Roadmap:

Zero-Fare with Zero-Emissions

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Discussion Route:

- REARVIEW MIRROR - Where have we been and what have we already done?
- CURRENT LOCATION – Where are we and what's happening now?
- DESTINATION - Where are we headed?
- TURN BY TURN - What are our next steps toward our destination?

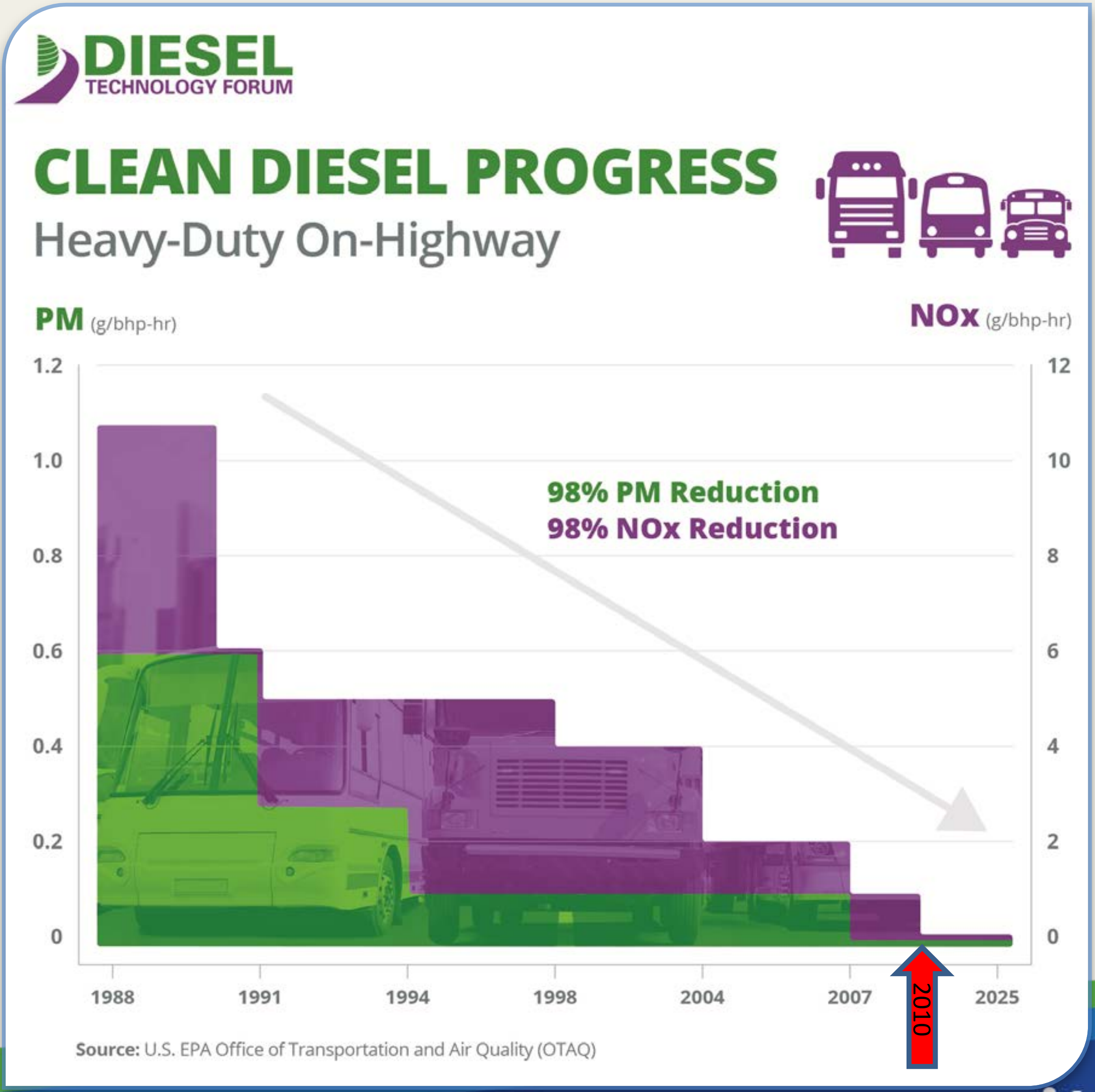
Definitions:

- BEB/BEV – Battery Electric Bus or Vehicle
- DAL – Intercity Transit Dial-A-lift vehicle used for paratransit services
- DOE RFI – U.S. Department of Energy's recent Request For Information for the Hydrogen Earthshot initiative
- ELECTROLYSIS – A process of making hydrogen from water
- FCEB – Fuel Cell Electric
- H2 – Hydrogen as a fuel in either liquid or gaseous form
- NON-REVENUE VEHICLES - Agency vehicles used in activities that support our transit services
- NOx – Oxides of Nitrogen – a greenhouse gas related to vehicle emissions
- PM – Particulate Matter – particles of solids or liquids contained in vehicle exhaust (soot, smoke, etc.)
- PV – Photovoltaic system (aka. Solar)
- REVENUE VEHICLES – Agency vehicles used in providing transportation services to the community
- SMR – Steam Methane Reformation – a process for producing hydrogen from Natural Gas

INTERcity TRANSIT

REARVIEW MIRROR:

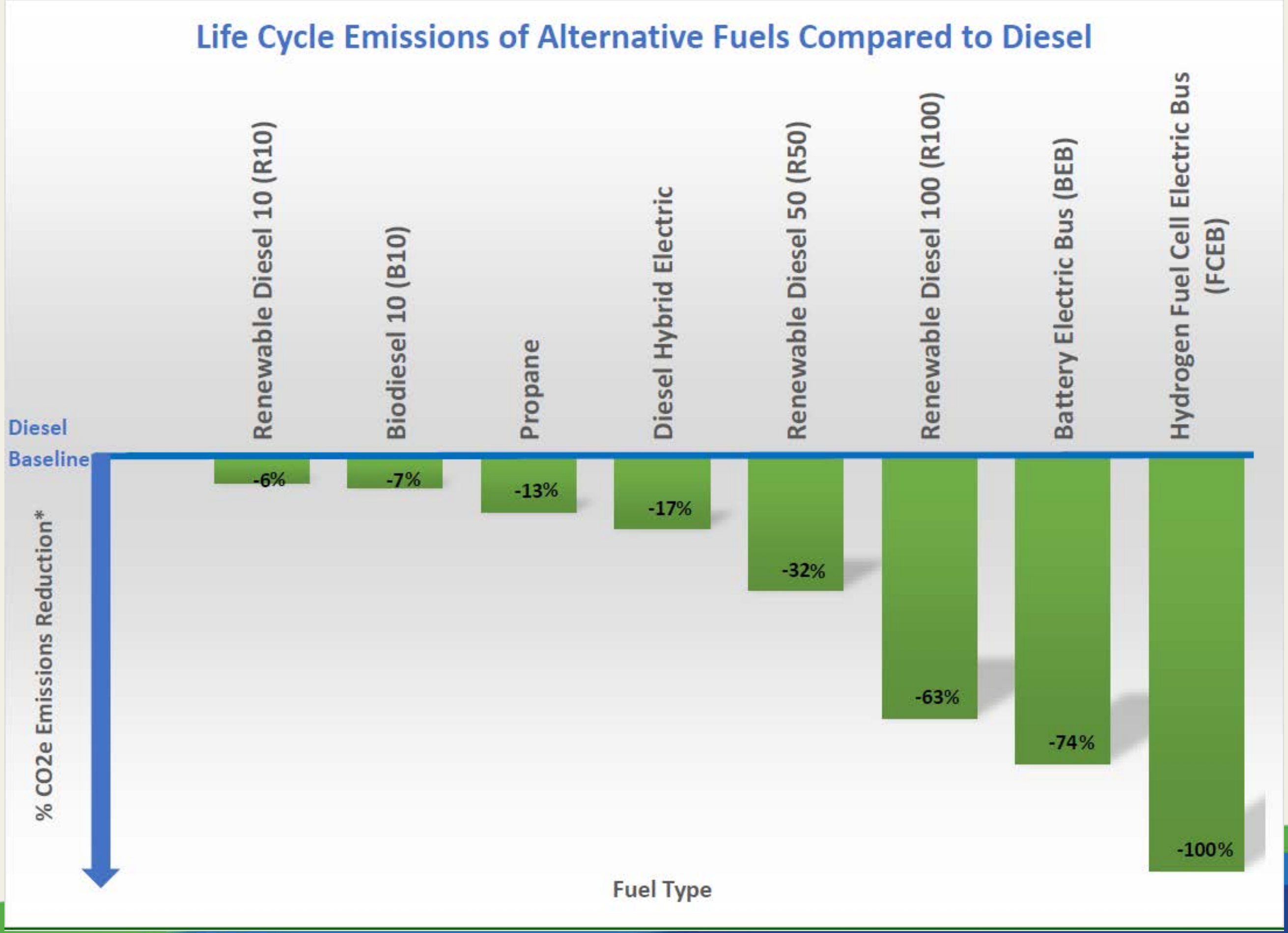
- FLEET REFRESH
  - Feb/March 2022 -- Wrapping up last 10 of 63 Clean Diesel bus purchase initiated in 2018
  - All remaining buses will be 2010 or newer



