

# Roadmap Update:

## Path to a Zero Emissions Fleet

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# Today's Discussion Route:

- ABOUT MAINTENANCE – A brief introduction to the department
- ZERO EMISSIONS ANALYSIS PROJECT OVERVIEW
  - About our partner – CTE
  - Project Goals
  - Project Plan and Schedule
  - ZEB 101
  - Progress to date
- ACTIONS AND IMPACT – What are we doing now?
- NEXT STEPS - What are our next steps toward our destination?

# DEPARTMENT OVERVIEW:

## Facilities Maintenance (15 FTE)

- 1037 bus stops, 291 bus shelters,
- Pattison Base (4 buildings)
  - Operations/Administration and Maintenance
- Transit Centers
  - Olympia Transit Center (2 buildings)
  - Lacey Transit Center
- Park and Rides (2)
- Centennial Station (Amtrak)



# DEPARTMENT OVERVIEW:

## Fleet Maintenance (58 FTE)



## Vehicles by NTD mode and Vehicle Type

	Count
Demand Response	60
Para Transit (Dial-A-Lift)	54
Village Van	6
Motor Bus	86
Bus	86
Staff Vehicles	38
Non-Revenue Service Vehicle	32
Trailer, non motorized	4
Vanpool	1
Walk N Roll/Bike Partners	1
Vanpool	195
Community Van	8
Vanpool	187
<b>Grand Total</b>	<b>379</b>

# PROJECT OVERVIEW:

## Zero Emissions Analysis

- Project Partner:
  - Center for Transportation and the Environment
    - Nelson Nygard
    - Hatch LTK



# About CTE



## WHO WE ARE

501(c)(3) nonprofit engineering and planning firm



## OUR MISSION

Improve the health of our climate and communities by bringing people together to develop and commercialize clean, efficient, and sustainable transportation technologies



## PORTFOLIO

\$850 million

- *Research, demonstration, deployment*
- *100+ Active Projects totaling over \$336 million*



## OUR FOCUS

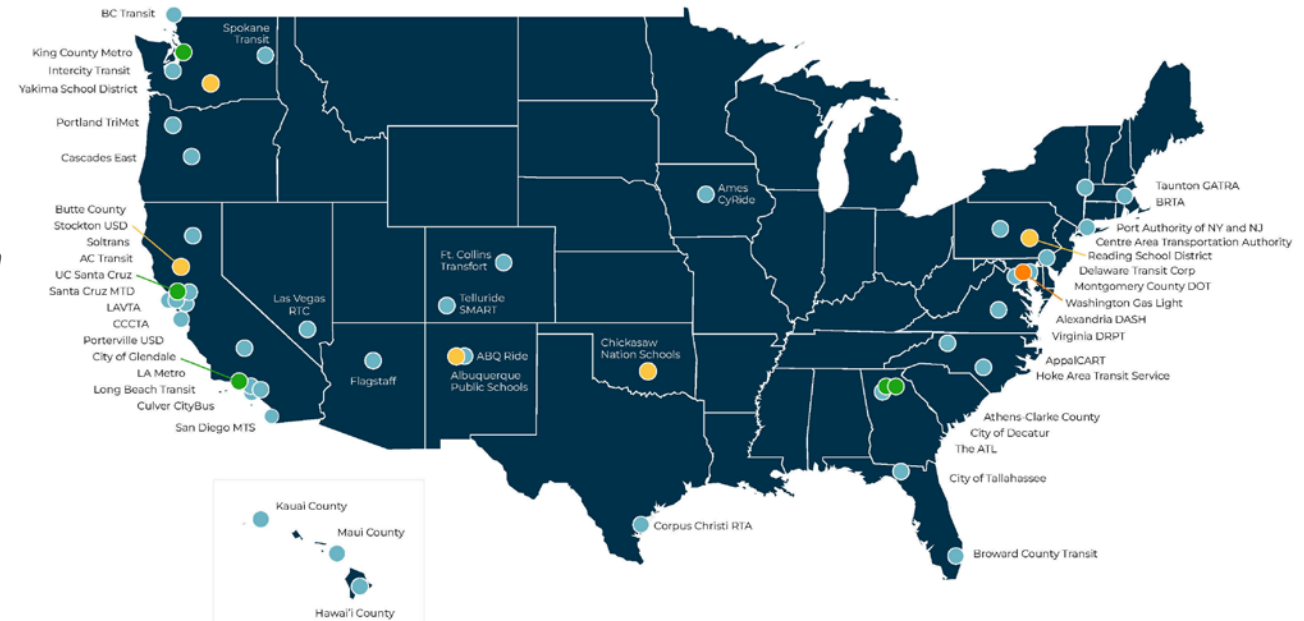
Zero-Emission Transportation Technologies



