

# Electric BUSES

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**Green Bus Program Update**  
**Green Wheel-Trans Bus Program Update**

July 14, 2022

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# Background – Emission Targets



## **TransformTO Target:**

July 2017: Reduce greenhouse gas (GHG) emissions 80% by 2050

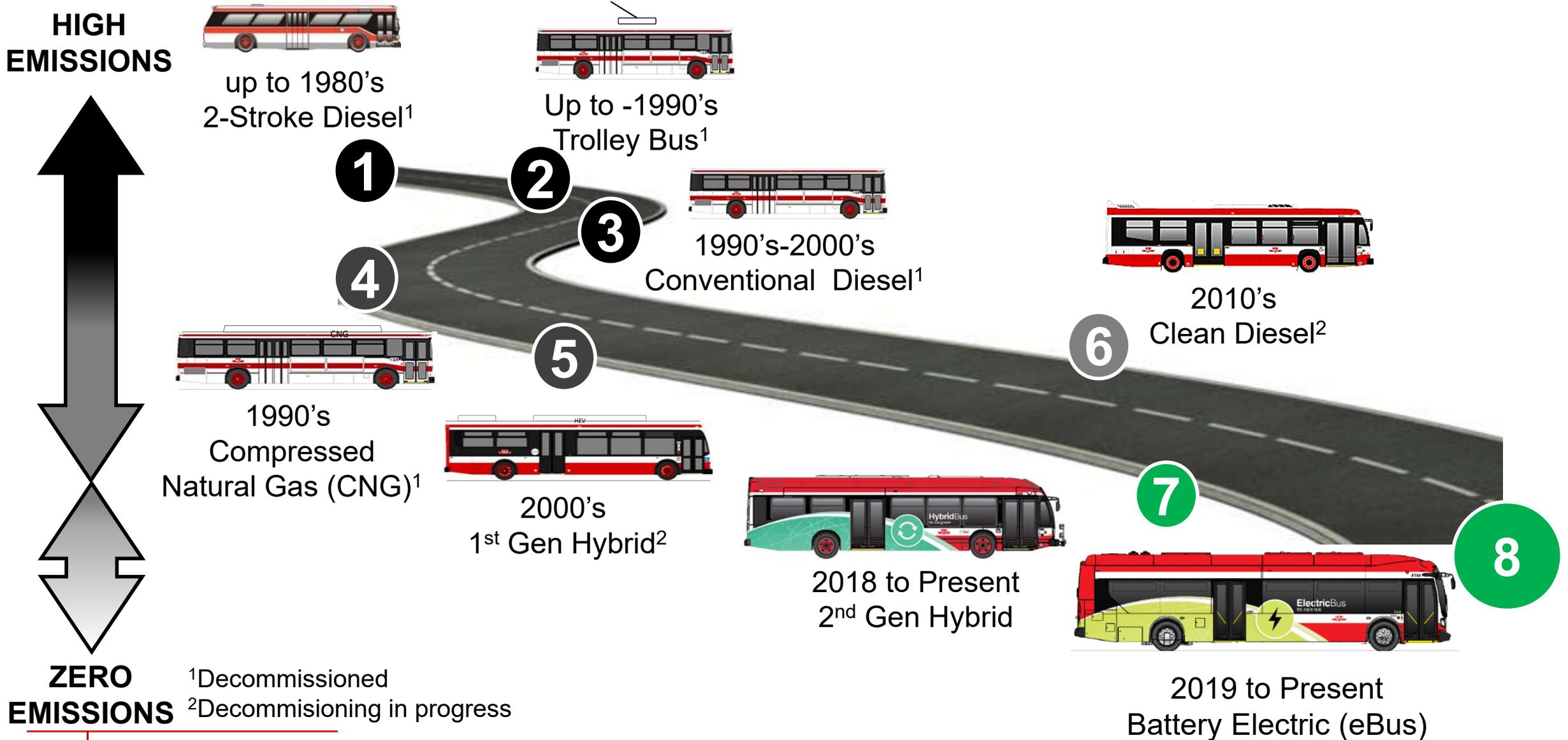
Dec 2021: Achieve net zero GHG emissions in Toronto by 2040



## **TTC Target:**

Nov 2017: Steady-state procurement of zero-emissions buses by 2025 and an all zero-emissions bus fleet by 2040.

