Maine Clean Transportation Roadmap for Medium- and Heavy-Duty Vehicles

Transportation Working Group Meeting

April 10, 2024

GOVERNOR'S OFFICE OF
Policy Innovation
and the Future

MaineDOT

CAMBRIDGE SYSTEMATICS

Agenda

- Project team and roadmap overview
- The current MHDV and ZEV landscape
- Total cost of ownership and funding
- Charging and grid impacts
- Policies and funding to consider

Roadmap and Project Team Overview

Chris Porter, Cambridge Systematics

Roadmap Objectives

- Chart a path for Maine to decarbonize the trucks and buses moving people and goods within and through the state
  - Characterize Maine's current MHDV fleet and potential future ZEV market penetration and use patterns
  - Evaluate needs for charging infrastructure and grid upgrades
  - Identify policies and incentives needed to make the transition happen in Maine
  - Document and communicate benefits of a ZEV transition in Maine
  - Engage with Maine fleet owners and other stakeholders to tee up near-term funding and demonstration opportunities

Project Team

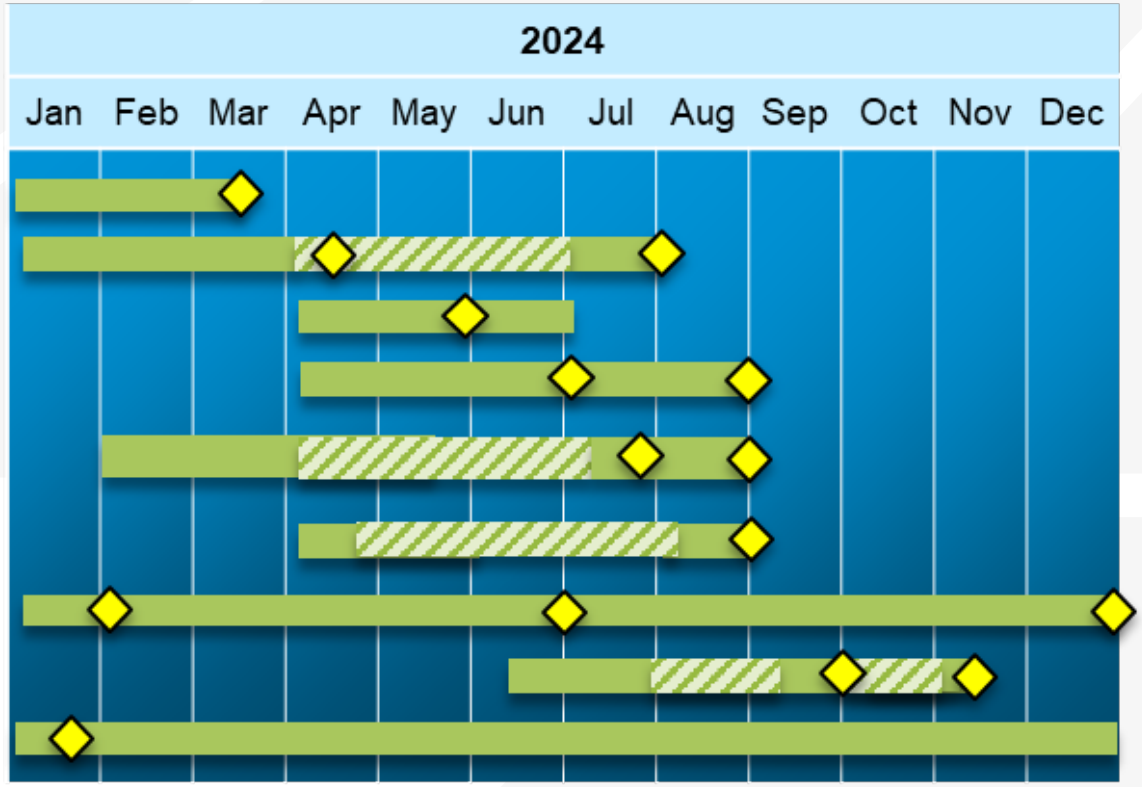
- State:
  - GOPIF
  - Maine DOT
  - Governor's Energy Office
- Consultant team:
  - Cambridge Systematics (lead)
  - CALSTART
  - ERG
  - Cadmus

Advisory Group

- **Aaron Smith**, Central Maine Power
- **TBD**, Hannaford Bros. *(invited)*
- **Barry Woods**, ReVision Energy
- **Ben Lake**, VEIC
- **Brian Cressey**, Thomas School Buses (WC Cressey and Sons, dealer)
- **Brian Hallowell**, Freightliner of Maine
- **Brian Parke**, Maine Motor Transport Association
- **Chad Heid**, Biddeford Saco Old Orchard Beach (BSOOB) Transit
- **TBD**, The Lynch Group *(invited)*
- **Claire Swingle**, Governor's Energy Office
- **Eric Feigenbaum**, Versant Power
- **Ethan Grumstrup**, Maine Public Utilities Commission
- **Jeff Castonguay**, Bison USA
- **Jeff Crawford**, Maine Department of Environmental Protection
- **Jessica Scott**, Governor's Office of Policy Innovation and the Future
- **Josh Caldwell**, Natural Resources Council of Maine
- **Matt Marks**, Cornerstone Government Affairs (representing Associated General Contractors)
- **Michael Stoddard**, Efficiency Maine
- **Mike Williams**, American Progress
- **Nate Moulton**, Joyce Taylor, MaineDOT
- **Ryan Daigle**, Freightliner of Maine
- **Steve Alberti**, Pine State Trading Co.

Tasks & Timeline

Task	
1.	Discovery
2.	Market Analysis
3.	MHDV Forecast
4.	Environmental Analysis
5.	Grid and Electric Vehicle Charging
6.	Additional Policy Analysis
7.	Stakeholder Engagement
8.	Roadmap Development
9.	Project Management



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Stakeholder Engagement

Stakeholder Group	Advisory Group	Interviews	Focus Groups	Existing Meetings	Case Studies	Public Outreach
CFI providers	✓	✓				✓
Cross-sector industry groups	✓	✓				✓
Environmental and community	✓		✓	✓		✓
Fleet operators (private)	✓		✓			✓
Fleet operators (public)	✓		✓		✓	✓
Labor groups	✓	✓				✓
OEMs		✓		✓		✓
Public agencies	✓	✓	✓	✓		✓
Truck and bus dealers	✓	✓		✓		✓
Utilities	✓	✓			✓	✓

The Current MHDV ZEV Landscape

Chris Porter, Cambridge Systematics

Jordan Stutt, CALSTART

Combining multiple data sources to understand the current and future MHDV landscape

Market Segmentation

- Registration data
- Telematics (LOCUS Truck)
- USDOT Vehicle Inventory & Use Survey

