



TTC Green Bus Program Update

February 2020

Bem A Case, Head of Vehicle Programs



| Contents

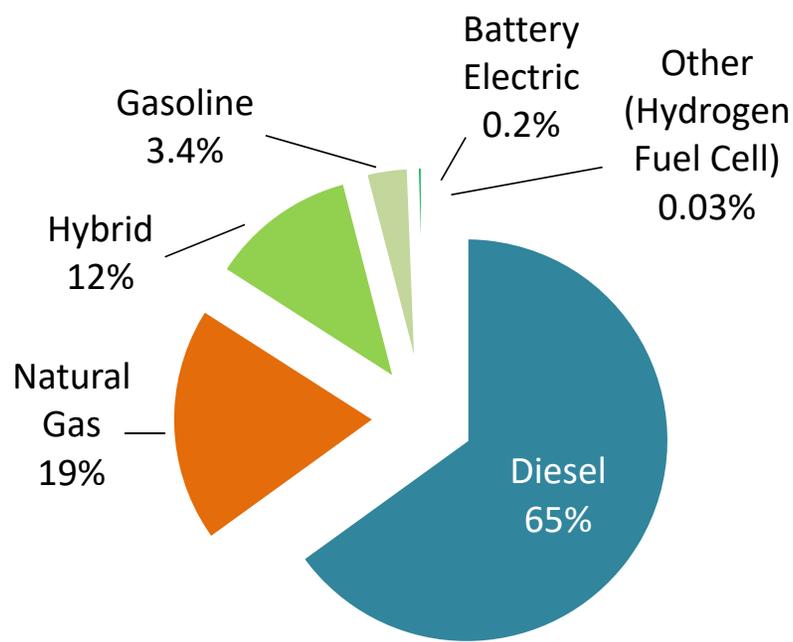
- 1. Industry Snapshot**
- 2. TTC's Green Bus Program**
- 3. Next Steps**



