



Off-Road Global Strategy

July 2024

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Agenda

- 1. CALSTART: Who We Are?**
- 2. Global Trends**
- 3. CORE Program**
- 4. Tool: O-ZETI**
- 5. Drive to Zero**
- 6. Program Pathways**
- 7. Some NGO Led Initiatives**

Who We Are?

We are a **nonprofit membership organization** founded in 1992

- Based in the US but have remote employees located internationally through our **Global Drive to Zero Program**
- We have 5 initiative areas: **truck, bus, light-duty vehicles, infrastructure, and innovative mobility**
- We work on 5 main activities across these initiatives:
 - Technology development and demonstration,
 - Technology assessment and validation,
 - Market acceleration,
 - Policy development and support
 - Industry services



Drive to Zero catalyzes real actions through three key strategies to overcome challenges and achieve these goals:



Drive to Zero’s co-leadership of the Global Memorandum of Understanding for ZE-MHDVs with the Government of The Netherlands;



Directed bi- and multi-lateral assistance to establish Global MOU aligned regulatory and policy development around best-in-world standards and investments;



Supporting rapid planning, market research, championing successes, technology and targeting innovative deployment directly and through partners.

THE SOLUTION:

The Global MOU sets a worldwide ambition and standard for countries and industry



Government of the Netherlands



GLOBAL

MEMORANDUM OF UNDERSTANDING

New ZE-MHDV sales

30% by 2030

100% by 2040

Secured 36 country signatories and over 150 subnational, industry, and other stakeholder endorsers for the Global MOU



MANUFACTURER AND SUPPLIER ENDORSERS



FLEET OWNER AND OPERATOR ENDORSERS



UTILITY AND INFRASTRUCTURE PROVIDER ENDORSERS



SUBNATIONAL GOVERNMENT ENDORSERS



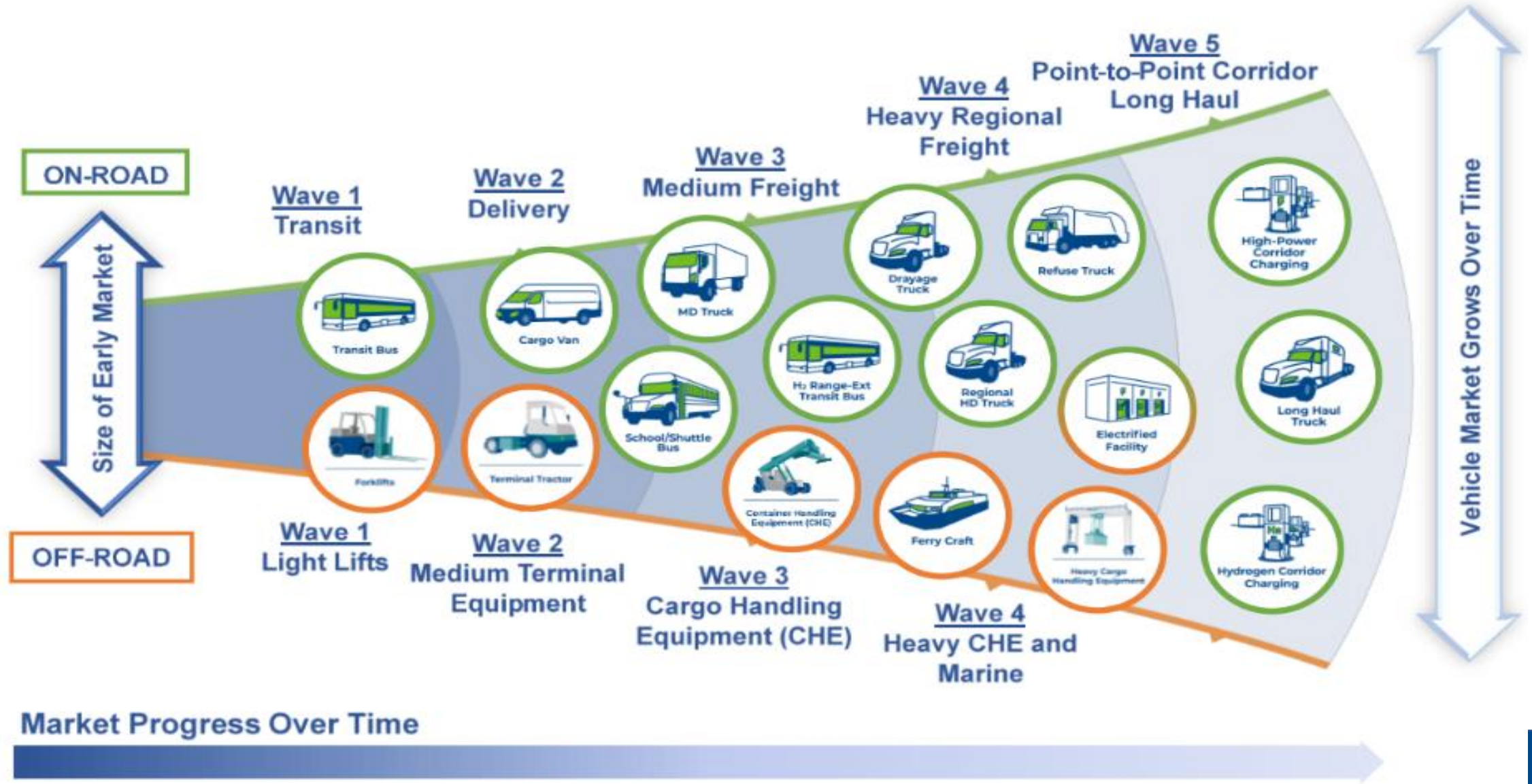
+ many more...

