Metro Transit ZEB Transition 2022 Annual Report

Transportation Committee | September 25, 2023

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Metro Transit
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Agenda

- ZEBTP Overview
- Key Performance Indicators
- Project Updates

Transition Plan Guiding Principles

Technical Viability

Strive to achieve a level of service where ZEBs and diesel buses are referred to as just "buses" rather than by their propulsion type

Technical Viability

Partner with Xcel Energy to assess and upgrade electrical infrastructure for bus operations and maintenance facilities

Equity & Environmental Justice

Implement and prioritize ZEB service reflecting transparent fact-driven community engagement and education

Equity & Environmental Justice

Target ZEB investment in communities where air pollution, racial, and socioeconomic disparities are greatest while also balancing the challenges of new technology

Fiscal Impact

Deploy ZEBs in a fiscally efficient manner in order to maximize use of vehicles and infrastructure

Fiscal Impact

Operate and invest within fiscal means by planning for and optimizing capital and operating expenditures while pursuing new funding streams

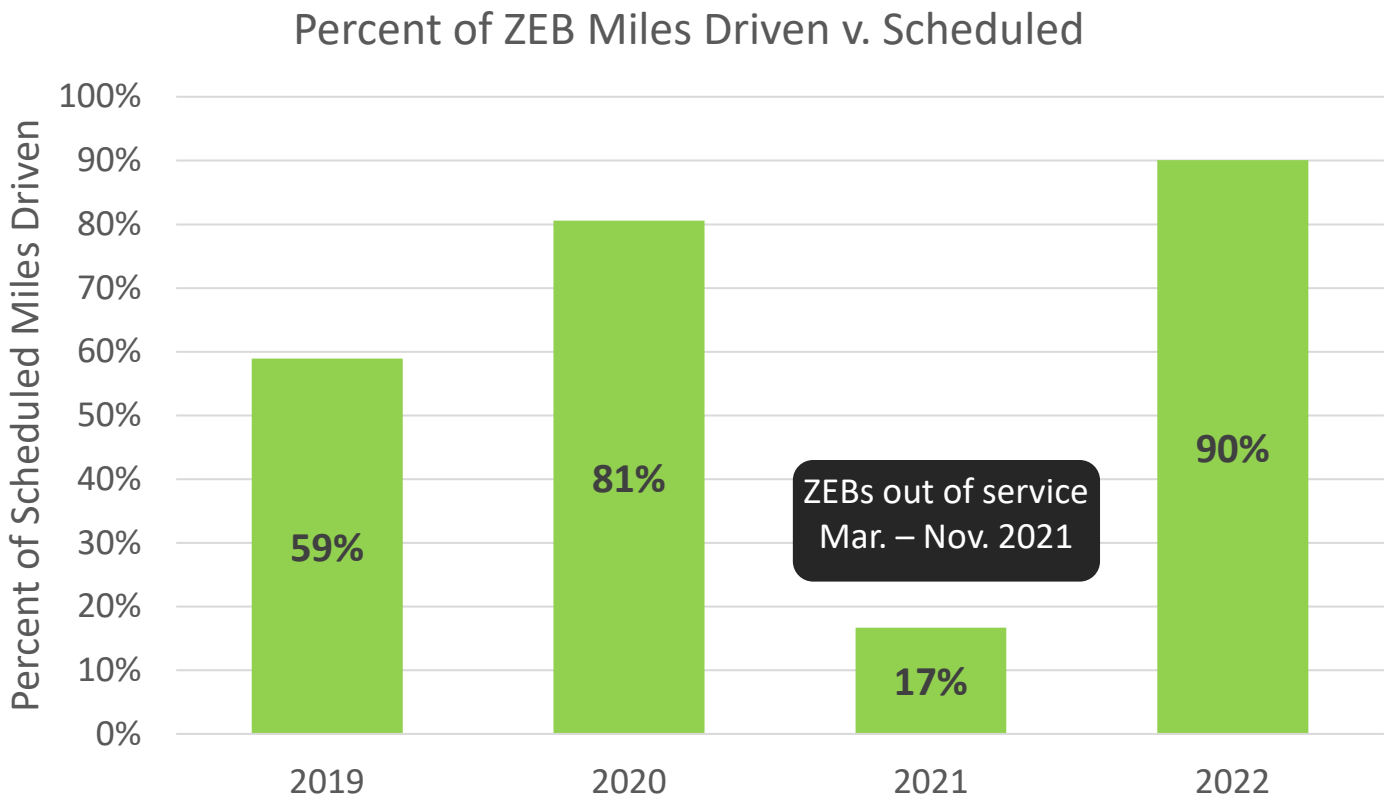
Transition Plan Guiding Principles – Key Performance Indicators

KPI	Guiding Principle		
	Technical Viability	Equity & Environmental Justice	Fiscal Impact
Fleet Mileage	✓		✓
Bus Reliability	✓	✓	✓
Environmental Impact		✓	
Equity and Environmental Justice (EEJ)		✓	
Energy Cost/Mile	✓		✓
Infrastructure Availability	✓		✓
Infrastructure Reliability	✓	✓	✓