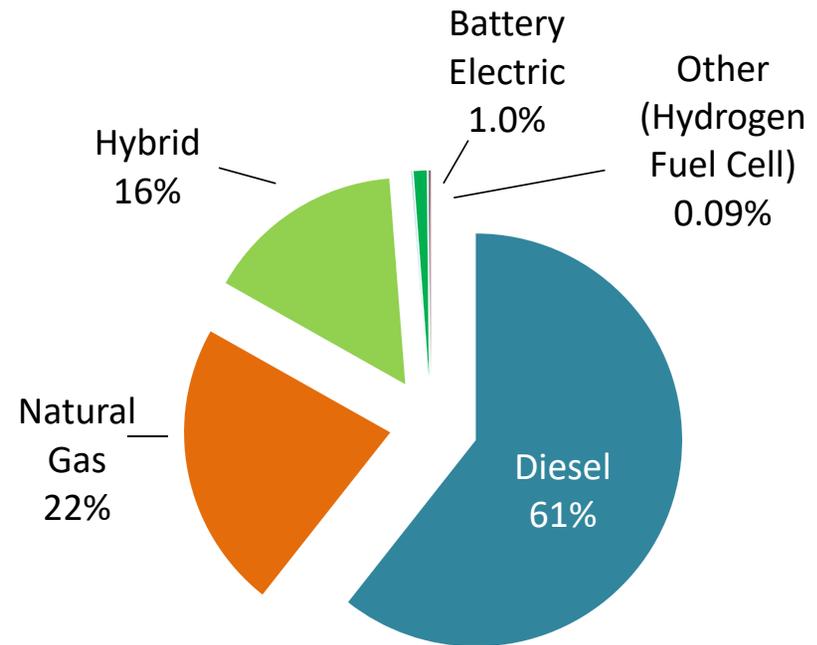
Industry Snapshot

Industry Snapshot: The Shift Toward Green Tech

North American Buses by Propulsion Type



North America in 2017

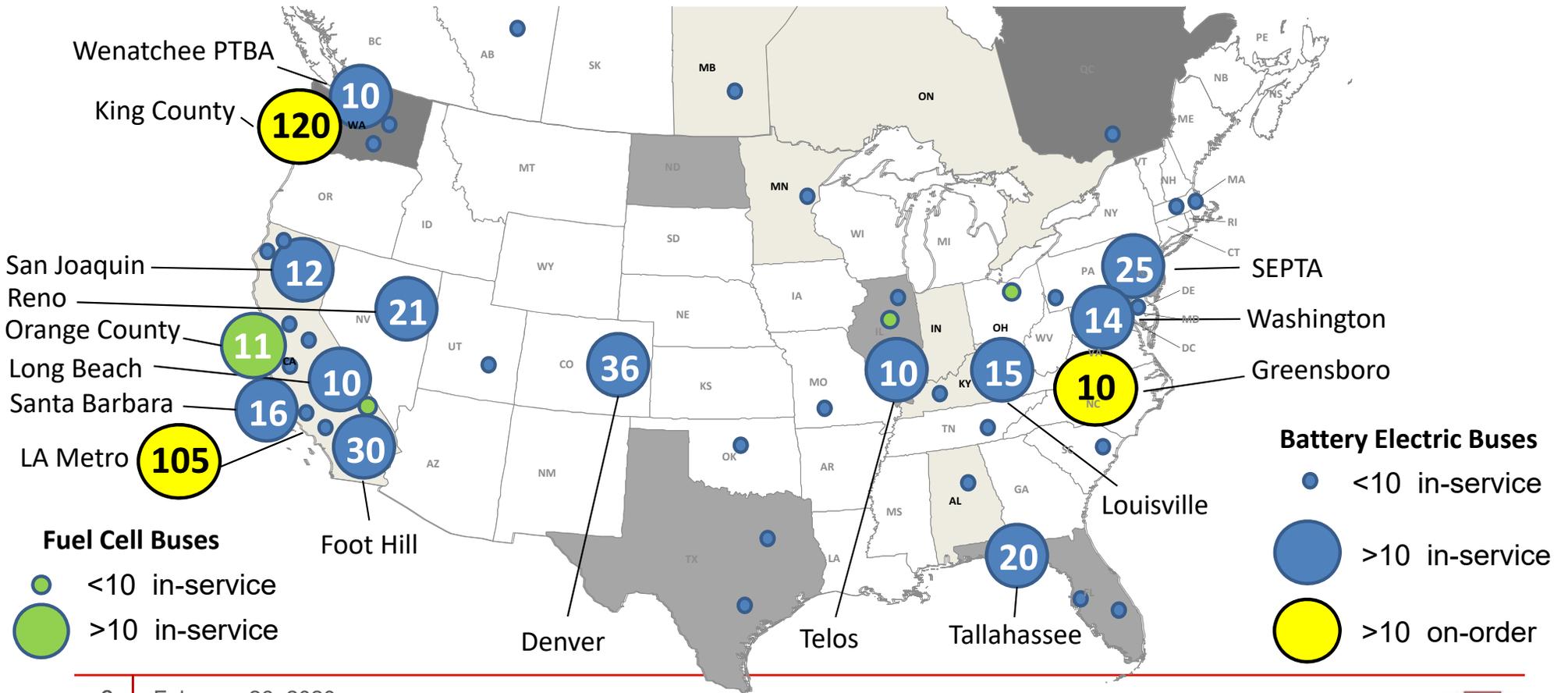


North America in 2019



Industry Snapshot: Propulsion Technologies

Zero Emissions Buses in North America (as February 2020)



