

GREENING THE TRANSIT FLEET

TOWARDS ELECTRIFICATION

Council Workshop
March 5, 2021

Brampton Transit



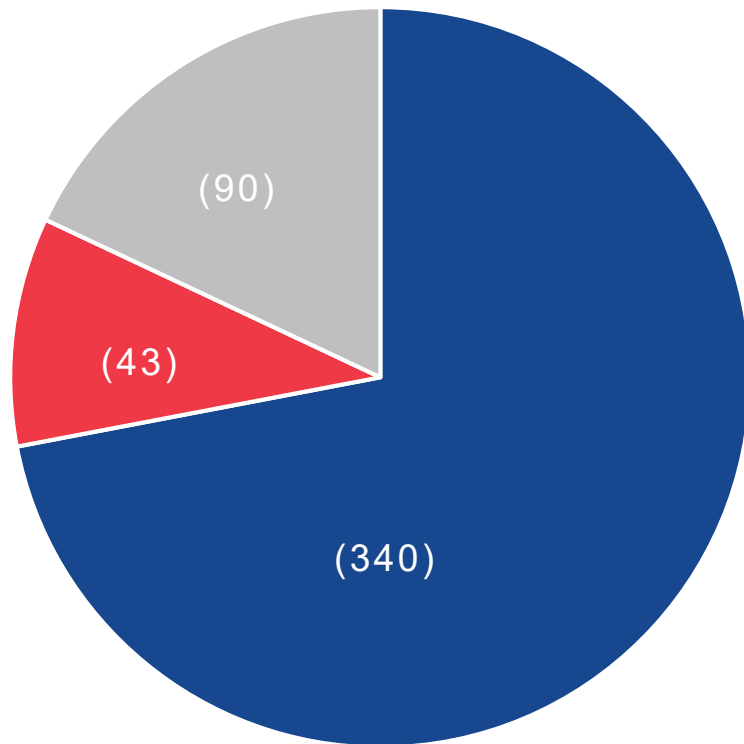
AGENDA

GREENING THE TRANSIT FLEET TOWARDS ELECTRIFICATION

01. Current & projected fleet
02. Bus deliveries (2020)
03. Pan-Canadian eBus trial
04. Federal policy landscape
05. Canada Infrastructure Bank (CIB)
06. Technology for Brampton
07. Analysis & roll out
08. New transit facility – electrification
09. Continuous Learning
10. Next Steps

Q&A

TRANSIT FLEET TODAY



■ Conventional 40' ■ Züm 40' ■ Züm 60'