## NATIONAL PRESENCE

Atlanta, Berkeley, Los Angeles, St. Paul

● = School Bus   ● = Commercial   ● = Municipal   ● = Transit



# Project Goals and Priorities

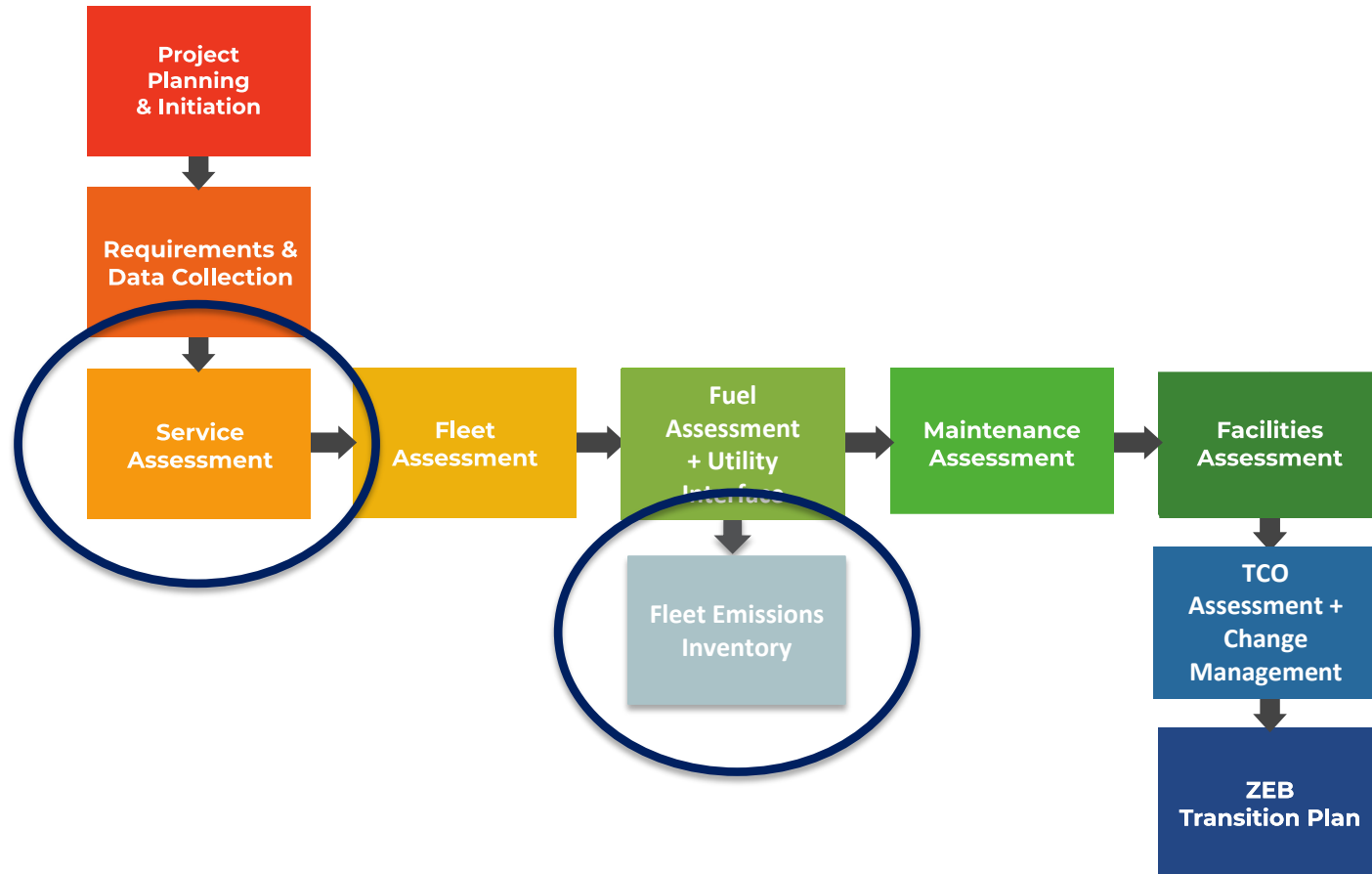
## ➤ Goals:

- Perform an analysis of current and emerging zero emission vehicle technology to assist Intercity in preparing for the development of a long-term zero emissions fleet transition plan.
- Understand the barriers, constraints, risks associated with transitioning to zero emission fleet.