Emissions Inventory

- MOVES model

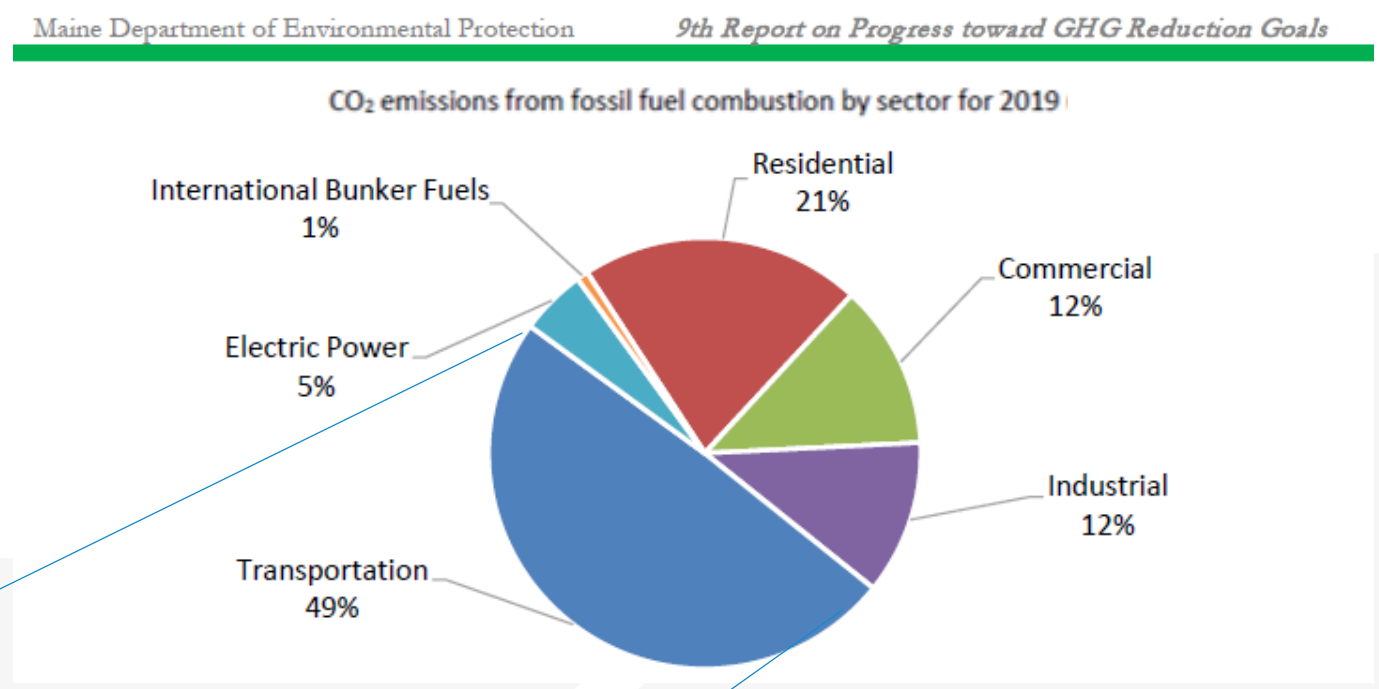
Zero-Emission Scenarios

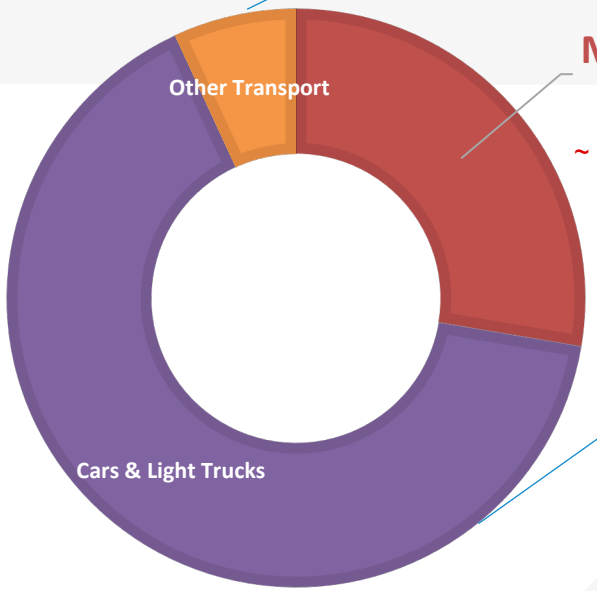
- By segment & geography through 2040
- Opportunity segments

Benefits and Impacts

- Energy
- Emissions
- Costs
- Supporting policies

Medium & Heavy-Duty Vehicles are 9% of Maine's vehicles, but contribute 28% of transportation GHGs





MHDV
28%
~ 2 $MMTCO_2eq$ / year

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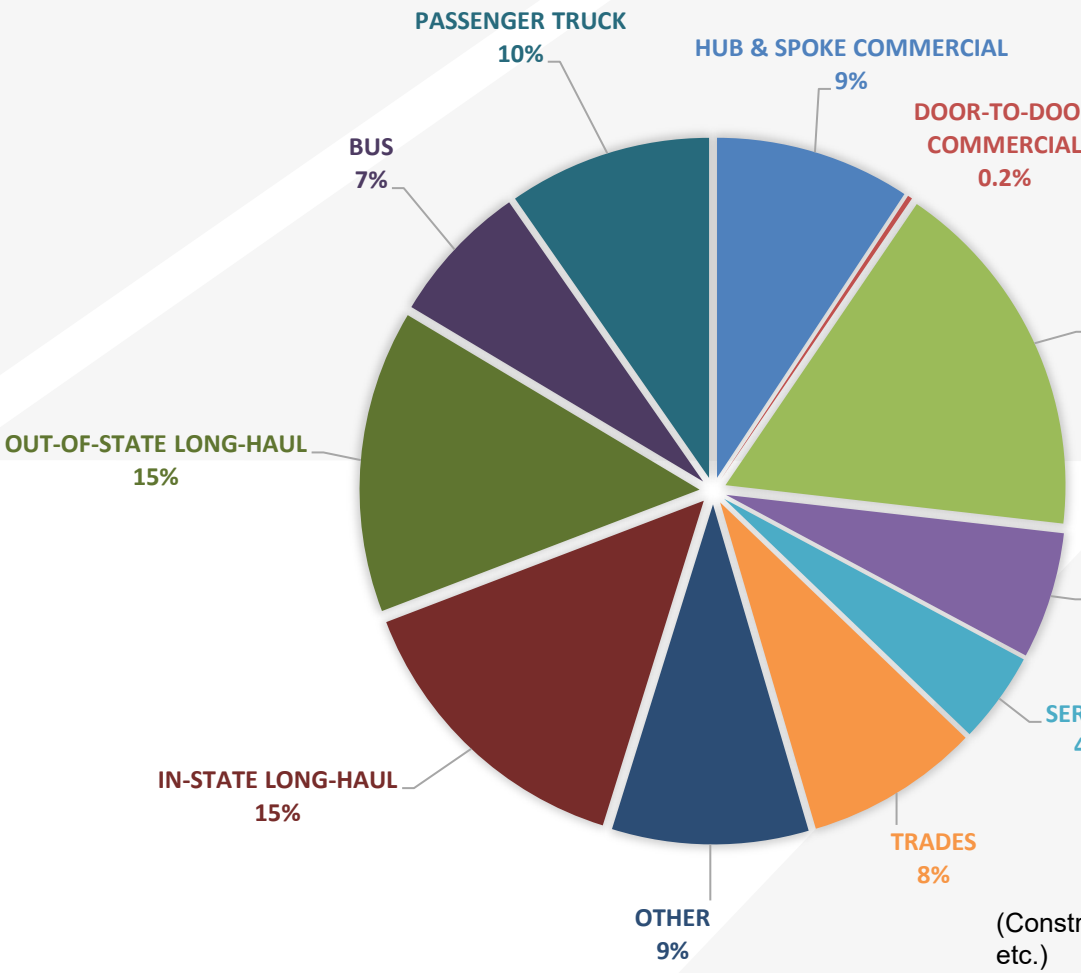
Market Segment Contribution to MHDV GHGs in Maine



(Large pickups and SUVs)

(Multiple round trips from single hub)

(Many short stops)

(>150 mile range, returns to same destination)

(<150 mile range)

(Municipal, Utilities, Waste)

(Construction, HVAC, Plumbing, Landscaping, etc.)