HYBRID ELECTRIC:
Züm

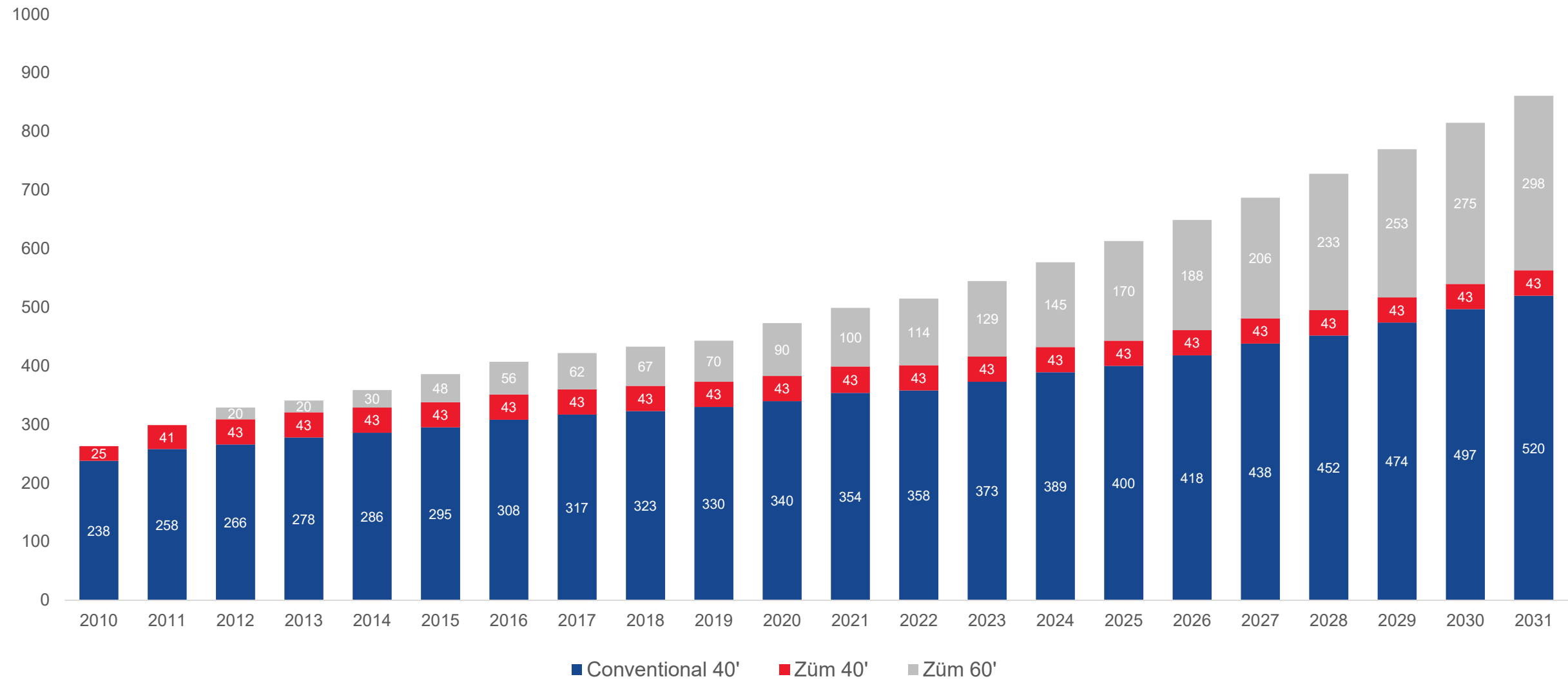
2010 = 133 Diesel-Electric
Hybrid Buses

BATTERY ELECTRIC:
CUTRIC Trial – Phase I

2021 = First 8 Battery-Electric
eBuses

TRANSIT FLEET

(HISTORICAL & PROJECTED GROWTH)



BUS DELIVERIES

To maintain our replacement schedule and address growth related service expansion, in 2020 Brampton Transit received:

- 23 growth buses
- 13 replacement buses

City recently signed onto the City of Toronto's cooperative fuel procurement for supply and delivery of bio-diesel.



PHASE I

PAN-CANADIAN ELECTRIC BUS TRIAL



Newmarket-Tay Power Distribution Ltd.



PHASE I

PAN-CANADIAN ELECTRIC BUS TRIAL



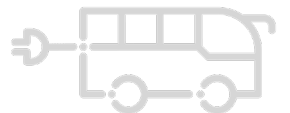
- Four (4) Battery Electric Buses
- Two (2) High-powered overhead chargers



- Eight (8) Battery Electric Buses
- Four (4) High-powered overhead chargers



- Six (6) Battery Electric Buses
- One (1) high-powered overhead charger



FEDERAL POLICY LANDSCAPE

- Federal ministerial mandate letters (December 2019)
 - ***Starting in 2023, ensure that new federal investments in public transit are used to support zero-emission buses and rail systems and work with municipalities to address any exceptional circumstances.***
 - ***Commit to working with provinces and territories to help school boards and municipalities purchase 5,000 zero-emission school and transit buses in the next five years.***
- Staff have participated in Clean Energy Canada consultations of industry experts for federal policy considerations, and OPTA/CIB consultation sessions.
- Government of Canada / Canada Infrastructure Bank announcement of \$10B (October 1, 2020).



CANADA INFRASTRUCTURE BANK

GROWTH PLAN

\$10 Billion

- Zero Emission Buses (ZEBs)
- Clean Power
- Energy Efficient Building Retrofits
- Large-scale Broadband Projects
- Agriculture-related Infrastructure



Supports Federal Mandate

- Growth electrification
- Purchase 5,000 zero-emission buses (2020-2024);
- Starting in 2023, new federal investments in public transit are used to support zero-emission buses.

Brampton-CIB MOU

- Non-binding Memorandum of Understanding
- Financing Agreement – Council/CIB approval



