in Pinawa, Manitoba
 - Spin-off of AECL technologies for non-nuclear applications (commercialization)
 - Growing interest and capabilities of Manitoba universities and colleges (research and training)
- Collaborations with AECL have already been underway on PAR technology



AECL Whiteshell



- ~\$15M in relevant infrastructure
 - Large-scale vented H₂ test range
 - Combustion engineering test facility (eg. H₂ flame test)



AECL PAR Technology



- ❑ PAR: Passive Autocatalytic Recombiner
- ❑ On-site technology assessment in 2004
- ❑ Winnipeg Transit bus garage - test effects of diesel fumes on PAR unit
- ❑ First-of-kind test for non-nuclear use



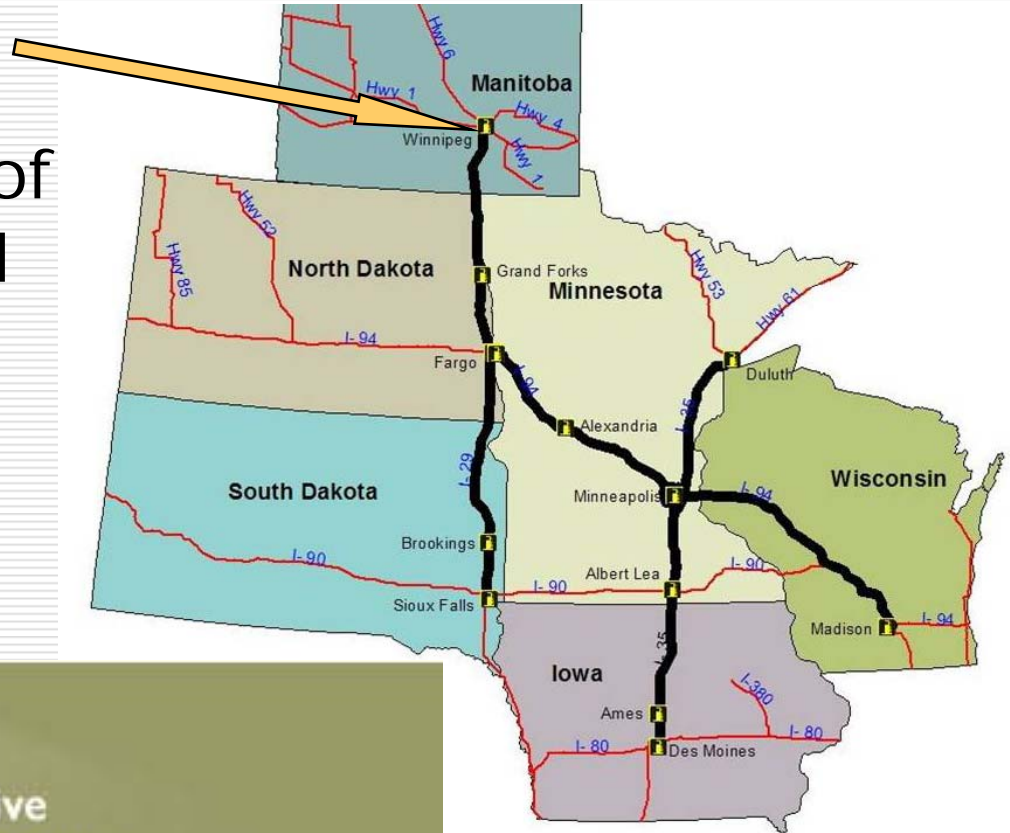
Iceland-MB MOU: H2 Development

- ❑ MOU signed
September 2003
- ❑ Many common links:
culture, business,
academic, renewable
energy
- ❑ First Iceland-
Manitoba Joint
Seminar on
Hydrogen held in
September 2006



UMHI Collaboration

- Winnipeg is the Northern node of the “Northern H Corridor”



Insight: Post-Secondary Role

- Important suggestion from Rolf Nordstrom of UMHI:
 - Post-secondary institutions represent THE ideal site for implementation of hydrogen technologies especially vehicles
 - Possess flexibility and capability to deal with advanced technologies
- During both hydrogen bus demonstrations in Manitoba, Red River College was extensively involved for these reasons



Insight: Weather Matters

- Canada is a cold in the winter- cold happens!
- If hydrogen is going to work across the breadth of Canada it has to work in Manitoba!
 - Well established cold-weather advantage
 - Coldest operation of hydrogen vehicles and free standing hydrogen infrastructure
 - Fuel cell more advanced but ICEs still more robust for cold weather
 - Water vapour is “Public Enemy #1”



Insight: Technologies

- Primary focus has been on fuel cells, but for hydrogen to become realistic there are many other component technology solutions required
 - Improving hydrogen production and reducing cost of fuel
 - Improving hydrogen safety with technologies like PAR
 - Even seemingly mundane issues - how to you fix a “ding” on a fuel cell vehicle when you can’t take the vehicle into a paint booth?