(Agriculture, Rental, Emergency, etc.)

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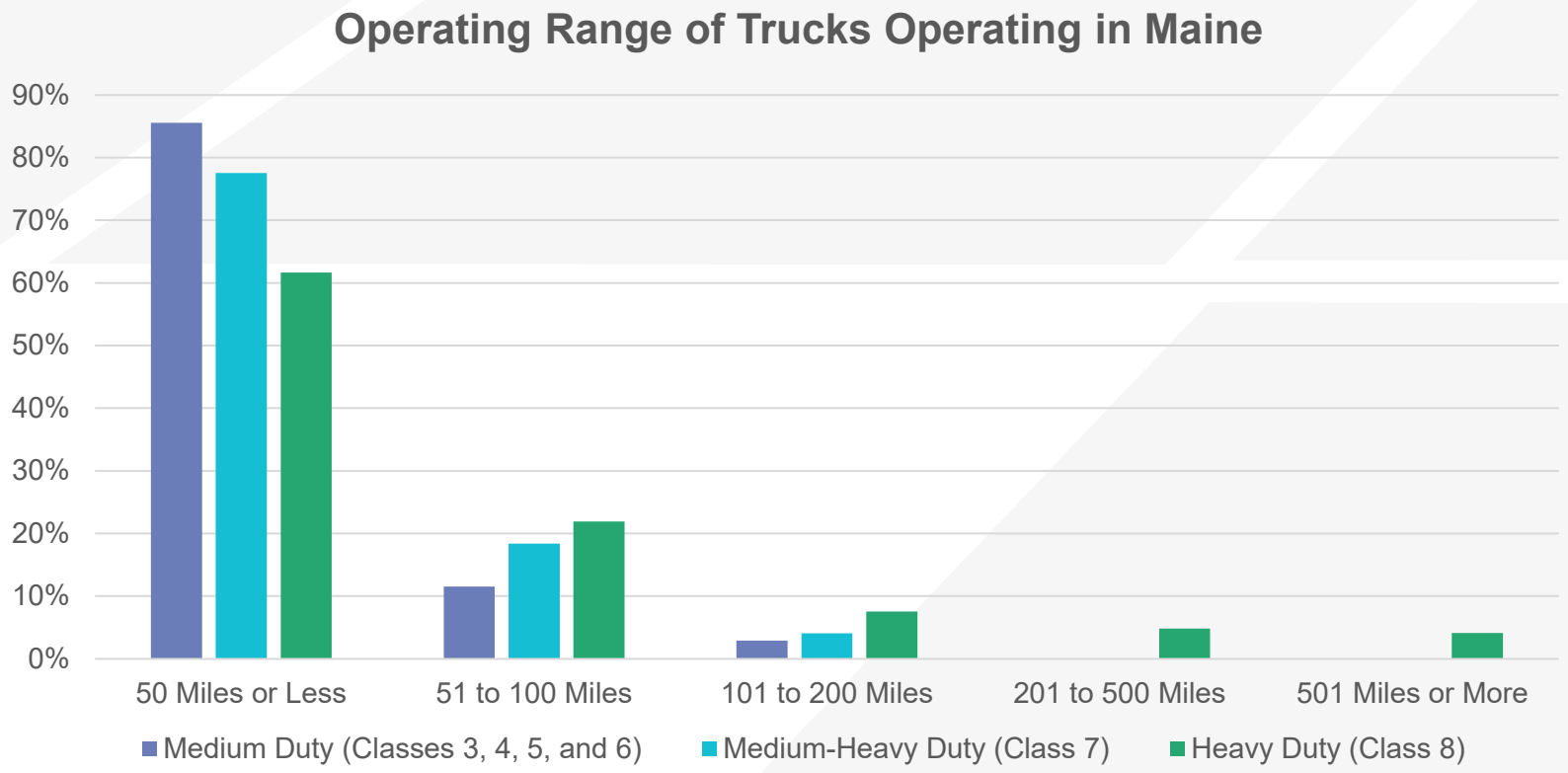
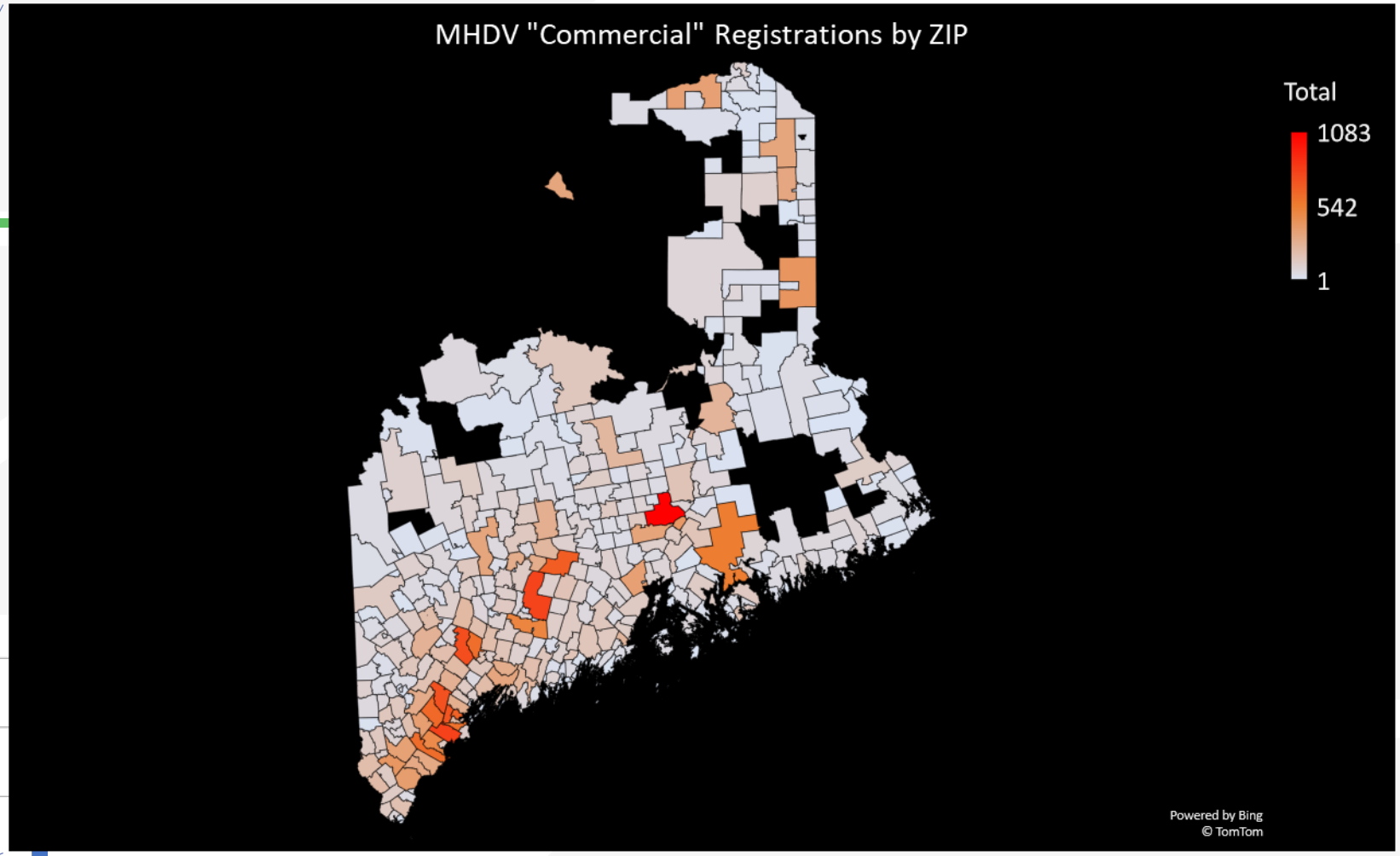
Maine's trucks stay relatively close to home

