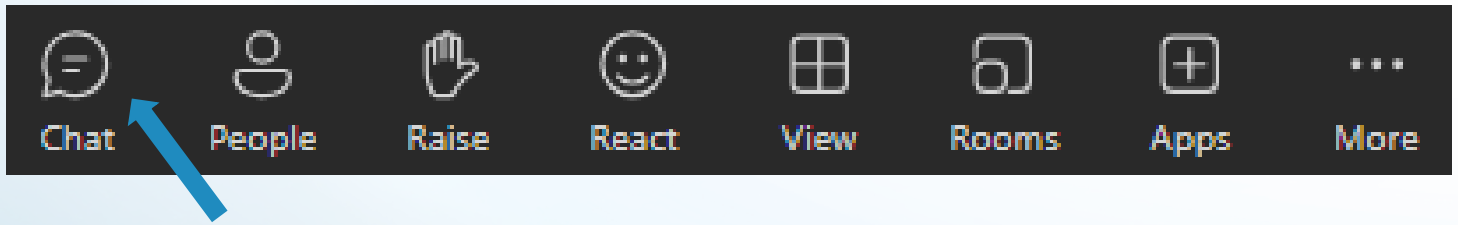
CALIFORNIA
AIR RESOURCES BOARD

Grant Orientation for Zero Emission Rail Operation (GO ZERO) Program

March 25, 2025

Housekeeping

- Participants will be able to ask questions at the end of the presentation by utilizing the “chat" feature. Type your question into the chat and staff will answer GO ZERO related questions.