Fleet Mileage

- **What is Being Measured?**
  - The total number of miles driven by ZEBs each year
- **How is it Being Measured?**
  - Total odometer miles for the ZEBs
- **Why is it Important?**
  - As Metro Transit makes progress towards transitioning its fleet to ZEBs, the total number of fleet miles driven by ZEBs will increase. Comparing annual vehicle mileage for ZEBs will help depict how they perform in our service environment

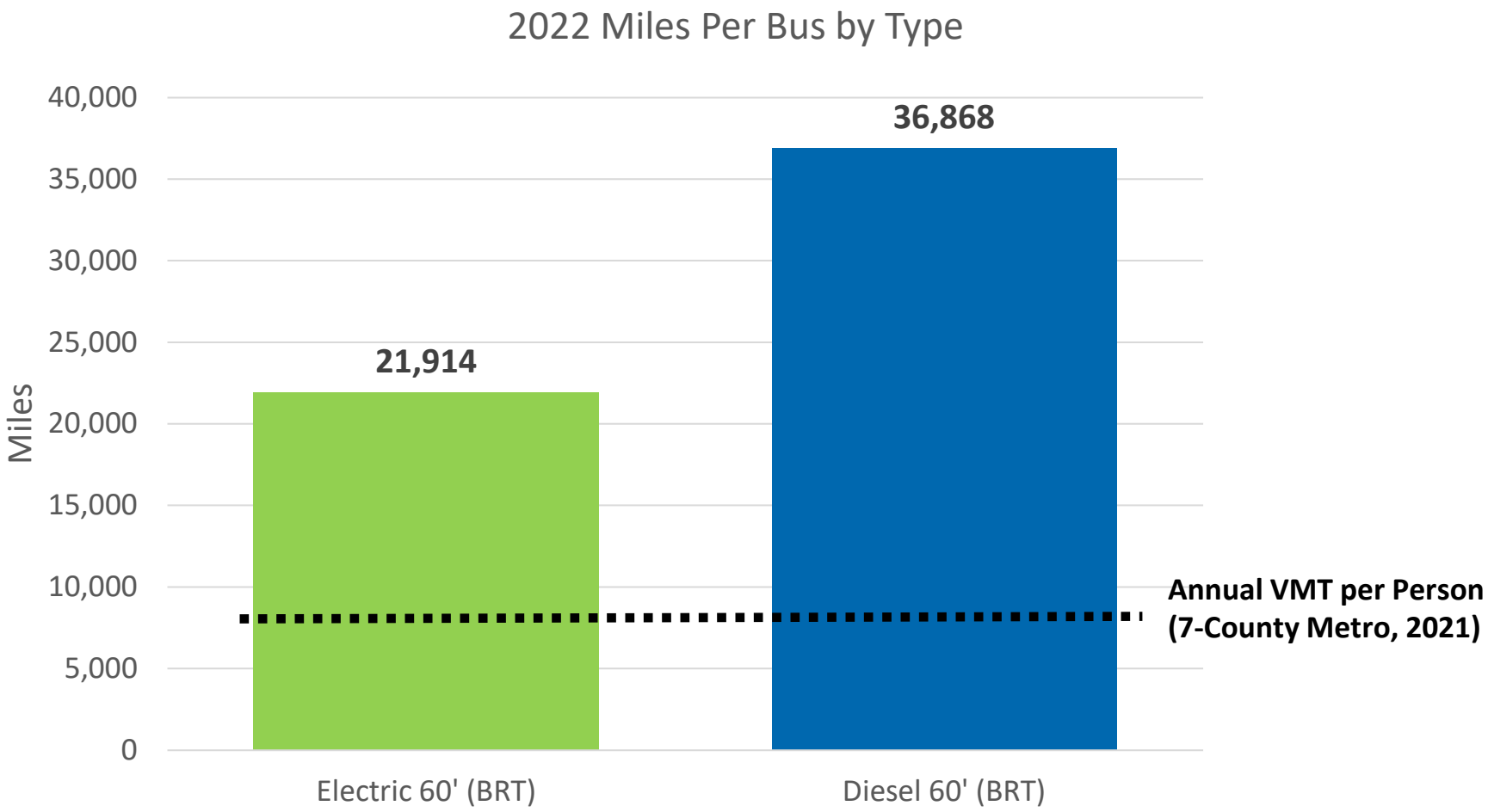
C Line ZEB miles driven reached 90% of scheduled miles in 2022



	2019	2020	2021	2022
Annual C Line ZEB Miles*	66,400	162,700	37,800	175,300
Annual C Line Diesel Miles*	312,600	466,700	625,200	476,900