Insight: Non-technical

- Even though hydrogen tends to have a technology focus, there are lots of important non-technical issues as well, including
 - Creative risk-management to reduce insurance costs
 - Public attitudes on hydrogen, for example reactions to hydrogen vehicles and associated safety perceptions



Key Learnings (by MB) on Hydrogen

- Importance of post-secondary institutions
- Flexibility and mandate oriented to new and advanced technologies
 - Not just research, but
 - Well suited for implementation as well
- RRC a key partner in hydrogen bus projects for infrastructure and refueling



Observations

- ❑ Manitoba is becoming recognized as a “hub” for activities on renewable energy, including hydrogen
- ❑ Manitoba is continuing with planned priority actions on hydrogen, and continue to seek partners for collaboration
- ❑ There continue to be many problems to solve on hydrogen, and thus a multitude of opportunities to find solutions



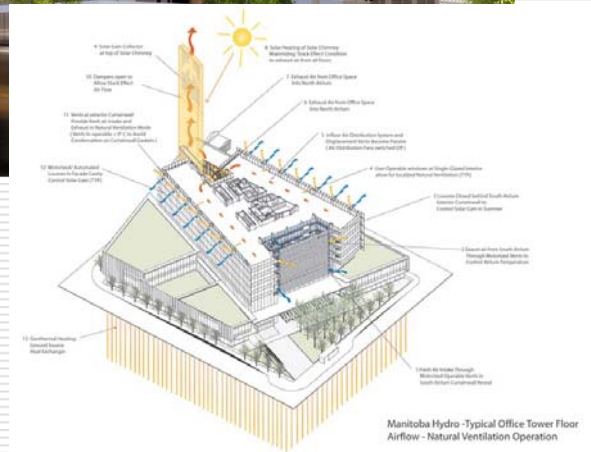
CARSI : Centre for Applied Research in Sustainable Infrastructure

- Mission: *...to develop advanced sustainable infrastructure technologies and products in Manitoba through innovation and excellence in applied research...*
- RRC's first-ever dedicated research centre
- 10,000 sf applied research facility (~\$1.7M)
 - CFI and MRIF
- Emphasis
 - Construction materials (primary)
 - Environmental/sustainable technology – **INCLUDING H2**
- Model sustainable intelligent building
 - Demonstrate energy efficient and alternate/renewable energy techniques, including hydrogen, solar, wind, and bio-energy
 - Incorporate advanced composite materials



CARSI: Manitoba Hydro

□ Manitoba Hydro – Curtain Wall Demo



RRC Collaboration Opportunities

- Take advantage of geographical location
 - climatic extremes
 - manufacturing and transportation hub
- Private industry, government & industry organizations, research institutions
 - ISIS Canada and Composites Innovation Centre
 - University of Manitoba – Engineering & Architecture
 - Manitoba Highways
 - National Research Council laboratories
 - Manitoba Hydro
- Transportation Sector
- (Prairie Agricultural) Machinery Institute/Westest
- International project partners
- Leverage
 - IRAP – especially with SME's
 - SR&ED: technological advancement, content & uncertainty
 - NSERC: CRD's (co-applicant) and I2I's



Summary

- Expertise and Experience
 - Hydrogen-fuelled vehicles
 - Operation and infrastructure (including refuelling)
 - Demonstration and testing – especially cold-weather
 - Partnerships with major vehicle and power-train manufacturers
- Multi-sector possibilities
 - Transportation
 - Energy
 - Manufacturing
- Leverage existing relationships, partnerships, and connections
- Adding value (much more than “*build-to-print*”)
- Willingness to the opportunities



Acknowledgment

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- www.manitobaenergy.ca



Q&A and THANK YOU!

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