

Welcome

Closed Door Meeting: Zero Emission Truck Policy Group

International Transport Forum
Summit - Leipzig, Germany

24 May 2023



Agenda

Goals

Zero Emission Truck Policy Overview

 **Table Breakouts**

Stakeholder Perspectives Examples: EU & CA

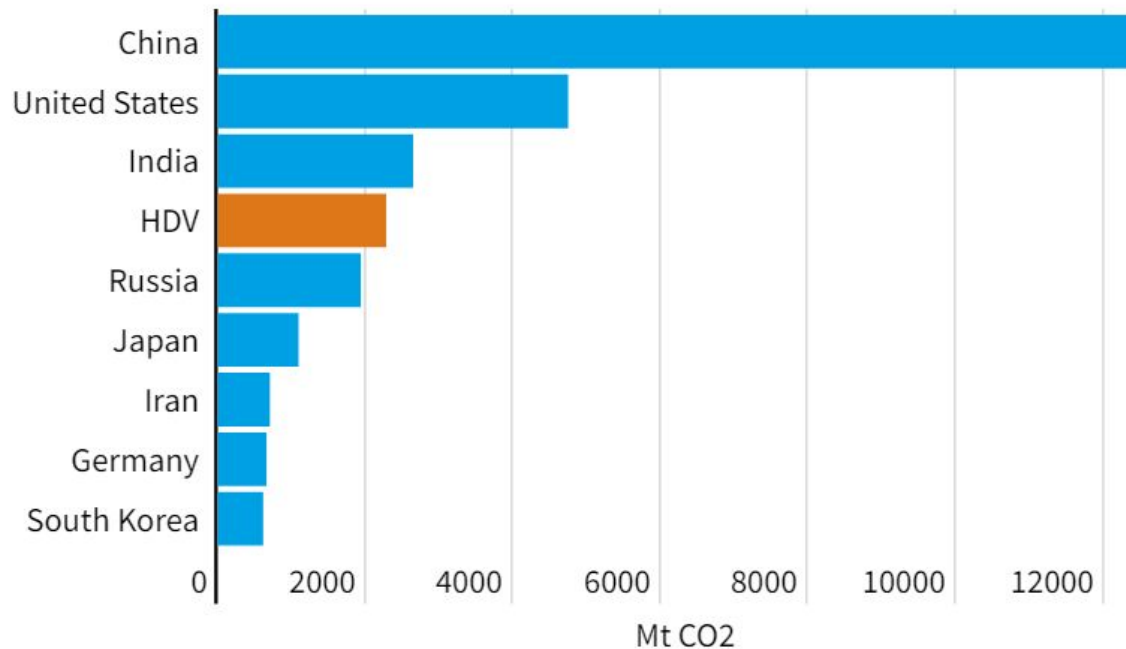
 **Table Breakouts**

Plenary Discussion

Closing

Why are we meeting?

HDVs would be **4th largest emitter** if they were a country



Note: includes all vehicles classified as 'heavy-duty' or 'bus' by their country's legislation.

Source: 2021 emissions in Mt CO2. STATISTA for HDV emissions worldwide, Emissions Database for Global Atmospheric Research (EDGAR) for emissions by country.

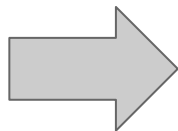
Why are we meeting?

Navigating stakeholder perspectives on ZET regulation



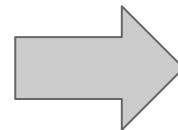
Who?

Who will have
an opinion?



What?

What will
they say?



Prepared

Responsive
Good Policy

Initiatives supporting the ZET transition

Global MHD ZEV MOU

CALSTART & Netherlands - national, non-binding targets

ACT Bootcamp

ICCT - technical workshop on policy, market, technology

ZEVWISE

Coalition - events focused on charging and finance

And more . . .

Cross- and sector specific

Today helps us identify next steps

- Today - Highlevel

- Supportive policies
- Stakeholders perspectives
- Supportive facts & inaccurate myths
- Identify your priorities

- Future Events - Deeper Dives

- Bring in stakeholders
- Workshop options for addressing perspectives
- Shared challenges and lessons learned

Zero emission trucks: Challenges and new momentum

Dale Hall

24 May 2023

Leipzig, Germany

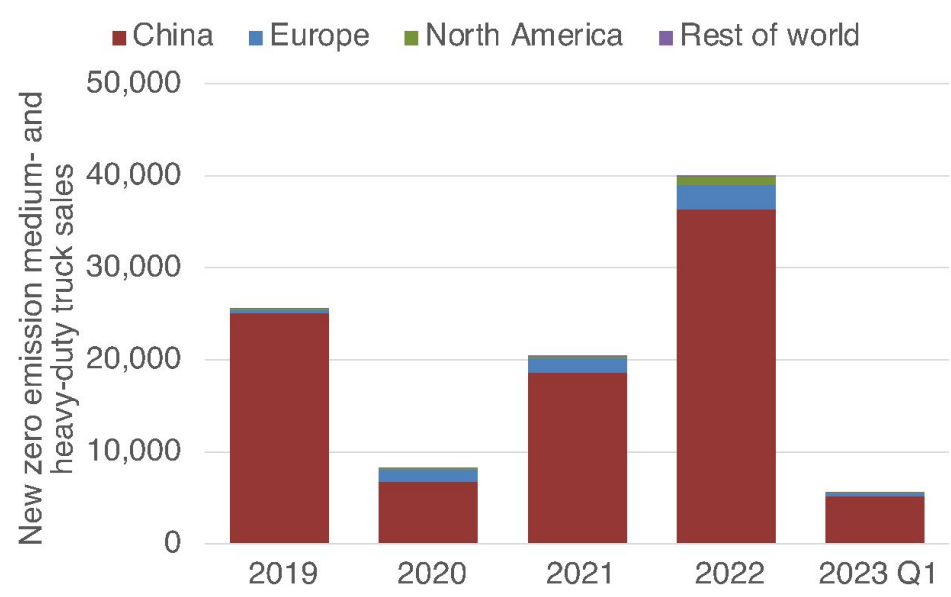
A big climate opportunity, but a long way to go

Required zero emission sales shares in major economies to meet Paris trajectory

| Vehicle type | 2025 | 2030 | 2035 | 2040 | 2045 |
|---|--------|---------|----------|----------|------|
| Bus (>3.5 tonnes) | 7%-30% | 75%-90% | 90%-100% | 100% | 100% |
| Medium truck (3.5 to 16 tonnes) | 3%-12% | 40%-50% | 75%-90% | 100% | 100% |
| Heavy truck (>16 tonnes) | 2%-9% | 30%-41% | 60%-75% | 90%-100% | 100% |
| All HDVs (sales-weighted average per country) | 3%-12% | 40%-56% | 69%-83% | 94%-100% | 100% |
| All HDVs (sales-weighted average for all ZEVTC members) | 4% | 45% | 76% | 97% | 100% |

ZE trucks through 2023: China, and the rest

- Over 90% of new ZE trucks sold in 2022 were in China
- Fewer than 4,000 ZE trucks were sold outside of China (<1% of new commercial truck sales)