- Presentation materials are available on the GO ZERO Webpage

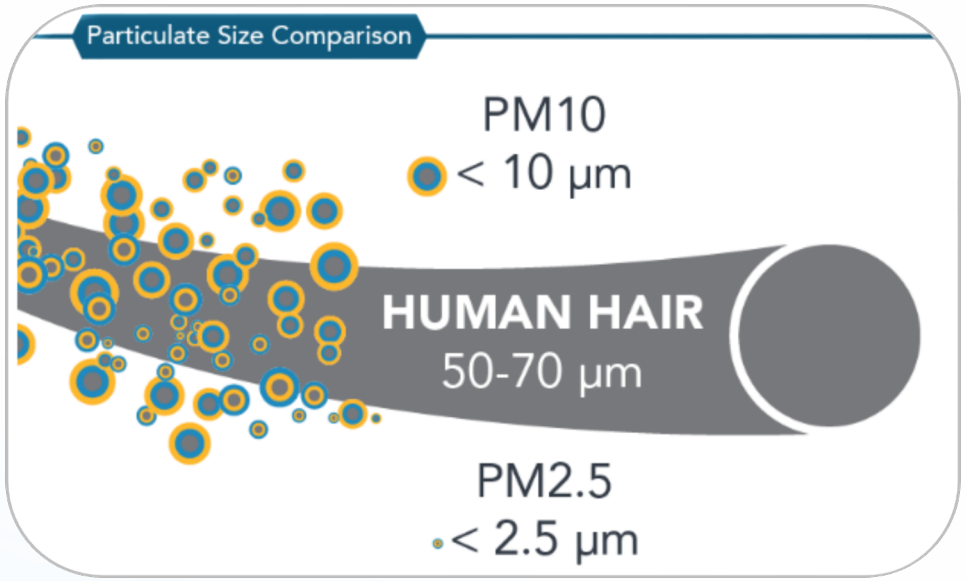
Agenda

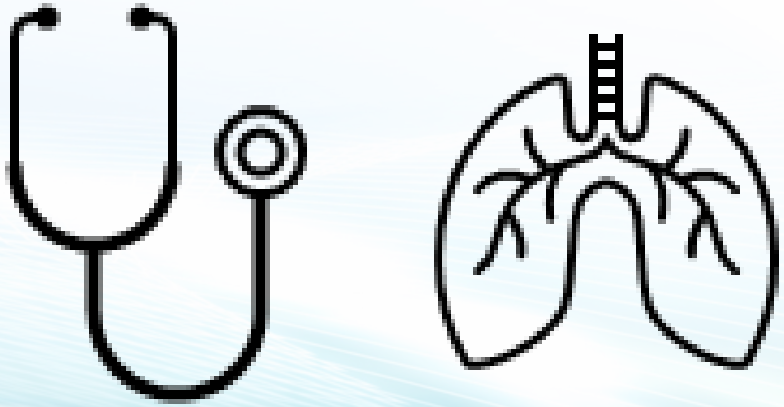
- Background
- GO ZERO Overview
- Consolidated Rail Infrastructure and Safety Improvements (CRISI)
- State Funding Opportunities
- Zero Emission (ZE) Equipment Overview
- Chat Q&A

Health Risks and Impacts

Exposure to diesel exhaust/particulate matter of 2.5 microns or less (PM2.5) and oxides of nitrogen (NOx) can lead to:

- Acute respiratory symptoms
- Asthma exacerbations; emergency room visits for asthma
- Bronchitis; chronic obstructive pulmonary disease (COPD)
- Heart attacks
- Nervous system effects (e.g., cognitive deficits)
- Lost work days
- Premature death
- Increased risk for cancer





CARB

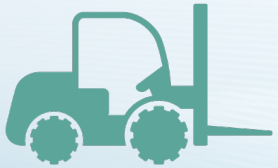
Zero Emission Operations

Locomotives
Still need ZE operations

TRUs
Use of ZE Technology increasing

Truck Fleets
Use of ZE Technology increasing

Forklifts
Use of ZE Technology increasing



Cargo Handling Equipment
Use of ZE Technology increasing

Drayage Trucks
Use of ZE Technology increasing

GO ZERO Program Overview

- **GO ZERO's Goal**
  - Assist operators in stacking funding opportunities for ZE rail equipment
- **2023/2024 CRISI Application**
  - FRA awarded CARB, in collaboration with Pacific Harbor Line, Watco, and Sacramento Valley Railroad, $36.5 million for zero emission equipment.

GO ZERO Program Overview

- This year, GO ZERO will focus on:
  - State level:
    - Volkswagen (VW) Mitigation Trust Funding
    - Carl Moyer
    - Prop 1B
    - Clean Off-Road Equipment Vouchers (CORE)
  - Federal Level:
    - Consolidated Rail Infrastructure and Safety Improvements (CRISI)

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U.S. Department of Transportation
Federal Railroad Administration

Consolidated Rail Infrastructure and Safety Improvements (CRISI) Overview

CRISI Overview

- **Goal:**
  - To fund projects that improve the safety, efficiency, and reliability of intercity passenger and freight rail.
- **Funding Sources**:
  - Bipartisan Infrastructure Law
- **FY 2023-2024**
  - Over $2.48 billion available

U.S. Department of Transportation
Federal Railroad Administration

CRISI Overview

- **Eligible projects:** Rehabilitating, remanufacturing, procuring, or overhauling locomotives, provided that such activities result in a significant reduction of emissions.

- **Requirements:**
  - A 20% minimum non-Federal match funds
  - Project Narrative
  - Statement of Work
  - Benefit-Cost Analysis
  - Environmental Compliance (NEPA) Documentation

CRISI Grant Recipient Requirements

- Grant agreement: scope, schedule, budget, performance measures
- Grant administration: meetings with FRA, quarterly progress and financial reports, invoice and deliverables review, etc.
- Monitoring: routine monitoring, annual monitoring reviews/site visits
- Final invoice: financial reconciliation
- Final performance report: documentation of results, outcomes, public benefits.