# Background – Path to Zero Emissions



# Green Bus Program Update

- Overview & Current Status
- Program Benefits
- Economics of Advancing Adoption of eBuses

# Hybrid-Electric Bus - Overview

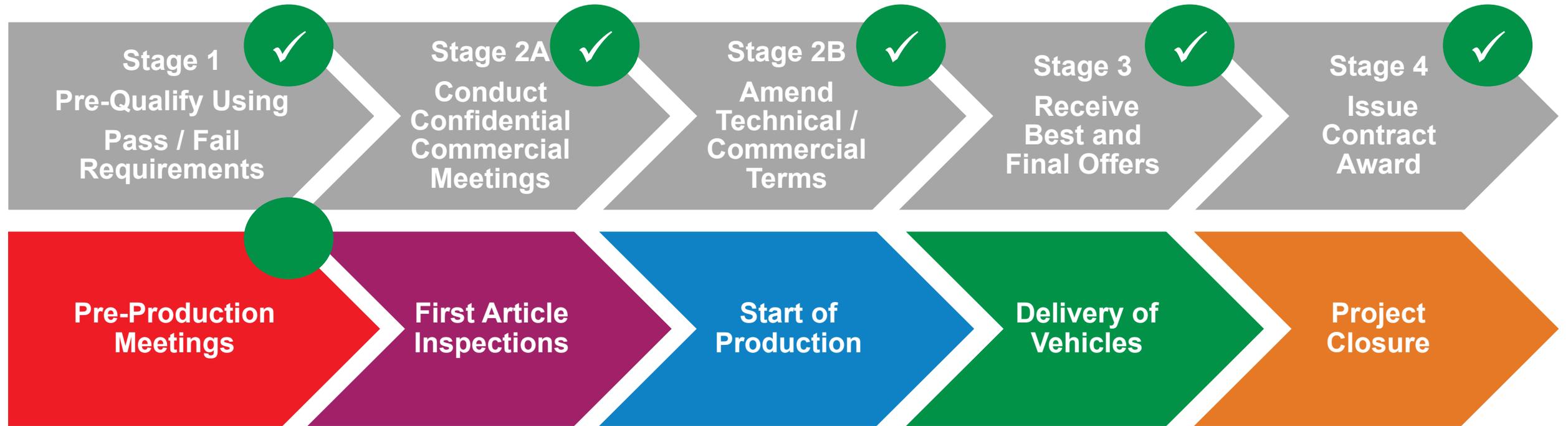
Green Bus Procurement Plan											
	2017-2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
<b>Hybrid</b>	255	336									336
<b>eBus</b>	60	50	183	167	170	175	175	190	190	190	1490
<b>Total</b>	0	386	183	167	170	175	175	190	190	190	1826

Starting in 2018: Introduced 255 latest generation hybrid-electric buses.

February 28, 2022: Awarded last hybrid-electric contract for 336 buses.



# Hybrid-Electric Bus – Procurement Update



- Pre-production design review meetings to close in July 2022
- First vehicle delivery planned for Q1 2023

# | Hybrid-Electric Bus - Benefits

## **Service Impact:**

- Reliability is more than double the Mean Distance Between Failure target of 30,000km

## **Environmental Impact:**

- Reduce GHG emissions by 47% over conventional diesel buses and 25% (or 23 tonnes/bus/yr) over a clean diesel.

## **Financial Impact:**

- Reduce fuel cost by 47% over conventional diesel buses and 25% (or \$12,700/bus/yr) over a clean diesel, at current diesel pricing.

## **Other Key Benefits:**

- Engine stop/start technology to prevent idling in traffic and at bus stops; and
- All-electric accessories, including doors, HVAC, power steering, and air compressor systems.