## ➤ Priorities:

- Provide transit services focused on community needs, not technology constraints
- Consider full lifecycle emissions of all solutions (well-to-wheels)

# ZEB Transition Approach and Methodology





# Project Schedule

Task Name	Duration	Start	Finish	Q4			Q1			Q2			Q3	
				Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
<input type="checkbox"/> Part 1: Zero Emission Analysis	205d	10/31/22	08/25/23											
<input type="checkbox"/> Planning, Initiation, and Kickoff	16d	10/31/22	11/22/22											
<input type="checkbox"/> Baseline	40d	11/16/22	01/17/23											
<input type="checkbox"/> GHG Emissions Inventory	139d	11/16/22	06/07/23											
<input type="checkbox"/> State of the Industry	35d	11/25/22	01/17/23											
<input type="checkbox"/> Analyze and Evaluate	137d	12/02/22	06/20/23											
<input type="checkbox"/> Economic and Cost Assessment	68d	03/22/23	06/27/23											
<input type="checkbox"/> Change Management	95d	02/02/23	06/16/23											
Potential Timeline	1d	06/21/23	06/21/23											
Outreach and Education	189d	11/25/22	08/25/23											
<input type="checkbox"/> Report and Recommendations	45d	06/01/23	08/04/23											
Draft Report (For Low-No Application)	10d	06/01/23	06/14/23											
Final Report	35d	06/15/23	08/04/23											

Contract states that the Statement of Work should be completed by July 31, 2023.



# Zero Emission Bus 101

# Why Zero-Emission Buses?

- Cleaner, lowers transit's contribution to climate change
  - Zero tailpipe emissions
  - Lower source emissions
- More efficient, lower energy consumption
- Quieter, Preferred by passengers
- Lower maintenance costs
- Lower fuel cost in some parts of the country
- US-produced fuel source, predictable fuel cost
- Innovative technology

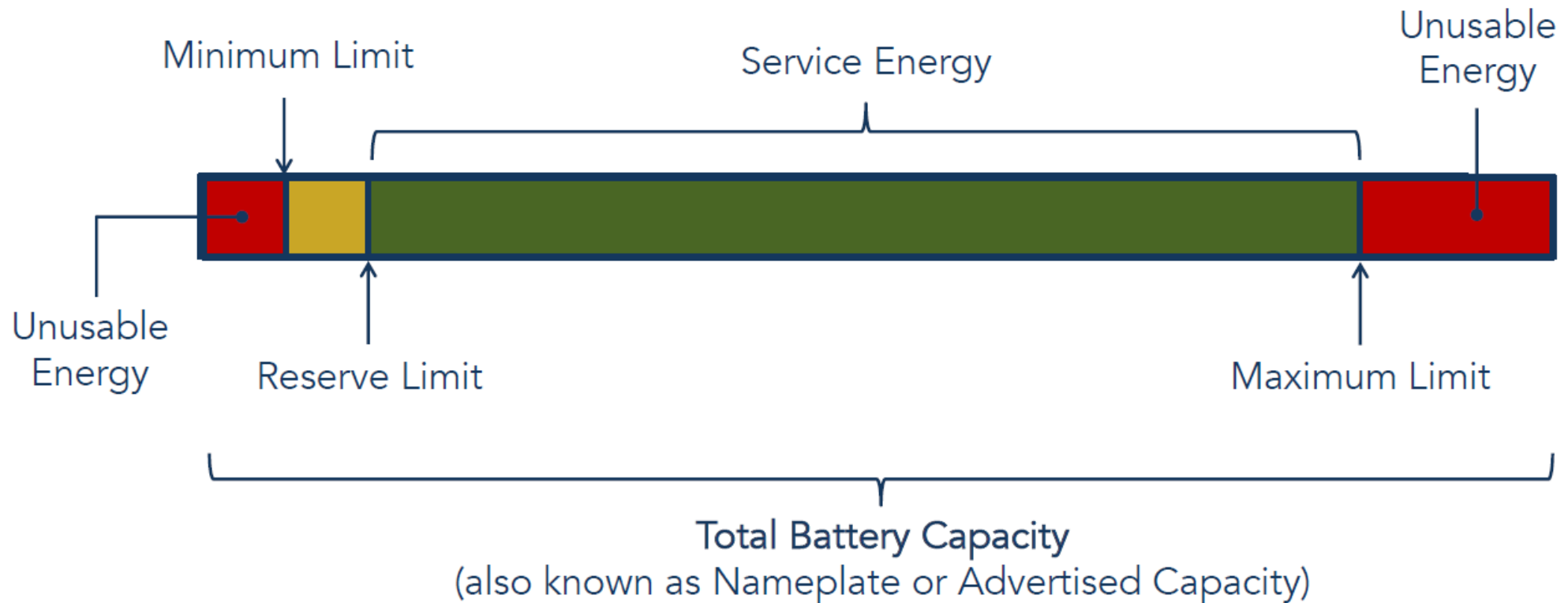


# Zero Emission Buses — Battery Technology



## New Battery

- Understanding how much of the battery is usable for service is critical for planning your deployment.