TTC's Green Bus Program

TTC's Green Bus Program: Targets

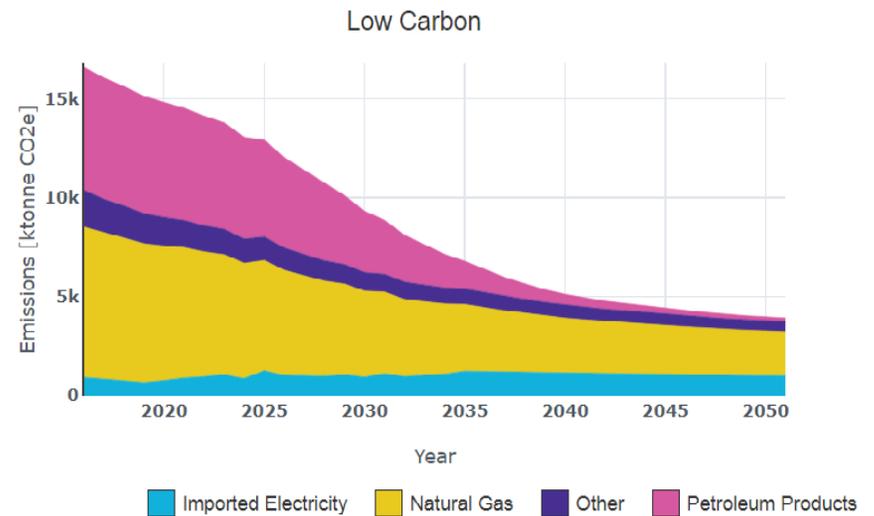
In July 2017, Toronto's City Council unanimously approved the TransformTO Climate Action Plan.



TransformTO Target:

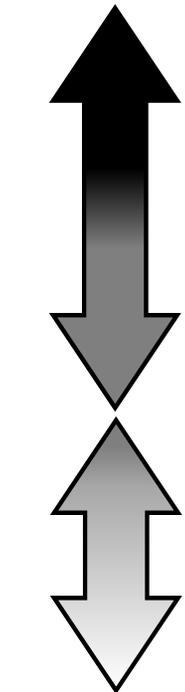
Reduce greenhouse gas (GHG) emissions 80% by 2050

Requires electrification of transportation to eliminate GHGs from combustion of fossil fuels

