CUTRIC · CRITUC

City of Mississauga Council Presentation

Wednesday, February 5th, 2025

Presented by:
Josipa Petrunic, CEO & President, CUTRIC

CANADIAN URBAN TRANSIT RESEARCH & INNOVATION CONSORTIUM (CUTRIC)
CONSORTIUM DE RECHERCHE ET D'INNOVATION EN TRANSPORT URBAIN AU CANADA (CRITUC)

Agenda

1. **About CUTRIC**
2. **What is a Battery Electric Bus (BEB) and what is a Hydrogen Fuel Cell Electric Bus (FCEB)?**
3. **The Pan-Canadian Hydrogen Fuel Cell Electric Bus Demonstration And Integration Trial**
    - Overview of MiWay project from launch to present day
    - Technical update
4. **Misinformation Clarification**
    - Highlighting the impacts of misinformation on transit progress

1. About CUTRIC

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About CUTRIC

Vision

Make Canada a global leader in clean and smart mobility

We strive to make Canada a global leader in low-carbon smart mobility technologies across heavy-duty and light-duty platforms, including advanced transit, transportation, and integrated mobility applications.

Mission

Collaborative RDD&I projects driving transit innovation

Our mission is to support the commercialization of technologies through industry-led collaborative research, development, demonstration and integration (RDD&I) projects that bring innovative design to Canada's low-carbon smart mobility ecosystem.

Values

- Collaborative
- Innovative
- Committed to Excellence
- Trustworthy
- Scientific & Knowledgeable
- Diverse

Who we are

- Non-profit, Canada-wide
- Consortium of 130+ members

What we do

- Technical knowledge sharing forums
- ZEB Research & Consulting Services
- Commercialization projects
- Government advocacy for transit tech

Members

Transit Agencies 26% | Industry 18% | Consulting & Construction 19% | Utilities 10% | Software Companies 4%

Government 1% | Academic Institutions 8% | Transit Operators 1% | Not-for-Profit 13%

2. What is a Battery Electric Bus (BEB) and what is a Hydrogen Fuel Cell Electric Bus (FCEB)?

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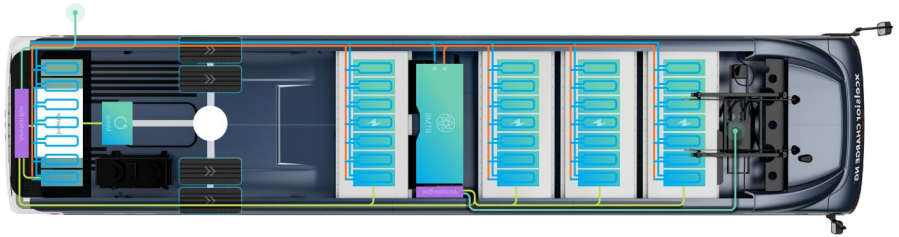
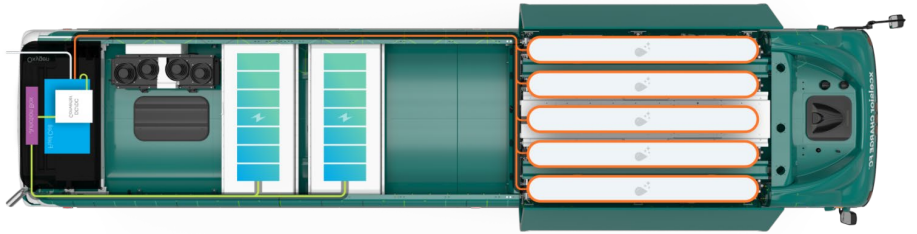
What is a Battery Electric Bus (BEB) and what is a Hydrogen Fuel Cell Electric Bus (FCEB)?