** Values rounded to the nearest 100*

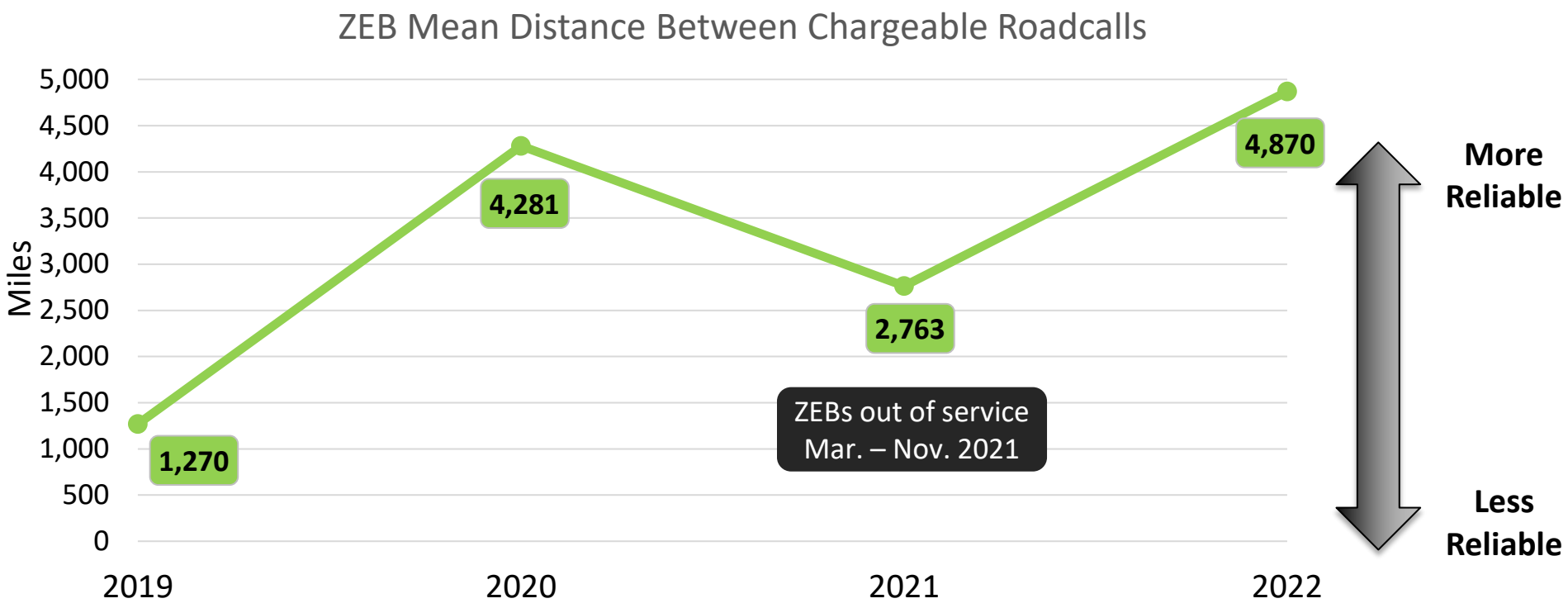
60’ ZEBs travel fewer miles than comparable diesel buses



Bus Reliability

- **What is Being Measured?**
  - Mean (average) distance between chargeable roadcalls.
    - Chargeable road calls are defined as instances when a bus requires unplanned maintenance attention while in service.
- **How is it Being Measured?**
  - Number of miles traveled divided by the number of chargeable roadcalls
- **Why is it Important?**
  - The **Bus Reliability** metric will help Metro Transit evaluate how often a bus breaks down while in service to assess the impact ZEBs have on service reliability and customer experience.