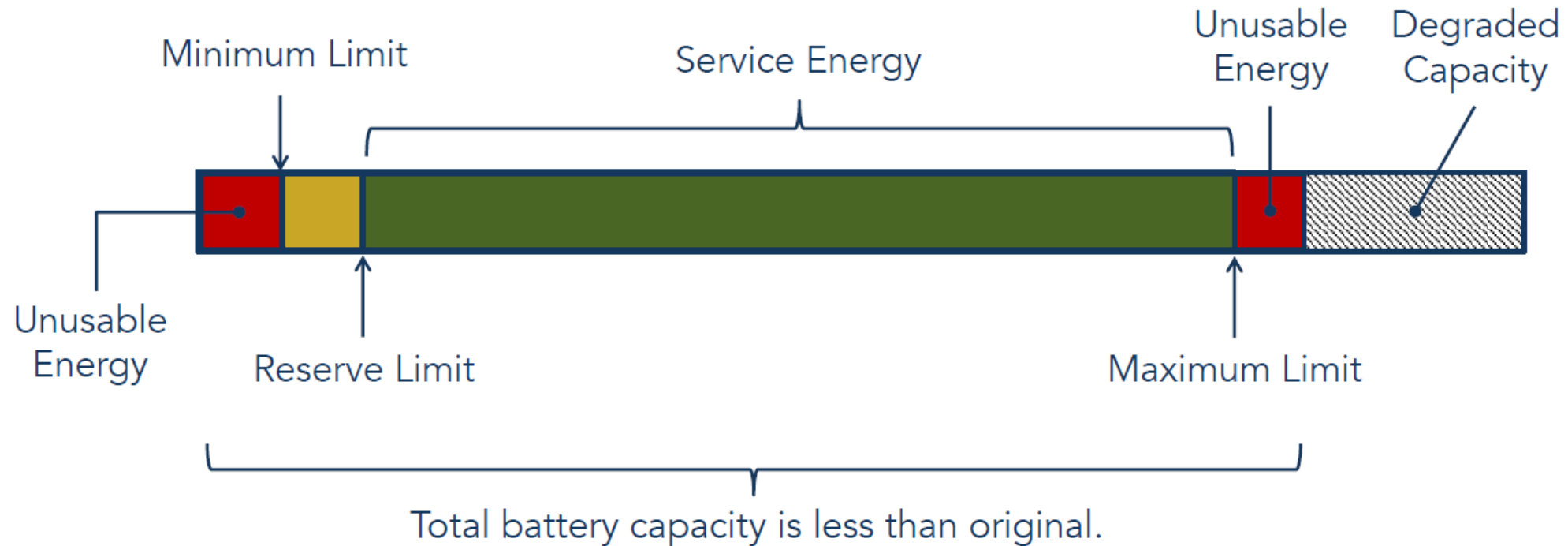


# Zero Emission Buses — Battery Technology



## Battery at End-of-Life\*

- Understanding how much of the battery is usable for service is critical for planning your deployment.