3. The Pan-Canadian Hydrogen Fuel Cell Electric Bus Demonstration And Integration Trial

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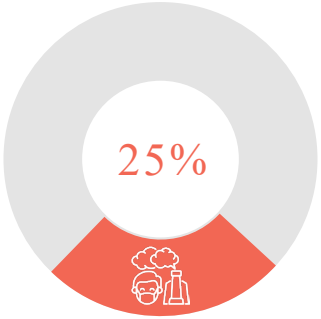
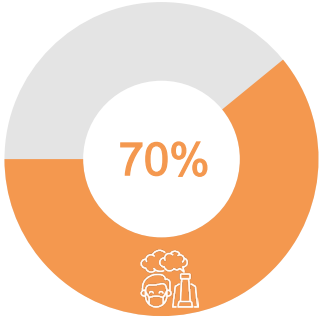
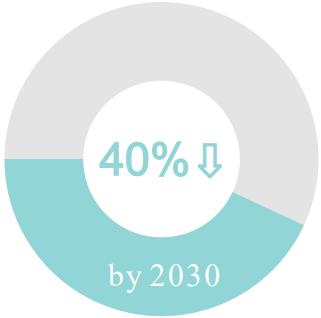
City of Mississauga's Goals

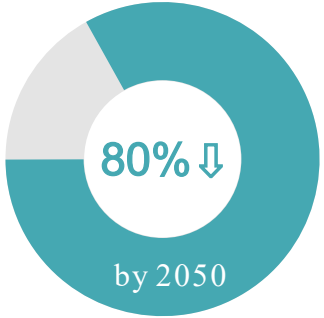


Transportation accounts for approx. 25% of **Canada**'s GHG emissions.



Transit accounts for approx. 70 % of **Mississauga**'s GHG emissions.





The City of Mississauga's CCAP aims to **reduce GHG emissions** by **40 per cent by 2030** and **80 per cent by 2050**.

Approximately **475 diesel buses** at MiWay will need to be replaced with zero emissions buses.