BRAMPTON DISCUSSIONS

Financing/Loan

- Differential cost between diesel bus and electric bus

Risk Mitigation

- Loan Repayment
- Other Funding



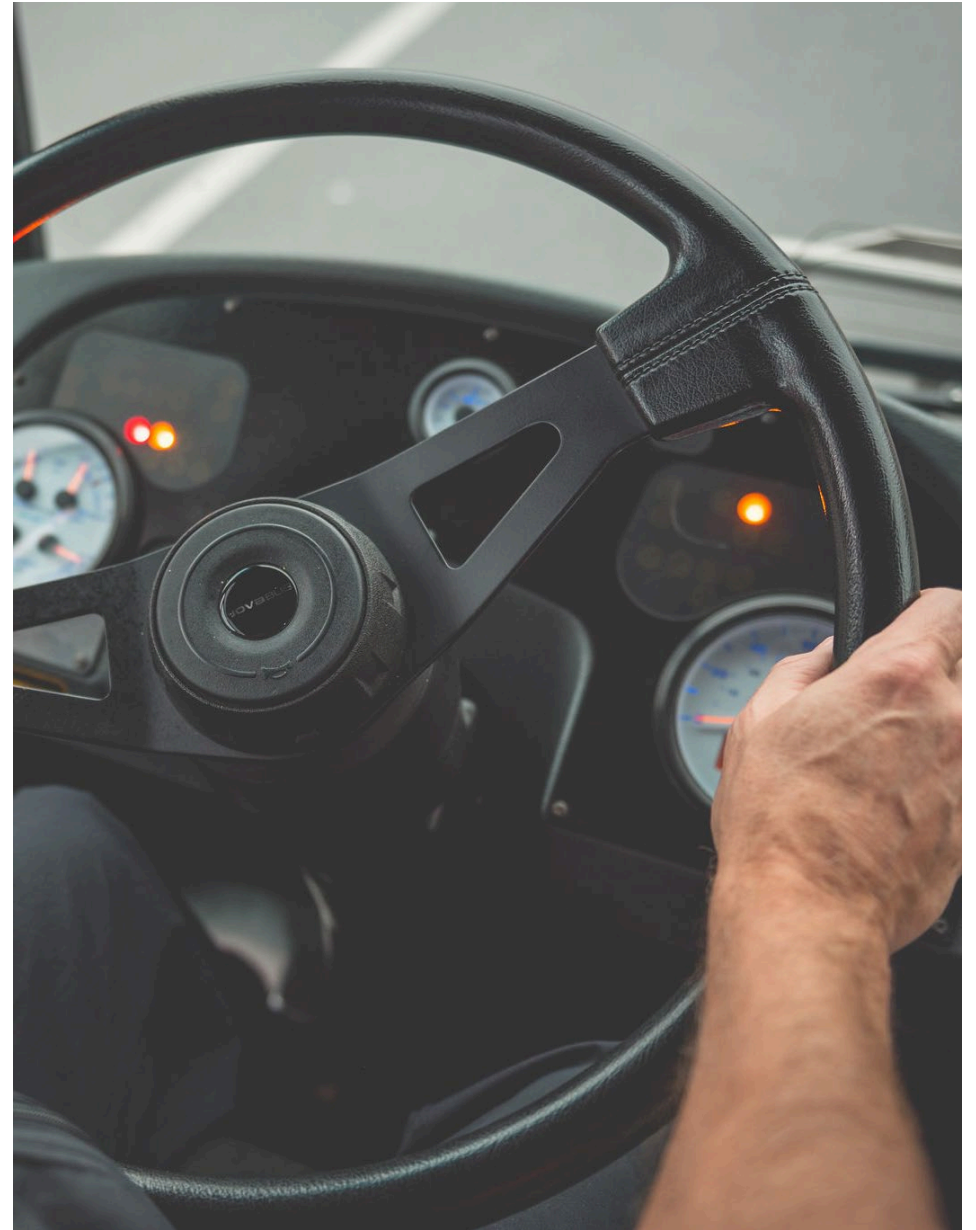
ZERO EMISSIONS BUSES

(ZEBs)

Q | Which ZEB technology is right for Brampton?

A | Based on what we know today, more than likely both BEB and FCEB
(to be determined based on each route)

- BEBs, most proven technology in North America currently
- Two key studies to be completed to help determine our hybrid



ELECTRIC BUS TECHNOLOGY

	A	B	C	D
	Battery Electric Bus (BEB)			Fuel Cell Electric Bus (FCEB)
	Diesel-Electric Hybrid	Opportunity (On-Street) Charging	Plug-In (In-Depot) Charging	
				
Zero Tailpipe Emission	☒	☒		☒
Infrastructure (plus electricity costs)	N/A	8:1 	2:1 	50:1 
Interoperability Standards	N/A	☒		☒

ANALYSIS & ROLL OUT

Transit Network Fleet Electrification Feasibility Analysis*

- Where (routes) and What (ZEB technology: BEB & FCEB)
- Very detailed assessment: route by route/block by block