ZEB reliability increased nearly 4x from 2019 to 2022

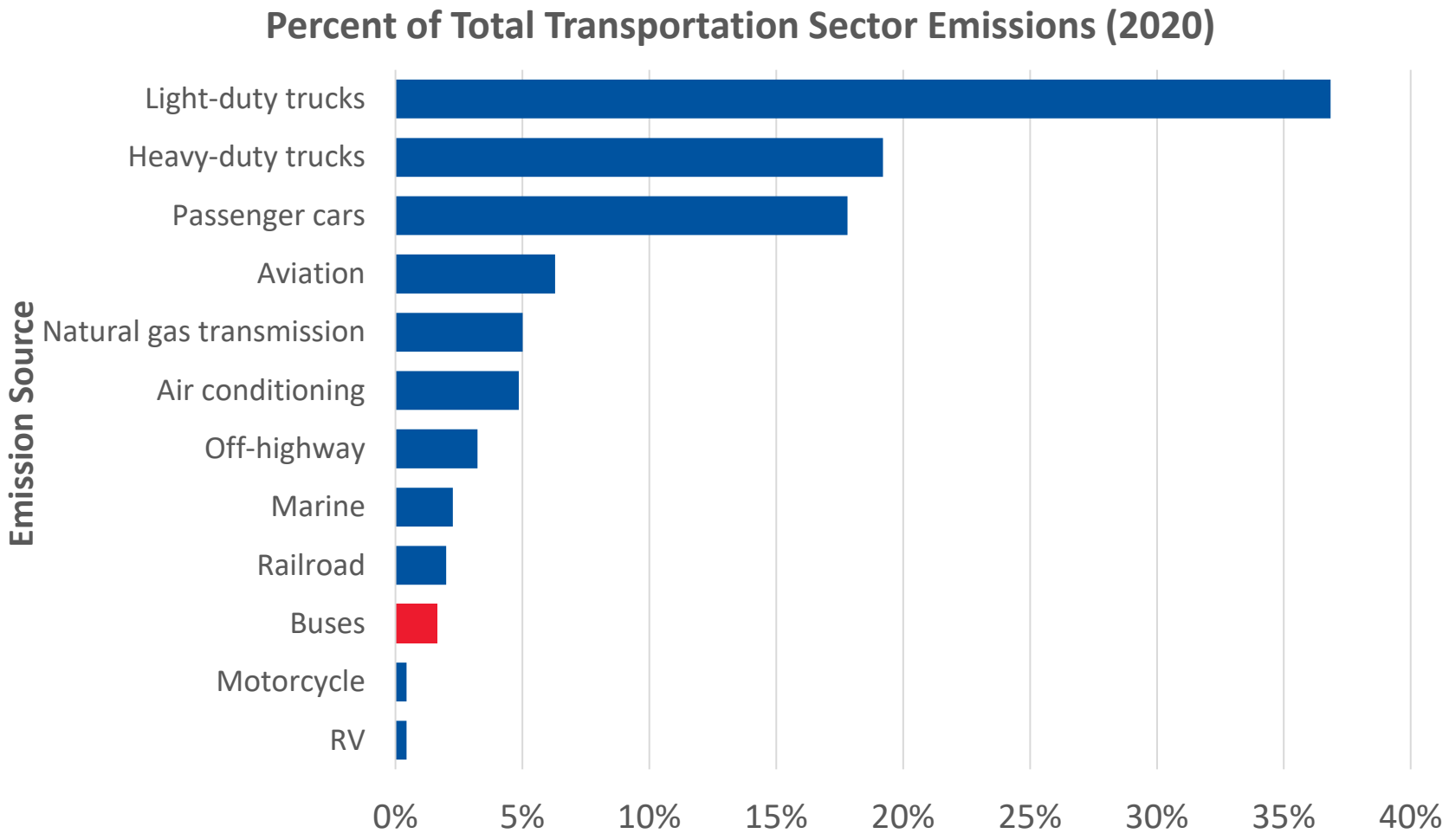


Mean Distance Between Chargeable Roadcalls	2019	2020	2021	2022
60' ZEB BRT Buses	1,270	4,281	2,763	4,870
60' Diesel BRT Buses	8,247	8,656	5,201	8,862

Environmental Impact

- **What is Being Measured?**
  - Greenhouse gas (GHG) emission reductions compared to a baseline diesel fleet
- **How is it Being Measured?**
  - Well-to-Wheel GHG reductions calculated using the Argonne National Laboratory's 2020 Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) model
- **Why is it Important?**
  - The **Environmental Impact** metric quantifies the impact the transition towards ZEBs has on reducing transit vehicle emissions and demonstrates the community benefits that ZEBs deliver to the region

Buses contribute less than 2% of Minnesota's transportation greenhouse gas emissions



Source: [2020 Sector Sources of GHG Emissions and Storage](), Minnesota Pollution Control Agency. Accessed May 2023

Through 2022, ZEB deployments have reduced GHG emissions by 370 Metric Tons CO_2e.

This is equivalent to the CO_2 emissions from:

36,149 gallons of diesel consumed

71.6 homes' electricity use for one year

Charging nearly 44,764,500 smartphones

Conversion Source: EPA Greenhouse Gas Equivalencies Calculator

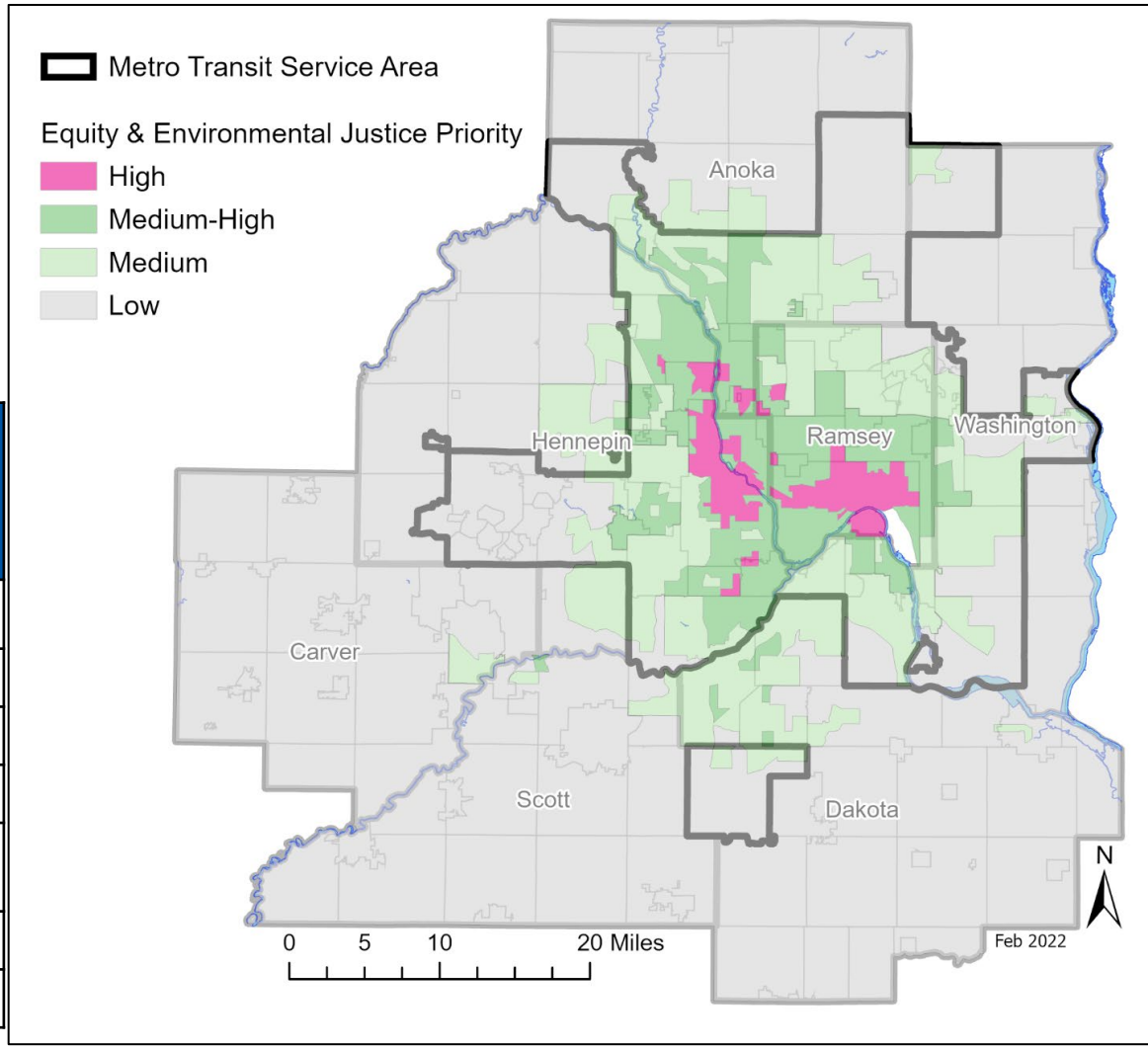
Equity and Environmental Justice (EEJ)