Partners and Vision

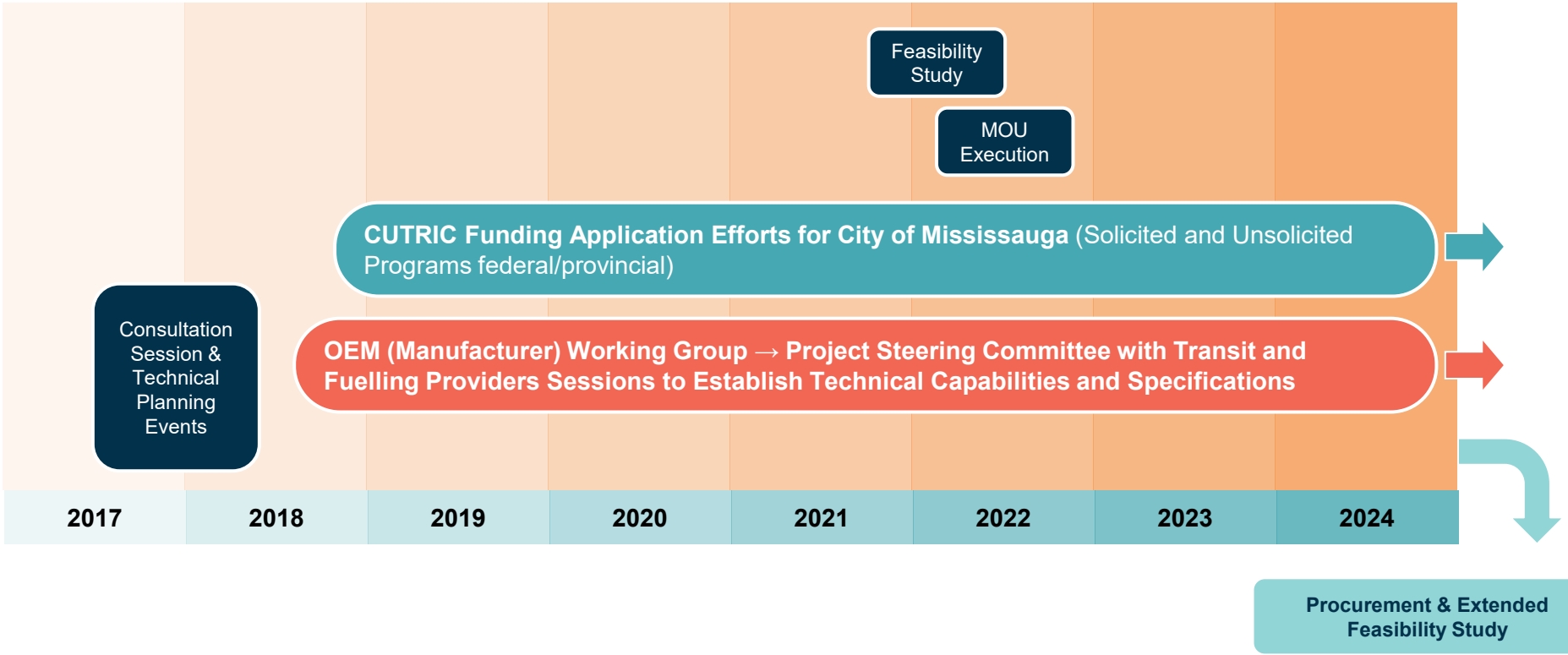
under the MOU agreement

Transit Agency	MiWAY
Manufacturers	NEW FLYER, BALLARD™
Hydrogen Supplier	ENBRIDGE

Canada's first demonstration of an **integrated supply chain of locally sourced green hydrogen** in Ontario, particularly the GTHA, **with FCEBs stored outdoors.**

Integrating and testing the use of FCEBs as a sustainable solution by **demonstrating their operational reliability, cost-effectiveness and environmental benefits**

Timeline



Project Steering Committee

In-kind Labour Contributions

7+ years of partner commitment

- In-kind labour contributions from all project partners since 2017
- Represents a multi-million dollar investment

Significant resource investment

- Efforts demonstrate significant investment, crucial for the successful deployment of this project and advancing Canada's clean energy goals.

Steering Committee & Stakeholder Engagement

Project scoping consultations

- Initial Consortium Project Scoping Consultations: May 2017 - April 2018

Formal Steering Committee Meetings (MOU-based)

- 2018 to 2021: 30 meetings
- January 2022 to present: 43 meetings (up to 15 participants per meeting)

Collaborative problem-solving

- Facilitated CUTRIC discussions and collaborative partners-based problem-solving

ZEB Feasibility Planning

- **MiWay Transit Fleet Electrification Analysis**
  - Funded in part by **Ministry of Economic Development, Job Creation and Trade**, Government of Ontario R&D Funding
  - Completed in **December 2022**

- **ZEB Feasibility Extended Planning**
  - Funded in part by Housing, Infrastructure and Communities Canada - **Zero Emission Transit Fund**
  - In progress with report delivery scheduled for **Q2 2025**

Current Progress

Procurement ready

Finalized technical specifications for FCEBs, ready for acquisition

Expanding collaboration

Attracted interest from other transit agencies, fostering wider adoption of green hydrogen technology

Green hydrogen ready

Established a "green" low-carbon hydrogen supply with a comprehensive fuel supply ready to contract

International recognition

Gained global attention for its pioneering approach to green hydrogen deployment in public transit

Refueling infrastructure planned

Detailed plans in place for hydrogen refueling infrastructure

Technical expertise

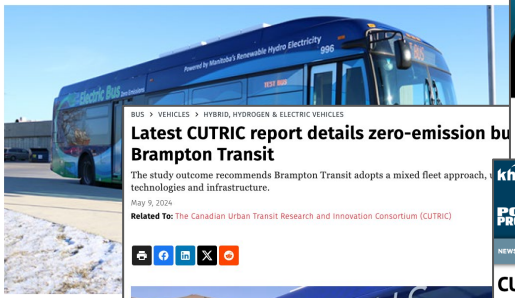
Successfully addressed technical challenges and developed expertise in hydrogen fuel cell technology

Coverage

Transit electrification opportunities in sharp focus at CUTRIC virtual conference

JUN 19, 2020 LUKE SARABIA

Canadian transit leaders weigh in on the path to electrification, the disruptions of COVID, and hydrogen fuel cell technology



Winnipeg Transit New Flyer

BUS > VEHICLES > HYBRID, HYDROGEN & ELECTRIC VEHICLES

Latest CUTRIC report details zero-emission bu Brampton Transit

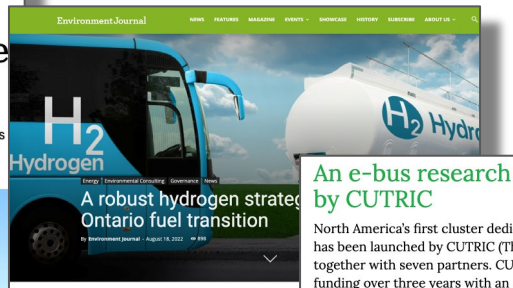
The study outcome recommends Brampton Transit adopts a mixed fleet approach, technologies and infrastructure.

