Zero Emission Bus Transition Plan
2024 Annual Report

Carrie Desmond | Manager Electric Bus Infrastructure

Jeremiah Riter | Assistant Director Bus Maintenance

Agenda

- Zero Emission Bus Transition Plan Overview
- C Line Electric Bus Pilot
- Project Updates: Building a Foundation of Learning

Transition Plan Key Elements

Guiding Principles

- Technical Viability
- Equity & Environmental Justice
- $ Fiscal Impact

Integrate learning objectives into each project to expand knowledge

Evaluate performance to inform future decisions

- Vehicle Procurement
  - Short term: 20% of 40-foot bus replacement procurements to be electric buses from 2025-2030.
  - Long term: provided in future updates based on realized experience in the short term and industry advancements.
- Infrastructure Procurement
  - Procure from multiple manufacturers and evaluate performance to inform future procurement decisions.

Guiding Principles & Key Performance Indicators

Key Performance Indicators	Guiding Principles		
	Technical Viability	Equity & Environmental Justice	Fiscal Impact
Fleet Mileage	◆		◆
Bus Availability	◆		◆
Bus Reliability	◆	◆	◆
Infrastructure Availability	◆		◆
Infrastructure Reliability	◆	◆	◆
Environmental Impact		◆	
Equity & Environmental Justice		◆	
Energy Cost per Mile	◆		◆

C Line Electric Bus Pilot

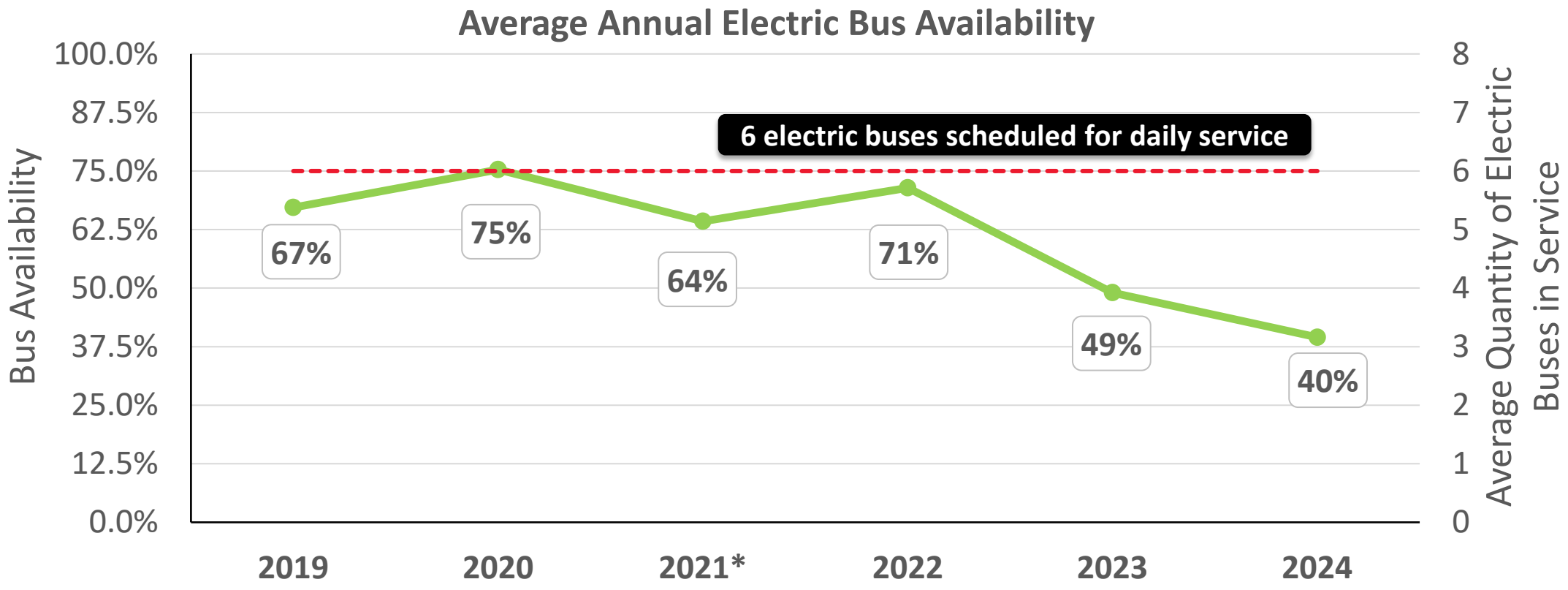
- Opened June 8, 2019
  - (8) 60-foot 466kWh electric buses
  - (8) 150kW plug-in garage chargers
    - Replaced under warranty in 2021
  - (2) 300kW overhead conductive chargers
    - Discontinued in 2023