INTERcity TRANSIT

REARVIEW MIRROR:

- EMISSION REDUCTION CHOICES
  - **2006-2010**: Ulta-low Sulfur Diesel phased in by US EPA (suppliers mandate)
  - **2008**: Began using Biodiesel blend (B10)
  - **2010-2014**: Purchased 23 hybrid buses
  - **2018**: Introduced Propane DAL vehicles
  - **2020**: Began using Renewable Diesel blend (R10)
  - **Late 2021**: Increase Renewable Diesel blend (R50)



*The figures above come from several sources and studies, and in some cases, reflect the middle of a range. Variables in the studies include bus size, location, and operation, as well as the source of fuel feedstock and electricity generation (e.g., power grid mix).

INTERcity TRANSIT

CURRENT LOCATION:

- GET INVOLVED AND CONTINUE TO LEARN
  - Staff regularly participates:
    - Zero Emissions Bus Resource Alliance (ZEBRA)
    - WSU Green Transportation Program
      - Alternative Fuels &Vehicles Technical Assistance Group (AFV-TAG)
    - APTA Zero Emission Fleet Committee
    - The Consortium for Hydrogen And Renewably Generated E-Fuels (CHARGE) created by the Joint Center for Deployment and Research in Earth Abundant Materials (JCDREAM)
  - Outreach and ongoing communication with many transit agencies across the United States for lessons learned in ZEB deployment
  - DOE RFI and 2 Legislative asks for future earmark funds, State Reps
  - Continued partnerships on the horizon: PSE, PNNL, City of Olympia, multiple suppliers

CURRENT LOCATION:

- FLEET COMPOSITION – “REVENUE” VEHICLES
  - Buses (86)
    - 10 Gillig Diesel (2007) – pending Replacement
    - 23 Gillig Hybrid (2010, 2012 and 2014)
    - 53 Gillig Clean Diesel (2018-2021)
      - ON ORDER -- 10 Gillig Clean Diesel (Starting production in Jan 2022)
- Dial-A-Lift (54)
  - 18 Chevrolet Diesel (2011)
  - 10 Chevrolet Diesel (2012)
  - 19 Ford Propane (2018 and 2019)
    - ON ORDER – 28 Ford Propane
  - 7 Ford Unleaded (2019)

INTERcity TRANSIT

CURRENT LOCATION:

- FLEET COMPOSITION – NON-REVENUE
  - Operations Support
    - 3 – Explorer SUV
    - 2 - F150 Pickup
  - Facilities Support
    - 2 – Vans
    - 9 – Utility trucks
    - 1 - Sweeper
  - Fleet Support
    - 2 – Utility Trucks
    - 5 - Staff Cars
  - Village Vans – 6
  - Community Vans - 8
  - Walk-N-Roll - 1

INTERcity TRANSIT

DESTINATION:

- OUR LONG TERM GOAL – ZERO-FARE/ZERO-EMISSIONS
  - How do we decide which fleet technology?
    - Focus on “Green” and Efficiency and Cost
    - Funding availability
    - Infrastructure requirements and available space
    - “Fuel/Energy” availability
    - Expected vehicle performance
    - “Fit” into existing operations and our service to the Community

DESTINATION:

- OUR LONG TERM GOAL – ZERO-FARE/ZERO-EMISSIONS

"We are committed to pursuing zero-emissions transit service in support of environmental and social stewardship, economic responsibility, and fulfilling the vision for our community. That vision also includes providing fare-free transit which Intercity Transit began in January 2020. Our goal is Zero-Fare and Zero Emissions to achieve equity and access for all."