State Funding Opportunities for Rail

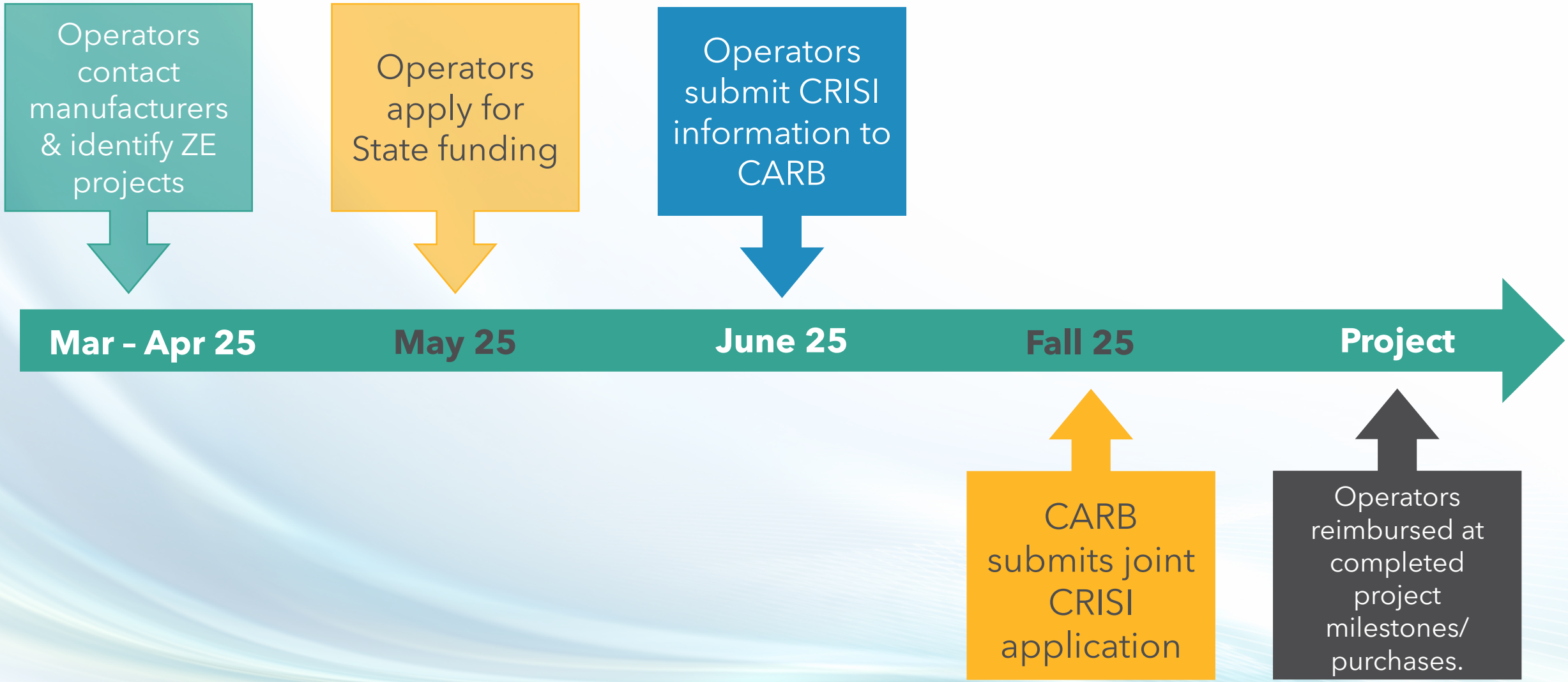
- Volkswagen (VW) Mitigation Trust Funding
- Carl Moyer
- Prop 1B
- Clean Off-Road Equipment Vouchers (CORE)

GO ZERO Program Benefits

- Streamlined Application Process
  - Assistance with CRISI application

- Low-Cost ZE Equipment
  - Offer a chance to replace old equipment with low to no cost ZE options that benefit the environment and neighboring communities.

GO ZERO Tentative Timeline



Zero-Emission Equipment Overview

All data is provided by manufacturers. CARB did not verify accuracy of the data. Contact manufacturer directly for more details. All models are battery electric.