MARKET ACCELERATION: CALSTART INCENTIVE PROGRAMS

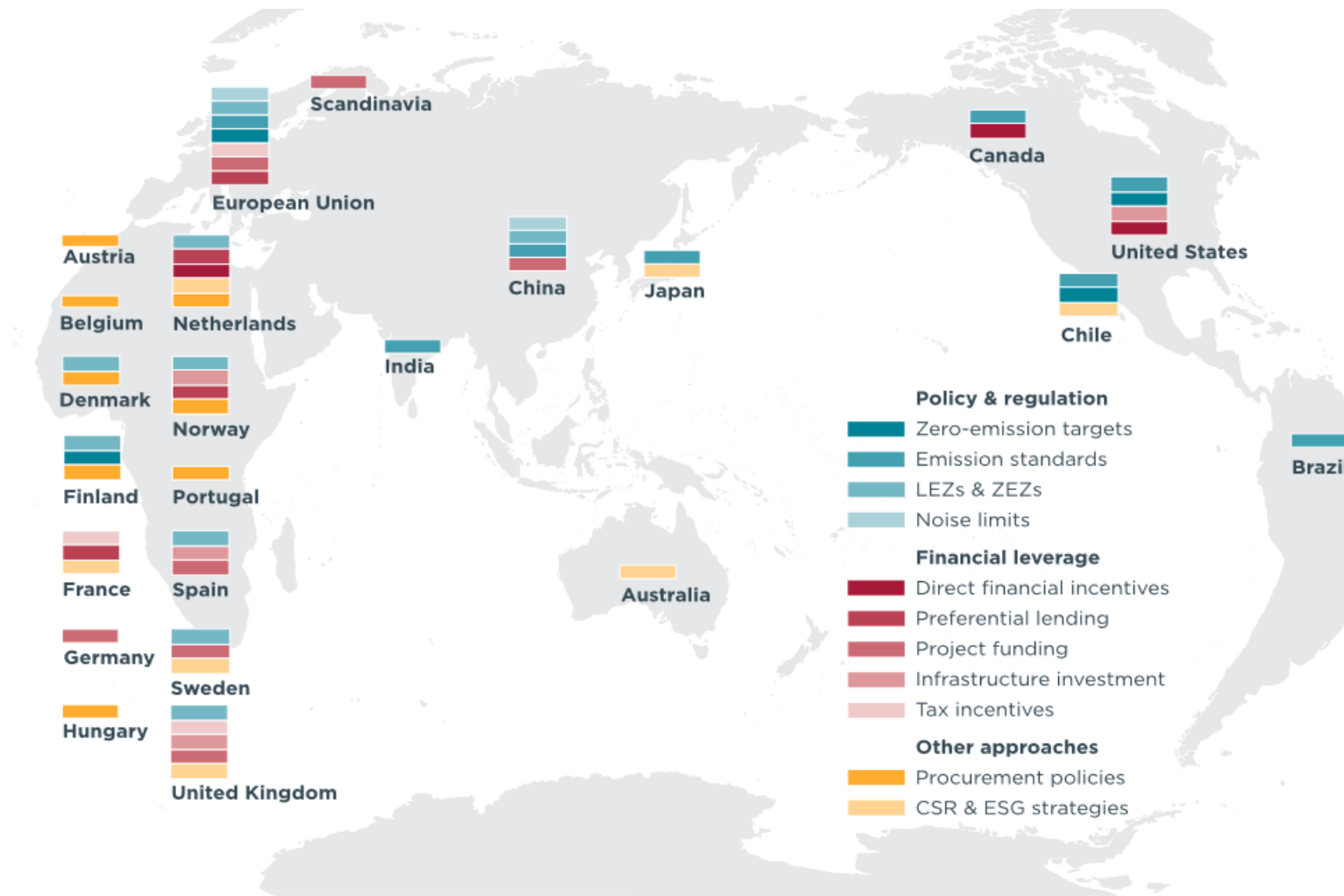
- **Clean Off-Road Equipment Voucher Incentive Program (CORE) – CARB**
- **Hybrid & Zero-Emission Truck & Bus Voucher Incentive Program (HVIP) – Calif Air Resources Board (CARB)**
 - 9,000+ on-road vehicles, 1,580 participating fleets
 - \$600 million+ funded through 2021, \$660 million more in 2022/23. Additional \$1.1B for school buses 2024-28
- **Energy Infrastructure Incentives for Zero-Emission Commercial Vehicles (ENERGIIZE) – Calif Energy Commission**
 - Funds infrastructure (BEV and fuel cell) for commercial & muni fleets
 - \$50 million authorized in 2021

CALSTART partners seek to bring the point-of-sale voucher incentive model to other states and federally

The Beachhead Model: Target the easiest sectors to electrify



Countries and Regions Implementing Measures to Promote Zero-Emission Off-Road Equipment



“..information among stakeholders is not being widely shared globally, and there is generally a limited understanding of the policy progress in promoting zero-emission off-road equipment.”