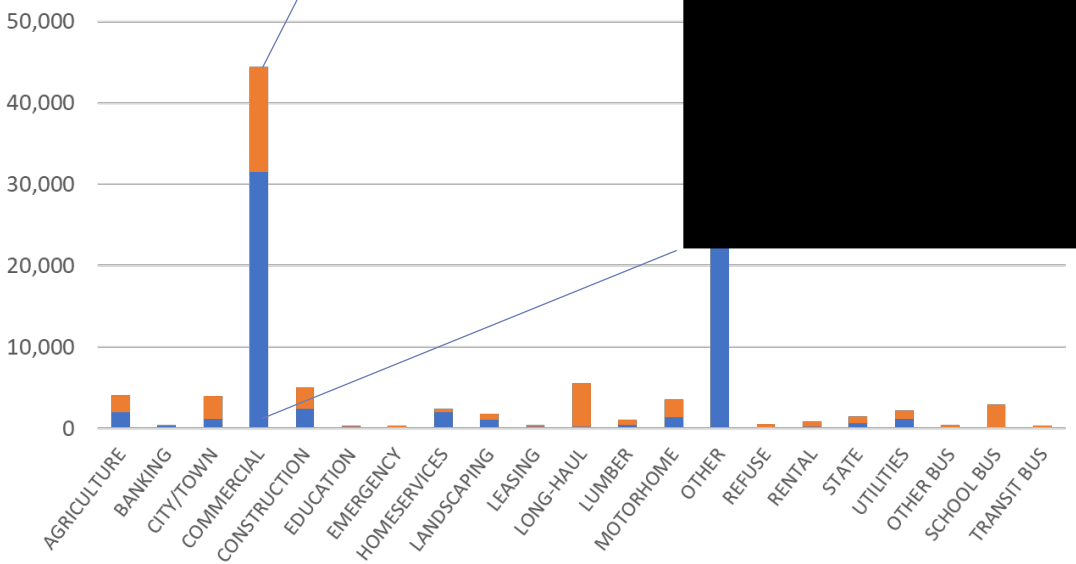
» Nearly 80% of Class 8 trucks operate within 100 miles, compared to less than 60% for the US (and over 90% of Class 3 – 6 trucks)



Source: Bureau of Transportation Statistics, 2021 Vehicle Inventory and Use Survey

“Commercial” registration by ZIP





Source: Maine BMV registration data, processed by DEP and further analyzed by ERG

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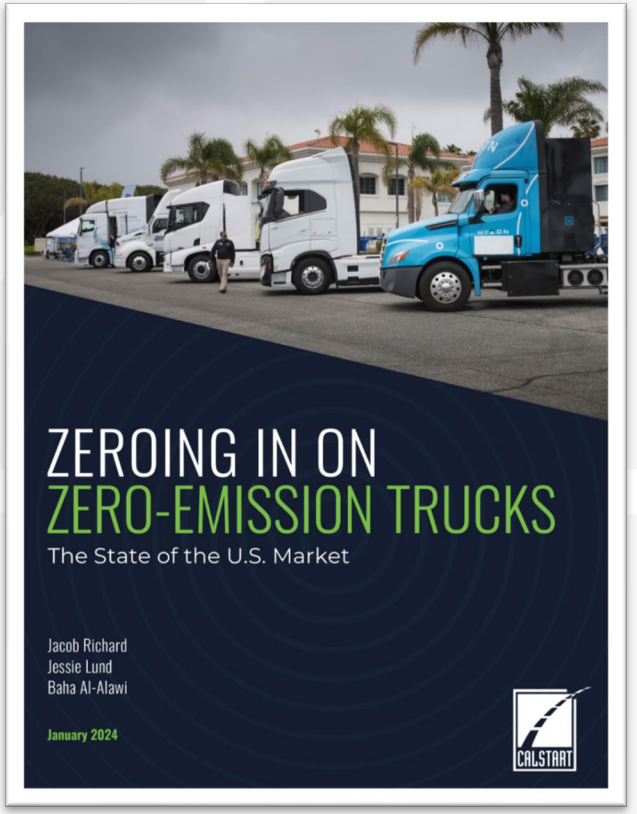
State of Zero-Emission Truck Market

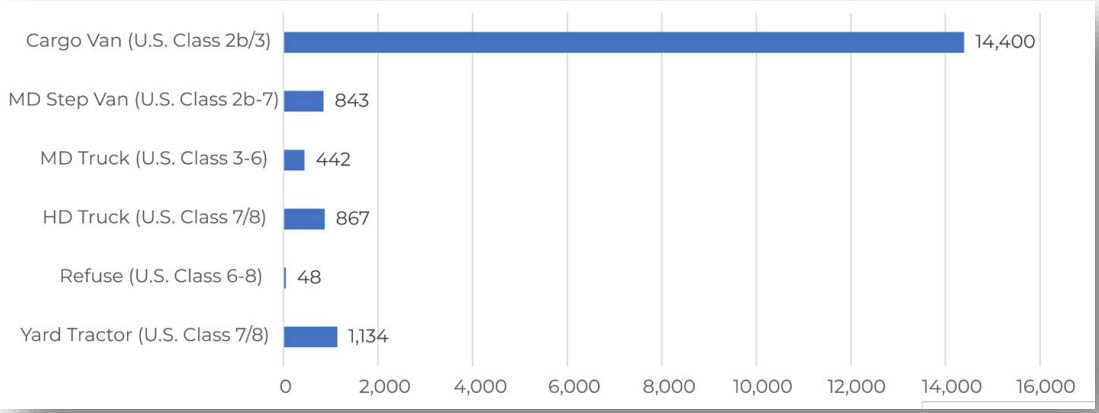
- Jan. 2024 report highlights US MHD zero-emission truck (ZET) deployments through June 2023
  - Class 2b–8
  - Buses (Transit + School Bus) covered in separate report
- >17,500 ZETs deployed nationwide
- >160 ZET models from over 40 OEMs

