

LDV and MHDV electrification challenges & progress

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Smoky Mountains Mobility Conference
11/16/22

San Francisco ●

★ Washington, DC
(headquarters)

● Berlin

● Beijing

● New Delhi

Mexico City ○

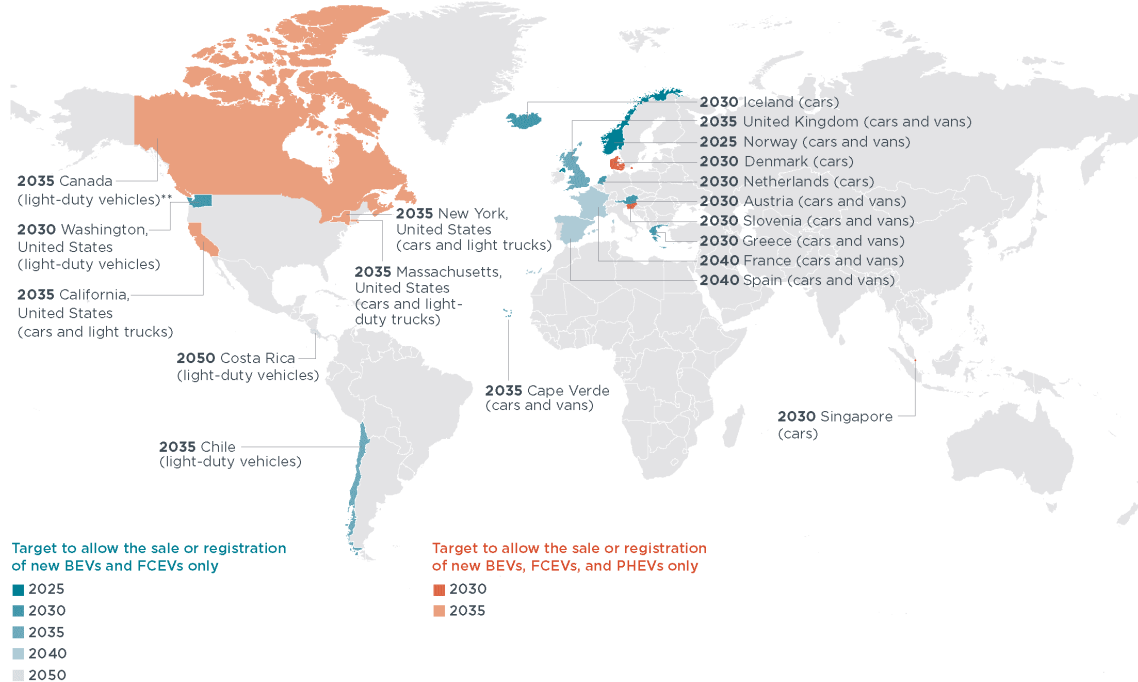
Bogotá ○

● São Paulo

○ Jakarta

LDV electrification – global goals

Governments with official targets to 100% phase out sales or registrations of new internal combustion engine light-duty vehicles (passenger cars and vans/light trucks) by a certain date* (Status: Through September 2022)