(International Council on Clean Transportation (ICCT). December 2023)

Figure 1. Countries and regions implementing measures to promote zero-emission off-road equipment

CALIFORNIA CORE OVERVIEW

- **Point-of-Sale Voucher Incentive Program** to purchase or lease zero-emission off-road equipment
- **Offset Costs** of zero-emission technology (incremental cost) with point-of-sale discount
- **Additional Funding** for charging and fuel stations, equipment deployed in disadvantaged communities (DAC) and operated by a small business



ELIGIBLE EQUIPMENT AND VOUCHER AMOUNTS



Large Forklifts

Up to \$500,000



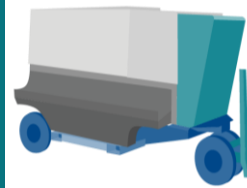
Container-Handling Equipment (CHE)

Up to \$500,000



Airport Cargo Loader

Up to \$100,000



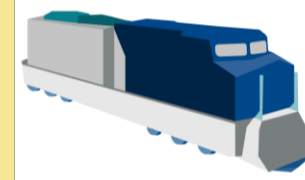
Mobile & Ground Power Units

Up to \$300,000



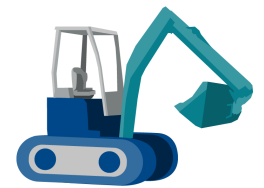
Railcar Movers

Up to \$500,000



Switcher Locomotive

Up to \$500,000



Construction

Up to \$500,000



RTG Cranes

Up to \$500,000



Shore-Power Cable Systems

Up to \$500,000



On- & Off-Road Terminal Tractor

Up to \$120,000



Transport Refrigerator Units (TRU)

Up to \$65,000



Wide-Body Aircraft Tugs

Up to \$500,000



Commercial Harbor Craft

Up to \$1,000,000



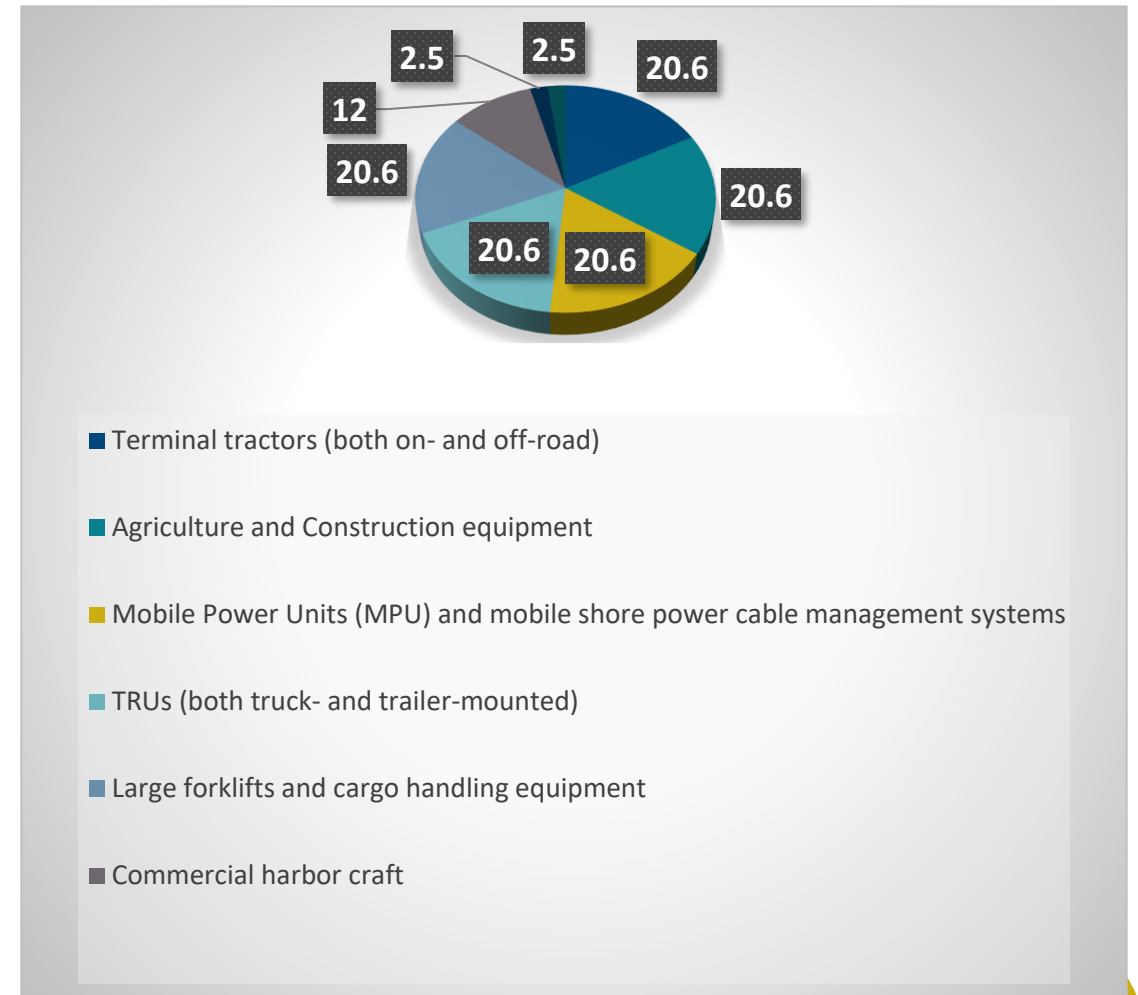
Agriculture

Up to \$500,000

FY2023-24 CORE PROJECT OVERVIEW

- \$120 million available for the FY23/24 heavy-duty funding lane.
- 8 eligible equipment technologies across the following categories