# Battery-Electric Bus - Overview

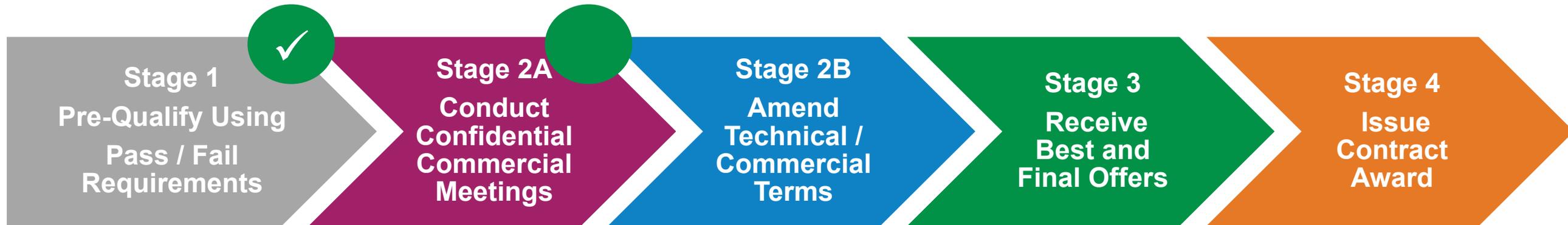
Green Bus Procurement Plan												
	2017-2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2022-2031 Total
<b>Hybrid</b>	255	-	336	-	-	-	-	-	-	-	-	336
<b>eBus</b>	60	-	50	183	167	170	175	175	190	190	190	1490
<b>Total</b>	0	0	386	183	167	170	175	175	190	190	190	1826

Starting in 2019: Introduced 60 battery-electric buses.

April 4, 2022: Initiated procurement of 240 eBuses with the intent of increasing to 400 with increased funding.



# Battery-Electric Bus – Procurement Update



- Currently in Stage 2A
- Working with government partners in parallel to secure matching funds
- Contract Award targeted for September 2022
- Deliveries to commence in Q4 2023

# | Battery-Electric Bus - Benefits

## **Service Impact:**

- Reliability continues to improve and lessons learned from the eBus Head-to-Head evaluation were used to inform the new bulk eBus procurement