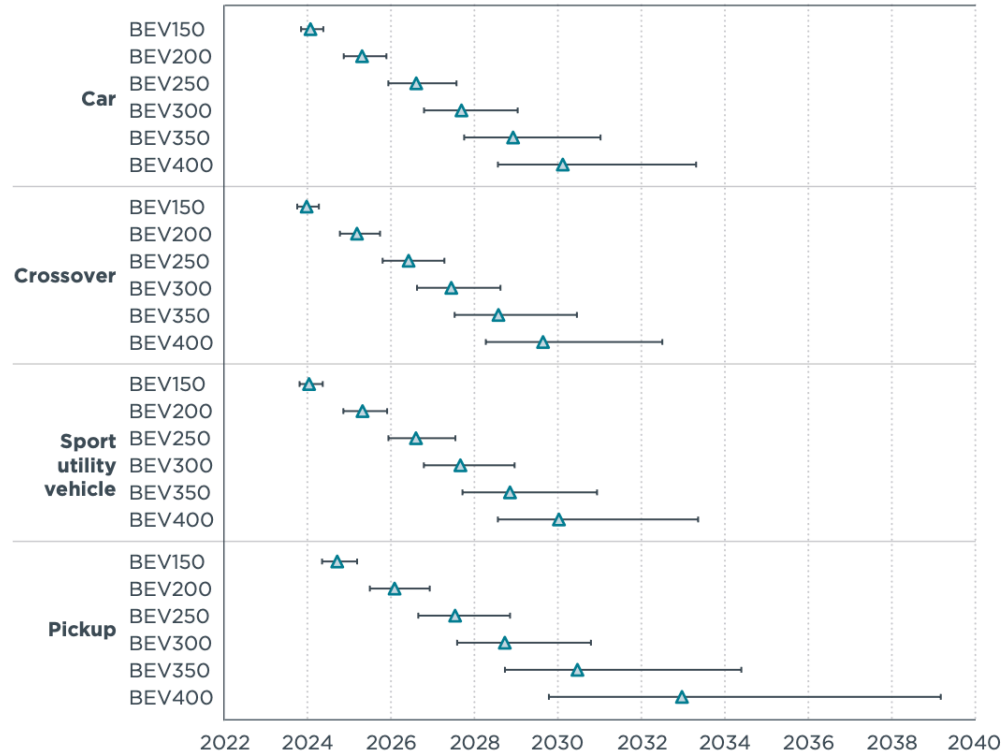
* Includes countries, states, and provinces that have set targets to only allow the sale or registration of new battery electric vehicles (BEVs), fuel cell electric vehicles (FCEVs), and plug-in hybrid electric vehicles (PHEVs). Countries such as Japan with pledges that include hybrid electric vehicles (HEVs) and mild hybrid electric vehicles (MHEVs) are excluded as these vehicles are non plug-in hybrids.
 ** The Canadian province of British Columbia has set its 2040 target into binding regulation; the Canadian province of Québec has also set a target for 2035.

LDV electrification – availability and TCO



Source: Slowik, P., Isenstadt, A., Pierce, L., and Searle, S. (2022) Assessment of light-duty electric vehicle costs and consumer benefits in the United States in the 2022-2035 timeframe, Washington DC: ICCT, <https://theicct.org/wp-content/uploads/2022/10/ev-cost-benefits-2035-oct22.pdf>

LDV electrification - TCO



Battery electric vehicle price parity year for varied battery costs.

LDV electrification – barriers & progress

- Range, performance, and model availability – being addressed by governments and automakers' investment¹
- 1 million public chargers needed by 2030 – More than 80,000 infrastructure jobs created²
- Equitable charging infrastructure deployment – more ongoing conversations³

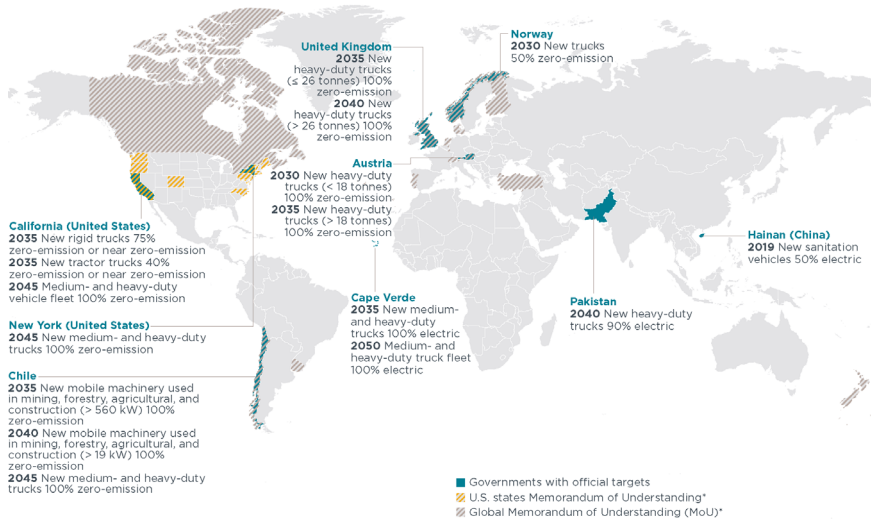
¹ Bui, A., Money makes the world go electric: Why the U.S. government should invest in the electric vehicle industry, <https://theicct.org/us-ev-investment-jul22/>