Equipment Category	Allocation Amoun
Terminal tractors (both on- and off-road)	\$20.6 M
Agriculture and Construction equipment	\$20.6 M
Mobile Power Units (MPU) and mobile shore power cable management systems	\$20.6 M
TRUs (both truck- and trailer-mounted)	\$20.6 M
Large forklifts and cargo handling equipment	\$20.6 M
Commercial harbor craft	\$12.0 M
Airport ground support equipment (airport cargo loaders, wide-body aircraft tugs, Equipment Category Allocation Amount and aircraft GPUs)	\$2.5 M
Railcar movers and freight locomotives	\$2.5 M
Total	\$120 M



EQUIPMENT USER PARTICIPATION

Any off-road equipment user in California is eligible

Equipment must be domiciled and operated in California for at least 3 years

Equipment users must submit activity reports for 3 years

The size of the fleet does not affect voucher amounts, and equipment users have no limit on the number of vouchers for which they can apply



DRIVING CHANGE: THE IMPACT OF CORE ON CALIFORNIA'S HEAVY-DUTY INDUSTRY



47
Manufacturers



105
Dealerships



294
Eligible
Equipment
Models



1262
Vouchers
Requested



3418
Equipment
Requested



1887
EVSE
Requested



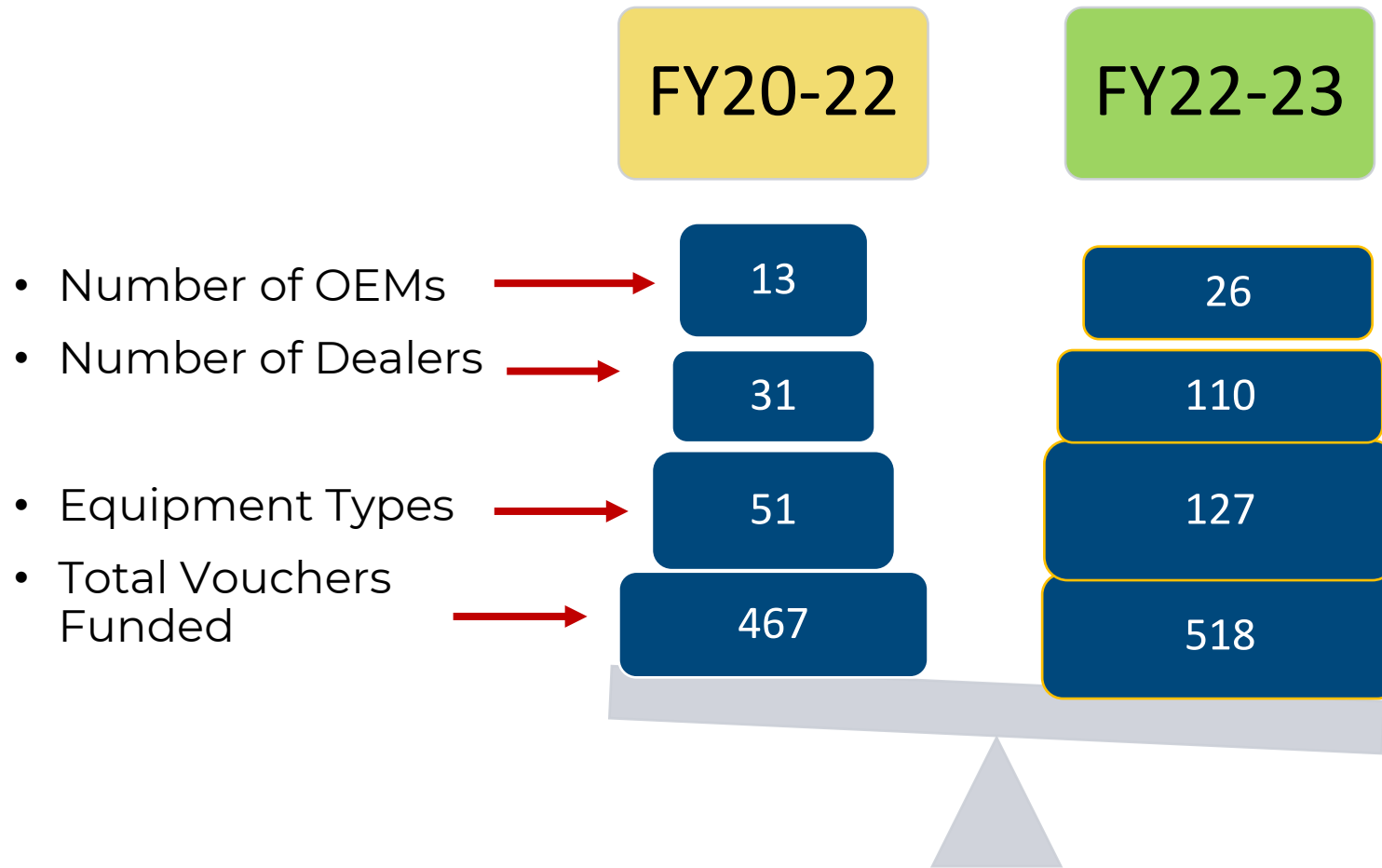
997
Vouchers
in DACs



317
Small
Business
Purchasers

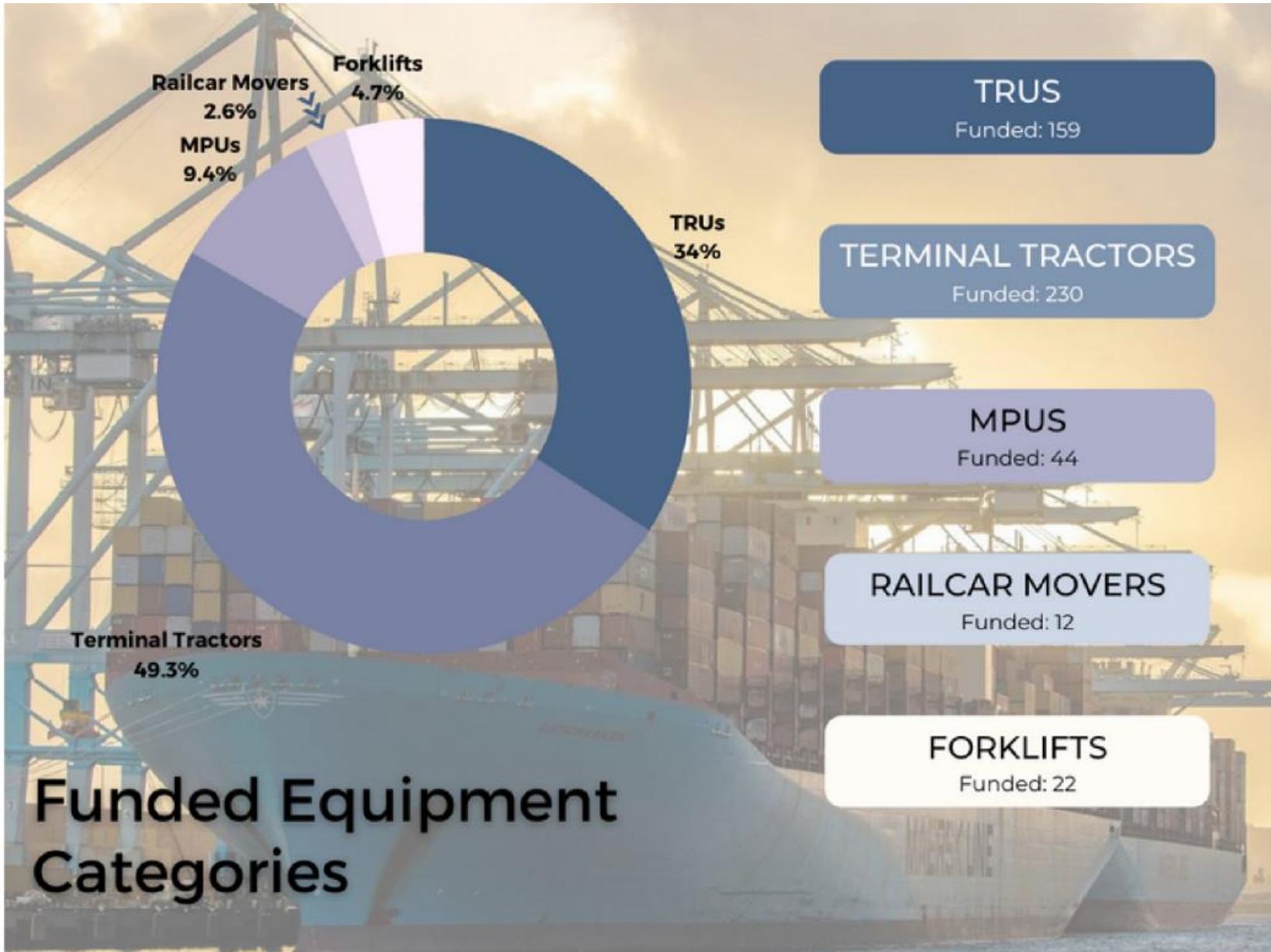
Updated March 2024

CORE PROJECT THROUGH THE YEARS



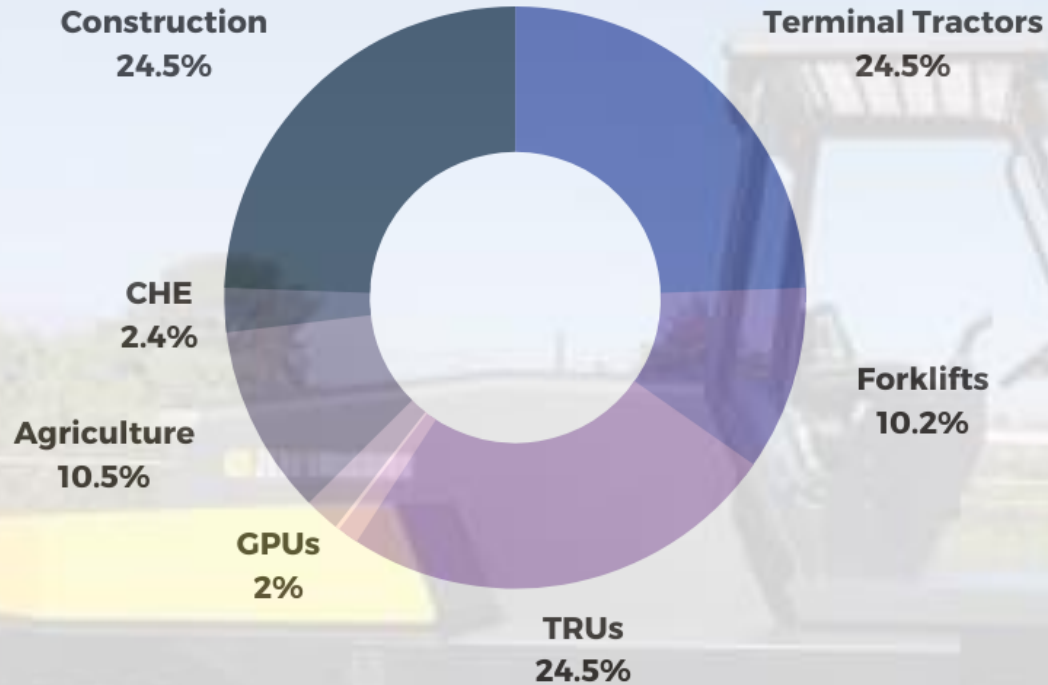
The number of OEMs, dealers and types of equipment increased to the double in one cycle of operation of the CORE

CORE FY20-22 FUNDING RESULTS