May 9, 2024

Related To: The Canadian Urban Transit Research and Innovation Consortium (CUTRIC)

A Brampton Transit BEB.

The latest report from the Canadian Urban Transit Research and Innovation Consortium details the outcomes of its collaboration with Brampton Transit to develop a comprehensi emission bus implementation and rollout plan for Brampton Transit's fleet.



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CUTRIC conference addressed topics transit

Art Aiello
Editor, Power Briefing

05 November 2024
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The Canadian Urban Transit Research & Innovation Consortium (CUTRIC) held its six annual Zero Emission Transit & Mobility (ZETM) conference in Burlington, Ontario, in late October. CUTRIC promised the event would be a deep dive into a variety of topic including Canadian transit electrification, zero emission bus rollouts and the use of hydrogen in transit.

Power Progress spoke with several of the ZETM conference organizers at CUTRIC about the conference and its outcomes.

An e-bus research cluster is being launched in Canada by CUTRIC

North America's first cluster dedicated to researching battery electric and fuel cell electric buses has been launched by CUTRIC (The Canadian Urban Transit Research and Innovation Consortium) together with seven partners. CUTRIC and its members are contributing a total of $4.2 million in funding over three years with an additional $551,000 through the federally supported Mitacs [...]

20 February 2020 by Editorial

How axial fans are redefining the performance of off-highway machinery

PARTNER CONTENT

4. Misinformation Clarification

Misinformation Clarification

Statement made at Council	Status
"Globally, battery-electric buses outnumber hydrogen fuel cell buses by a factor of 300 to 1."	**Unverifiable & misleading** 

Misinformation Clarification

Statement made at Council	Status
"The demonstration project is in no way unique."	**Incorrect** 

Misinformation Clarification

Statement made at Council	Status
"Fuel cell buses have been rejected globally due to being more expensive, less reliable, and harder to maintain."	**Incorrect** & **Misleading** 

Misinformation Clarification

Statement made at Council	Status
"There is no credible plan to fuel the buses with green hydrogen."	**Incorrect** 

Misinformation Clarification

Statement made at Council	Status
"Buses using gray hydrogen would achieve only 50% decarbonization, while battery buses are already 90% decarbonized, approaching 97%."	**Partially correct** 

Misinformation Clarification

Statement made at Council	Status
"Fuel cell buses are more expensive to operate and require heavy subsidies."	**Accurate** 

Misinformation Clarification

Statement made at Council	Status
"CUTRIC's report for Brampton contains fundamental errors in cost estimates and system complexity."	**Incorrect** 

Misinformation Clarification

Statement made at Council	Status
"Hydrogen fuel systems are complex and costly to maintain, with up to 30% of capital costs in some systems (e.g., California)."	**Partially correct** 

Misinformation Clarification

Statement made at Council	Status
"Hydrogen is difficult to handle, prone to leaks, with a global warming potential over 100 times CO_2."	**Accurate** 

Misinformation Clarification

Statement made at Council	Status
"Hydrogen fuel cell technology has not improved significantly in 20 years."	**Incorrect** 