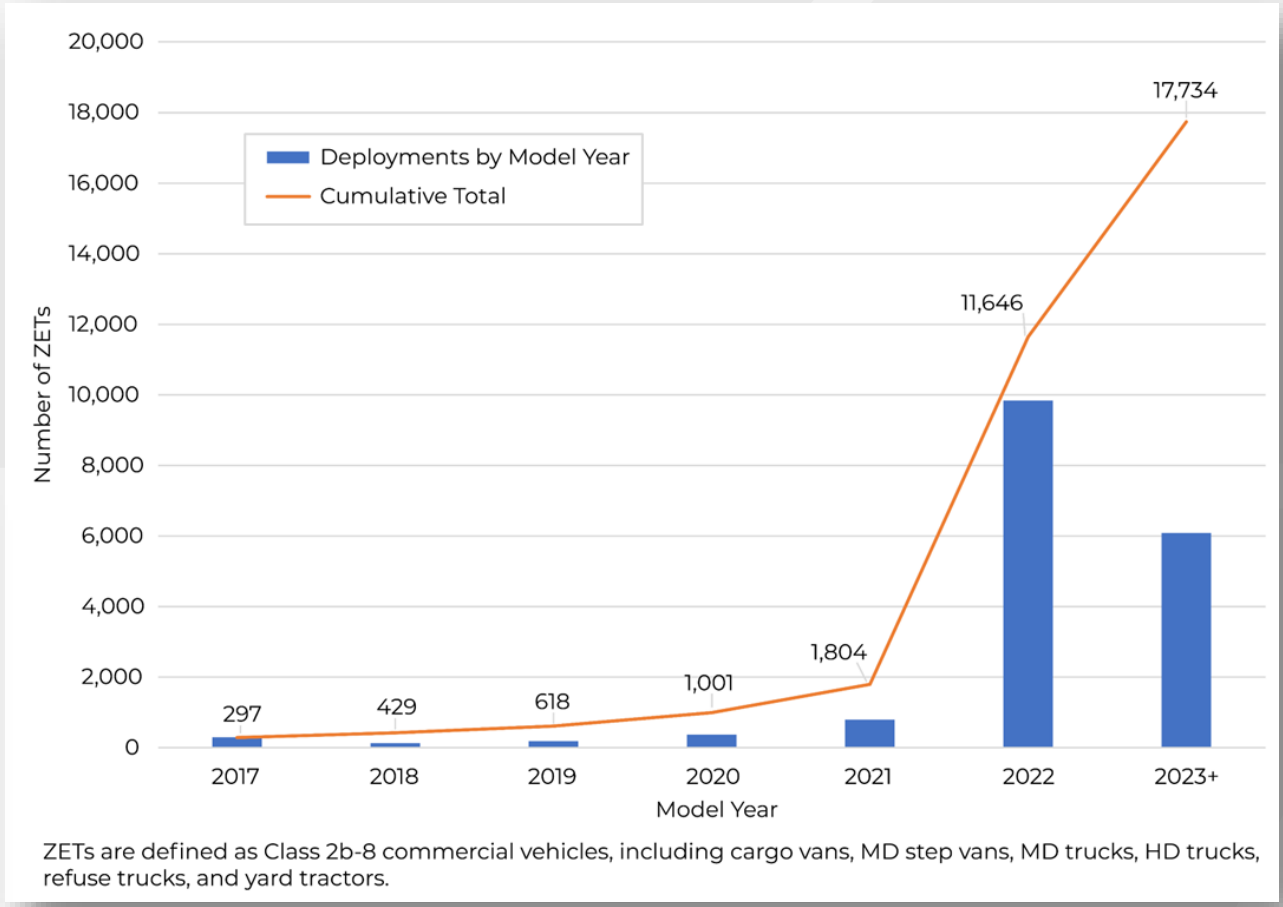


CALSTART, Zeroing in on Zero-Emission Trucks, January 2024

Zero-Emission Trucks on the Rise

- Dramatic growth in recent ZET deployment
  - 2023 EOY sales expected to significantly outpace 2022
- Cargo vans dominating early ZET deployment