- Total Funding: \$69,001,565
- \$44 million to deploy zero-emission off-road freight enabling equipment
- \$30 million to fund the contingency list
- Total No. of Vouchers: 467
- Equipment Operated in DACs: 297 (63.60%)

CORE FY22-23 FUNDING RESULTS (To Date)



- Total Funding: \$125+ million
- \$30 million set aside to fund ZE lawn and garden equipment
- Terminal tractors: \$25,000,000
- TRUs: \$25,000,000
- Large forklifts and CHE: \$10,470,213
- Airport ground support equipment: \$2,000,000
- Railcar movers and switchers: \$247,500
- MPUs and mobile shore power cable management systems: \$1,200,000
- Agriculture equipment: \$10,768,097
- Construction: equipment: \$25,000,000

Coming this summer: new funding round - \$200 million in additional funding!

Market Tools Designed to Assist Purchase Decisions

Off-Road Zero-Emission Technology Inventory Tool (O-ZETI)

- Tableau-based interface provides current market data on zero-emission equipment model availability across off-road industry
- First iteration launched in February 2024
- Additional categories to be launch in Q3 2024

Off-Road Total Cost of Ownership Tool

- Tool provides purchasers, stakeholders, and policymakers with an ability to assess the lifetime cost of ownership of zero-emission equipment compared to its diesel counterpart.
- Launched in March 2024



Opportunity: Build an off-road zero-emission global policy and regulation tracking tool



OFF-ROAD ZERO-EMISSION TECHNOLOGY INVENTORY