- **What is Being Measured?**
  - Percent of ZEB deployments on “High Priority” EEJ service blocks as defined in Section 8.3.2 of Metro Transit’s Zero-Emission Bus Transition Plan (February 2022)
- **How is it Being Measured?**
  - ZEB deployments on “High Priority” EEJ service blocks divided by the total number of ZEB deployments
- **Why is it Important?**
  - The **Equity and Environmental Justice** metric will help Metro Transit understand the impact ZEB deployment prioritization is having in the community based on environmental, racial, and socioeconomic considerations

Equity and Environmental Justice (EEJ)

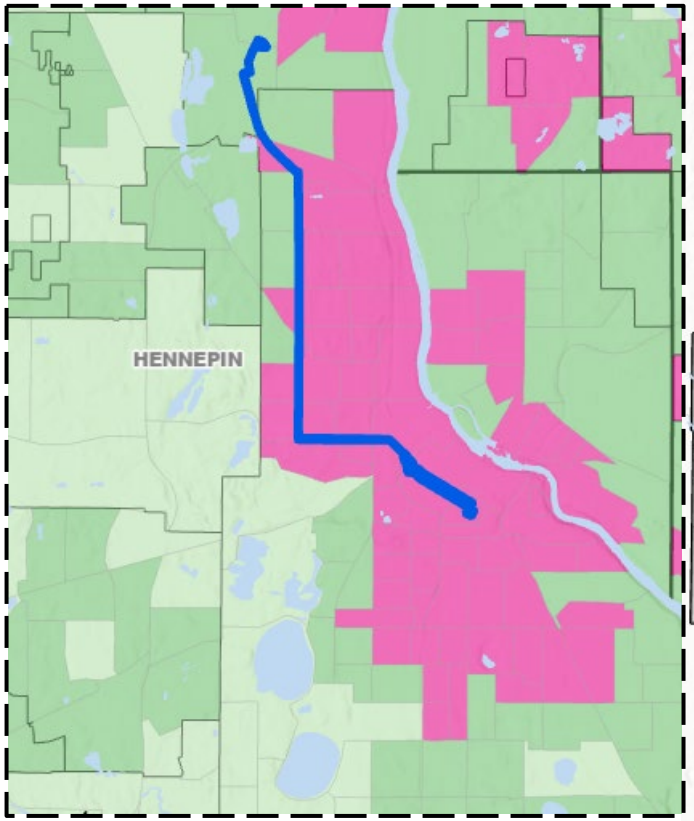
- High Priority service blocks have the greatest portion of bus mileage in High Priority (pink) EEJ Areas