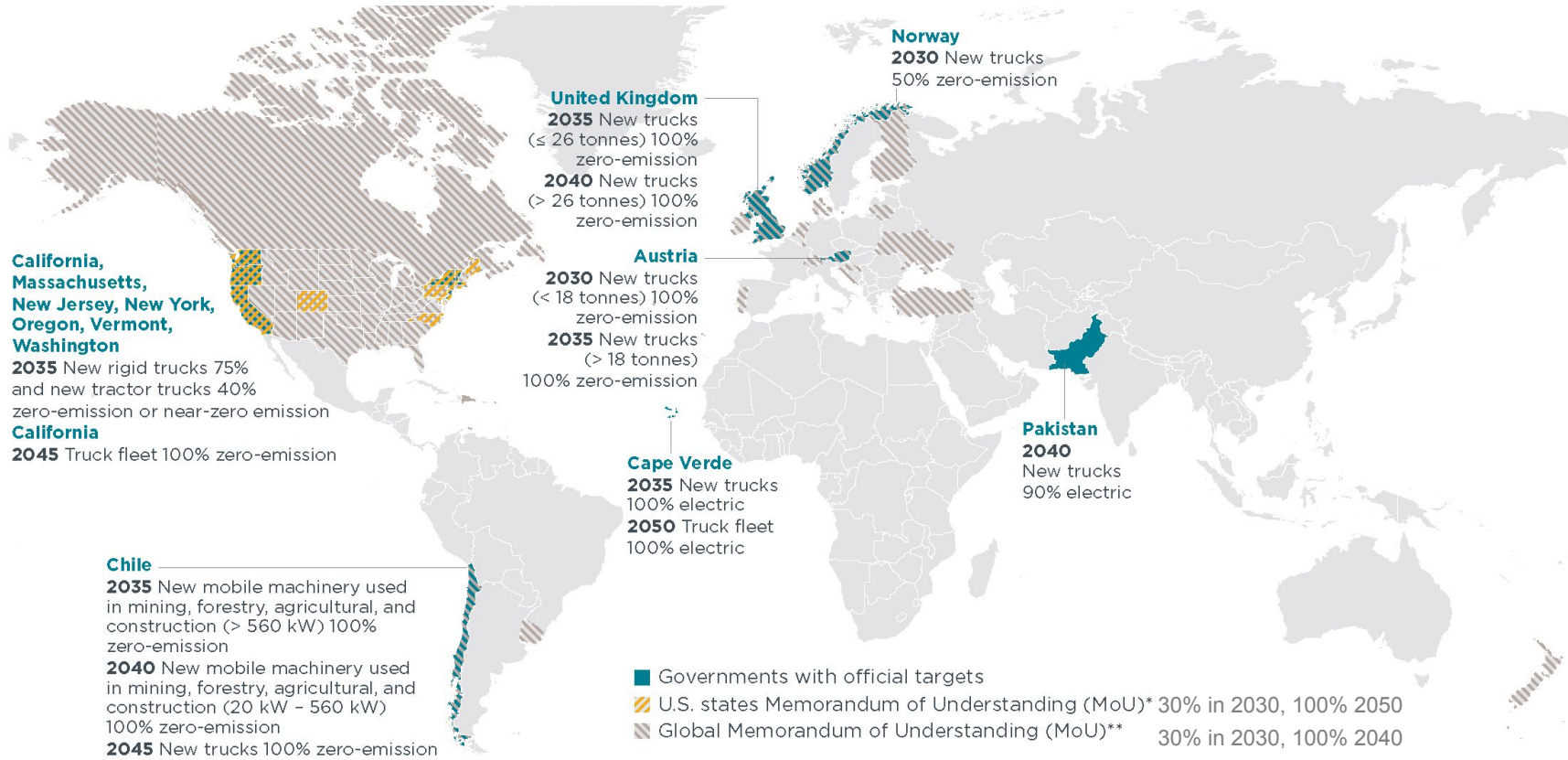
The transition rests on 5 policy levers

1. Phase-out targets
2. Binding ZEV/CO₂ regulations
3. Infrastructure rollout
4. Fleet procurement
5. Fiscal incentives (for the early market)

The transition rests on 5 policy levers

1. Phase-out targets
2. **Binding ZEV/CO₂ regulations**
>95% of light-duty ZEV sales are in markets with CO₂ regulations and/or ZEV standards
3. Fleet procurement
4. Infrastructure rollout
5. Fiscal incentives (for the early market)

Governments increasingly setting phase-out targets; many do not have regulatory backing



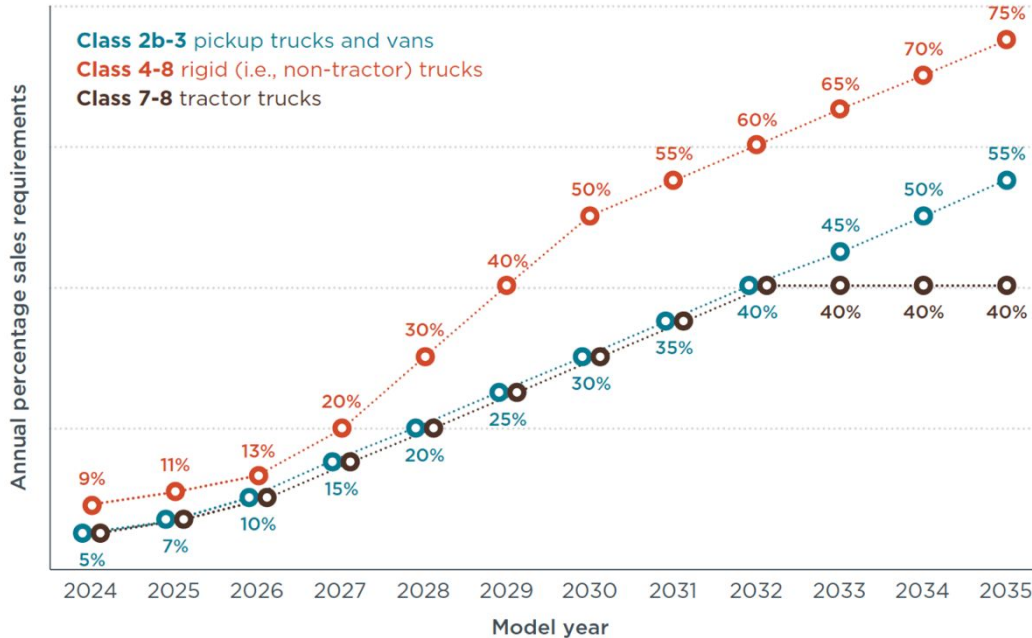
4 new policy advances suggest new momentum

- **California/US states:** Advanced Clean Trucks (*adopted in 7 states*) and Advanced Clean Fleets (*adopted in CA*)
- **European Union:** HDV CO₂ (*proposal*)
- **United States:** Phase 3 HDV GHG standards (*proposal*)

Advanced Clean Trucks: New sales 2024–2035



Sets targets for share of trucks which must be ZEV by category, for each manufacturer



ACF adjusts this further with a 100% sales by 2036 target (see next slides)

Advanced Clean Fleets: New sales 2036+



- **100%** *new* medium- and heavy-duty vehicles must be ZEVs from 2036, ending combustion vehicle sales
 - Supersedes Advanced Clean Trucks rigid and bus targets
- **100%** of newly registered drayage trucks ZEV from 2024
 - Based on online registry, for all drayage activities in California

Advanced Clean Fleets: Fleet targets



- Applies to government (state, local, federal) and high priority (large) private fleets (30% of total trucks, 67% of Class 7–8)
- Option 1: 100% new registrations from 2024 (federal & high priority) or 2027 (state and local, 50% from 2024)
- Option 2: ZEV milestones by fleet type

| Percentage of vehicles that must be zero-emission | 10% | 25% | 50% | 75% | 100% |
|---|------|------|------|------|------|
| Box trucks, vans, buses with two axles, yard tractors, light-duty package delivery vehicles | 2025 | 2028 | 2031 | 2033 | 2035 |
| Work trucks, day cab tractors, buses with three axles | 2027 | 2030 | 2033 | 2036 | 2039 |
| Sleeper cab tractors and specialty vehicles | 2030 | 2033 | 2036 | 2039 | 2042 |


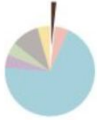
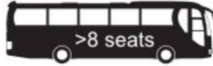








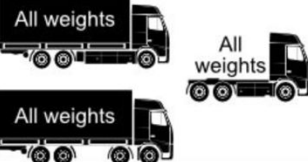


EU heavy-duty CO₂ standards



- Covers 83% of HDV sales accounting for 91% of emissions (vs 60% of trucks today)
- Adds targets for trailers for the first time
- Could require 49% ZEV share for trucks by 2035

Most segments see a 90% reduction by 2040



| Reduction targets relative to baseline (2019) | 2025 | 2030 | 2035 | 2040 | Annual emissions share | Reduction targets relative to baseline (2019) | 2025 | 2030 | 2035 | 2040 | Annual emissions share |
|---|------|------|------|------|---|---|------|------|------|------|---|
|  5t-7.4t 5t-7.4t | 0% | 43% | 64% | 90% |  |  >8 seats | 0% | 43% | 64% | 90% |  |
|  7.4t-16t | 0% | 43% | 64% | 90% |  |  >8 seats | 0% | 100% | 100% | 100% |  |
| 4x2 and 6x2 trucks  >16t >16t >16t >16t | 15% | 43% | 64% | 90% |  |  >3.5t | 0% | 15% | 15% | 15% | n.a. |
| 6x4 and 8x4 trucks  All weights All weights All weights | 0% | 43% | 64% | 90% |  |  >3.5t | 0% | 7.5% | 7.5% | 7.5% | n.a. |

Eamonn Mulholland (2023). "Europe's New Heavy-duty CO2 standards, explained." ICCT, <https://theicct.org/eu-co2-hdv-standards-explained-feb23/>

US Phase 3: Increased efficiency 2027–2032



- Represents GHG reduction of 25% (sleeper)–34% (day cab) vs 2027 targets under Phase 2 rule (adopted in 2016)
- *Projected ZEV sales shares in MY2032**:

50% for vocational vehicles

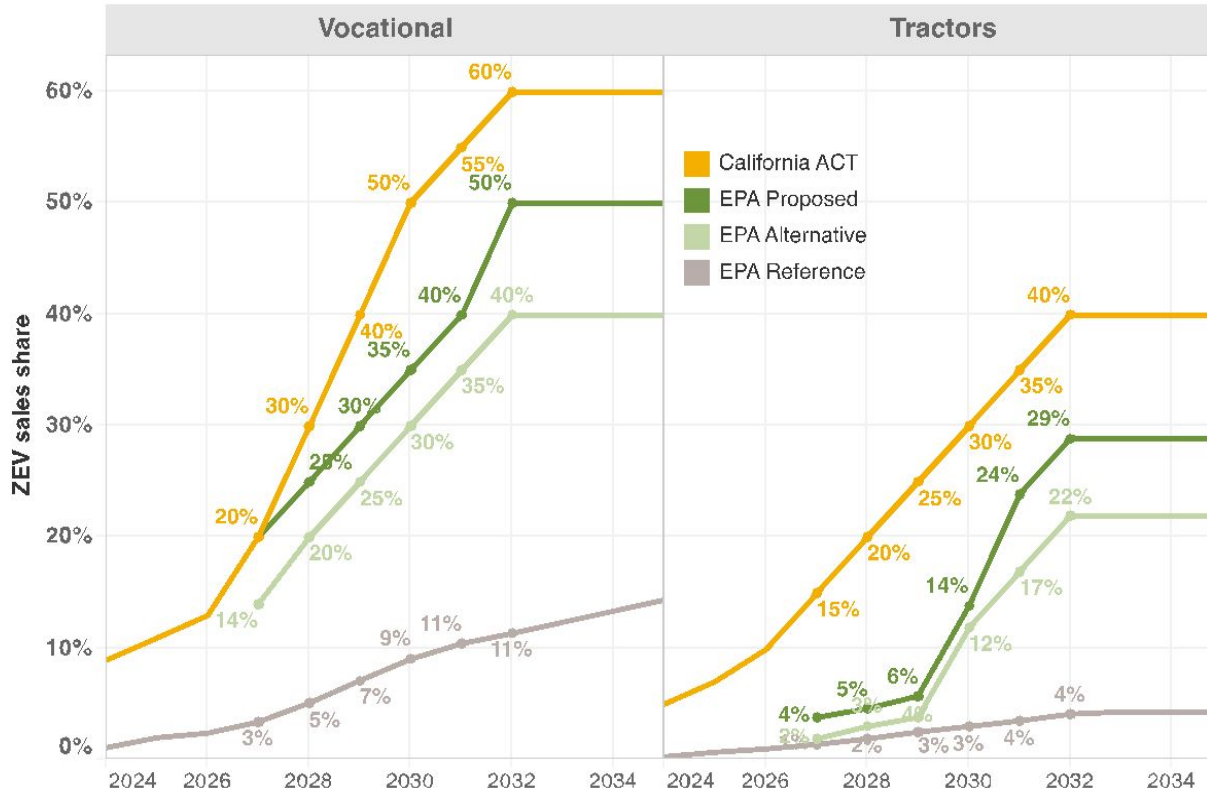
34% for day cab tractors

25% for sleeper cab tractors

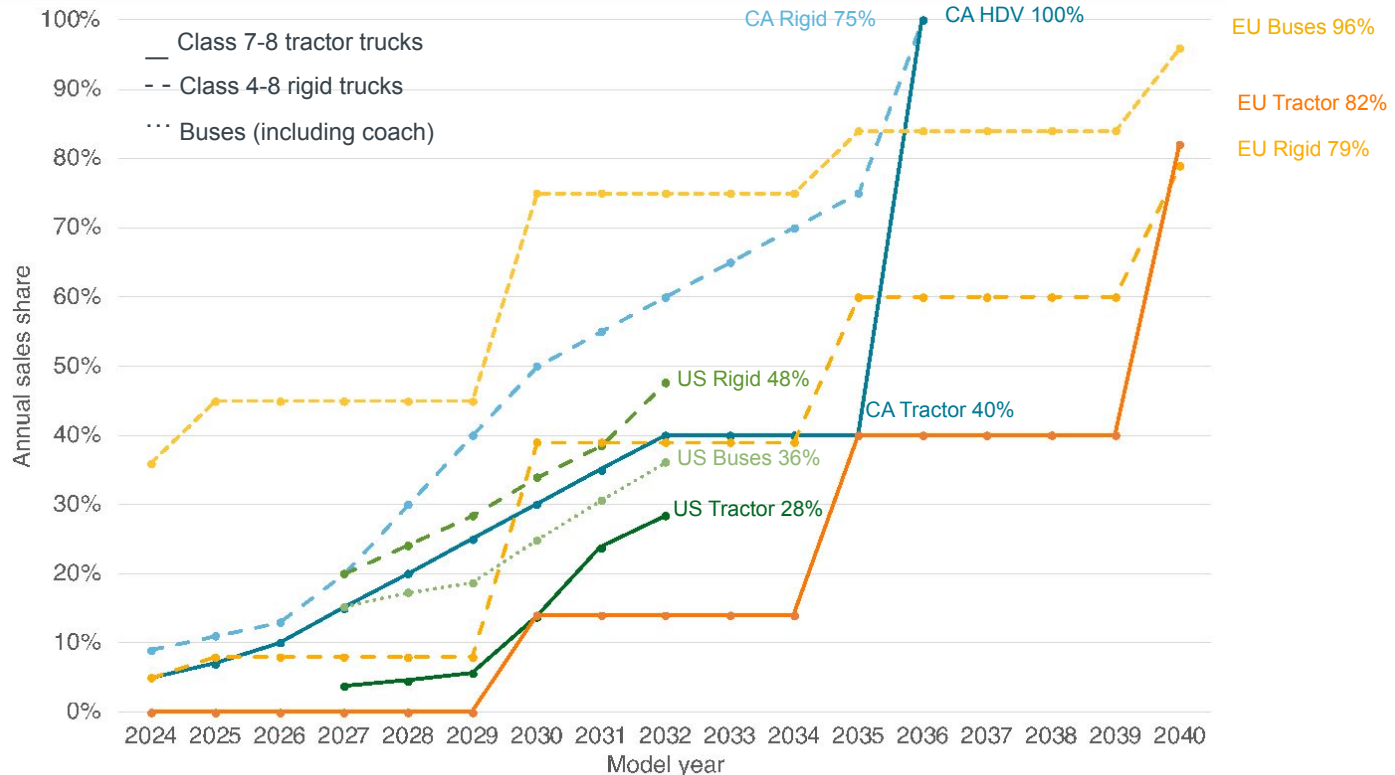


**Based on likely compliance paths; policy is technology-neutral*

US proposal lags CA sales targets



Summary: California's regulations lead the world, with Europe and US 2–3 years behind



Next year critical for finalizing proposals

- **California:** Implementation; Adoption of ACT, ACF to be considered by additional states
- **US:** Comments due mid-June, final rule (likely) late 2023, formal adoption 2024
- **EU:** Parliament & Council positions finalized in late 2023, final regulation in spring 2024, entry into force late 2024
- **Others** (UK, Canada, China, Korea...): Your move!

Thank you.
For questions, please contact:
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icct

THE INTERNATIONAL COUNCIL
ON CLEAN TRANSPORTATION

San Francisco ●

Mexico City ○

Bogotá ○

● São Paulo

★ Washington, DC
(headquarters)

● Berlin

● New Delhi

● Beijing

○ Jakarta





Table Breakout: Policies

Navigating Stakeholders

Examples from the EU & CA

Jennifer Helfrich & Sofie Defour

24 May 2023

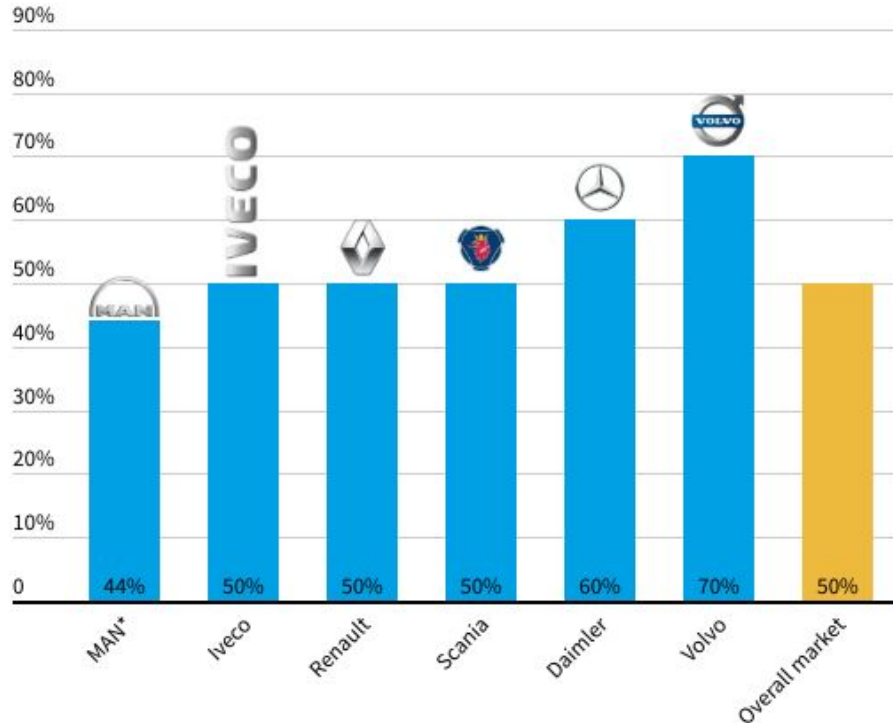
ITF Summit - Leipzig, Germany



Stakeholder Perspectives

Truck manufacturers support zero emission transition

Voluntary 2030 ZEV sales share commitments by EU OEMs



Public announcements by **Scania**, **Volvo**, and **Daimler** to only sell zero-emission trucks by 2040

Traton wants to be a pioneer
Scania from 2040 only electric



The vehicle manufacturer Traton drives. Scania is already questioning Christian Levin.