## **Environmental Impact:**

- Zero GHG emissions

## **Financial Impact:**

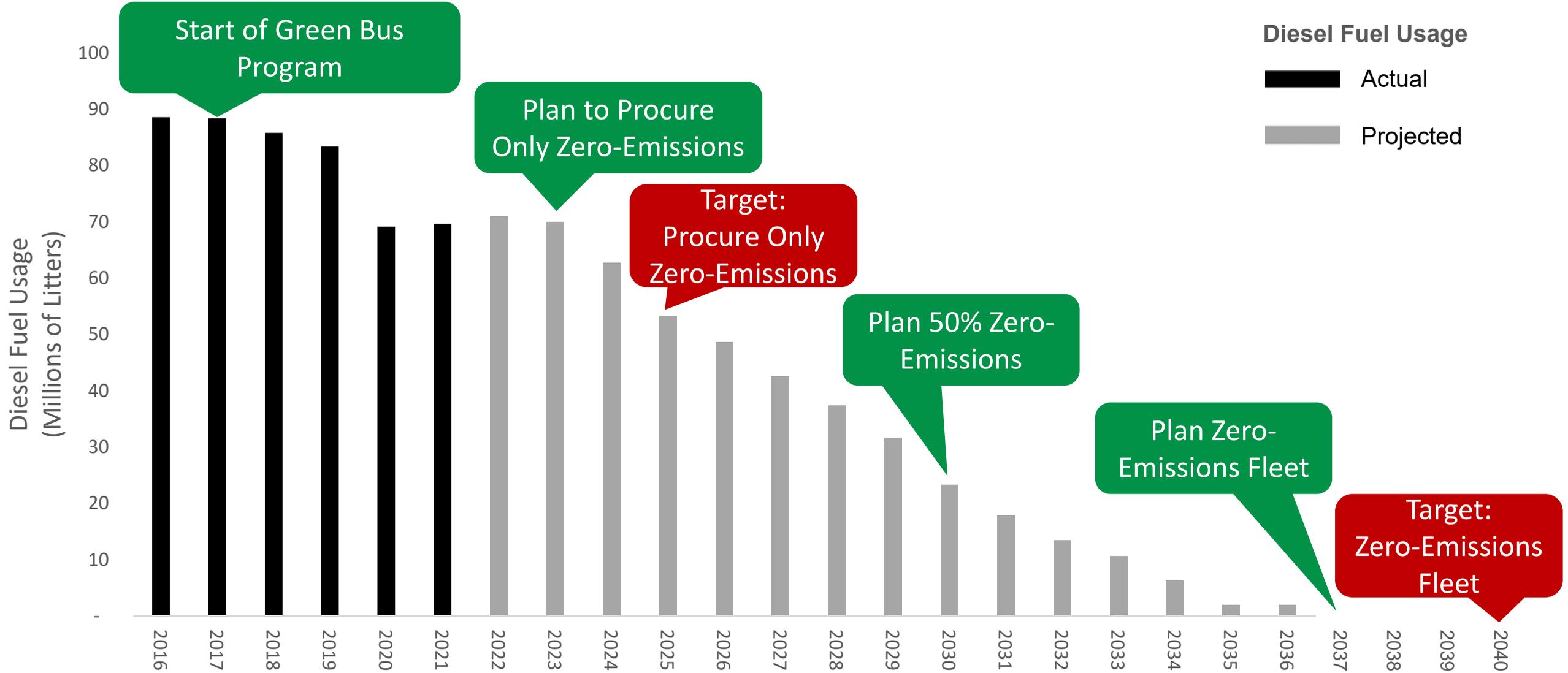
- Reduced fuel/energy cost by 77% or \$40,000 /bus/yr over clean diesel
- Reduce maintenance cost by 25% or \$10,000 /bus/yr over clean diesel

## **Other Key Benefits:**

- Zero tailpipe emissions
- Reduced operating noise
- Improved vehicle reliability



# Battery-Electric Bus - Benefits



# Battery-Electric Bus - Benefits

## Operating Budget Savings: ~\$400 million between 2023 and 2040

Savings relative to the 2022 approved operating budget may be used to offset operating budget pressures or secure recoverable debt.

	2023-2025	2026-2030	2031-2035	2036-2040	Total Cumulative
Fuel and Maintenance Budget Savings	(\$6,200)	(\$63,300)	(\$126,400)	(\$203,400)	(\$399,300)

### Operating Costs (based on 2022 budget):

- Diesel Cost: \$1.13/L
- Electricity Costs: \$0.12/kw/h
- Annual mileage: 65,000 km

### Maintenance Costs:

- Diesel Bus Maint. Cost: \$0.52/km (based on 2022 budget)
- Electric Bus Maint. Cost: 25% less than diesel
- Electrification Infrastructure Cost: included.

## Operating Budget Cost Avoidance: ~\$900 million between 2023 and 2040

Based on expected escalation in fuel prices, battery-electric buses are expected to avoid significant future operating costs estimated \$900 million cumulatively from 2023 to 2040\*

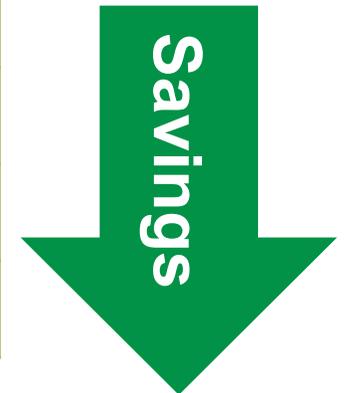
\*Based on forecast price of \$1.50 in 2023, and increasing 7% each year to 2040 (ref. US Energy Information Administration).



# Economics of Advancing eBus Adoption

Based on \$50,000/year and 1% interest on capital.