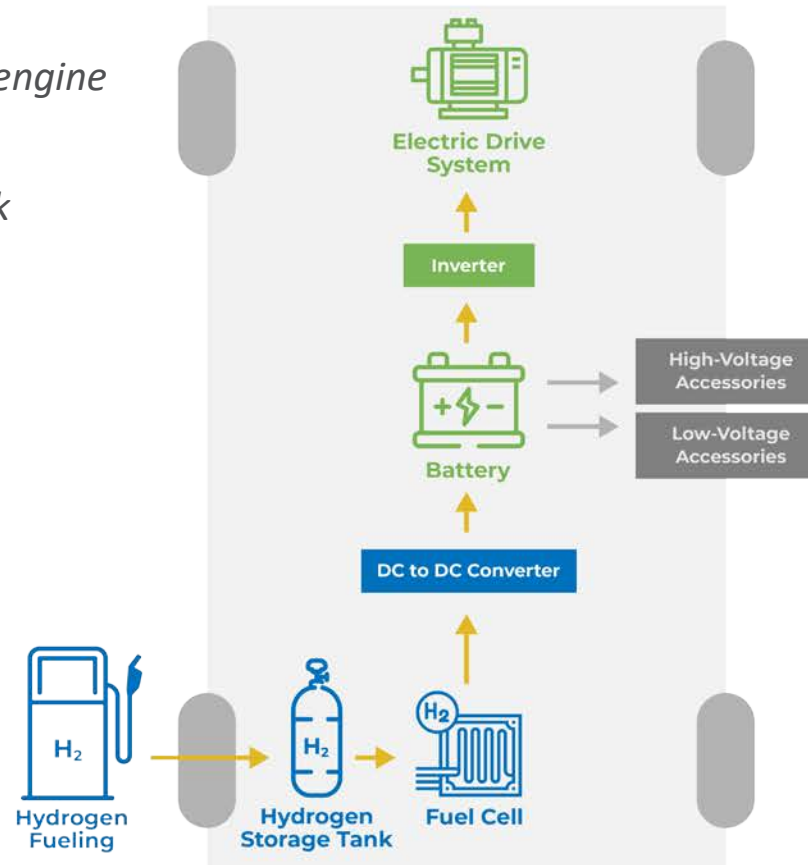
\*as defined by battery warranty

# Zero Emission Buses — What's Different?

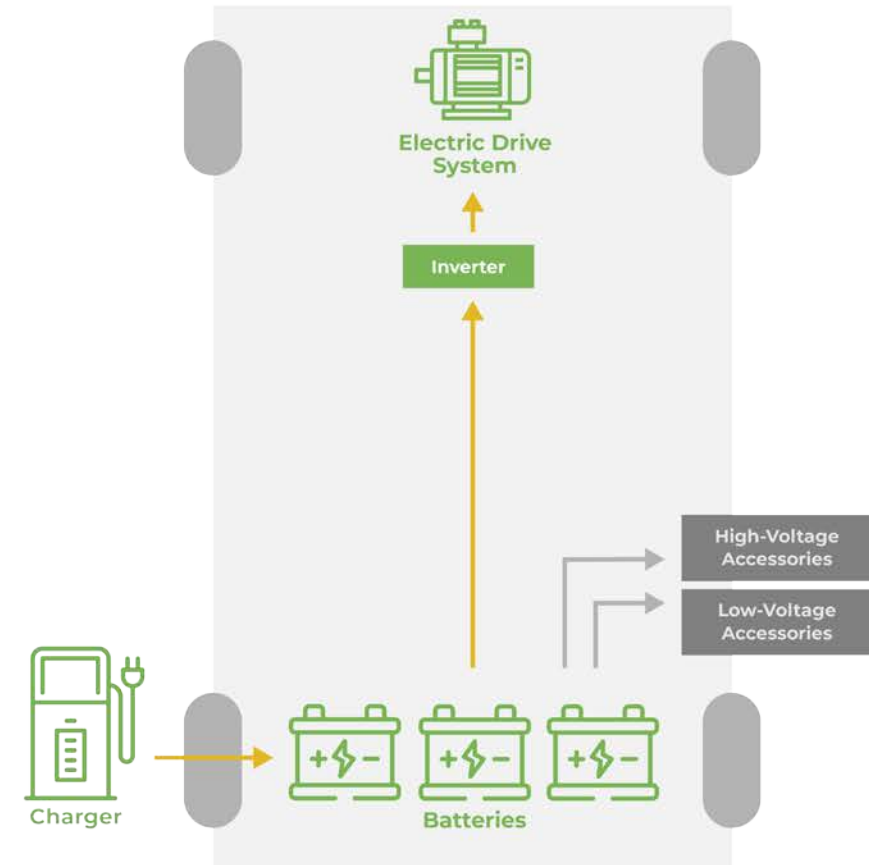


- Propulsion System
  - Traction Motor instead of engine
- Energy Storage System
  - Battery instead of fuel tank
- HVAC
  - No “free” heat
  - Electric heater
- Time to “Re-fuel”
  - FCEB: 10 minutes
  - BEB: ~3 hours