Misinformation Clarification

New claim	Status
CUTRIC “bias” towards hydrogen	**Incorrect** 

Point of Interest

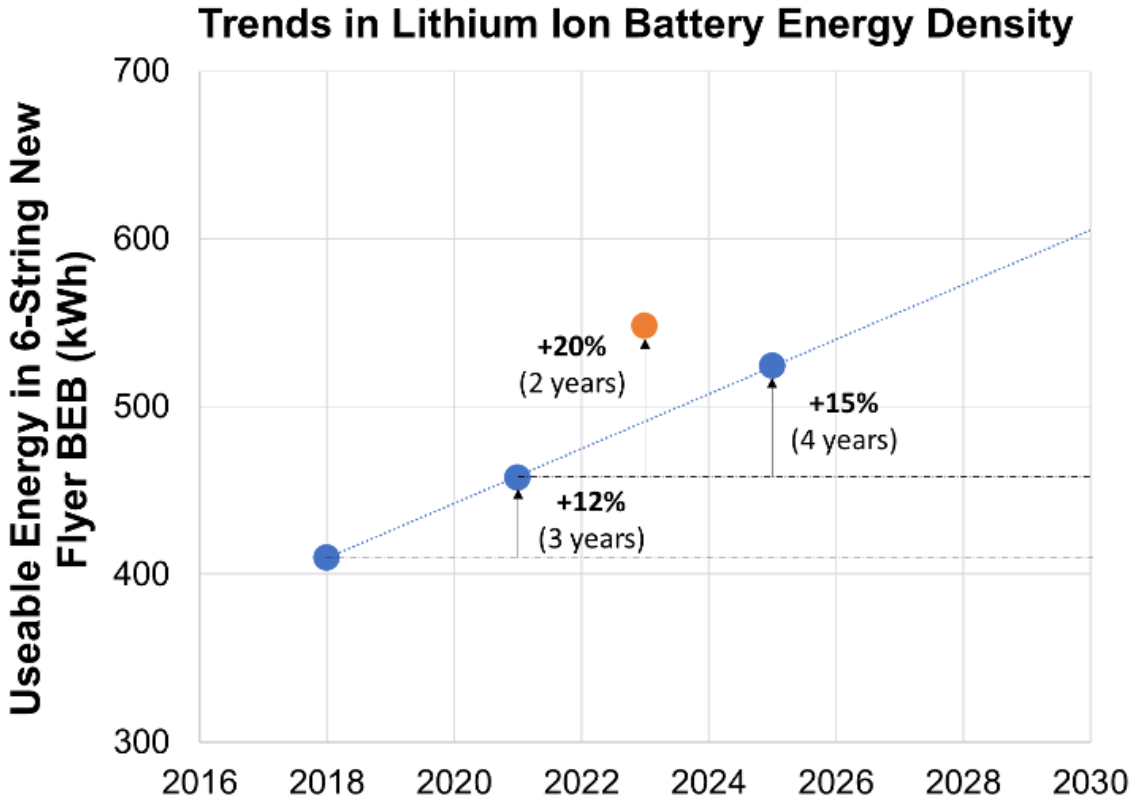
Question
What is the GHG comparison between BEB and FCEB?

Total life cycle GHGs (tCO2e):

- Diesel: 1 million
- Hybrid: 832, 000 (17% decrease)
- BEB with electric heater: 322,000 (68% decrease)
- BEB with DFAH: 322,000 (68% decrease)
- FCEB with green H2: 395,000 (61% decrease)
- FCEB with blue H2: 546,000 (46% decrease)
- FCEB with grey H2: 761,000 (24% decrease)

Point of Interest

Question
What is the BEB Energy Density per NFI vehicles?



Brampton conclusions

	Base case scenario (Diesel and HEB)	Scenario One (Full BEB solution)	Scenario Two (Full FCEB solution)	Scenario Three (Mixed green fleet solution)
Operational GHG emission reduction (18 year life cycle) BEBs without DFAH Green H2	0%	97%	85%	95%
Total cost of ownership per bus (NVP) - 18 year lifecycle (12m')	$1.77 million	$3.26 million	$5.25 million	BEBs: $2.26 million FCEBs: $5.25 million
Lifecycle cost of transition (NVP) (18-year life cycle) BEBs without DFAH Green H2	$7.56 billion	$8.95 billion (18% increase over base case)	$9.85 billion (30% increase over base case)	$8.94 billion (18% increase over base case)
H2 consumption annually	-	-	5.9 million kg	1.3 to 2.2 million kg
On-route chargers needed	-	18	-	18
Annual energy consumption (2041)		106 to 131 Gwh		106-131 Gwh
Fleet size in 2041 BEBs with DFAH	938	1,161	1,418	1,312

Thank You & Questions

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