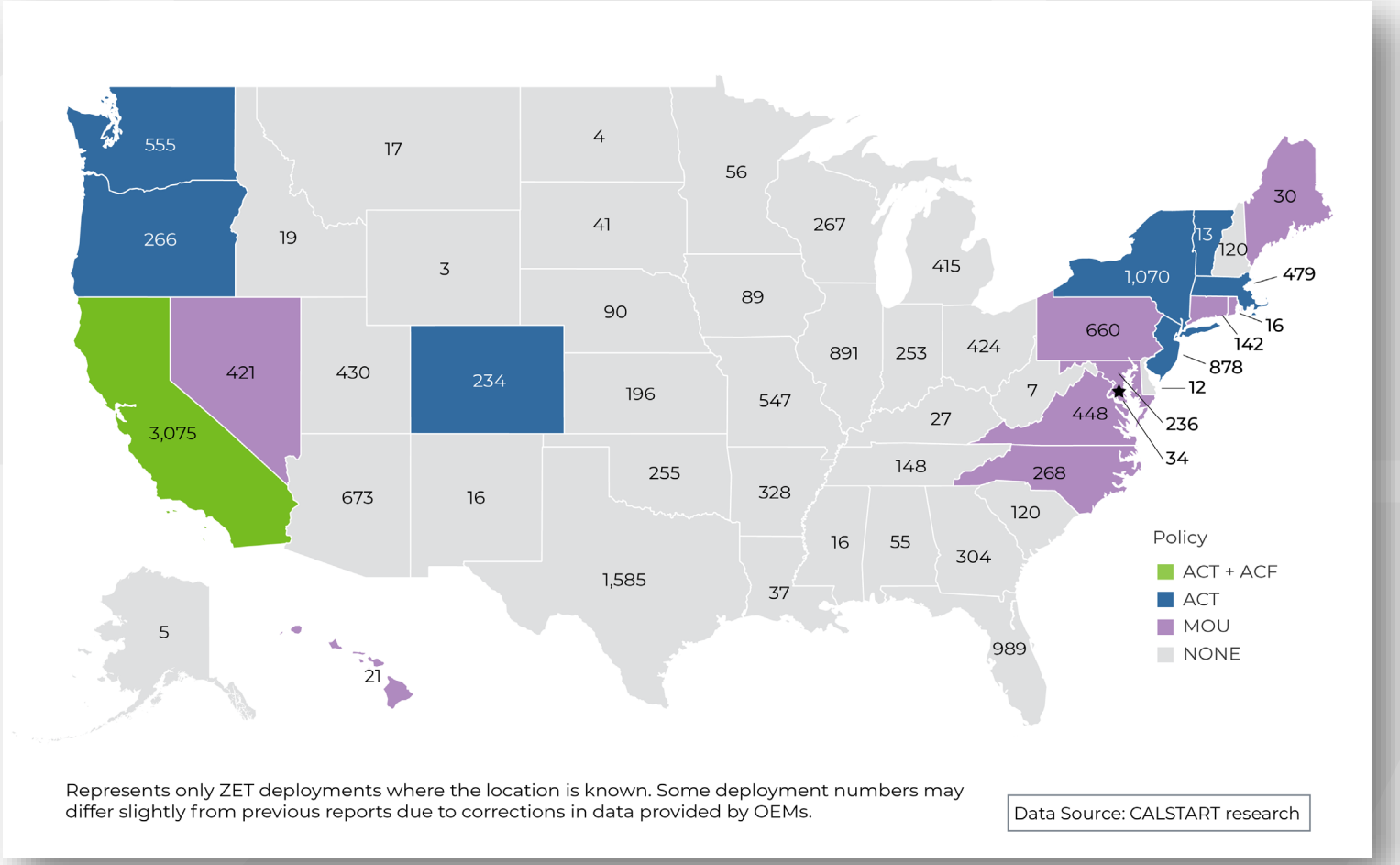




CALSTART, Zeroing in on Zero-Emission Trucks, January 2024

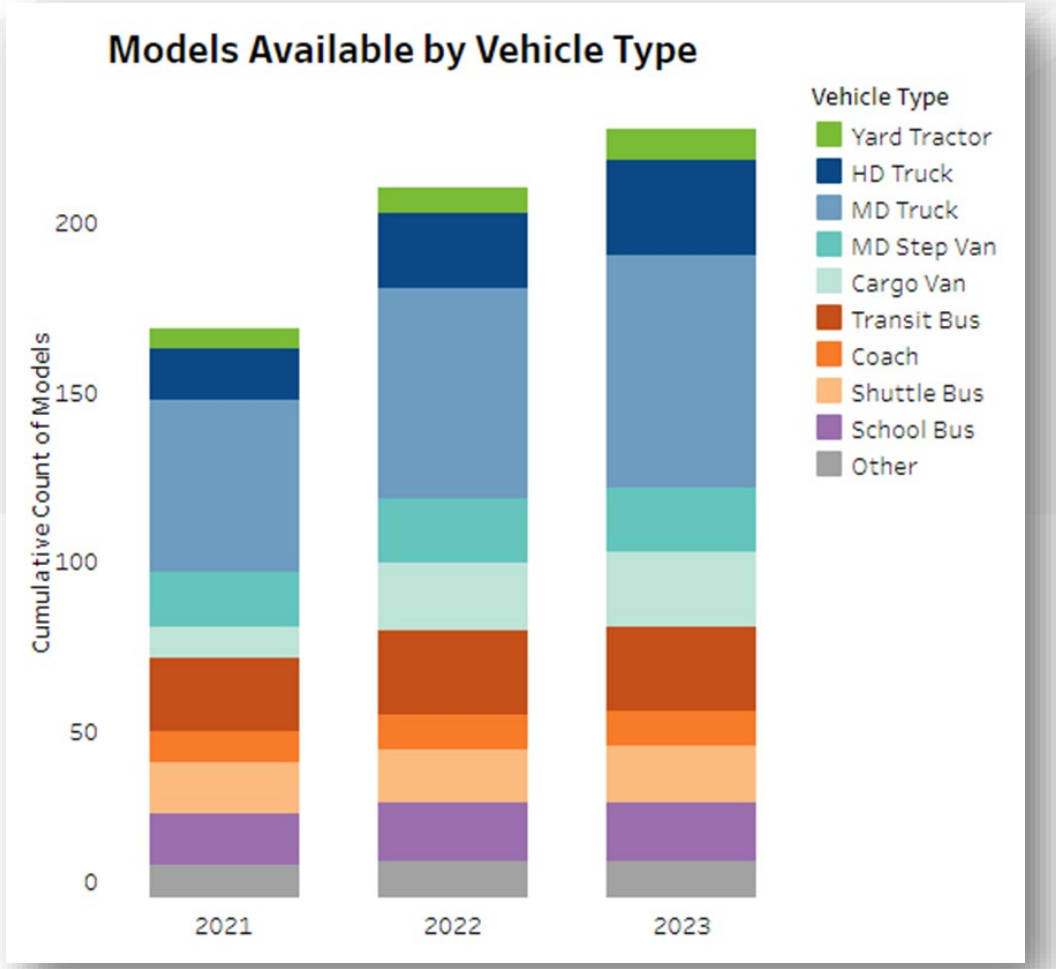
ZET Deployments by State

- 38% of ZETs deployed in states that have adopted Advanced Clean Trucks (ACT) rule
  - » ACT states account for 25% of all trucks
- 50% of ZETs in states without zero-emission MHD policy
- Deployments increasing across all geographies and climates



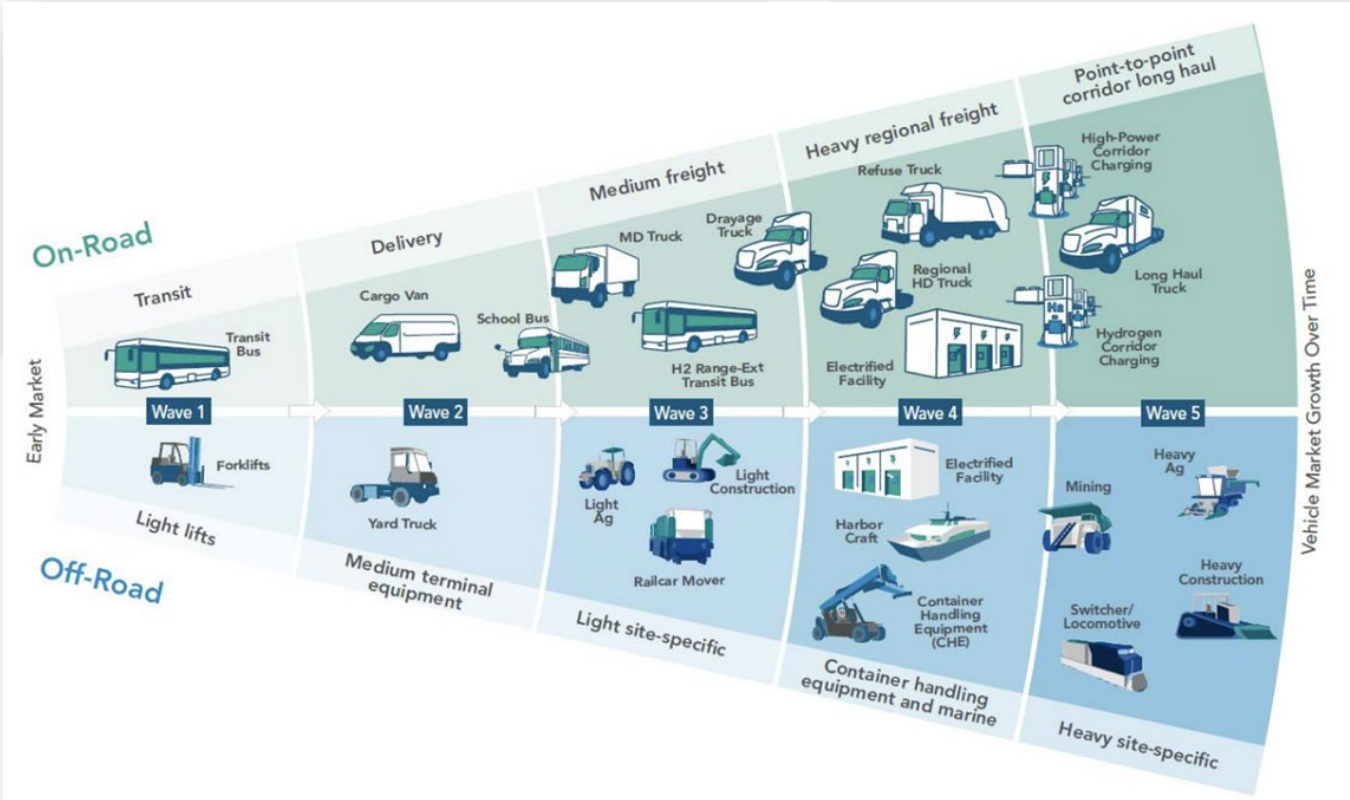
CALSTART, Zeroing in on Zero-Emission Trucks, January 2024