² Bui, A., Pierce, L., Ragon, P., and Searle, S. Upcoming infrastructure job publication, preliminary result

³ Bui, A., Pierce, L., Upcoming Multifamily housing and Rural charging barriers and solutions publication

MHDV electrification – global goals

Governments with targets toward phasing out sales of internal combustion engine trucks by a certain date (Status: Through September 2022)



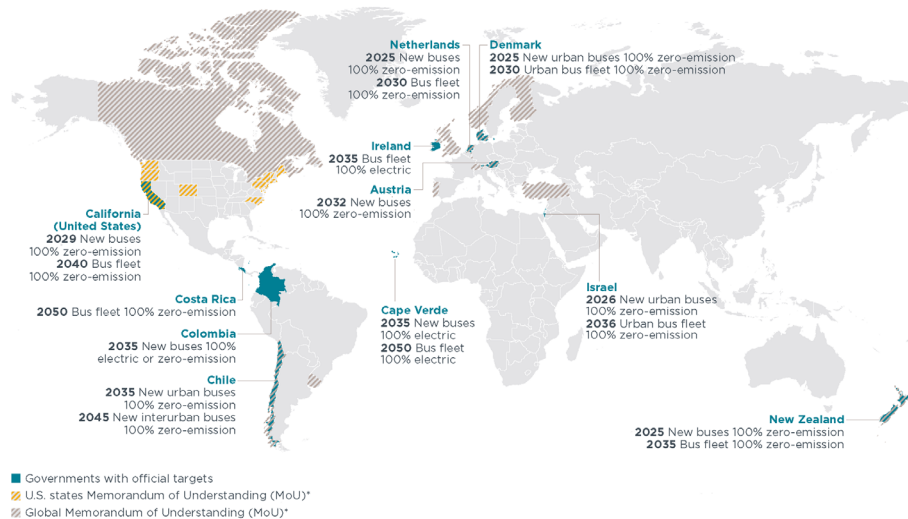
U.S. states Memorandum of Understanding (MoU)

California, Colorado, Connecticut, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont and Washington and the District of Columbia

2030 New medium- and heavy-duty vehicles 30% zero-emission
2050 New medium- and heavy-duty vehicles 100% zero-emission

* Not necessarily yet reflected in an official national/state policy document such as a climate or transport strategy/plan, in a law, or in a similar framework.

Governments with official targets to 100% phase out sales of internal combustion engine buses by a certain date (Status: Through September 2022)