- Learning Objectives
  - ✓ Compare electric and diesel bus performance on the same route
  - ✓ Gain experience operating electric buses in our climate
  - ✓ Understand performance of electric buses on ABRT service
  - ✓ Pilot combination charging strategy at the garage and on route

Fleet Key Performance Indicators

- **Fleet Mileage:** The total number of miles driven and the percent of scheduled miles driven by electric buses each year
- **Bus Availability:** The percent of electric buses available for use in service
- **Bus Reliability:** Average distance in miles between instances when a bus requires unplanned maintenance attention while in service
  - Also known as mean distance between chargeable road calls (MDBCR)
- **Why are these metrics important?**
  - Fleet metrics help depict how buses perform in our service environment and help Metro Transit assess product ability to consistently provide reliable service to our customers

Bus Availability Relates To All Fleet Metrics



*2021 metrics measured for the 90 days electric buses were used in revenue service

Fleet Key Performance Indicator Summary

Key Performance Indicator	2019*	2020	2021	2022	2023	2024
Electric Bus Availability	67%	75%	64%	71%	49%	**40%**
Annual C Line Electric Bus Miles	66,400	162,700	37,800	175,300	117,400	**64,000**
Annual C Line Diesel Bus Miles	312,600	466,700	625,200	476,900	561,800	**631,100**
Electric Bus Miles Driven v. Scheduled	59%	81%	17%	90%	63%	**51%**
MDBCR– Electric Bus Miles	1,270	4,281	2,763	4,870	2,668	**2,287**
MDBCR– Diesel Bus Miles	8,247	8,656	5,201	8,862	7,700	**8,214**

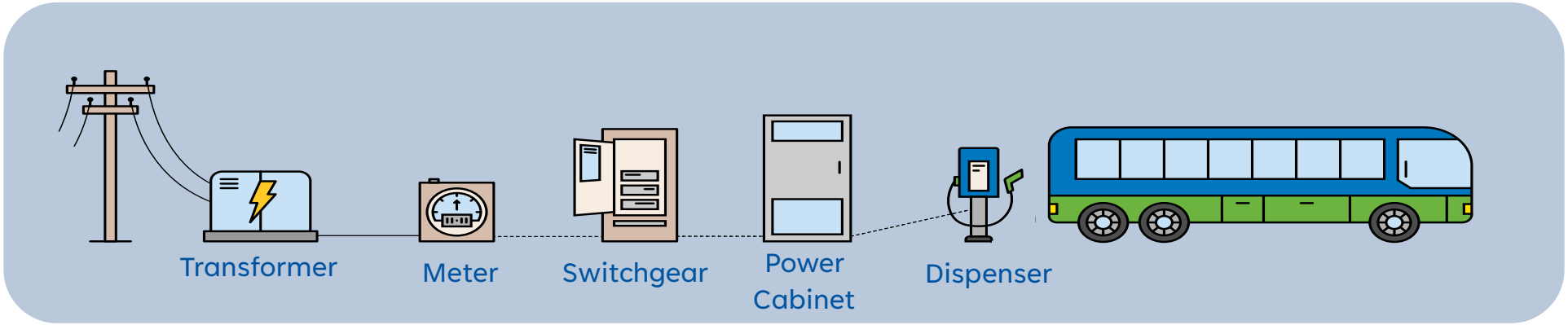
*2019 metrics for period from June, 8, 2019 through end of 2019

Infrastructure Key Performance Indicators

- **Infrastructure Availability:** Percent of chargers available to charge a bus for revenue service
- **Infrastructure Reliability:** The quantity of incidents that take a charger out of service sorted by charger and electric utility incidents
- **Why is it Important?**
  - Historically, fuel pump availability and reliability were not a concern. The infrastructure metrics will help Metro Transit assess technology ability to consistently provide reliable service to our customers and understand infrastructure maintenance requirements.