Shows regions where zero-emission brands are available for purchase including incentives

Equipment Specifications

Future models and when are expected to become available

SELECT EQUIPMENT CATEGORY

Transport Refrigeration Unit



Cargo-Handling Equipment



Forklift



Terminal Tractor



FORKLIFT SUMMARY

25 OEMs
564 Models

SELECT EQUIPMENT TYPE

- (All)
- Forklift (Light)
- Forklift (Medium)
- Forklift (Heavy)

FILTER EQUIPMENT

Location:

Technology: Electric Fuel Cell

Battery Capacity (kWh):

Range (hour):

SELECT MANUFACTURER



SELECT MODEL TO COMPARE

E40HSD3

J30XNT

J35XNT

J40XNT

J40XNTL Integrated Lithium-Ion

COMPARE UP TO THREE MODELS

<https://globaldrivetozero.org/tools/zeti-offroad/>

Interactive online global database for finding commercially available zero-emission off-road and non-road vehicles and equipment.

O-ZETI Tool: Looking Ahead

Coming Soon

- Construction - *over 200 zero-emission models*
- Mining
- Agriculture
- Commercial Harbor Craft
- Mobile Power Units
- Rail and Locomotive
- Airport Ground Support Equipment



**Do you want to collaborate with the
OZETI tool? Write to dday@calstart.org**

CALSTART's Global Commercial Drive to Zero Program

Mission: Decarbonize Off-Road Sector

Ports

Freight

Construction

Public Private
Partnership



- Established commitment for signatories in the Medium and Heavy-Duty zero-emission vehicle industry
- Opportunity to leverage network of signatories with similar off-road commitment to accelerate the adoption of zero-emission equipment
- Following Beachhead Strategy