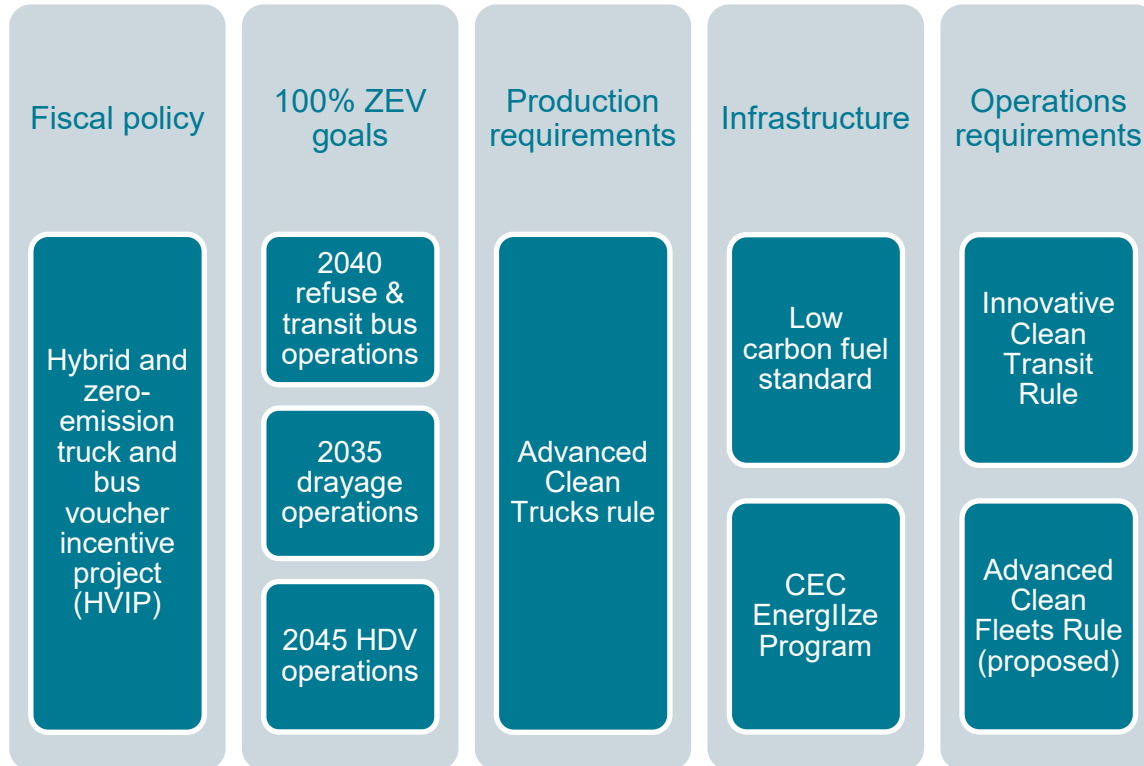
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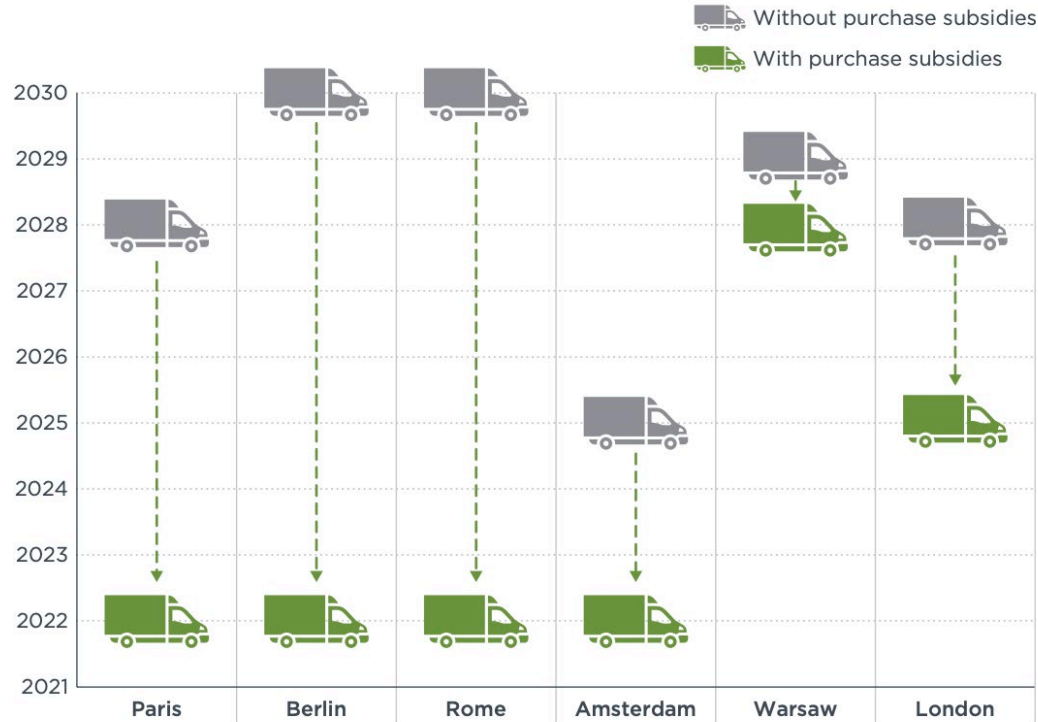