MHD ZEV Model Availability



CALSTART, [ZETI Data Explorer](), November 2023

Zero-Emission Beachhead Strategy



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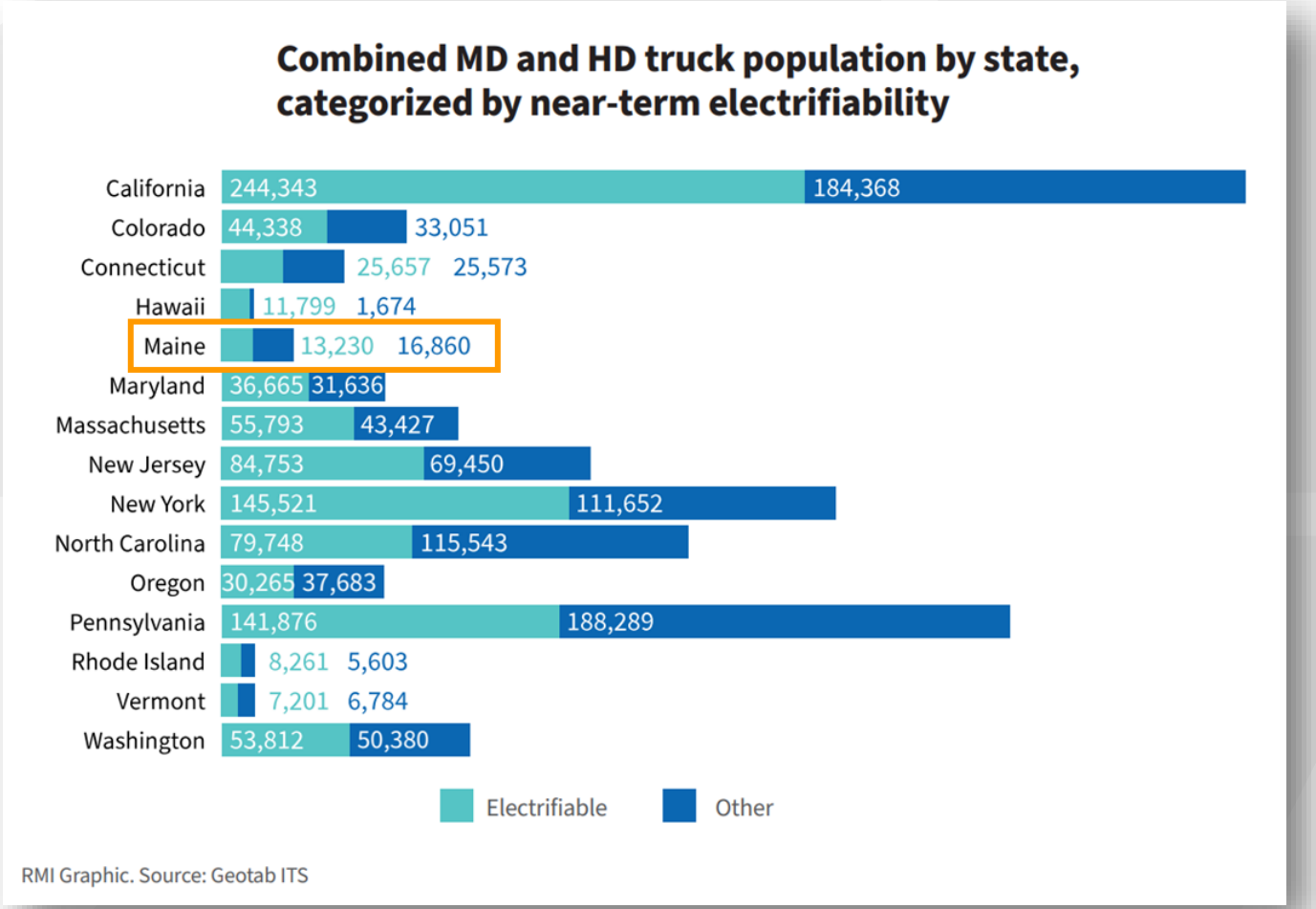
MHD ZEV Performance

- Range of early generation electric trucks: <100 miles/charge
- Today's electric trucks: >300 miles/charge
  - » Range further increased through electrified trailers and/or maximized regenerative braking
- 44% of Maine's MHD trucks categorized as electrifiable in the near term
  - » <300 miles before returning to depot/home



RMI, ACT Now: Impacts of the Advanced Clean Trucks Rule on the Electric Grid and Fleets, February 2024

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Real-World Electric Trucking Demonstration

- North American Council for Freight Efficiency (NACFE) demonstration in 2021
- Piloted 13 electric trucks across North America that fall under 4 market segments

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MHD ZEVs Viable Across Market Segments

Class 3, 4, and 5 Vans & Step Vans

Class 6 Box Trucks

Class 8 Terminal Tractors

Class 8 Regional Haul Tractors

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Total Cost of Ownership and Funding

Total Cost of Ownership (TCO)

- Businesses achieving savings through electrification
- **Barrier:** upfront purchase costs remain higher for MHD ZEVs than diesel alternatives
  - » Incentives can bridge gap
- **Opportunity:** MHD ZEVs deliver savings on fuel and maintenance
  - » Savings increase with higher utilization
- Electrification-as-a-Service
  - » Fleets see cost parity or savings immediately