Number of Years Accelerated	NPV (Operating Savings)	NPV (1% Interest)	NPV (Net Cost Savings)	NPV (Cost Savings compared to base scenario)
Base Scenario (No acceleration)	355,000	0	355,000	0
1	395,000	(13,000)	382,000	27,000
2	434,000	(25,000)	410,000	55,000
3	474,000	(37,000)	437,000	82,000

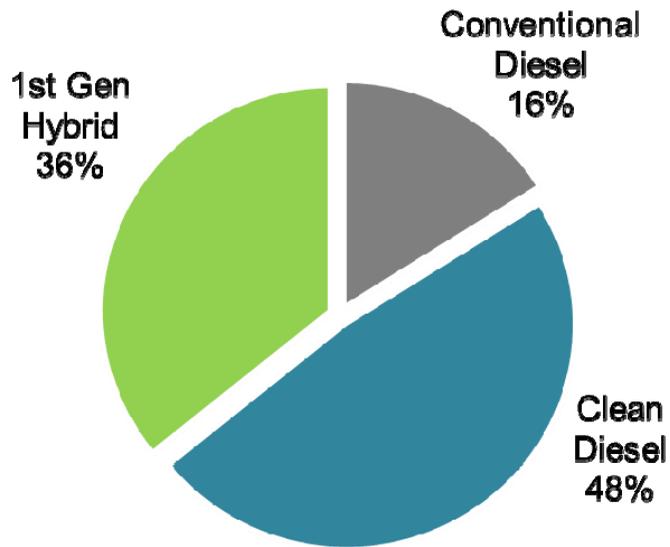


Net operating savings is greater than cost of capital.