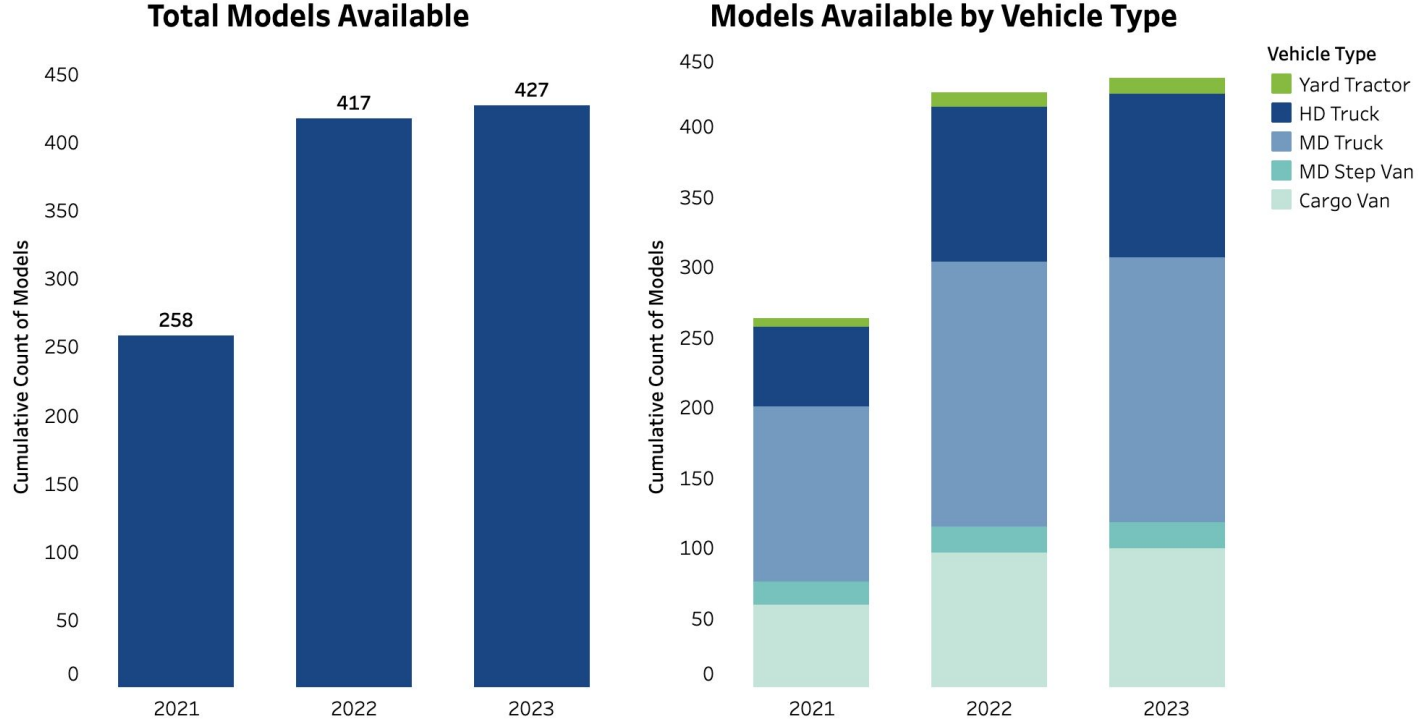
07.09.2022 Matthew Rathmann



Daimler Trucks & Buses targets completely CO2-neutral fleet of new vehicles by 2039 in key regions

Truck manufacturers are producing ZETs

Over 400 ZET models worldwide for a wide range of truck applications



Source: CALSTART (2023). ZETI Data Explorer

Legacy truck manufacturers & suppliers positions

Some companies & industry associations have lobbied for weaker requirements



- EMA (in US), CLEPA (in EU)
- US - Volvo, Daimler Truck, Volkswagen (Navistar) and PACCAR lobbied against Advanced Clean Truck (ACT) rule
- EU - split between laggards (DAF, Iveco) & frontrunners (Traton, Volvo, Daimler)



Concerns include:

- Targets should be lower & slower
- Feasibility of ZET technology for all use-cases
- Supply of critical minerals & volatility of supply chains
- Availability of charging and refueling infrastructure
- Insufficient demand - e.g. no one will buy the trucks



ZET Manufacturers & Value Chain

New manufacturers & value chain providers rising to meet demand

They support strong policy:

- Market certainty/clarity
- Level the playing field
- Create jobs



Workforce

United Auto Workers Union (UAW):
400,000 members in US, Canada &
Puerto Rico



**Unions want
a just transition for workers**

US: UAW withholding an endorsement for Biden's 2024 presidential campaign

Concerned about:

- Job loss/disruption
- Lower quality jobs in zero emission vehicle industry

EU: split between engine suppliers, drivers and OEM workforce

Private Fleets

Trucking associations have raised concerns about:

- High up-front costs
- SMEs particularly cost focused
- Availability of charging and refueling infrastructure
- Availability of sufficient energy / grid capacity
- Feasibility of ZET technology for all use-cases



Private Fleets

Major fleets support strong policies



SIEMENS



Many fleets have set targets and/or ordered/deployed ZETs

They see benefits, including:

- Meeting corporate climate goals
- Competitive advantage & brand enhancement
- Cost savings
- Access to capital

Cities

Air pollution drives transition in EU:

- Urban buses: almost 1/3rd sales ZE in 2022
 - Trend to reach 100% in 2026
 - 2025 ZE pledge: many big cities across continent
 - 2030 ZE pledge: Daimler & MAN
 - TCO parity there or very near
 - (Bio)gas still emits air pollutants
- But: **standards exclude 20% of sales**, incl. small trucks (<5t), garbage and construction trucks

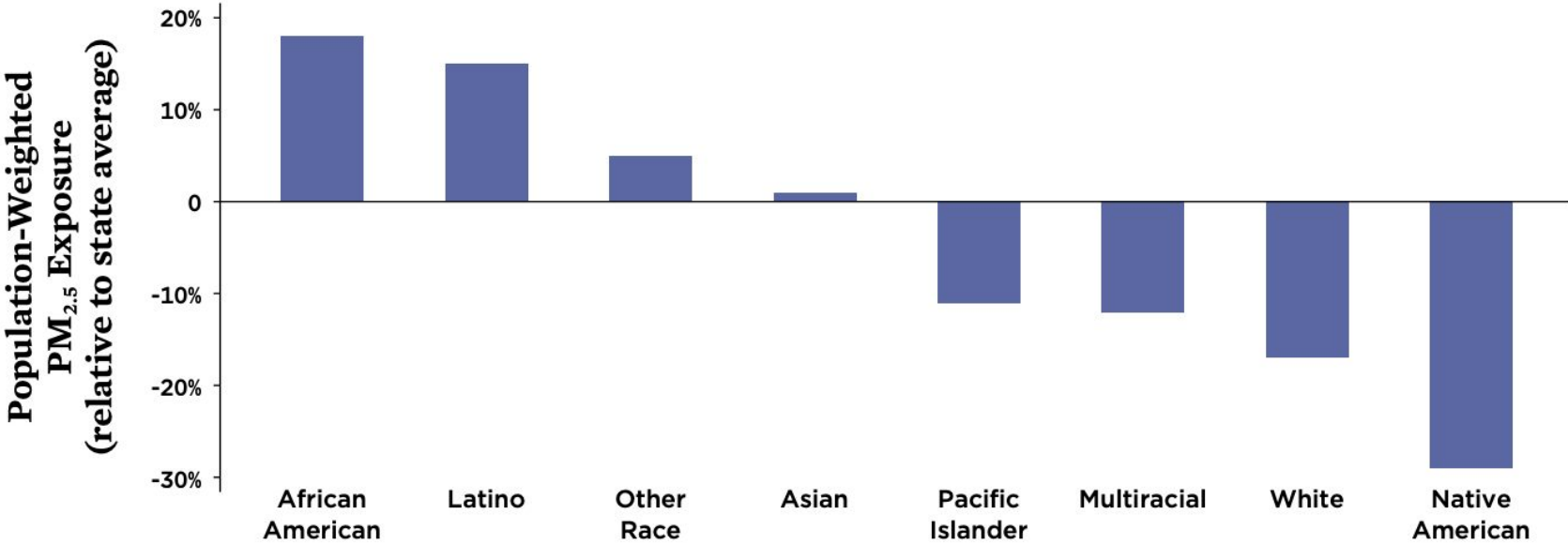
Concerns from cities:

- Lack of supply => standards
- Price => standards
- Charging infrastructure
- Grid capacity



Environmental Justice & Public Health Professionals

FIGURE 1. Disproportionately High Exposure for African Americans and Latinos in California



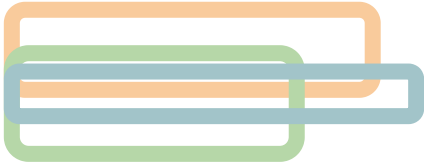
African American and Latino Californians have 19 and 15 percent higher exposure to PM_{2.5}, respectively, than the state average, while white Californians are exposed to 17 percent lower concentrations.

Source: Union of Concerned Scientists

Environmental Justice & Public Health Professionals

- **California engagement included:**
 - Community groups
 - Clean air & public health NGOs
 - Hospitals, medical professionals
- **Supported ambition, saying:**
 - Children, the elderly, and marginalized communities had the worst of the pollution
 - Costs: healthcare & human
 - They deserve clean air

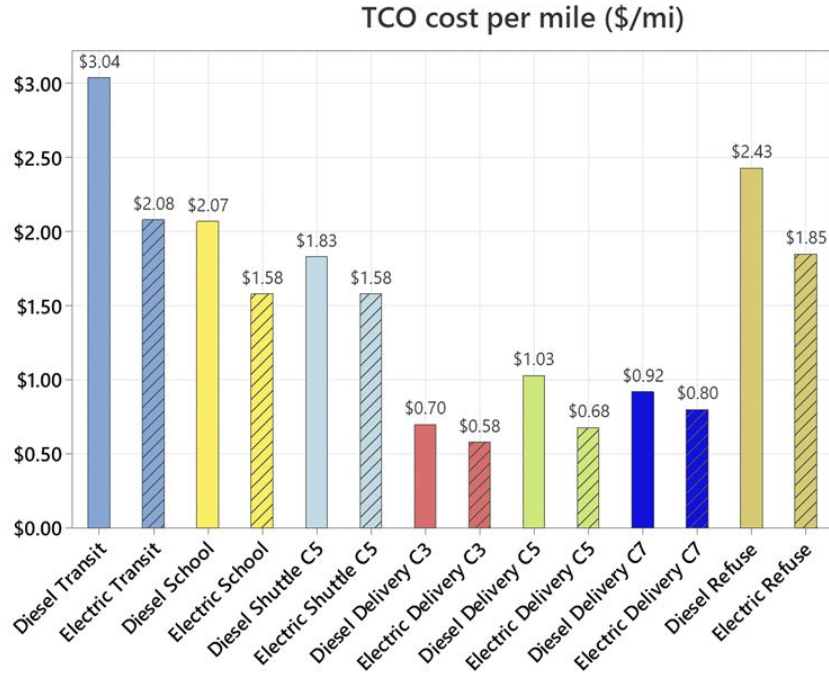




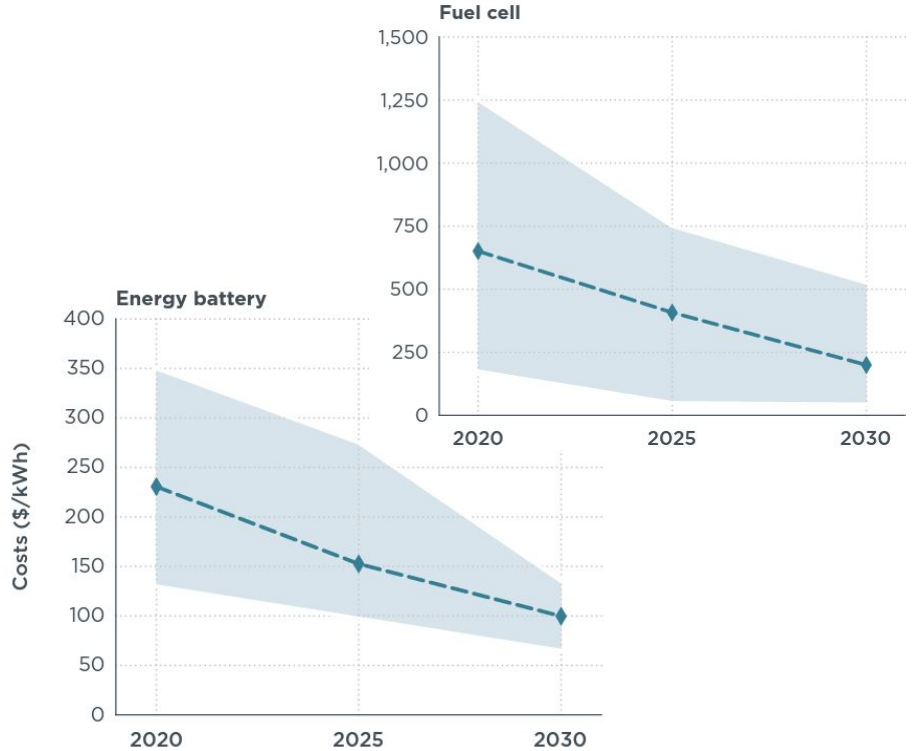
Fact Checking Stakeholder Concerns

ZETs cost more upfront but offer savings

A number of models/use-cases already offer total cost of ownership savings



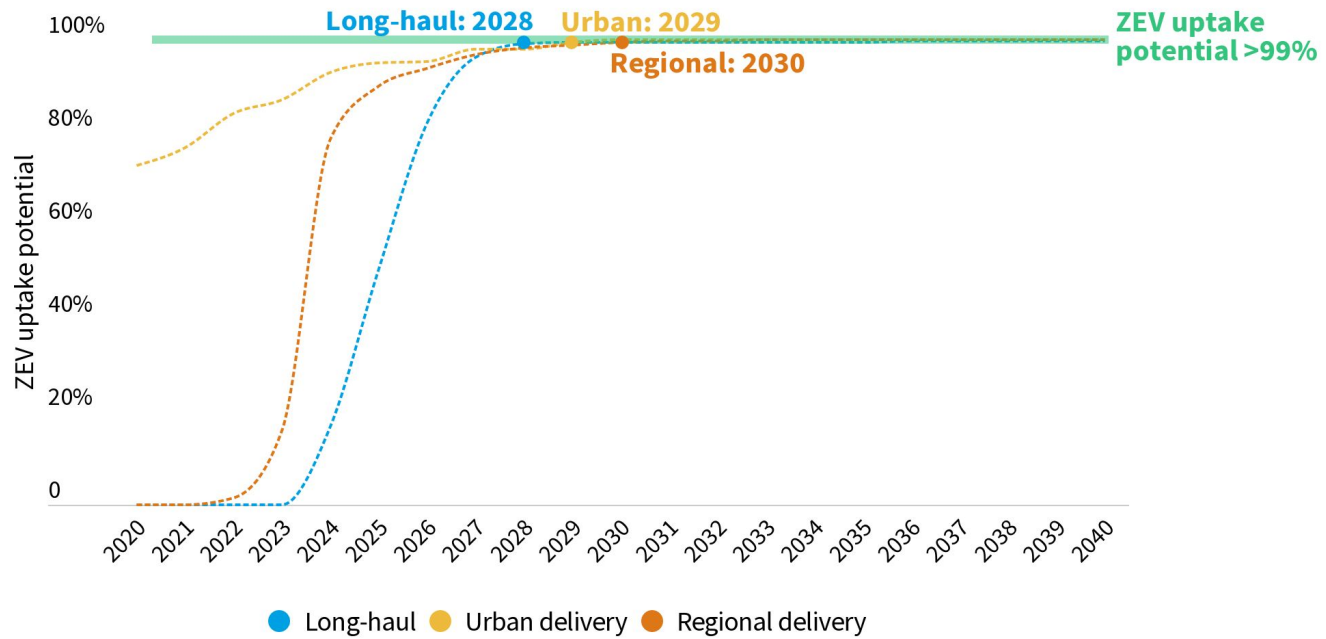
Costs continue to decline



EU price parity of ZETs with diesel

> 99% of electric freight trucks beat diesel in 2035

- ✓ Cheaper to run
- ✓ Driving as far
- ✓ Carrying as much

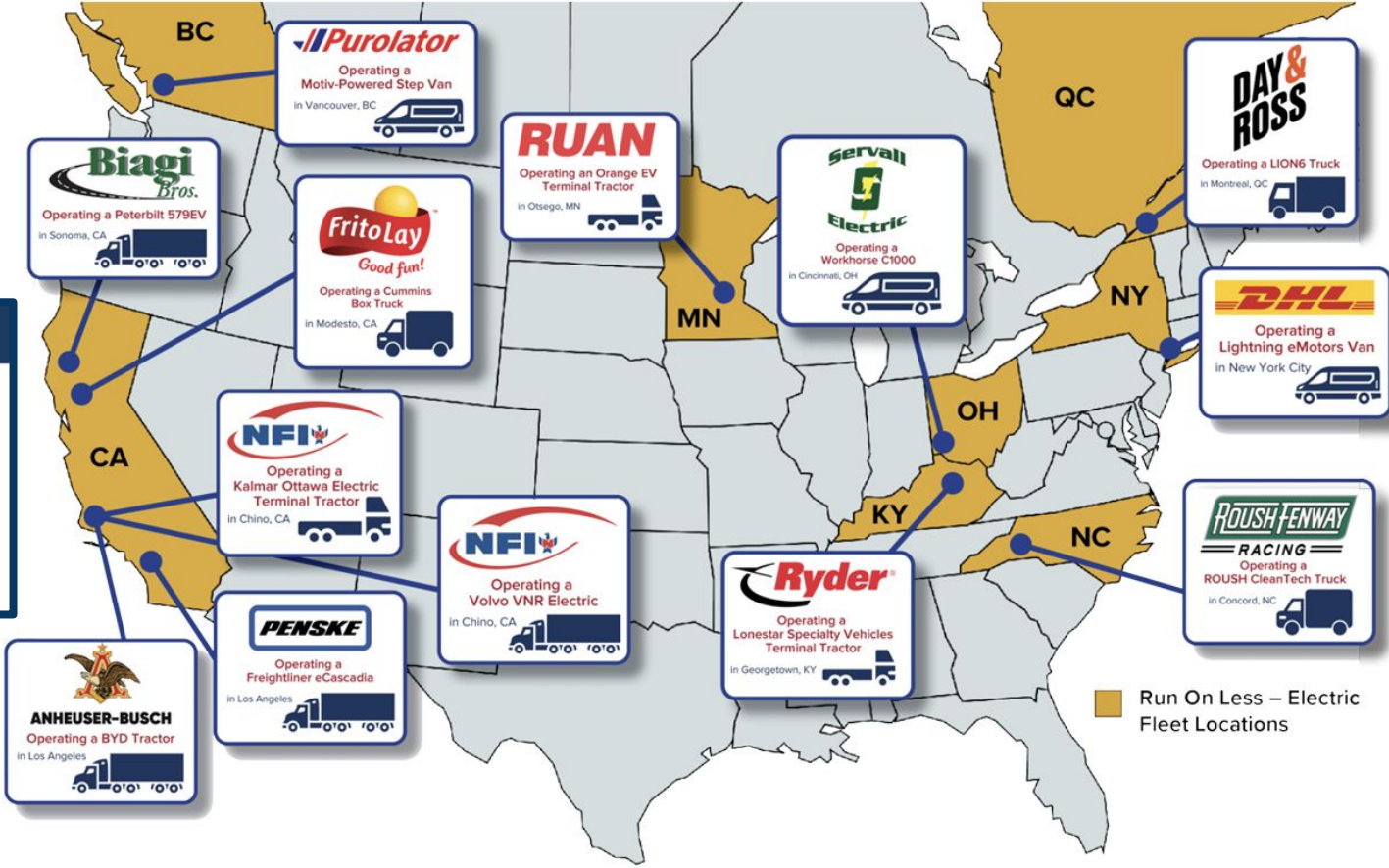


ZETs feasible for most use cases today



MARKET SEGMENTS

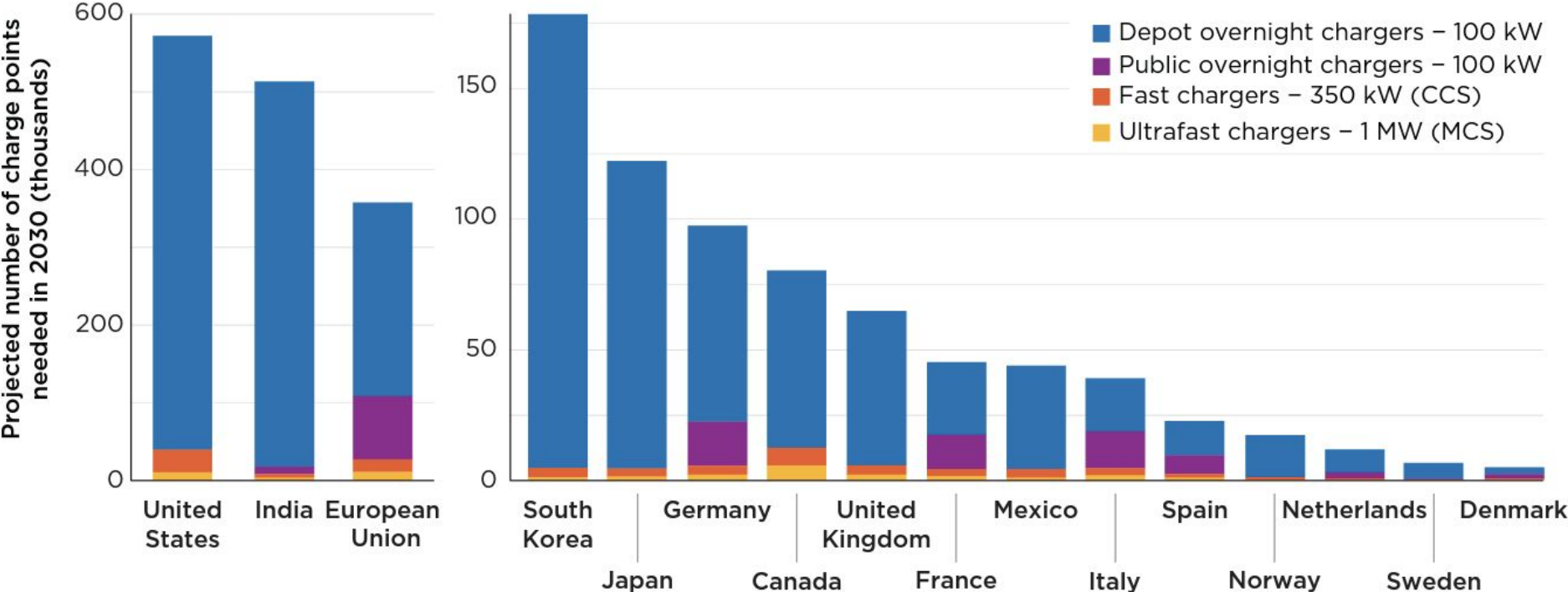
- Class 3, 4, 5 Vans & Step Vans
- Class 6 Box Trucks
- Class 8 Terminal Tractors
- Class 8 Regional Haul Tractors