Excerpt from Intercity Transit's response to DOE Hydrogen Energy Earthshot RFI – July 2021

DESTINATION:

- OUR LONG TERM GOAL – ZERO-FARE/ZERO-EMISSIONS
  - Current focus for primary, long-term solutions, but remain open to technology advancements
    - Hydrogen fueling infrastructure and FCEB Revenue fleets
    - BEV for support/non-revenue fleets
    - PV integration for some grid independence

DESTINATION:

- REVENUE FLEET SOLUTION
  - Hydrogen Fuel Cell Electric Buses (FCEB)
    - WHY?
      - Outreach and Research Results
      - Minimal operational/service impacts
      - Resiliency/Emergency Response

DESTINATION:

- REVENUE FLEET – FCEB Benefits vs BEB
  - Longer Range
    - Consistent regardless of environment
  - No need for mid-day or on route charging
    - Can be fueled similar to diesel buses
  - Fewer batteries

DESTINATION:

- REVENUE FLEET -- OUTREACH AND RESEARCH RESULTS (PERFORMANCE)

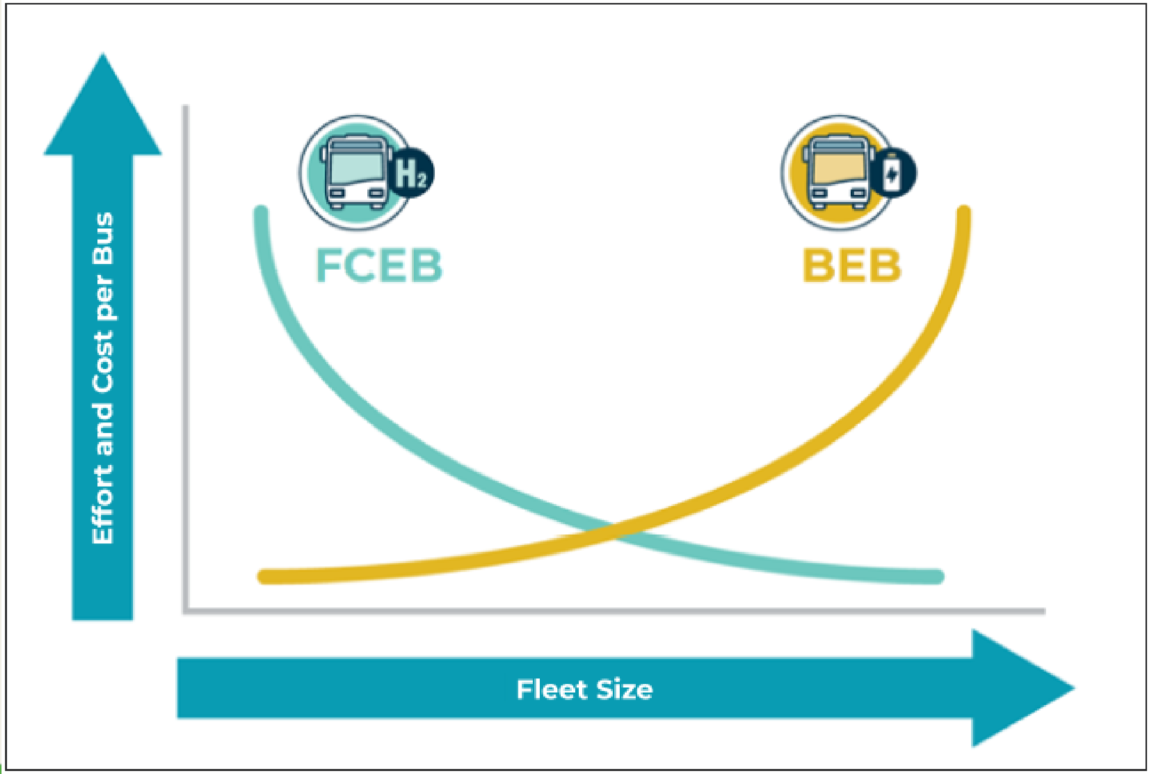
	Battery Electric Bus	Fuel Cell Electric Bus
Reliable Range	130-190 miles on a single charge (or indefinite range with on-route charging)	200-320 miles before refueling
Fueling Technology	Depot or on-route charging • Plug-in charging • Wireless inductive charging • Overhead conductive charging	Hydrogen storage and fueling station • Purchased liquid or gaseous hydrogen (most common) • Produce hydrogen on-site through electrolysis or natural gas reformation
Capital Costs	• BEBs are currently more expensive than diesel buses • Charging infrastructure costs vary and do not scale easily; incrementally more charging infrastructure will be required for more buses	• FCEBs are currently more expensive than BEBs • Fueling infrastructure costs vary and depend on the required fueling rate. • Infrastructure scales more easily with similar equipment and space requirements. Additional buses do not necessarily require additional infrastructure
Fueling Considerations	• Depot-charged buses may require hours to fully recharge • Electricity rates will have a significant impact on fuel costs	• Refueling procedure and time required are slower than diesel buses, but similar to Compressed Natural Gas (CNG) fueling • Electricity costs may be significant if producing hydrogen on-site • Relatively few hydrogen suppliers across the country; costs may vary based on the distance from the supplier