AMPS Traction

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
IS2-600	2 Axle -New	Battery Electric	Switching – yard/ industrial	50 Klbs starting / 50 Klbs Cont	Up to 600Kwh	AMPS Traction conducts an energy analysis tailored to specific applications using a complementary data logging system for precise optimization.		Starting at $1.6M plus Infrastructure separate	J1772/CCS1 Charger	Charger installation support
IS4S-1000	4 Axle 44 feet - New	Battery Electric	Switching - yard/ industrial/ FRA	80 Klbs starting / 60 Klbs Cont	Up to 1000Kwh			Starting at $2.6M plus Infrastructure separate	CCS1/MCS Charger	Charger installation support
IS4-2000	4 Axle 52 feet – New / Repower	Battery Electric	Switching - yard/ industrial/ FRA	80 Klbs starting / 60 Klbs Cont	Up to 2000Kwh			Starting at $2.6M plus Infrastructure separate	CCS1/MCS Charger	Charger installation support
IS6-2300	6 Axle 63 feet - Repower	Battery Electric	Switching - yard/ industrial/ FRA	120 Klbs starting / 90 Klbs Cont	Up to 2300Kwh			Starting at $3.1M plus Infrastructure separate	CCS1/MCS Charger	Charger installation support

*Estimated operation time is based on two duty cycles, and assumes all auxiliary loads (air compressor, etc) and parasitic loads (cooling system, etc) are active full time.
†US EPA Switcher Duty Cycle is ~60% idle, ~25% notches 1-2, and ~15% notches 3-8 (time in mode).
‡High Idle Duty Cycle is 92% idle, and 8% notches 1-3 (time in mode).

Brookville

Independent manufacturer that has established relationships with suppliers of all power system types, including battery, hydrogen, and electrical component suppliers that allow for unique custom solutions across a broad range of models for both new builds and conversions of existing units. Brookville's focus is on integrating proven technologies and systems specifically for rail applications.

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
Brookville BL-E	EMD, GE, Alco, NRE switching, general purpose, and industrial/yard locomotives	Battery electric	Industrial, yard switching, port and terminal switching, light duty switching	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application	Highly variable, depending on the unique demands of the operator, technology or chemistry selection, performance requirements, among many other factors	Requires Pantograph Down or Plug-In Charging Station	Can Coordinate/Has Relationships either directly or via suppliers with organizations that can provide infrastructure support for charging stations and H2 infrastructure.
Brookville BL-H		H2 fuel cell	Industrial, yard switching, port and terminal switching, light duty switching	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application		Fueling Station and Storage Capabilities	
Brookville BL-E		Overhead catenary system	Industrial, yard switching, port and terminal switching, light duty switching	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application	Variable. Based on customer application		Requires Catenary Infrastructure	

Medha

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
Medha MBL	Any make and model of 4-axle or 6-axle diesel locomotive to 100% battery (Conversion) HP rating - 1000HP to 3000HP **4-axle locomotives already converted and/or under conversion - SW1200, SW1500, GP9, GP10, GP15;**	Battery electric LFP, LTO, NMC or other battery chemistry as required to meet the operational needs; Default offering is LFP battery - for various reasons - including safety, energy density, rate of charge etc.;	Switching, Shortline, Ports, Industrial, Heritage and Excursion trains, Museums, and similar applications; (Not suitable for main-line operations)	Will be same or similar to the diesel locomotive being converted	0.6 MWh to 2.4 MWh (depending on installed battery bank size)	10-16 hours of operation on battery power (2-6 hrs charging, based on battery size and charger rating); **Our existing BEL's are being charged once every 3-4 days;**	Can go up to 1 week or more between charges; More accurate usage hours will be calculated based on locomotive operational duty cycle;	TBD (e.g. 1500 HP battery locomotive approx. $2.6 - $3.0 M)	Battery charger (Way-side or Pantograph) Charger capacity 180kW to 750kW 3phase 480V supply	Medha provides turn-key solution (engineering to commissioning) to convert diesel loco to 100% battery; After sales service support including remote monitoring, fault diagnostics and extended warranties;

*Estimated operation time is based on two duty cycles, and assumes all auxiliary loads (air compressor, etc) and parasitic loads (cooling system, etc) are active full time.
†US EPA Switcher Duty Cycle is ~60% idle, ~25% notches 1-2, and ~15% notches 3-8 (time in mode).
‡High Idle Duty Cycle is 92% idle, and 8% notches 1-3 (time in mode).

Medha (Cont.)