# Bus Fleet Composition

2017



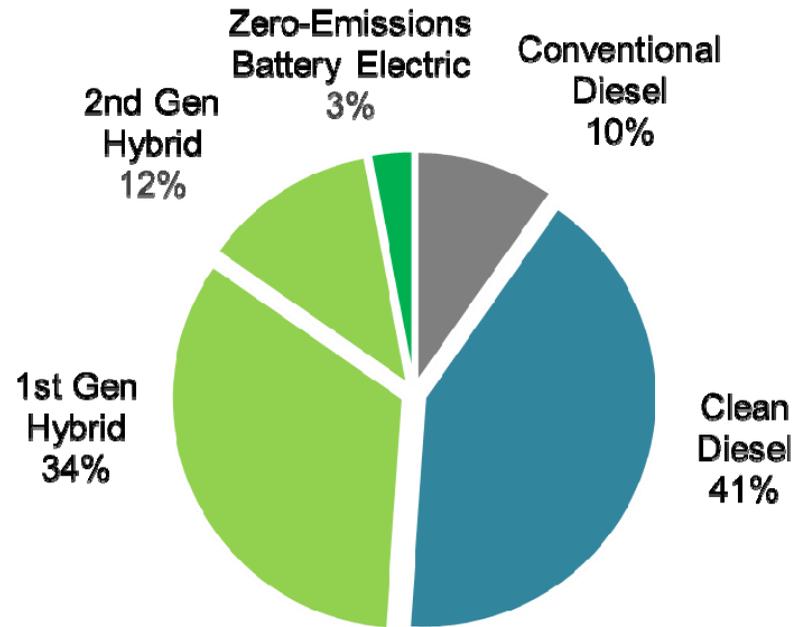
Average Bus GHG Emissions Rate

**1.65**

Kg CO2e/km

**20% Reduction**

2022



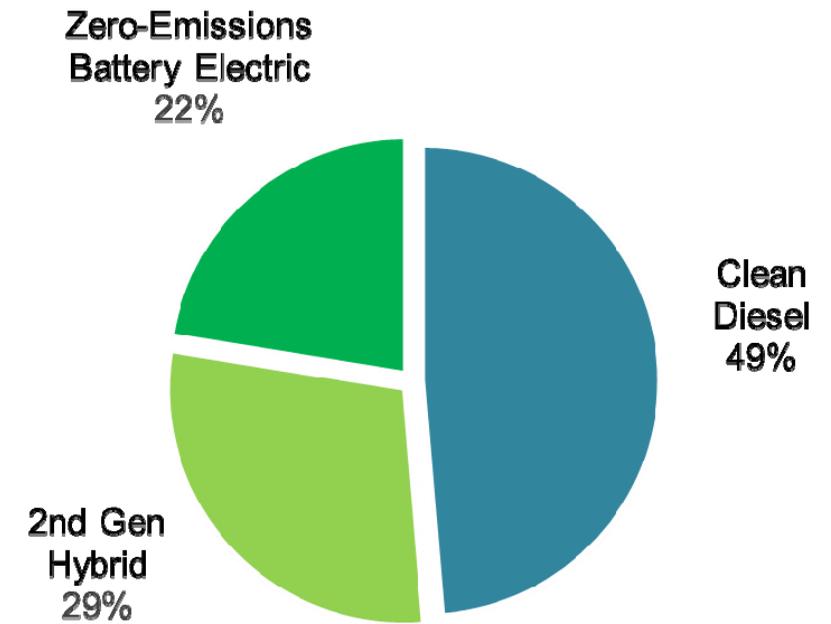
Average Bus GHG Emissions Rate

**1.33**

Kg CO2e/km

**20% Reduction**

2025



Average Bus GHG Emissions Rate

**1.06**

Kg CO2e/km



# Wheel-Trans Green Bus Program Update

- Overview & Current Status
- Program Benefits
- Next Steps

# Wheel-Trans Bus - Overview

Green Wheel-Trans Bus Procurement Plan												
	2017-2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total (2022-2031)
<b>Gasoline 7m</b>	2	84	52	-	3	3	3	45	22	-	-	212
<b>Gasoline 6m</b>	148	-	23	54	7	10	-	19	32	-	-	145
<b>Pilot eBus</b>			-	5	10	-	-	-	-	-	-	15
<b>7m eBus</b>			-	-	-	-	-	45	28	6	6	85
<b>6m eBus</b>			-	-	-	-	-	18	28	12	14	72
<b>Total</b>	<b>150</b>	<b>84</b>	<b>75</b>	<b>59</b>	<b>20</b>	<b>13</b>	<b>3</b>	<b>127</b>	<b>110</b>	<b>18</b>	<b>20</b>	<b>529</b>

Retire Last Diesel Wheel-Trans Bus by Q2 2023

Procurement Split to be Confirmed Through Head-to-Head Evaluation

To date:

- 148, 6m ProMaster delivered
- 22 of 138, 7m ProMasters delivered
- 2030: Steady State Procurement of only Electric Wheel-Trans (eWT) buses



# Wheel-Trans Bus - Benefits

## **Service Impact:**

- 6m ProMasters have a Mean Distance Between Failures of 65,000km which is approximately 5 times greater than that of the diesel fleet