Infrastructure Key Performance Indicators Summary

Key Performance Indicator	2020	2021	2022	2023	2024
Charger Availability	93%	22%	99.8%	92%	**96%**
Charger Reliability (# incidents)	13	19	2	8	**7**
Power Outages				1	**1**
Momentary Power Disruptions				2	**0**



Environmental Key Performance Indicators

- **Environmental Impact:** Greenhouse gas (GHG) emission reductions compared to a baseline diesel fleet using Argonne National Laboratory's 2024 (AFLEET) model
- **Equity and Environmental Justice:** Percent of electric bus deployments on "High Priority" EEJ service blocks as defined in Section 7.5 of Metro Transit's Zero-Emission Bus Transition Plan (February 2025)
- **Why is it Important?**
  - The environmental metrics quantify the impact the transition towards electric buses has on reducing emissions and demonstrates how we are doing relative to our prioritization method that was co-created with community members for where electric buses operate in the region

Environmental Benefit

- In 2024, 100% of electric bus deployments were on “high priority” EEJ blocks
- Electric bus deployment GHG emissions reductions:
  - 2024: 32 metric tons CO_2e
  - 2019-2024 cumulative: 458 metric tons CO_2e

- 2019-2024 cumulative emissions reductions are approximately equivalent to:

GHG emissions from 107 gasoline-powered passenger vehicles driven for one year

CO_2 emissions from 44,990 gallons of diesel consumed

CO_2 emissions from 95.4 homes’ electricity use for one year

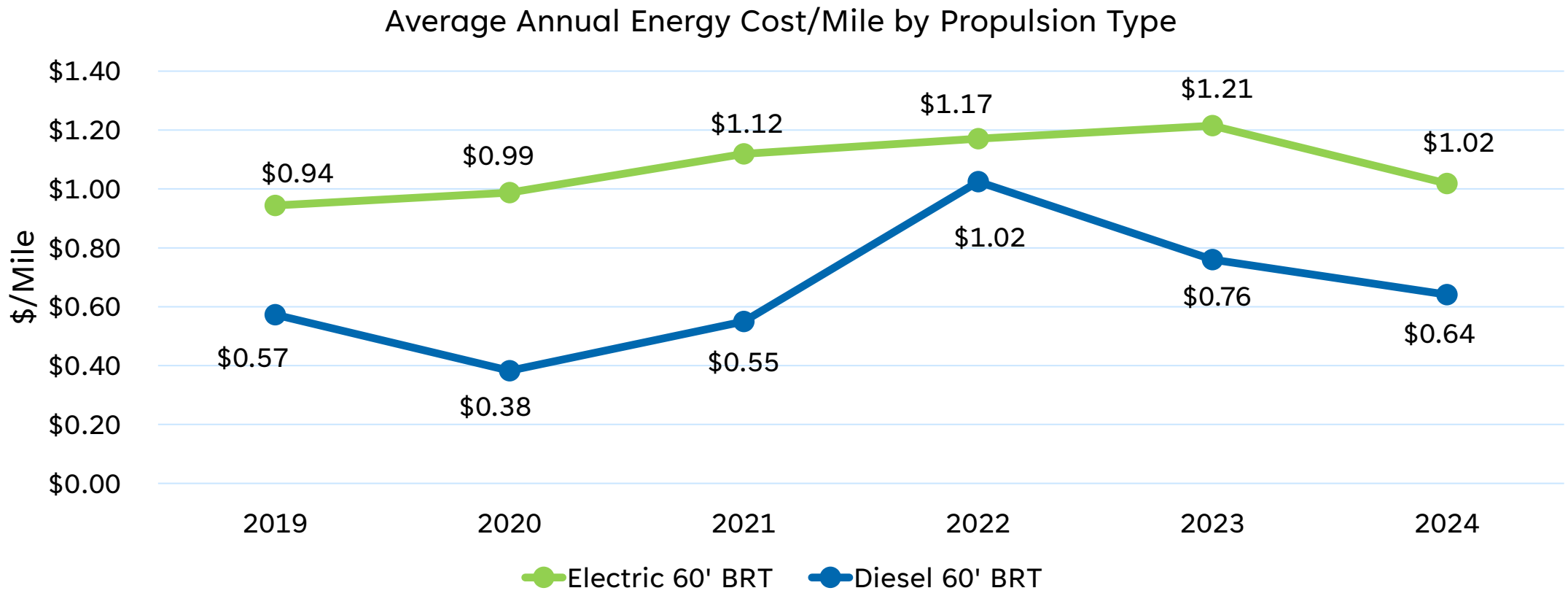
Conversion Source: [EPA Greenhouse Gas Equivalencies Calculator]

Energy Cost Per Mile

- **Energy Cost Per Mile:** Energy cost a bus uses to travel one mile inclusive of propulsion energy (diesel or electricity) and diesel fuel for bus auxiliary heat