ZEB Technology Comparison Table [modified] from ZEBRA Zero-Emission Bus Deployment Guidebook (p. 9)

INTERcity TRANSIT

DESTINATION:

- REVENUE FLEET -- OUTREACH AND RESEARCH RESULTS (SCALABILITY)

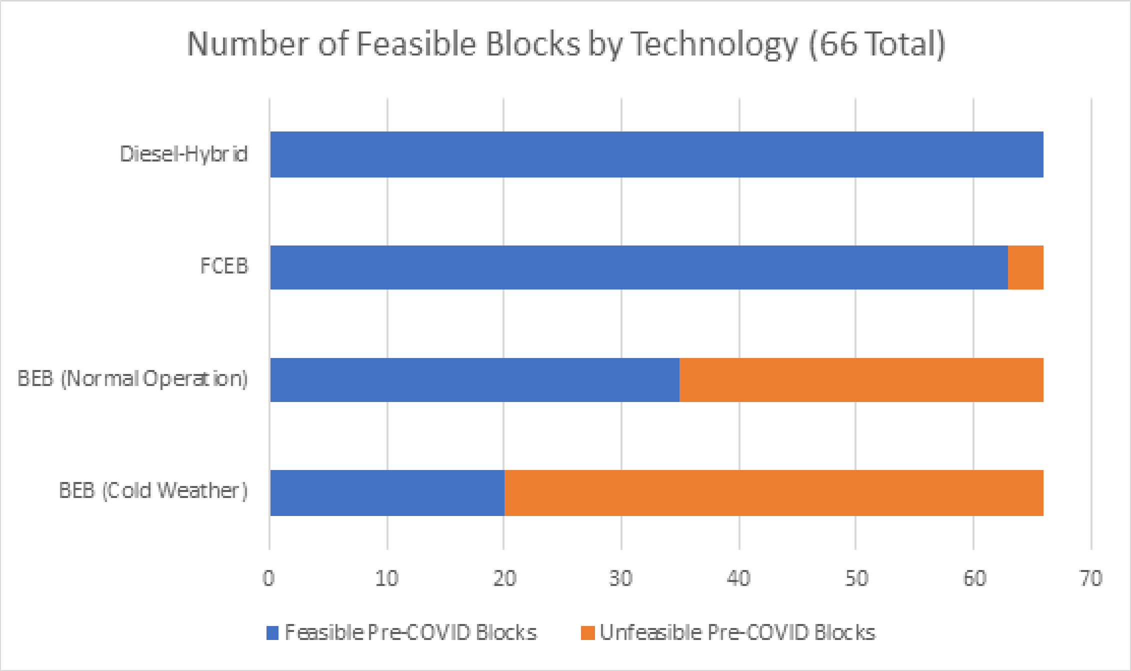


- **FCEB:** High initial cost for hydrogen fueling stations can be leveraged over many buses in larger fleets.
- **BEB:** More equipment and infrastructure required to support larger fleets