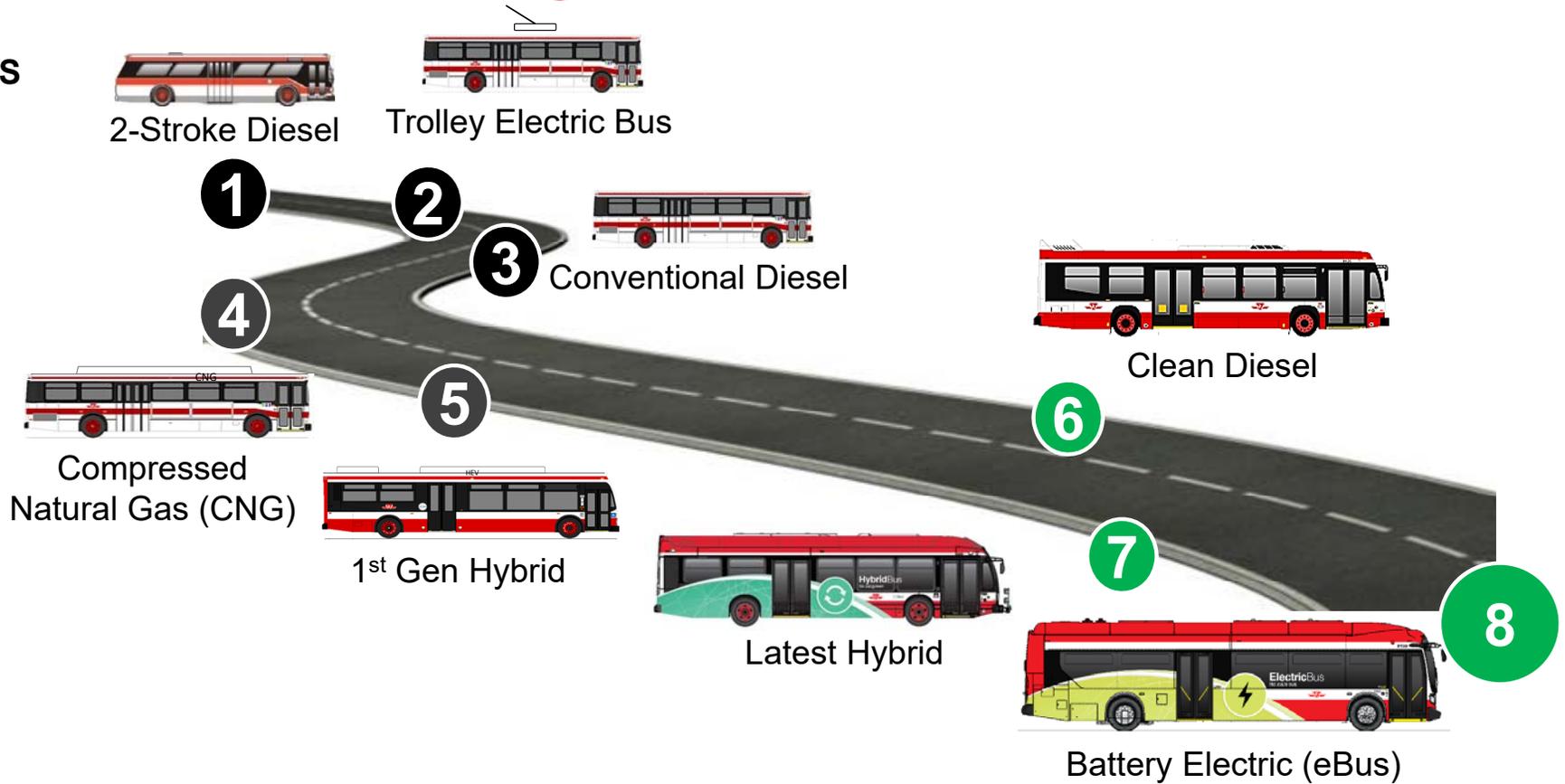


TTC's Green Bus Program: Path to Zero Emissions

HIGH
EMISSIONS



ZERO
EMISSIONS



TTC's Green Bus Program: Scope Overview

1. Bus Procurements
 - 728 Clean Diesel Buses
 - 255 Hybrid-Electric Buses
 - 60 All-Electric eBuses
2. Charging System Infrastructure
3. eBus Operations Deployment



TTC's Green Bus Program: Hybrid-Electric Buses

Program Delivery:

255 Hybrid-Electric Buses delivered and in service.

Benefits Realization:

Performance	Target	Measured
Improved Operational Reliability MBDF	TBD	> 25,000 km
Fuel Consumption (L/100km)	42	40 to 43
Net Fuel Savings	45%	45%
Reduced GHG Emissions	38%	47%



TTC's Green Bus Program: Hybrid-Electric Buses

Program Delivery:

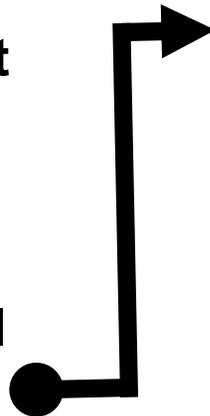
255 Hybrid-Electric Buses delivered and in service.

Benefits Realization:

**Additional
Capital Cost
\$81M**



**Annual Fuel
Savings
\$6.5M**



**Payback
Period
12.5 Years**



TTC's Green Bus Program: Hybrid-Electric Buses

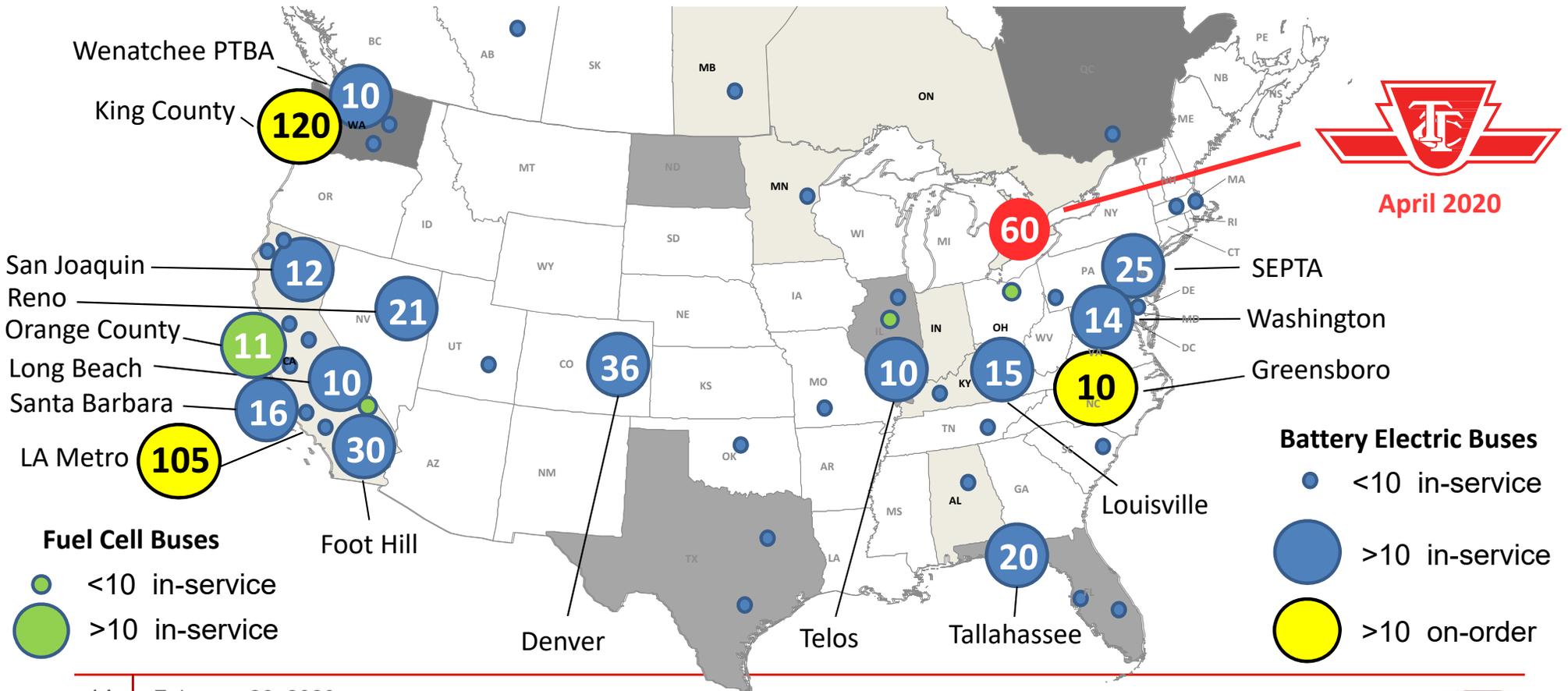
Benefits optimization over the next few years:

- 1. Leverage Transition Technology**
- 2. Improve fuel efficiency**
- 3. Deploy in electric vehicle (EV) mode**