- **Why is it Important?**
  - The energy cost per mile metric will help Metro Transit understand the ongoing costs and necessary budget to operate electric buses

Average Energy Costs Per Mile Are Higher For Electric Buses Than Diesel Buses

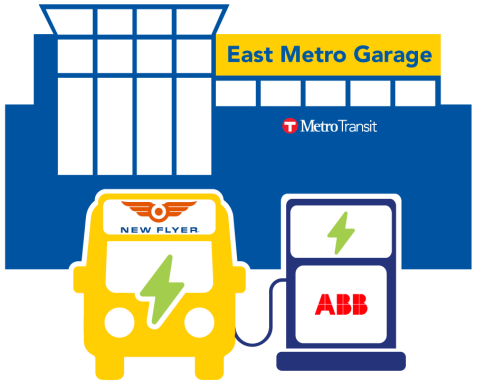


Project Updates: Building a Foundation of Learning

- ✓Experience multiple bus, charger, & software vendors
- ✓Experience multiple service types (ABRT, BRT, Local)
- ✓Understand vehicle range in our climate
- ✓Expand workforce development

METRO Gold Line Electric Bus Service Begins August 2025

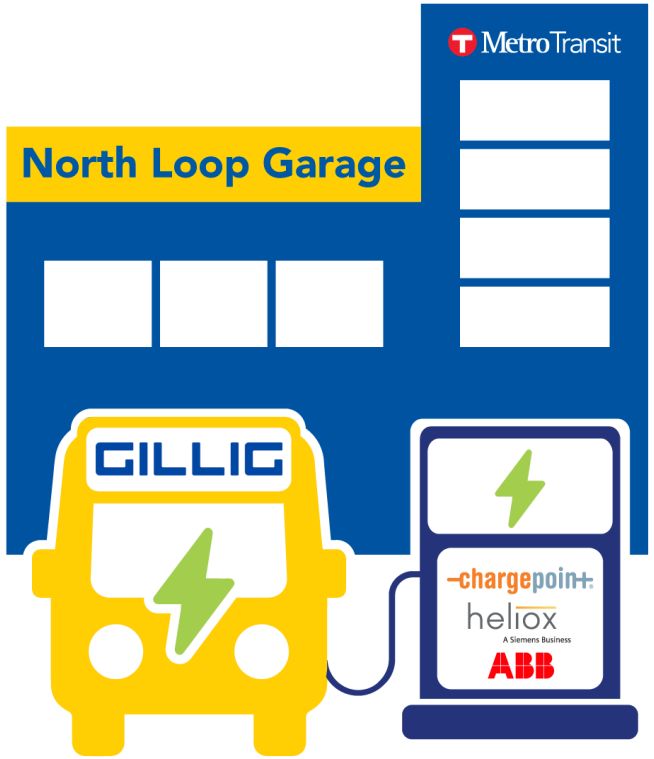
- (5) 60-foot 690kWh New Flyer electric buses
- (4) ABB chargers
- (1) Heliox mobile charger for maintenance use
- The Mobility House charge management software



- Learning Objectives
  - ✓ Understand performance of latest generation 60-foot electric buses
  - ✓ Experience two additional charger manufacturers
  - ✓ Pilot charge management software
  - ✓ Use electric buses on dedicated guideway BRT

Electric Buses Coming to Urban Local Service in 2026

- (20) 40-foot 686kWh Gillig electric buses
- (18) plug-in chargers from ABB, Chargepoint, Heliox
- (3) Heliox mobile chargers for maintenance use
- Viriciti charge management software



North Loop Garage: Metro Transit's Testing & Training Hub

- One of only a few testing and training hubs in North America

- Learning Objectives
  - ✓ Experience Gillig 40-foot electric bus technology
  - ✓ Test interoperability with three charger manufacturers
  - ✓ Pilot electric buses on local service
  - ✓ Utilize Hastus update for electric bus scheduling
  - ✓ Implement EEJ prioritization
  - ✓ Pilot charge management software
  - ✓ Advance workforce development

Program of Planning Projects Inform Next Steps

- Fire Hazard Facility Analysis
- Service Evaluation
- Garage Capacity Analysis
- Fleet Propulsion Type Performance and Alternatives Analysis
- Climate Action Workplan Metric Development
  - Total Emissions per Passenger Mile Traveled

Thank You!

www.metrotransit.org/electric-buses