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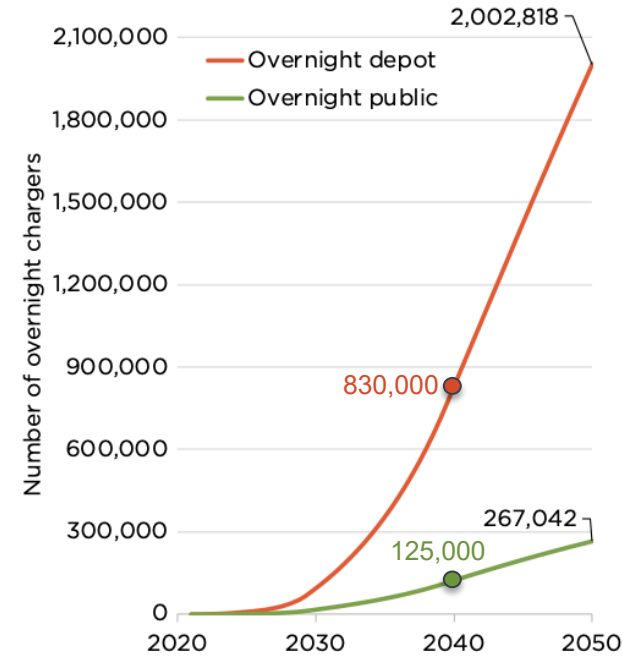
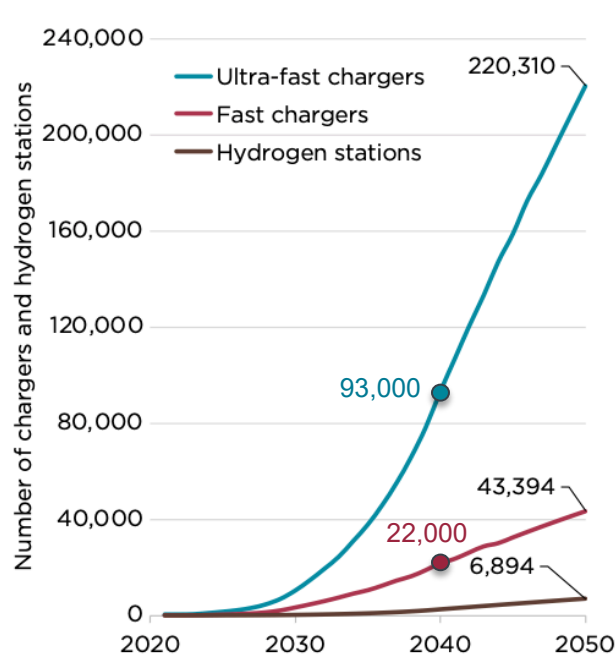
MHDV electrification – California policies