Transit Sustainable Fleet Strategy & Rollout Plan*

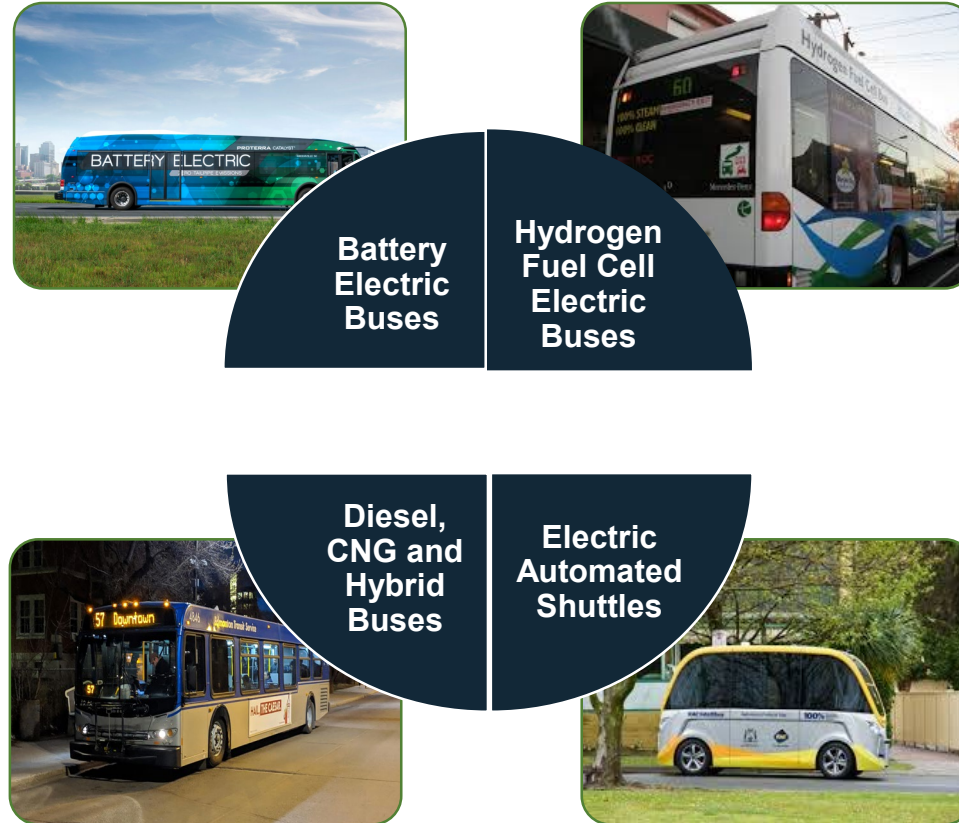
- When (fleet year-by-year) and How (funding/procurement plan)
- Costing Analysis and Budget Forecasting



* Approved by Brampton City Council on September 30, 2020.

CUTRIC's ROUTΣ.i™ MODELLING FUNCTIONALITY

- Calculate actual electricity costs in local jurisdictions
- Predict state-of-charge (SOC) of battery onboard bus
- Predictively assess ZEB or AV shuttle energy consumption
- Predict performance success rates for ZEBs considering revenue and non-revenue operations
- Conduct downtime assessments for BEB charging (on route and depot) and FCEB fuelling



- Assess suitability of route/block/vehicles for electrification
- Make recommendations for BEB, FCEB, e-LSAs selection
- Locate optimal locations for opportunity chargers and fuelling stations
- Calculate actual GHG reduction from ZEBs, compared with fossil-fuel sources
- Assess the ease of electrification

THIRD TRANSIT FACILITY

PHASE I 250 bus capacity
\$204M

PHASE II Additional 190 buses
(total 440)
\$TBD

ELECTRIFICATION
OF FACILITY \$150M*

*A rough order of magnitude costing estimate, subject to further feasibility review and detailed design.



THIRD TRANSIT FACILITY

(CONTINUED)

Key considerations required to electrify facility in support of a fully electric bus fleet operating from the new facility:

- Power requirements
- Charging equipment
- On-site energy storage



CONTINUOUS LEARNING

CUTRIC Pan-Canadian Trial:



Opportunity charging,
8 eBuses, 4 eChargers



Opportunity charging,
4 eBuses, 2 eChargers



Opportunity charging,
6 eBuses, 1 eCharger

Other Canadian Agencies:



Depot-charging, 3 garages, 30 buses
(10 each: New Flyer, Proterra, BYD)



Depot-charging using overhead chargers,
40 buses (2020; Proterra)



Depot-charging using overhead chargers,
60 buses (2020; 30 long-range, 30 quick-charge)

North American Peer-2-Peer (Quarterly):

Canada



USA



OVERVIEW – NEXT STEPS

- Transit Network Fleet Electrification Feasibility Analysis
- Transit Sustainable Fleet Strategy & Rollout Plan
- Financial Options
- Report back to Council

THANK YOU!