TTC's Green Bus Program: Zero Emissions Buses

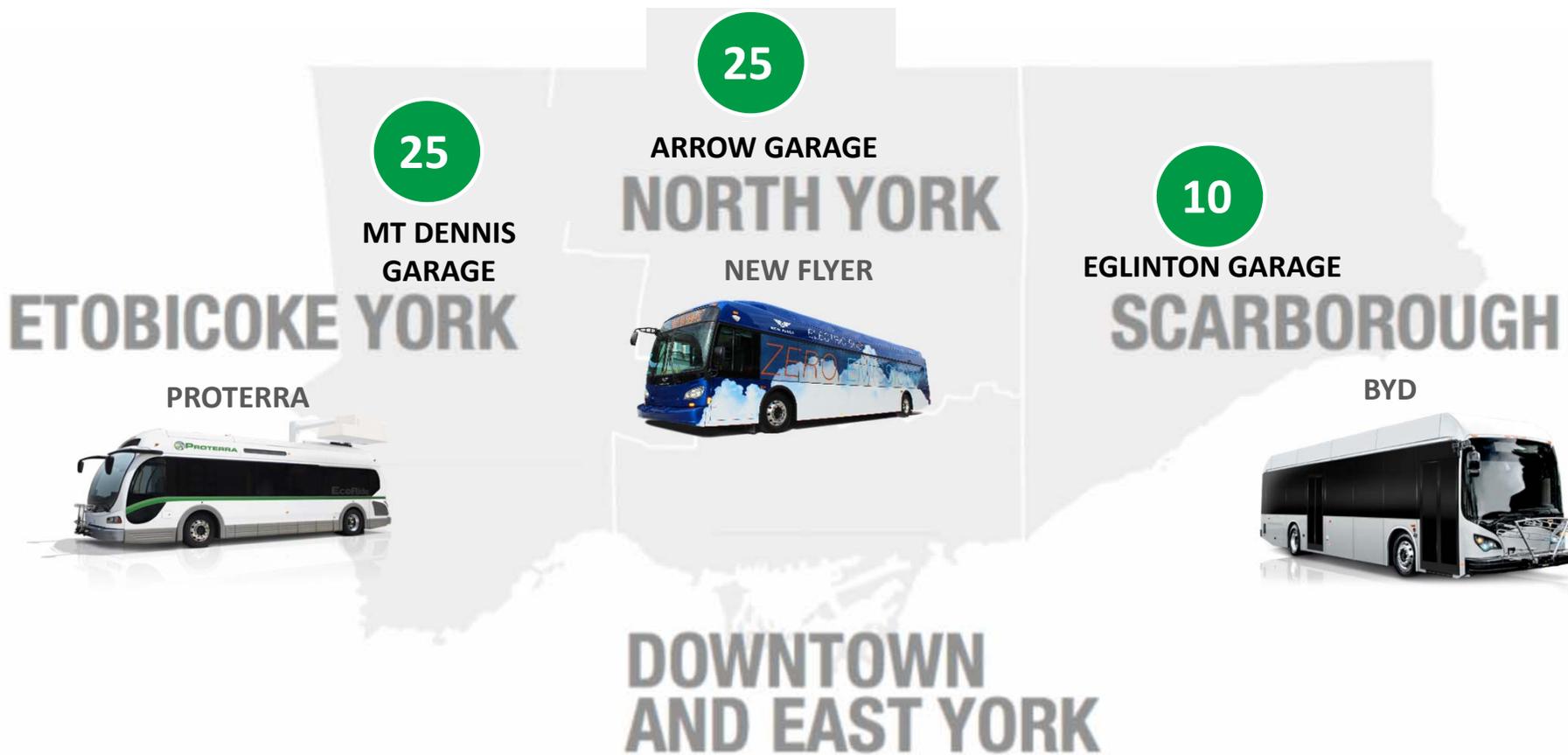
Zero Emissions Buses in North America



April 2020



TTC's Green Bus Program: Head-to-Head Evaluation



TTC's Green Bus Program: Head-to-Head Evaluation

TTC's head-to-head evaluation of the only three currently offering long-range electric buses in North America is the first of its kind.



Evaluation Domains:

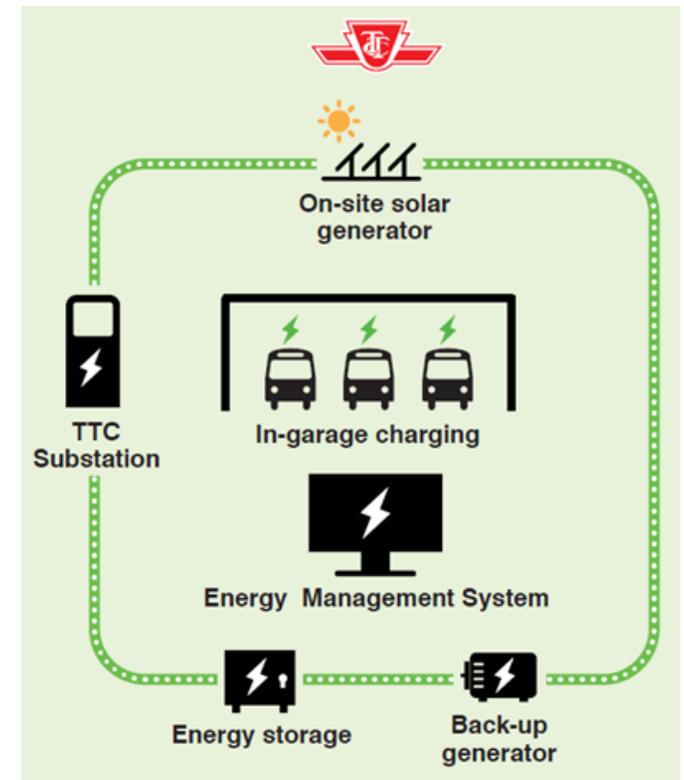
1. Accessibility
2. Customer Experience
3. Operator Experience
4. Maintainability
5. Vendor Performance
6. Vehicle and Charging System Performance