Global Off-Road Measures Promoting Zero-Emission Equipment

Government & Regulatory Action

- **North America:** DERA, CARB ZE targets with other states following suit, EPA Clean Ports Program
- **Europe:** EU Big Buyers Initiative, Fit for 55, 13+ countries with regulations or incentive structures, Low & Zero Emission Zones
- **Asia Pacific:** China, Japan nonroad emission standards, Maritime Singapore Decarbonisation Blueprint
- **South America:** Chile, Brazil lead with electromobility strategy, fuel economy policies, 100% ZE targets (includes off-road)
- **India:** Bharat Stage 4 and 5 Non-Road Emission Standards (ag & construction)

NGO Initiatives

- Getting to Zero Coalition
- C40 Cities Clean Construction Declaration
- US Green Building Council Electrified Construction Coalition
- Zero Emission Maritime Buyers Alliance (ZEMBA)
- WEF First Movers Coalition

SOME KEY ISSUES REGARDING ELECTRIFICATION FOR OFF-ROAD SECTOR GOING FORWARD

- **Irregular duty cycles:** Is the equipment's duty cycle a match for electrification? The same equipment is often used differently according to end-user
- **Adequate power:** will electricity provide enough power for attachments when compared to hydraulics?
- **Space constraints:** will there be enough space on the equipment for batteries?
- **Energy storage:** will battery supply be able to meet future demand of the sector?
- **Infrastructure:** how do you charge equipment at remote job sites?



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HOW THE PROCESS WORKS FOR END-USERS

1. Select equipment that suits your needs from the CORE catalog

2. Contact an approved dealer – they are trained to submit the CORE voucher request

3. Provide the dealer with equipment domicile location and other required information

4. Receive your approved funding status of your voucher request

5. Purchase your CORE-discounted equipment

6. Dealer redeems voucher when equipment delivered, voucher amount deducted from sales price



MANUFACTURER STEPS TO PARTICIPATE

1. Review the CORE Implementation Manual

2. Compile documents outlined in Attachment A

3. Send complete application packet to
CORE@arb.ca.gov

4. Advise dealers to enroll

EQUIPMENT ELIGIBILITY APPLICATION (ATTACHMENT A)

Section A

- Cover letter
- Application table of contents
- Description of the equipment or conversion-kit
- Test methodologies and results
- Cost information
- Dealer, service-and-repair, and conversion-kit installer information
- Warranty information

Section B

- Service-and-repair information
- Commercial readiness information
- Telematics and data-collection system(S) information
- Tell-tale information
- Charge, fuel, and range indicators
- Annual user experience report
- Information to be distributed to purchasers
- End-of-life disposal plan
- Approval of conversion-kit installers



BECOME A DEALER IN FOUR EASY STEPS

1

Review the training material located on the CORE website.*

2

Notify CORE admins at coredealertraining@californiacore.org to show your interest.

3

Score 100% on the CORE Dealer Quiz

4

Submit required documentation to CORE admins.

*All training materials are located on the CORE website under the “Participate” tab. For more information, email coredealertraining@californiacore.org.