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
Medha - MHL H2 Fuel Cell Locomotive Primary Source: Fuel Cell; Complimentary source: Battery;	Any make and model of 4-axle or 6-axle diesel locomotive to H2 Fuel cell + battery (Conversion) HP rating - 800 HP and above Project under execution - conversion of diesel-electric passenger train (DEMU) to H2 Fuel Cell and Battery	H2 Fuel cells + Batteries Fuel Cell as prime source for traction power and battery as complimentary source to meet spikes and peak loads;	Switching, Shortline, Ports, Industrial uses, Heritage and Excursion trains, Museums, and similar applications (Including main-line operations)	Will be same or similar to the diesel locomotive being converted	Will be same as rated power of the diesel locomotive being converted	Operation time will depend on H2 Fuel tank storage capacity;	Operation time will depend on H2 Fuel tank storage capacity;	TBD	H2 (Hydrogen) filling station;	Medha provides turn-key solution (engineering to commissioning) to convert diesel loco to H2 Fuel Cell locomotive; After sales service support including remote monitoring, fault diagnostics and extended warranties;

*Estimated operation time is based on two duty cycles, and assumes all auxiliary loads (air compressor, etc) and parasitic loads (cooling system, etc) are active full time.
†US EPA Switcher Duty Cycle is ~60% idle, ~25% notches 1-2, and ~15% notches 3-8 (time in mode).
‡High Idle Duty Cycle is 92% idle, and 8% notches 1-3 (time in mode).

Medha (Cont.)

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
Manufacturer - Medha Model - eAPU Li-Ion battery based eAPU (an advanced and consolidated system including starting batteries, auto-engine start-stop and auxiliary power unit functionalities in a single system that eliminates the need of APU diesel engine)	To be used on any make and model of diesel locomotive	Battery operated eAPU	Any make and model of locomotive; eAPU main objective is to cutdown loco idling using battery instead of using diesel engine.	Not Applicable	Will be defined by the battery size that will be installed for eAPU	It will cut down most of the 59.8% of idling in switcher locomotives; eAPU will not impact the locomotive operation time.	It will cut down large portion of 92% of high idle. eAPU will not impact the locomotive operation time.	TBD	Not required	eAPU system integration, installation, commissioning and after sales service support;

Wabtec

Manufacturer/ Model	Applicable Model	ZE Technology	Application	Tractive Force (lbf)	Usable Energy	Estimated Operation Time*		Cost	Required Infrastructure	Support Provided by Manufacturer
						U.S EPA Switcher Duty Cycle†	High Idle Duty Cycle‡			
Wabtec Corporation	FLXswitch 1.2 (4 axles)	Battery electric	Switching, Local, Industrial	STE: 85,000	0.7-1.0 MWh	5-8 hrs	19-27 hrs	Varies based on final specifications	Battery charger ($480V_{ac}$)	Broad range of support offered
Wabtec Corporation	FLXswitch 2.4 (4 axles)	Battery electric	Switching, Local, Industrial	STE: 105,000	1.5-2.1 MWh	7-9 hrs	31-44 hrs	Varies based on final specifications	Battery charger ($480V_{ac}$)	Broad range of support offered
Wabtec Corporation	FLXswitch 2.7 (6 axles)	Battery electric	Switching, Local, Industrial	STE: 200,000	1.7-2.4 MWh	7-10 hrs	34-48 hrs	Varies based on final specifications	Battery charger ($480V_{ac}$)	Broad range of support offered

Required Actions from Operators

1. **Identify ZE Project**
   - Contact manufacturers (information on previous slides)
2. **Apply for State Funding:**
   - ASAP
   - (Optional) Request CARB staff to review application for completeness
3. **Submit CRISI Information to CARB:** locomotives@arb.ca.gov
   - Manufacturer, model, cost, project timeline
   - Baseline locomotive info
   - Location, Usage info (gallons)
   - Form available on GO ZERO webpage
   - Tentative deadline: June 2, 2025

Information available at:
CARB's GO ZERO Website

Contact Information

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Air Pollution Specialist
Freight Systems Section

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