Intelligent Labor and Moving: Arlington, MA

Anheuser-Busch: Hunts Point, Bronx, NY

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Unprecedented Federal Funding

- EPA Climate Pollution Reduction Grants: $4.6B - Applications submitted 4/1
- EPA Clean Ports: $3B ($2.6B for ZE equipment) – Open now, due 5/28
- FTA Low-No / Bus and Bus Facilities Grants: $8B thru FY26
- FHWA Charging & Fueling Infrastructure (CFI): $2.5B thru FY26
- EPA Clean Heavy Duty: $1B for rebates – NOFO expected April
- EPA Clean School Bus: $5B for rebates – ongoing thru FY26
- DOE VTO and Joint Office FOAs
- Tax Credits
  - 45W: $40K or 30% credit for MHD ZEVs
  - 30C: $30K to $100K credit for alternative fueling station

CFI Grant Recipients

- Charging and Fueling Infrastructure (CFI) Program awarded:
  - $167M in grant funding to 5 battery electric MHDV projects
  - $98M to 4 hydrogen fuel cell MHDV projects

Truck charging sites with DCFCs and MW chargers, solar and battery storage, and rest areas	EV charging depot for both freight and passenger vehicles	Drayage truck charging for ports	Hydrogen station for transit fleet	Public modular fueling stations for hydrogen fueling for MHDVs	Hydrogen fueling station for LDVs to HDVs	Hydrogen refueling network for medium- and heavy-duty freight trucks
$140 M awarded	**$15 M awarded**	**$12 M awarded**	**$12 M awarded**	**$9 M awarded**	**$7 M awarded**	**$70 M awarded**

- $623M total distributed and $1.9 billion remain to be distributed over the next 4 years across 3 more rounds

Charging and Grid Impacts

MHDV charging is different than LDV

- MHDV have larger batteries, requiring more time OR higher power chargers (e.g., 1 MW as opposed to 150 kW for fast charging)

Charging level	Peak demand (kW)	Potential applications
Level 1	1.4–1.9	Smaller vehicles, lightly used
Level 2	Up to 19.2	Overnight charging of small/medium vehicles
DC fast charging (sometimes called Level 3)	36–240	Fast charging of small/medium vehicles, overnight charging of larger vehicles
Tesla megacharger	1,000–1,600	Class 8 long-haul tractors

- AC Level 1 and Level 2 charging not sufficient to meet battery needs of MHDV ZEVs (except some overnight depot charging for medium duty vehicles)
- Level 3 will not be “fast” for many vehicles, and 1 MW chargers will be needed

MHDV charging typology

- Overnight charging at a private depot or public in rest areas along highways (up to 100kW)
- Opportunity fast charging at destinations or along highways (up to 350 kW)
- Opportunity ultra-fast public charging (above 1MW)

Charger type	Nominal power output	Charging standard	Location	Estimated charging times
Overnight	50–150 kW DC	Combined Charging System (CCS) or CHAdeMO	Depot, public parking space	8 hours
Opportunity fast	150–350 kW DC		Public charging station, depot, destination location	0.5 hours
Opportunity ultra-fast	750 kW–3 MW DC	Megawatt Charging System (MCS) or ChaoJI	Public charging station, depot, destination location	0.5 hours

Variation in MHDV Charging

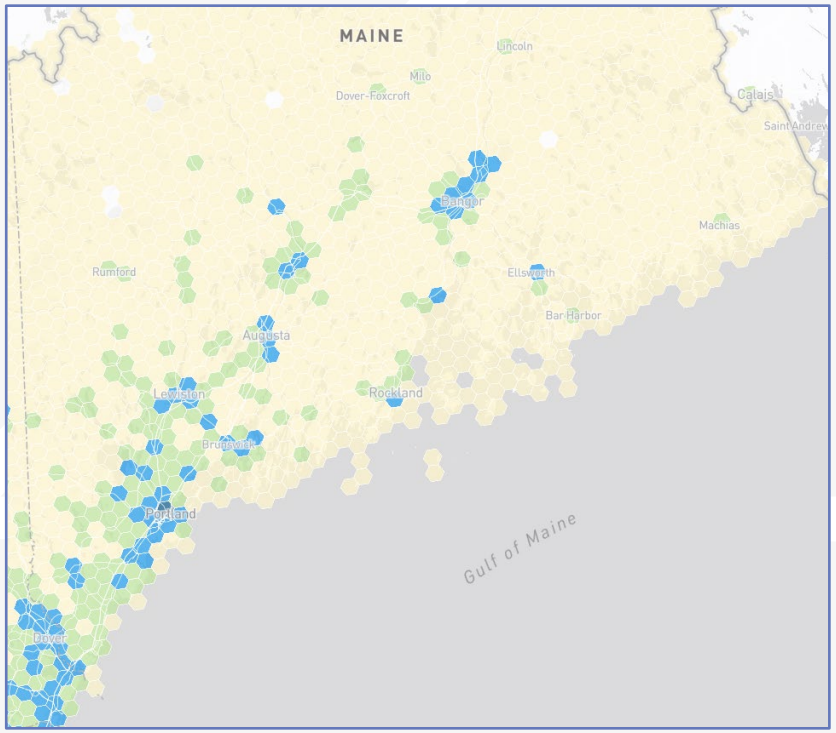
- Exact charging needs vary greatly by fleet so many kinds of charging solutions will need to be considered
- Long-haul heavy-duty truck concerns:
  - Federal hours-of-service – battery charging needs to take place during mandatory rest periods for long-haul truckers
  - Truck parking availability is major industry concern
- Medium-duty vocational vehicle concerns:
  - Grid capacity for depot charging of fleet

Minimizing Grid Impacts

- Grid impacts of MHDVs will occur mostly at distribution level
  - » New substations, transformers, and feeders will be needed, rather than new transmission infrastructure
- Grid impacts can be reduced through mitigation of peak load events
  - » Pricing schemes to encourage off-peak charging and smart charging
- Grid planning in Maine by EMT, GEO, utilities
  - » Case studies being conducted via this project

Case Studies

- Focus on 4-6 high-demand locations
  - » Consider needs to support charging infrastructure in different contexts
- Discussions with site owner & fleet operators:
  - » Existing and potential traffic and charging/refueling patterns
  - » Barriers to MHDV ZEV infrastructure and its use
  - » Potential incentives & support
- Discussions with the local utility:
  - » Existing grid capacity
  - » Potential upgrades – needs, opportunities, barriers, costs



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Policies to Support MHD ZEV Transition

Policy Categories

- **Vehicle and Infrastructure Incentives**
  - » Colorado: Clean Fleet Vehicle and Fleet-ZERO (Infrastructure)
- **Utility Rate Design and Make-Ready Programs**
  - » Time-of-use rates, demand charge discounts, make-ready incentives
- **Fleet Advisory Services**
  - » Mass Fleet Advisor
- **Clean Air & Vehicle Regulations**
  - » Advanced Clean Trucks
- **Public Outreach & Engagement**

Thank you for your input!

- Additional thoughts, questions, or comments? Email us:
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  - Jessica.P.Scott@maine.gov

Unused Slides

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