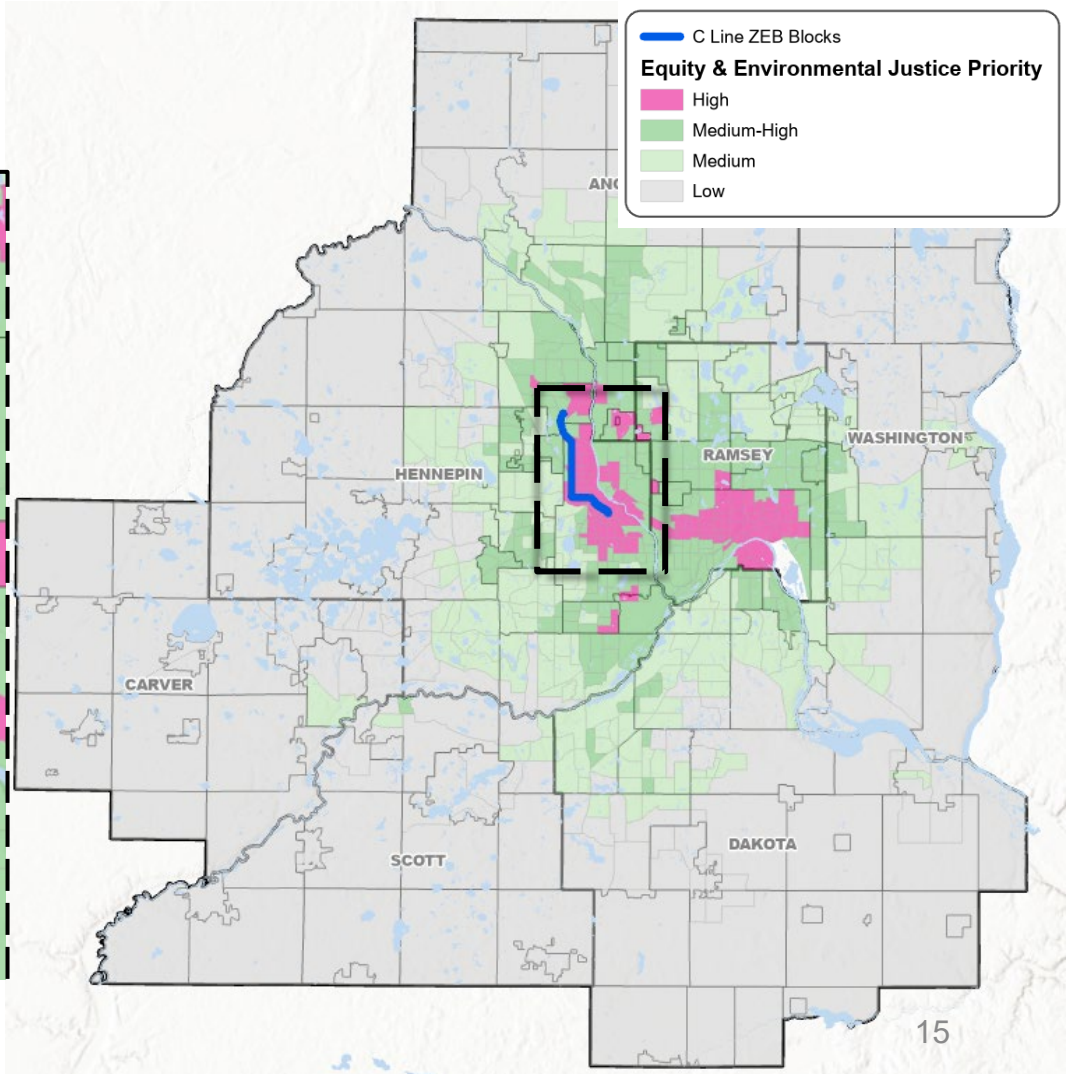
Component	% of Census Tract EEJ Score
Cancer Risk	34%
Population Density	22%
% BIPOC	17%
% Zero Car Household	11%
# of Years Area of Concentrated Poverty	9%
Avg. Land Temperature	4%
% Housing Cost Burdened	3%