Run On Less – Electric Fleet Locations

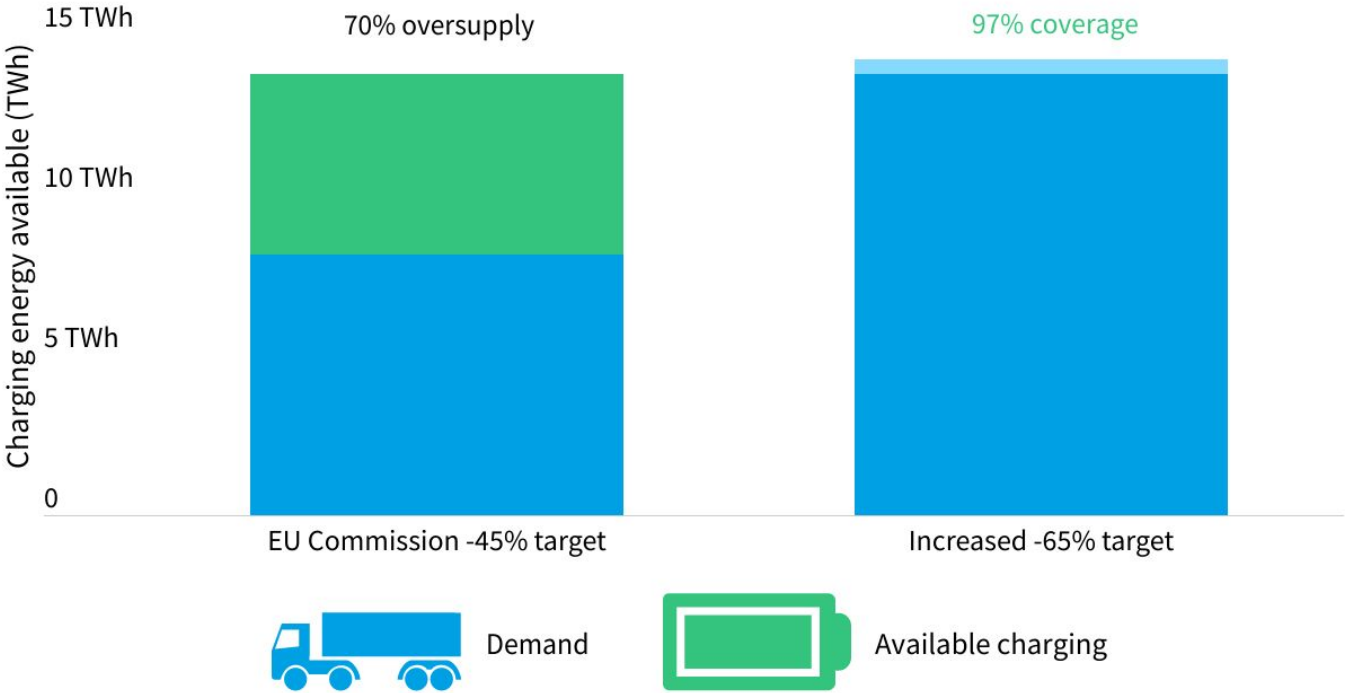
Charging Infrastructure

Charging infrastructure will be a major investment but is feasible



Charging Infrastructure

Enough infrastructure in the EU for higher 2030 target



Note: Projected gross energy demand from HDVs in EU-27 in 2030 that needs to be provided by public charging compared to available charging energy.
Source: T&E calculations based on T&E (2022) and EU (2023).

Customer Demand

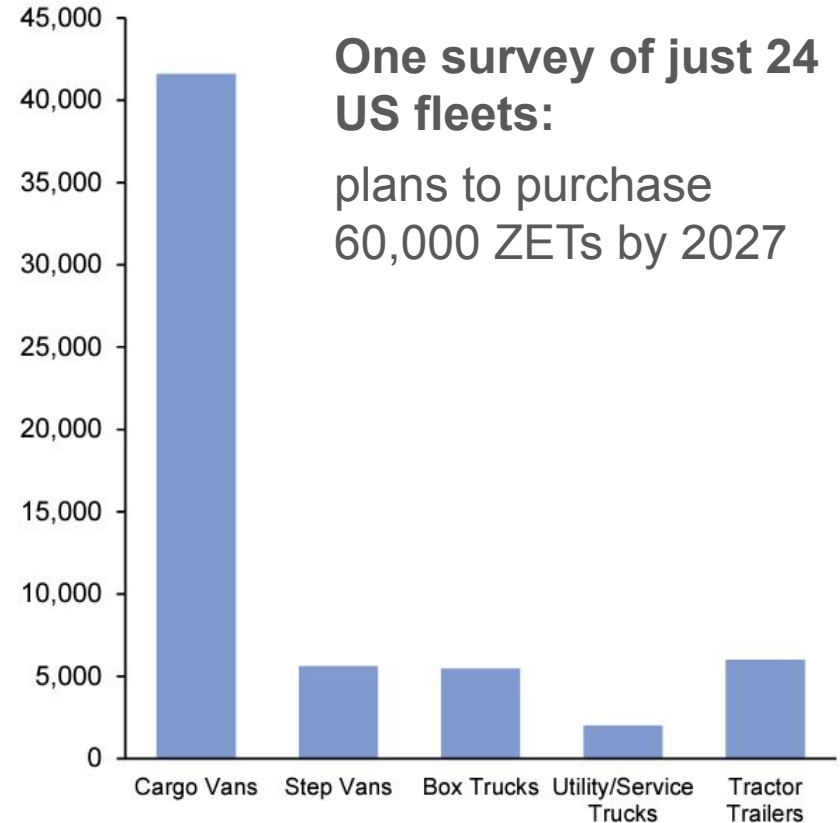
Companies say top challenge is insufficient model availability

- Waiting lists for many models

“

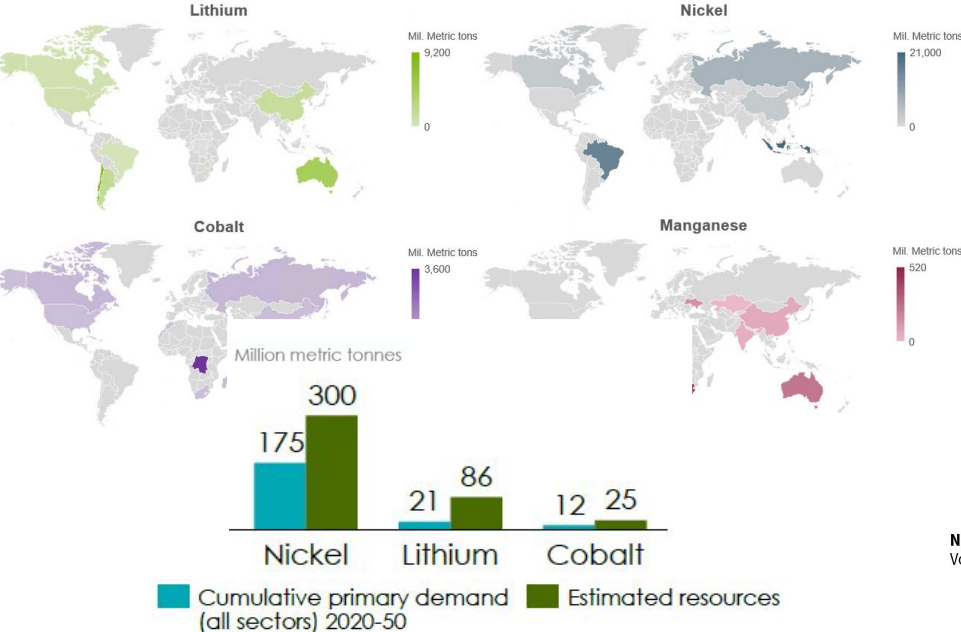
Nestlé strongly encourages the nation's governors to adopt the Advanced Clean Trucks rule and dramatically expand the market for zero-emission commercial vehicles.

”