TTC's Green Bus Program: Current Status

Program Delivery: As of today, TTC has 40 of the 60 eBuses ordered with the remaining due by March 31, 2020

Vendor	Buses Ordered	Buses Delivered (Feb 25, 2019)	Bus Garage	Charging Capacity (Number of Buses)			ESS (Energy Storage System)	Back-up Generator
				10	20	25		
BYD	10	10	Eglinton	✓	-	-	March 2020	-
New Flyer	25	19	Arrow Road	✓	✓	✓	March 2020	March 2020
Proterra	25	11	Mount Dennis	✓	✓	✓	March 2020	-



TTC's Green Bus Program: Importance of Partnerships

Funding and Implementation Partners



Industry Partners: Knowledge Share



| TTC's Green Bus Program: Importance of Partnerships



TTC's Commitment to Learn and Share

Chair Bi-Monthly Technical Calls

- Boston
- Brampton
- Chicago
- Los Angeles
- Montreal
- New York
- Philadelphia
- Portland
- Seattle
- Washington
- York Region



| **TTC's Green Bus Program: Importance of Partnerships**



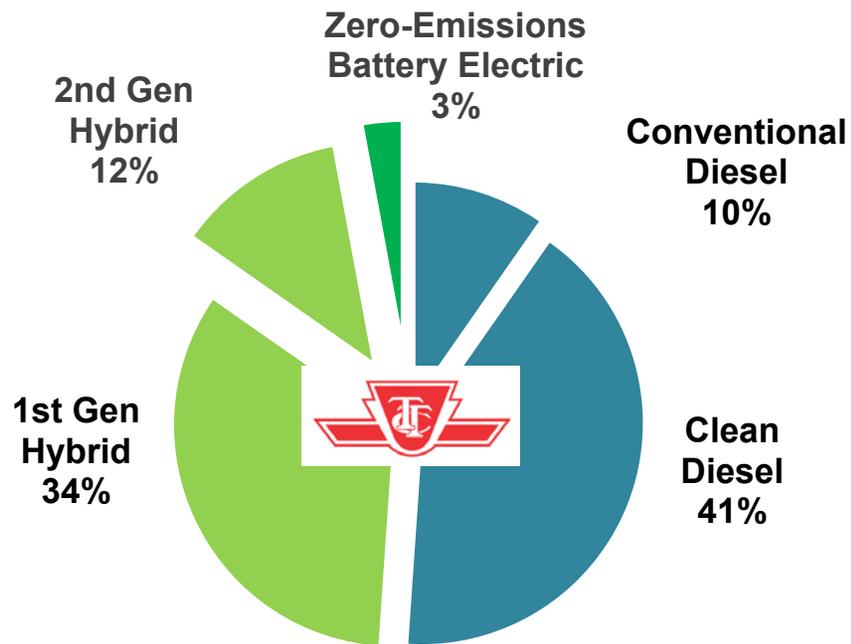
TTC's Commitment to Learn and Share

Host 2020 eBus Peer-to-Peer Summit

- Factors for Success: Commitment, Partnerships and Resources
- Bus and Charging Systems Engineering
- Vendor and Systems Performance
- Lessons Learned



TTC's Green Bus Program: Progress Made To-Date



**41% Less
GHG**

Baseline



Next Steps

| Next Steps

	<u>Target Completion</u>
1. 60 eBus Delivery and Commissioning	Q1 2020
2. eBus Service Planning Network Review	Q4 2020
3. Garage and Station Infrastructure Feasibility Study	Q4 2020
4. eBus Peer-to-Peer Summit	Q4 2020
5. Head-to-Head eBus Evaluation	Q2 2022