## FUEL CELL ELECTRIC VEHICLE



## BATTERY ELECTRIC VEHICLE



### Legend

Battery Electric Components

Hydrogen Fuel Cell Components

Shared Vehicle Components

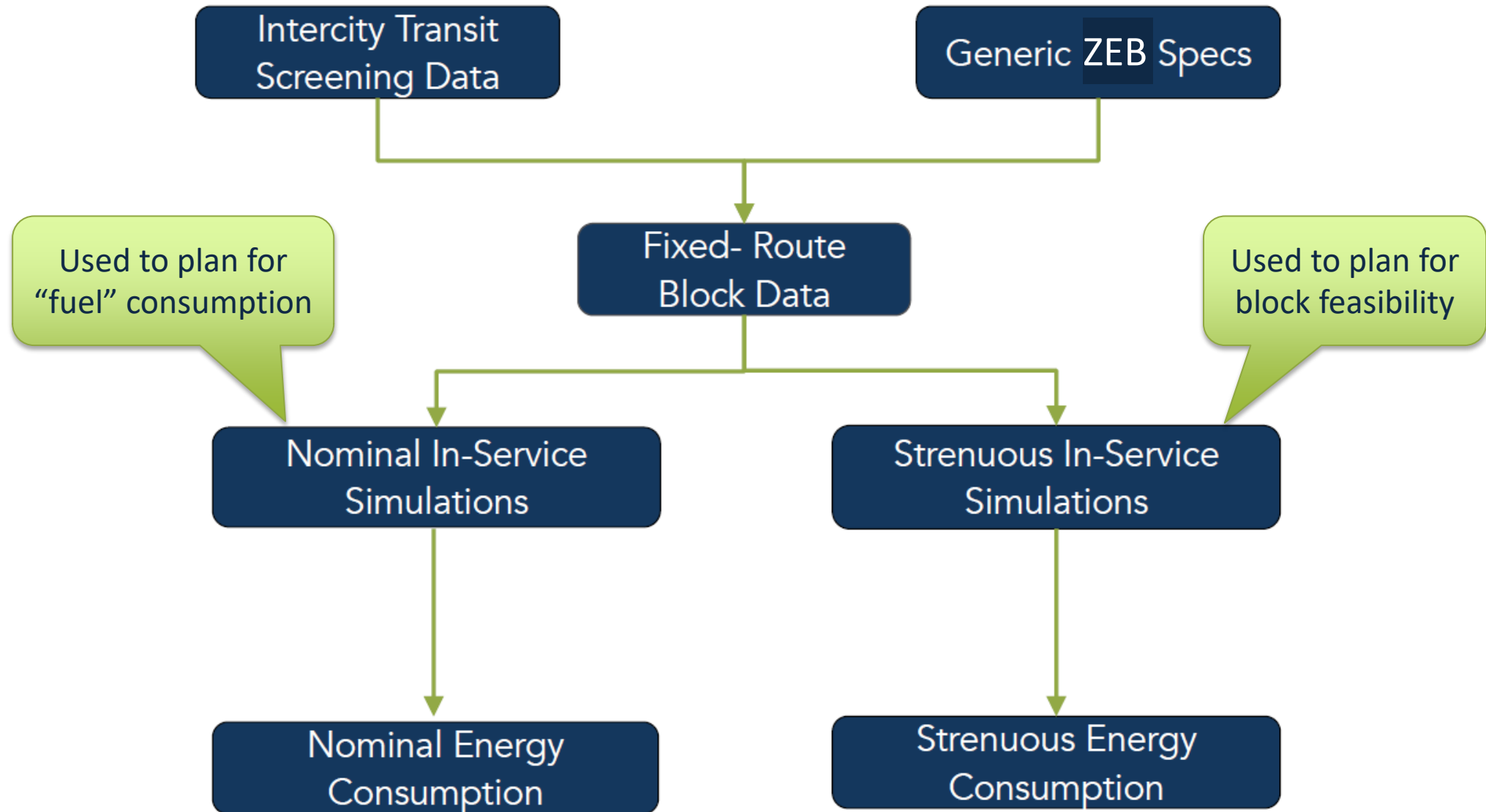
# PROJECT OVERVIEW:

## Zero Emissions Analysis

### Progress to date:

- Kick-off Day and Site tour complete
- Bi-weekly project meetings
- Initial data provided and analysis underway
- Current work in progress:
  - Service assessment – Baseline and feasibility of each Technology
  - GhG emissions analysis

# Modeling and Simulation Approach





# ZEB Transition Analysis

## Fleet Emissions Inventory

### Fleet Emissions Inventory

- Calculate Intercity's greenhouse gas (GhG) emissions for the baseline fleet, future fleet, and historic fleet (beginning with 2010). Fixed route, paratransit, vanpool, and non-revenue fleets will be included.
- Develop a tool for Intercity to calculate GhG emissions in future years.