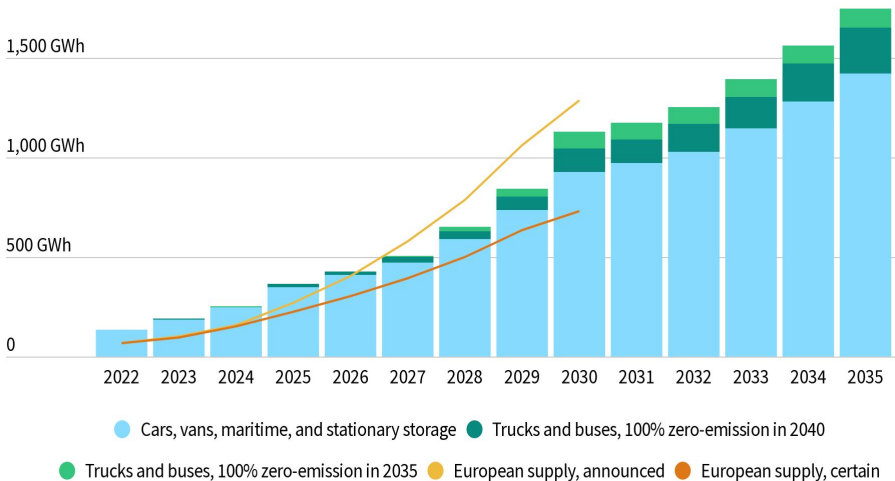


Critical Minerals and Supply Chains

Resources are sufficient and dispersed around the globe



EU: enough battery production for electric trucks & buses

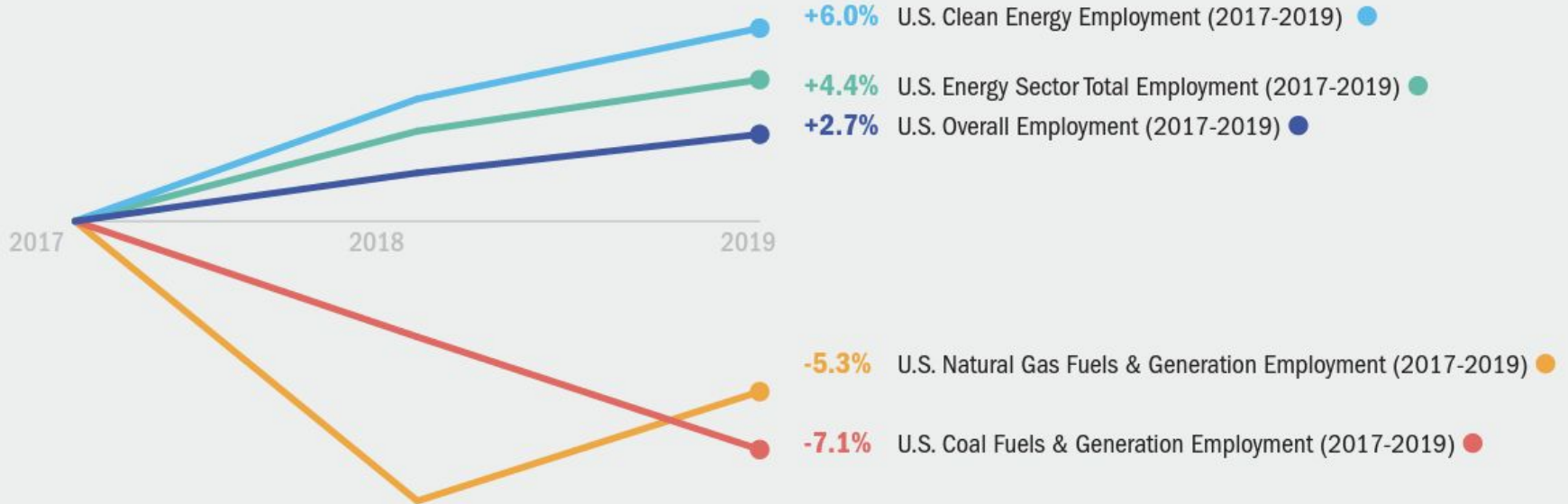


Note: European battery cell production is forecasted based on capacity from planned gigafactories and accounts for scrap. Vocational trucks reach 100% zero-emission sales in 2040 in both scenarios.

Sources: LMC Automotive 2020, US Geological Survey, Energy Transitions Commission - ETC Supply Chains Workshop 02.03.2023

Job losses in the fossil fuel industry Job growth in clean energy and transportation

FIGURE 3: JOB GROWTH RATES BY ENERGY SECTOR, 2017-2019



EU impact of 100% target in 2040:

- Net job increase: 13,000 in 2030, 83,000 in 2040, 121,000 in 2050
- Mainly in electronics sector, power and hydrogen + increased consumer expenditure
- GDP: +0.02 in 2030, +0.11% in 2040 and +0.10% in 2050

Table 17: Impacts on the output within the most affected sectors (million EUR in 2015 price) and percentage change from the baseline

| | Baseline | Low | Medium | High |
|------------------------------|-----------|--------|--------|--------|
| 2030 | | | | |
| Petroleum refining | 333 268 | -0.21% | -0.32% | -0.51% |
| Automotive | 867 506 | 0.01% | -0.01% | -0.01% |
| Electronics | 412 685 | 0.01% | 0.02% | 0.02% |
| Metals | 1 014 944 | 0.01% | 0.01% | 0.01% |
| Electrical equipment | 310 232 | 0.06% | 0.08% | 0.13% |
| Electricity, gas, water, etc | 1 186 861 | 0.08% | 0.11% | 0.17% |
| 2040 | | | | |
| Petroleum refining | 224 365 | -2.21% | -2.79% | -3.67% |
| Automotive | 937 985 | 0.05% | -0.05% | -0.08% |
| Electronics | 476 499 | 0.07% | 0.09% | 0.15% |
| Metals | 1 100 704 | 0.05% | 0.08% | 0.12% |
| Electrical equipment | 356 527 | 0.14% | 0.22% | 0.37% |
| Electricity, gas, water, etc | 1 289 883 | 0.43% | 0.66% | 1.11% |
| 2050 | | | | |
| Petroleum refining | 165,852 | -2.37% | -2.38% | -2.39% |
| Automotive | 1,034,706 | 0.00% | -0.08% | -0.09% |
| Electronics | 552,025 | 0.10% | 0.16% | 0.15% |
| Metals | 1,205,507 | 0.04% | 0.12% | 0.14% |
| Electrical equipment | 411,582 | 0.23% | 0.23% | 0.21% |
| Electricity, gas, water, etc | 1,373,390 | 1.63% | 1.86% | 2.02% |

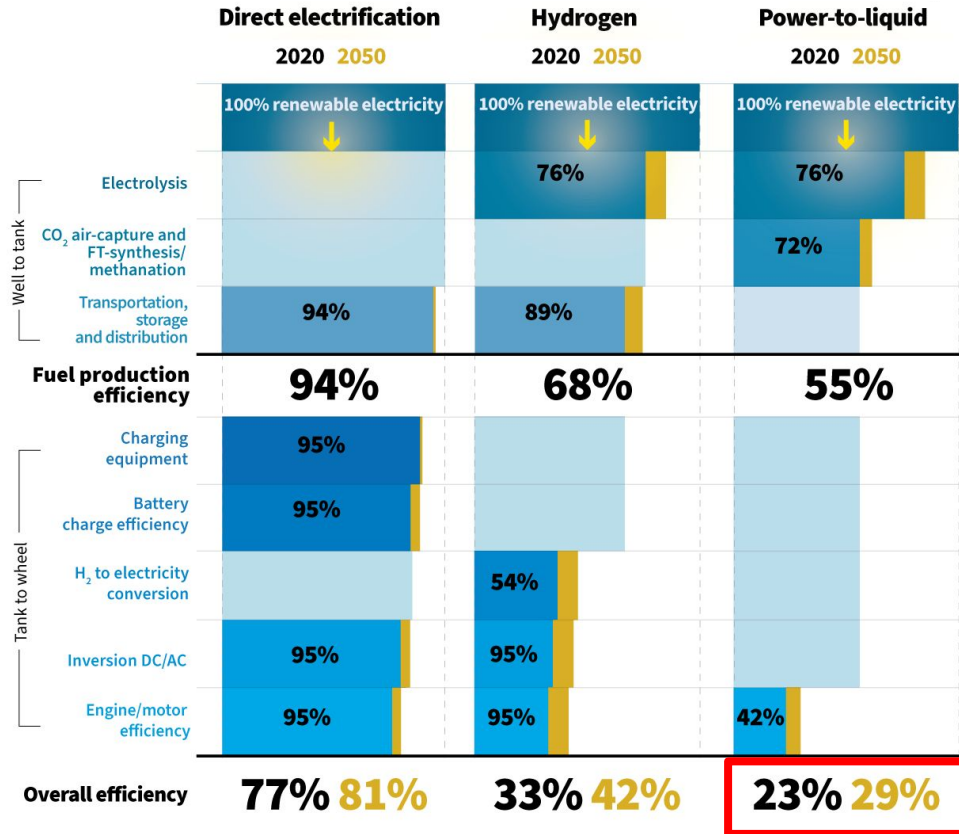
Jobs

Clean transportation sector has the fastest growing clean jobs

// U.S. CLEAN ENERGY EMPLOYMENT GROWTH by fastest-growing subsector 2020–2021

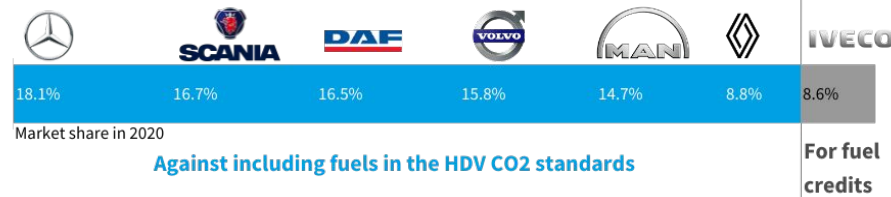


Fuels



<<< Electric trucks king of efficiency

EU OEMs don't want e-fuels or biofuels to qualify as ZE under EU standards



Expensive!

Berkeley Law

Center for Law, Energy, & the Environment



Table Breakout: Stakeholders & Perspectives



Plenary Discussion

Closed Door Meeting: Zero Emission Truck Policy Group

International Transport Forum
Summit - Leipzig, Germany

Thank You



ZETs feasible for most use cases today

Mountainous regions

- Driving uphill and regenerative braking will cancel each other out (ex. *Tesla Semi crossing Grapevine Mountains*)
- Medium- and high-voltage power lines regularly cross mountainous EU regions such as the Alps.

Remote areas

- Ranges are there: 800km Tesla Semi, 450-500km EU OEMs (800km in late '20s)
- Off-grid charging with hydrogen

Extreme temperatures

- 0-5% higher consumption, but payload can +30%
- Compact heat pumps for cabin heating and thermal management systems
- salty air: H2 combustion engine