Conceptual graph illustrating relative cost and effort of deploying FCEB and BEB fleets
- Source: "A Zero-Emission Transition for the U.S. Transit Fleet" prepared by Center for Transportation and the Environment (CTE)

DESTINATION:

- REVENUE FLEET -- OPERATIONAL IMPACTS
  - FCEB performance similar to diesel or CNG
    - Range 300+
    - Fueling time ~10 min



Estimated ranges applied to Intercity's pre-COVID service level

INTERCITY TRANSIT

DESTINATION:

- REVENUE FLEET – RESILIENCY/EMERGENCY RESPONSE
    - Hydrogen (H2) Infrastructure allows lower grid reliance than BEV charging at full fleet scale
        - Increased grid independence with PV integration
        - Possible future use of hydrogen for other site back-up power needs
    - Ability to receive H2 deliveries if on-site production is out of service

DESTINATION:

- NON-REVENUE FLEET SOLUTION
  - Battery Electric Vehicles (BEV)
    - WHY?
      - Limited range required for support services
      - Several commercially available options available
      - Charging demand significantly less than BEBs

INTERcity TRANSIT

TURN BY TURN:

- H2 INFRASTRUCTURE AND VEHICLES
  1. Prepare for Grant opportunities:
     - 2022 Budget includes the following to prepare for grant opportunities:
       - Project Management Consultant
       - Design Services
         - Master planning
         - Detailed design
  2. Analyze long-term financial impact and develop ZEB Transition Plan

TURN BY TURN:

- H2 STATION OPTIONS (Preliminary estimates)

H2 Solution	Energy	Water	Space	Estimated Project Cost
Liquid Storage	0.3 MW	N/A	4800 sqft	$4-6M
On-site electrolysis production w/liquid storage	1-3 MW	172,000 gal/mo	13,000 sqft	$15-18M
On-site SMR production w/liquid storage	0.3 MW Natural Gas: 6600 MMBTU/mo	286,000 gal/mo	16,000 sqft	$20-23M

TURN BY TURN:

- BUS REPLACEMENT SCHEDULE
  - ZEBs can be phased in as a percentage of annual replacements throughout our existing lifecycles to minimize cost impact

Bus Type	Length	Quantity	Replacement Year	Diesel Unit Cost	FCEB Unit Cost	Annual Diesel Replacement Cost	Annual Full FCEB Replacement Cost
2010 Diesel Hybrid	40-ft	6	2023	$646,636	$1,200,000	$3,879,815	$7,200,000
2012 Diesel Hybrid	40-ft	7	2024	$666,035	$1,236,000	$4,662,244	$8,652,000
2014 Diesel Hybrid	40-ft	10	2026	$705,997	$1,310,160	$7,059,970	$13,101,600
2019 Clean Diesel	35-ft	8	2031	$785,117	$1,461,779	$6,280,933	$11,694,234
2019 Clean Diesel	40-ft	16	2031	$790,717	$1,467,379	$12,651,466	$23,478,067
2020 Clean Diesel	35-ft	16	2032	$809,288	$1,506,251	$12,948,610	$24,100,009
2021 Clean Diesel	35-ft	7	2033	$833,567	$1,551,438	$5,834,967	$10,860,067
2021 Clean Diesel	40-ft	6	2033	$838,160	$1,555,422	$5,028,958	$9,332,532
2023 Clean Diesel	40-ft	10	2034	$863,304	$1,602,085	$8,633,044	$16,020,846
						$66,980,005	**$124,439,354**

SUMMARY:

- REARVIEW MIRROR
  - We have made significant progress in emissions reduction through our lifecycle replacements and Fuel choices
- CURRENT LOCATION
  - We will continue incorporating green strategies in decisions and stay active in national and global forums to stay informed of best practices and emerging technologies
- DESTINATION
  - We will remain focused on our current goals, but flexible to change course if needed
- TURN BY TURN –
  - 2022 Focus will be: developing our plans and financial capacity to support upcoming grant opportunities and our transition toward **ZERO FARE with ZERO EMISSIONS**