In 2022, 100% of ZEB deployments were on “High Priority” EEJ blocks

METRO C Line

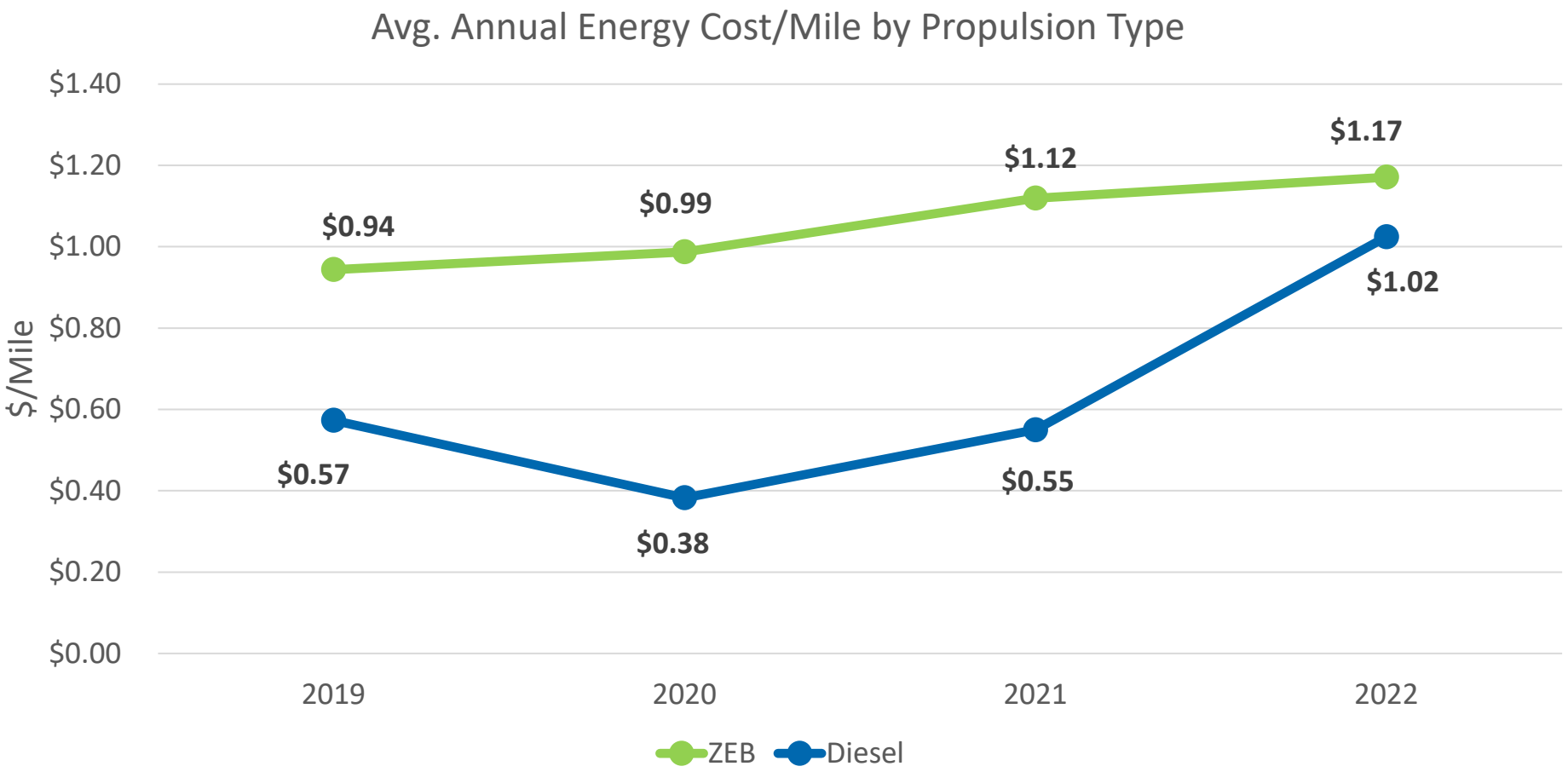




Energy Cost/Mile

- **What is Being Measured?**
  - Energy cost a bus uses to travel one mile inclusive of propulsion energy (diesel or electricity) and diesel fuel for bus auxiliary heat
- **How is it Being Measured?**
  - The total energy cost by vehicle group divided by the total miles traveled by that group
- **Why is it Important?**
  - The **Energy Cost/Mile** metric will help Metro Transit understand the ongoing costs and necessary budget to operate ZEBs

Average annual energy costs per mile are historically higher for ZEBs than diesel buses



Infrastructure Availability

- **What is Being Measured?**
  - Percent of chargers available to charge a bus for revenue service
- **How is it Being Measured?**
  - Total number of days each charger is available to support deploying buses in revenue service divided by the total number of planned service days
- **Why is it Important?**
  - Historically fuel pump availability was not a concern, however early charger deployments have had lower availability. The **Infrastructure Availability** metric will help Metro Transit assess technology ability to consistently provide reliable service.

In 2022, all charger locations achieved an average availability greater than 95%

Plug-In: Heywood Garage

2020	2021	2022
93%	22%	99.8%

On-Route: BCTC

2020	2021	2022
62%	87%†	96%

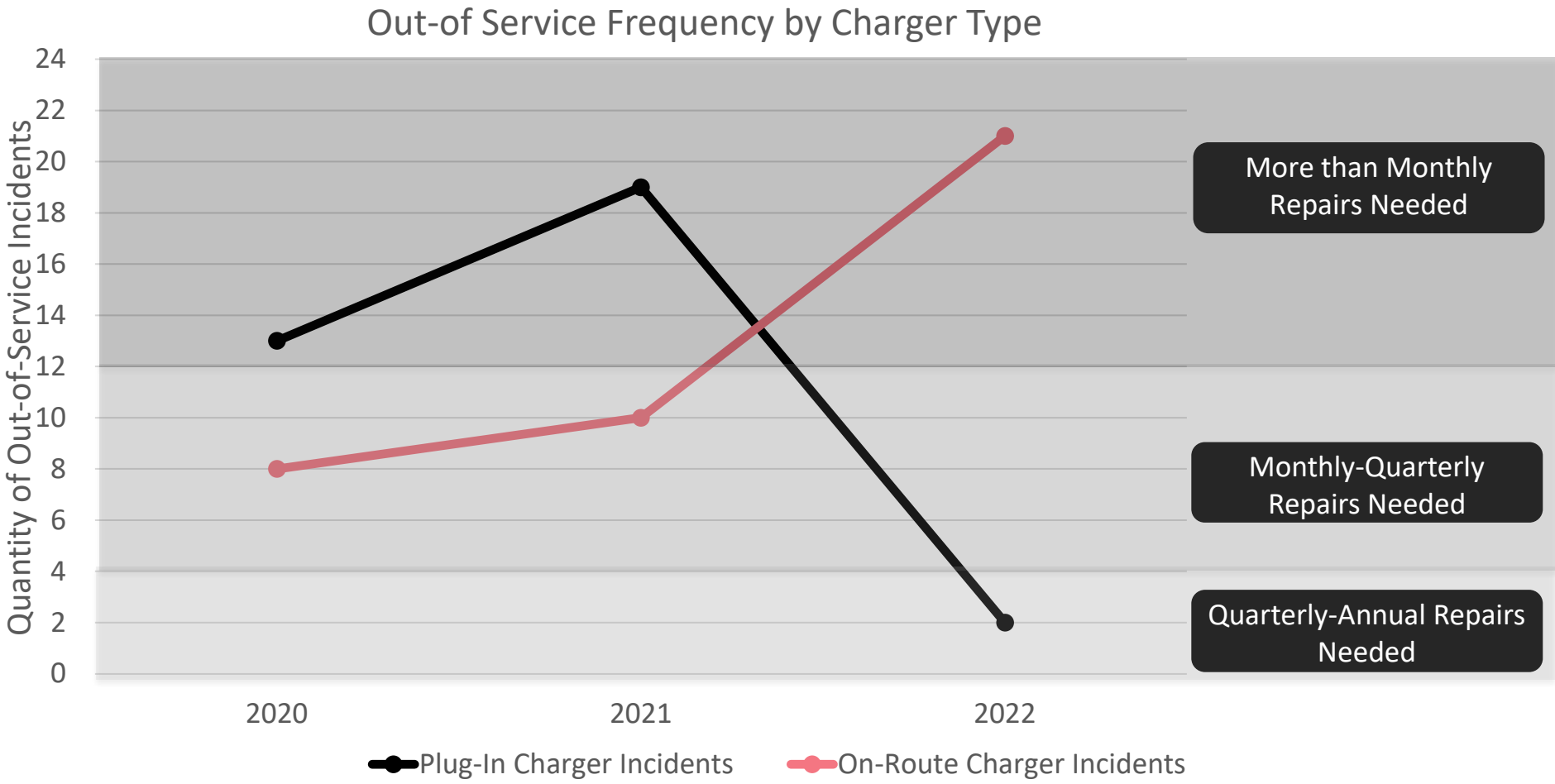
** Metrics not reported for 2019 while commissioning was ongoing*