NINE EQUIPMENT FUNDING CATEGORIES

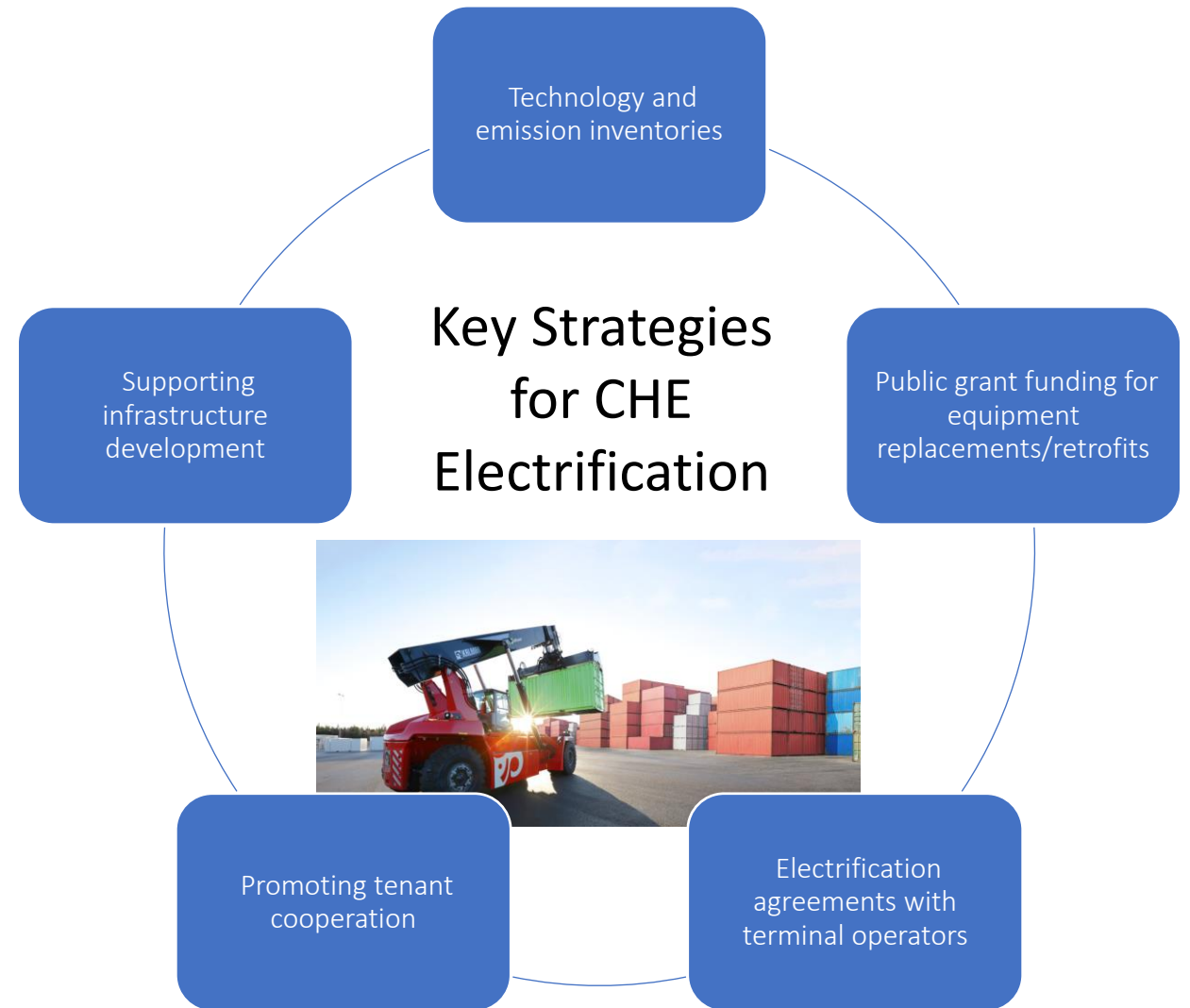
- 1 • Terminal tractors (on- and off-road)
- 2 • Transport refrigeration units
- 3 • Large forklifts and container- handling equipment (rubber-tired gantry [RTG] cranes, straddle carriers, reach stackers, side picks, and top picks)
- 4 • Airport ground-support equipment (airport cargo loaders, wide-body aircraft tugs, and aircraft GPUs)
- 5 • Railcar movers and switchers
- 6 • Mobile Power Units (MPUs) and mobile shore-power cable management systems
- 7 • Construction equipment (excavators, dozers, skid-steers, loaders, backhoes, mining equipment and other construction equipment types)
- 8 • Agriculture equipment (agricultural harvesting equipment and agricultural tractors)
- 9 • Commercial harbor craft (fishing and excursion vessels, ferries, tug, tow, crew and supply boats, barges, dredges, and other vessel types)

CURRENTLY AVAILABLE ZERO-EMISSION OFF-ROAD EQUIPMENT



Ports

- Global developments related to Clean Air Action and Climate Plans for Ports
 - U.S. - Port of Houston, EPA Clean Ports Program, Ports of LA & LB
 - EU – MOU for Onshore Power at Container terminals
- Maritime Strategy
 - Ocean-going vessels
 - Shore-side power
 - Commercial Harbor Craft
- Collaboration with private terminal operators is key to transition
 - Cargo-handling equipment
 - Terminal Tractors
 - Gantry Cranes



Freight Facilities

Over 600 models of zero-emission forklifts are currently commercially available.



- Intermodal terminals, Container freight stations, Distribution and fulfillment centers, Railyards etc.
 - Forklifts – *Battery-electric forklifts expected to make up 75% of U.S. forklift market by 2029; hydrogen fuel cell 3%*
 - Material Handling Equipment
 - Terminal Tractors
 - Railcar Movers
- ZE can improve air quality near DACs and LICs, in indoor facilities
- Opportunity to engage private companies involved in supply chain logistics industry

Construction

- Rental industry for construction equipment plays large role in industry transition to ZE
- Zero-emission on-site mobile power and charging stations
- Lower total cost of ownership and noise reduction for ZE equipment compared to diesel
- Battery electric mini excavators expected to make up 15% of market for U.S. and CA by 2029.



Volvo Construction Equipment is an industry leader with new ZE models, such as the EC230 excavator



The city of Oslo, Norway implemented the first pilot zero-emissions construction sites at Olav Vs Gate and Kingenberggata (right). All sites could be zero-emission by 2025. (KlimaOslo 2019)

Program Pathways

Multilateral Agreement

- Can be added as addendum to existing Medium and Heavy-Duty MOU

Cities and Ports Joint Initiative

- More localized approach
- Streamlined implementation

- Signatory nations commit to 30% of all off-road equipment sales in the country to be zero-emission by 2030.
- Establish heavy-duty off-road baseline of zero-emission sales by 2030 and achieve 100% zero-emission new off-road sales and manufacturing by 2040.

- Non-binding agreement applying to cities, municipalities, and ports within the jurisdiction of the signatory country.
- Joint initiative aiming for 50% of off-road equipment fleets to be zero-emission by 2030 and 100% by 2040.
- Implementation of low-and zero-emission zones for 40% of off-road freight and construction sites.

ZEVWISE

CHARGING UP CHANGE

GLOBAL COMMERCIAL VEHICLE
DRIVE TO ZERO[™]
IMPLEMENTATION HUB NETWORK



GLOBAL COMMERCIAL VEHICLE
DRIVE TO ZERO[™]

A CAMPAIGN OF THE CLEAN ENERGY MINISTERIAL

ZETI

GLOBAL

MEMORANDUM OF UNDERSTANDING