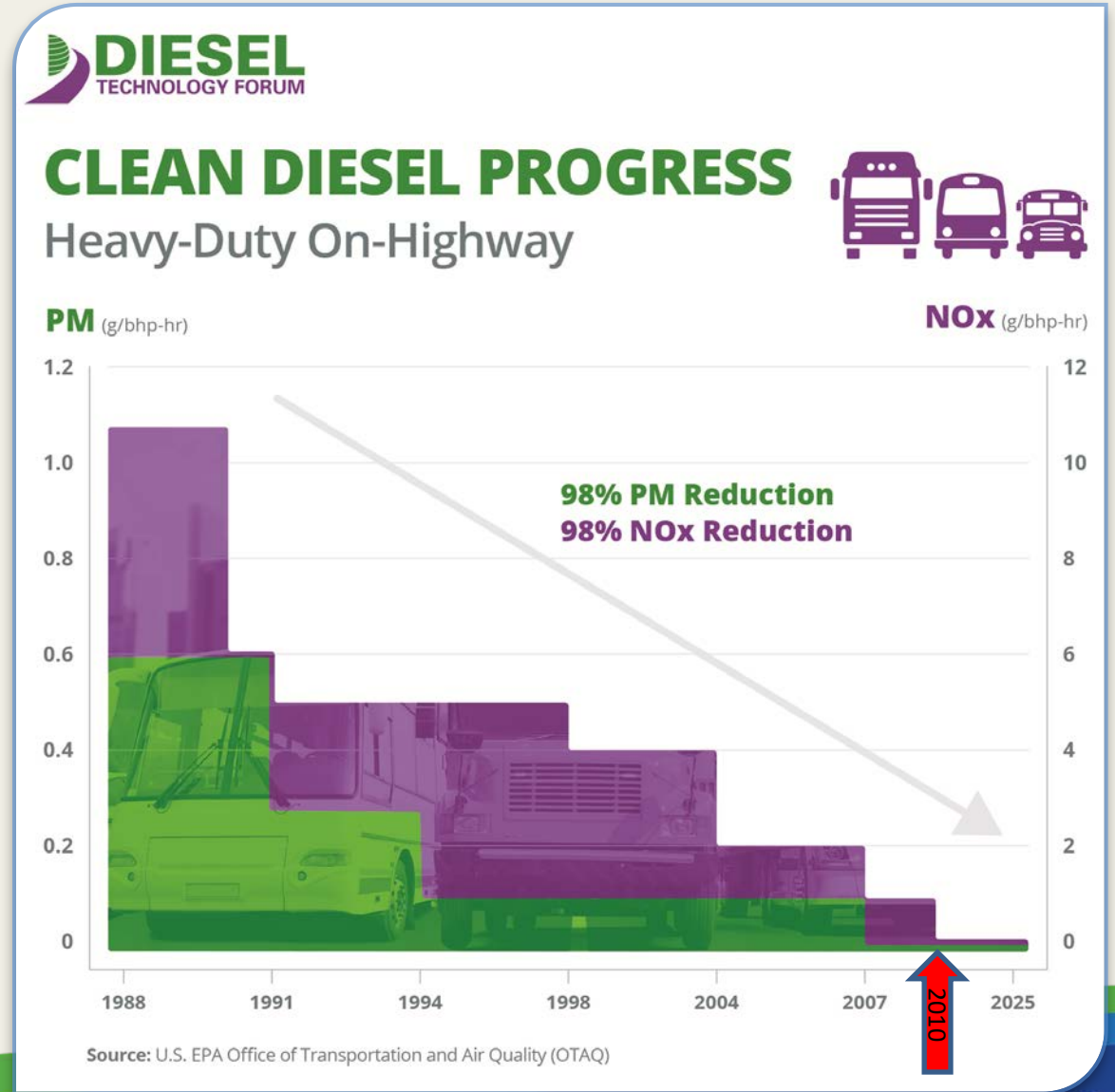


# ACTIONS AND IMPACT:

## Emissions Reductions:

### FLEET REFRESH – CLEAN DIESELS

- Q2 2022 – removed last of pre-2010 diesel buses from our fleet

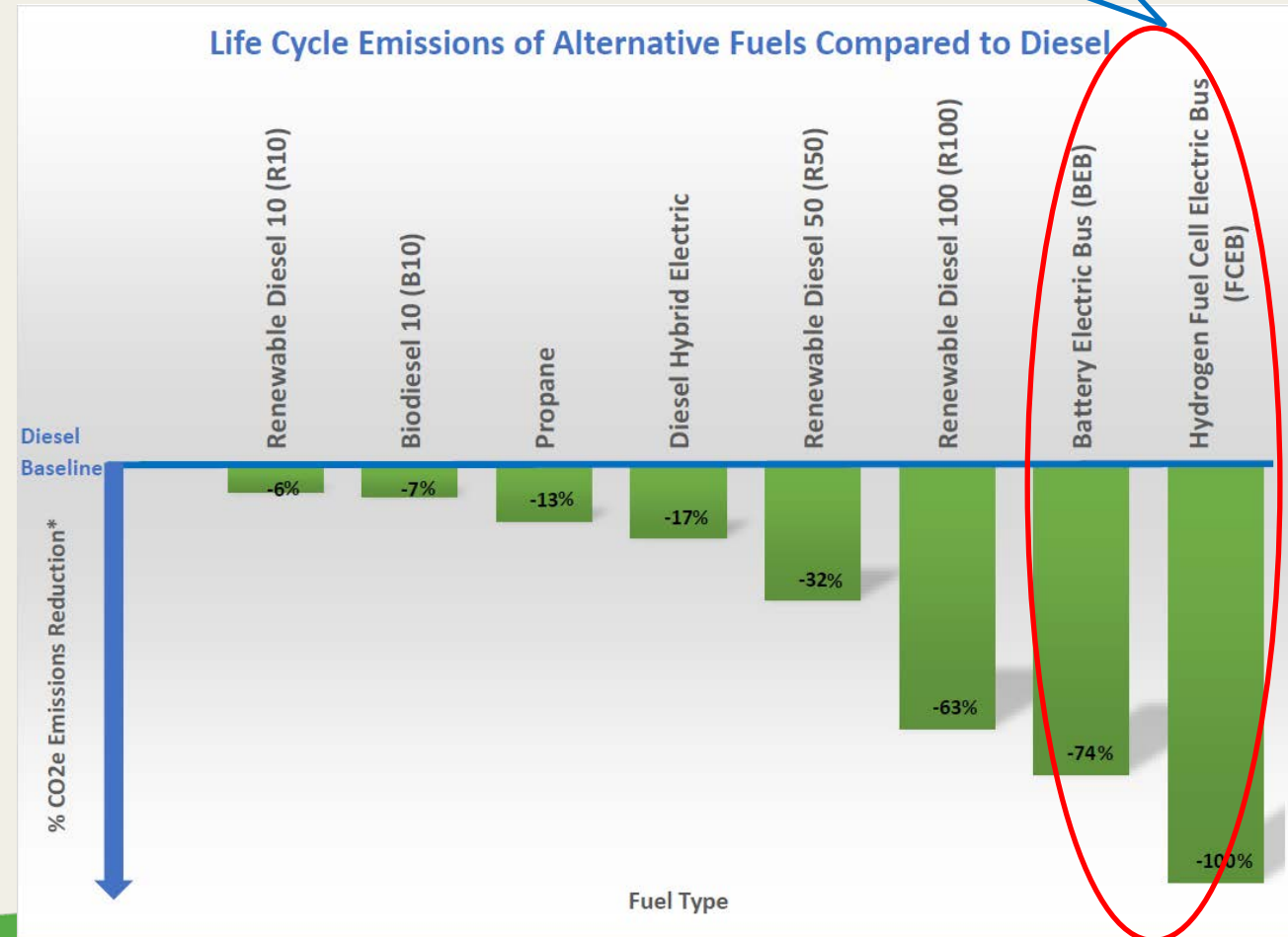


# ACTIONS AND IMPACT:

## Fuel Choice Reductions:

- EMISSION REDUCTION CHOICES
  - **2006-2010:** Ultra-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)
  - **2023:** transition to R99/R100

Both Zero tailpipe emissions, but lifecycle depends on production process and grid composition



\*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).

# ACTIONS AND IMPACT:

We have made significant progress in emissions reduction through our lifecycle replacements and fuel choices.

## Vehicle Replacements (arriving soon)

- 12 Toyota Sienna Hybrids - Vanpool
- 2 Chevrolet Bolt EV – Staff cars

## Fuel Choices

- 2023 - Transition to R99 (Renewable Diesel)

# NEXT STEPS

- STAY FOCUSED ON OUR PRIORITIES
  - Provide transit services focused on community needs, not technology
  - Consider full lifecycle emissions of all solutions (well-to-wheels)
- STAY INVOLVED AND CONTINUE TO LEARN
  - Staff regularly participates in the following, plus others:
    - WSU Green Transportation Program
    - The Consortium for Hydrogen And Renewably Generated E-Fuels (CHARGE)
    - RHA – Renewable hydrogen Alliance
    - PNWH2 – PNW Hydrogen Hub Association
    - Zero Emissions Bus Resource Alliance (ZEBRA)
    - APTA Zero Emission Fleet Committee
  - Outreach and communication with many transit agencies across the United States for lessons learned in ZEB deployment
  - Monitor State and Federal grant programs for future ZEB Projects
  - Continued partnerships: PSE, Port of Olympia, multiple suppliers (vehicles and infrastructure)

QUESTIONS?

# Definitions:

- BEB/BEV – Battery Electric Bus or Vehicle
- DAL – Intercity Transit Dial-A-lift vehicle used for paratransit services
- FCEB – Fuel Cell Electric Bus – uses an onboard hydrogen fuel cell to generate electrical energy
- NO<sub>x</sub> – 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.)