† 2021 On-Route Charger availability reflects data from 1/1/21 – 3/2/21 when ZEBs were in-service

Infrastructure Reliability

- **What is Being Measured?**
  - The quantity of incidents that take a charger out of service
- **How is it Being Measured?**
  - **Incident Quantity**: Number of incidents that take a charger out of service
- **Why is it Important?**
  - The **Infrastructure Reliability** metric will help Metro Transit understand how often chargers must be temporarily removed from service for unplanned maintenance. This will help Metro Transit assess technology ability to consistently provide reliable service.

Out-of-service incidents are decreasing for garage (plug-in) chargers and increasing for on-route chargers



Note: Metrics not reported for 2019 while commissioning was ongoing. 2021 On-Route charger reliability reflects data from 1/1/21-3/2/21 when ZEBs were in service

Zero-Emission Bus (ZEB) KPI Summary

2021 - 2022 Summary

KPI	Battery Electric 2021*	Battery Electric 2022**
Fleet Mileage* **	37,800	175,300
Bus Reliability *(Mean Distance Between **Chargeable** Road Calls)*	2,763	4,870
Environmental Impact** ** *(GHG [CO_2e] Reduction in Metric Tons)*	10	145
Equity and Environmental Justice (EEJ) *(Percent of BEB Deployments on "High Priority" EEJ Blocks)*	100%	100%
Energy Cost/Mile	$1.12 *($0.55 for diesel bus)*	$1.17 *($1.02 for diesel bus)*
Infrastructure Availability *(Average Full Days Available to Charge a Bus for Use in Revenue Service)*	Garage: 22% On-Route: 87%	Garage: 99.8% On-Route: 96%
Infrastructure Reliability *(Total incidents that take chargers out of service)*	Garage: 19 On-Route: 10	Garage: 2 On-Route: 21

** In calendar year 2021, ZEBs were out-of-service March-November*

*** Green cells or text indicate an improvement or consistent performance since 2021 while orange cells or text represent a decline*

**** Rounded to the nearest 100 miles*

***** Rounded to the nearest 5 Metric Tons*

January to June 2023 Preliminary Findings

- Numerous bus high voltage battery cell replacements
  - 70% of scheduled ZEB miles driven
- On-route charger reliability continues to be a challenge
  - BCTC chargers out of service June 15 - present
- Continue to have 100% BEB deployments on high-priority EEJ blocks
- Energy cost per mile continues to be higher for BEBs compared to diesel

FTA awards Metro Transit $17.5M for FY23 Low/No

Announcing:

New funding for zero-emission buses!

Metro Transit

Project Updates: Workforce Development

- Bus Maintenance Mechanic Technician Apprentice Program
- Infrastructure training & SOP development
- Peer exchange
- Formalized Electric Bus Infrastructure team with 3 staff
- Hiring Program Manager Bus Technologies

Project Updates: North Loop Garage

- Service started March 2023
- Built to accommodate electric bus technology, capacity for a growing zero-emission fleet
- 20 40ft Battery-electric buses in procurement for regular service routes
- 23 chargers (20 depot, 3 mobile)

Switchgear to power future BEB power cabinets

Project Updates: East Metro Garage

- 5 60-foot electric buses and chargers for Gold Line
- Working with Xcel for new power feeders and exterior site preparation
- Anticipate additional 40-foot electric buses after Gold Line

Engagement

- In 2022…
  - 13 events, tours or speaking engagements
  - 20 peer exchanges
  - 13 vendor meetings
  - 5 industry work groups & committee assignments
- Through August 2023…
  - 12 events, tours or speaking engagements
  - 10 peer exchanges
  - 6 vendor meetings
  - 4 industry work groups & committee assignments
- Save the Date
  - Stakeholder ZEBTP Update Summits
    - Oct. 26: 6pm
    - Oct. 27: 12pm

EV Day at the Capitol

Thank You!

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