## **Environmental Impact:**

- Reduce GHG emissions by ~33% or 4,200kg/bus/yr

## **Financial Impact:**

- Reduce fuel cost by ~20% or ~\$4,500/bus/yr

## **Other Key Benefits:**

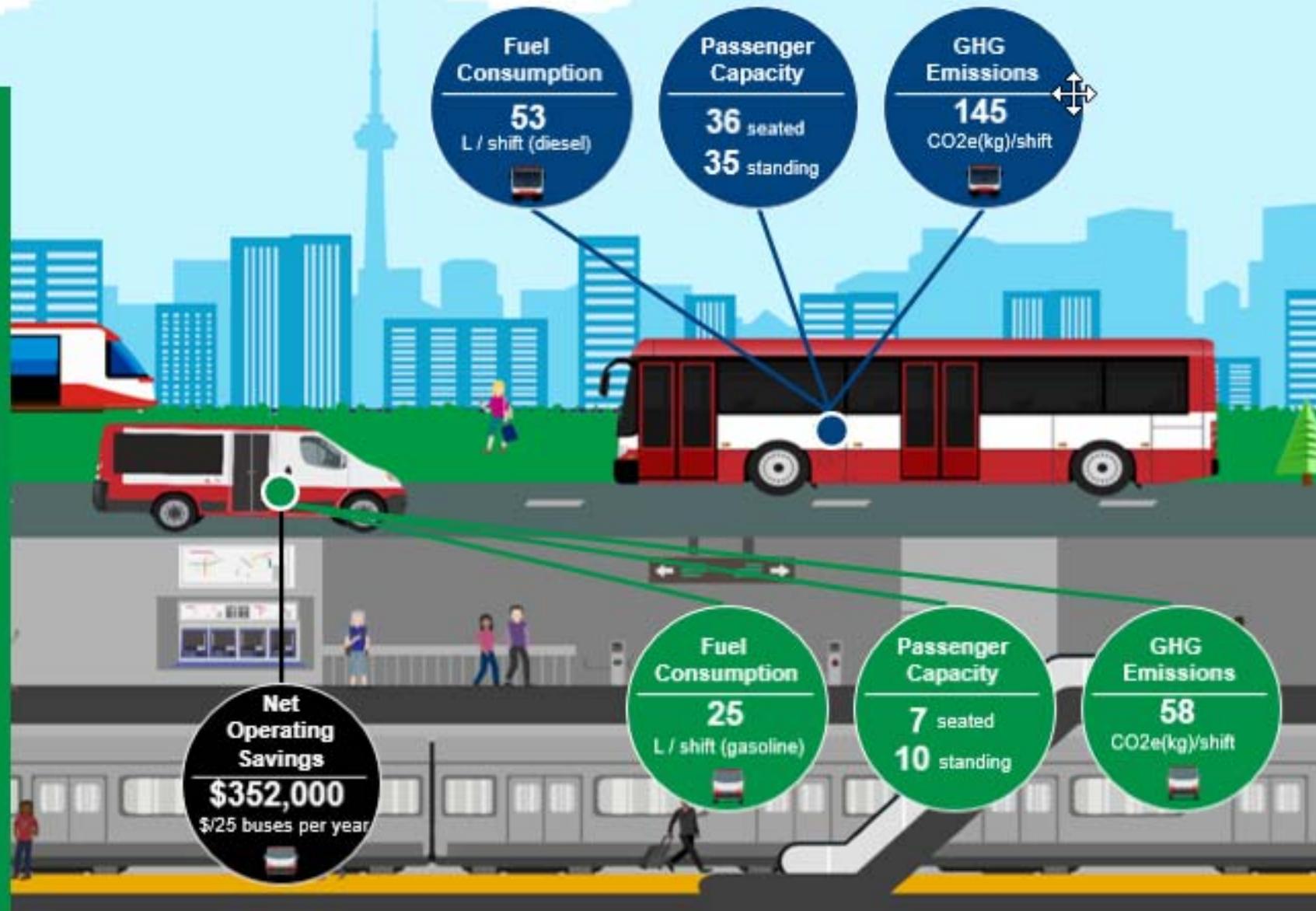
- Improved driveability in the city
- Continued operation of the Community Bus Program
- Vehicle size meets ridership target of 3 passengers per hour
- Lower capital cost



# Wheel-Trans Bus – Next Steps

Explore the innovative use of smaller Wheel-Trans buses to deliver micro transit services that save money and reduce our emissions on lower-volume routes.

Below is a 7m version of TTC's ProMaster minibus.



# Electric BUSES

[ttc.ca/green](http://ttc.ca/green)



**Thank you**

# Recommendations

## Recommendation

It is recommended that the TTC Board:

1. Receive this Green Bus and Wheel-Trans Green Bus Program Update for information;
2. Direct staff to report back to the TTC Board in January 2023 on the status of the eBus procurement through the CEO report; and
3. Endorse TTC staff's continued efforts to develop a financing strategy to enable the TTC to contribute to the funding of its Innovation and Sustainability Program implementation such that operating savings, from fleet electrification and other innovation and sustainability initiatives, can be reallocated to fund any new operating costs and secured to service debt borrowing costs for capital works arising from the implementation of TTC's Innovation and Sustainability Program.