MHDV electrification – availability and TCO



MHDV electrification



MHDV electrification – barriers & progress

- Infrastructure is not getting built nearly fast enough
 - States' NEVI fund likely will go more towards LDV
- Grid upgrades are not being planned far enough ahead - plan to upgrade our paper and talk with the utilities¹
- Close to 12,000 infrastructure jobs in 2030²
- Small truck fleet financing³
- Hydrogen is a fuel alternative for tractor-trailers but we should not wait for this technology

¹ Bernard, M., Tankou, A., Cui, H., and Ragon, P.. Upcoming charging solutions for battery-electric truck publication

² Bui, A., Pierce, L., Ragon, P., and Searle, S. Upcoming infrastructure job publication

³ Brito, J. (2022) No fleet left behind: Barriers and opportunities for small fleet zero-emission trucking, Washington DC: ICCT, <https://theicct.org/wp-content/uploads/2022/10/small-fleet-ze-trucking-oct22.pdf>

MHDV electrification - Recommendations

1. Fiscal incentives

- Adopt fiscal incentives equal to incremental cost across all vehicle classes
- Adopt in-use fiscal incentives such as road tolls

2. Phase-out targets

- Adopt a target of 100% zero emission sales of HDVs by 2040, with faster targets for key segments

3. Zero emission production requirements on manufacturers

- Adopt ZEV regulations to align with ZEV targets and transportation decarbonization goals.

4. Infrastructure planning and standards

- Develop a national zero-emission charging and H2 refueling plan to shape public and private investment

5. Zero-emission operations requirements on fleets

- Adopt national fleet purchase requirements and expand zero emission areas

Questions?
Comments?

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THE INTERNATIONAL COUNCIL
ON CLEAN TRANSPORTATION

LDV electrification – US goals

- National
 - 50% LDV EV sales goal and 500,000 charging stations by 2030
 - National Electric Vehicle Infrastructure program funding
 - Inflation Reduction Act incentives
- Local
 - California adopted Advanced Clean Cars II August 2022
 - Other states are working on adopting ACC II

MHDV electrification – US goal

- National
 - Federal fleet 100% zero-emission by 2035
- Local
 - 6 states adopted California Advanced Clean Trucks regulations
 - California Advanced Clean Fleets regulation has its first hearing in October

To align with Paris Agreement goals of well-below 2°C, HD ZEV sales should rise to 45% by 2030 and 100% no later than 2040

- Pace of transition varies by HDV segment
- Greater ambition needed for segments where ZEV technologies and market are more advanced

Vehicle type	2025	2030	2035	2040	2045
Bus	7%-30%	75%-90%	90%-100%	100%	100%
Medium truck	3%-12%	40%-50%	75%-90%	100%	100%
Heavy truck	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%

Require fleets to transition to zero emission operations

Example: California Proposed Advanced Clean Fleets Requirements

Zero-Emission Fleet Percentage	10%	25%	50%	75%	100%
Box trucks, vans, two-axle buses, yard trucks	2025	2028	2031	2033	2035
Work trucks, day cab tractors, three-axle buses	2027	2030	2033	2036	2039
Sleeper cab tractors and specialty vehicles	2030	2033	2036	2039	2042

Recommendations

- Establish national fleet purchase requirements for dedicated fleets
- Expand zero emission areas beyond city centers and including freight corridors

First-mover segment for HD ZEVs: Urban buses

- Buses account for about 4.7% of total HDV market in ZEVTC members
- Mature market with widespread commercial availability
- TCO parity with ICE equivalents achievable today, or before 2025
- **Recommendation: 100% ZE sales by 2030**

Battery-electric urban buses in the US and India



First-mover segment for HD ZEVs: Urban delivery vehicles

- Urban delivery vehicles (mostly short-haul medium-duty trucks) account for 27.5% of total HDV market in ZEVTC members
- Small-scale commercialization, orders from major fleet owners will be delivered in the next 3-5 years
- TCO parity with ICE equivalents by 2030, depending on vehicle size and daily driving distance
- **Recommendation: 100% ZE sales by 2035**

A battery-electric UPS delivery van manufactured by Arrival



Image source <https://about.ups.com/be/en/our-stories/innovation-driven/delivering-world-firsts.html>:

First-mover segment for HD ZEVs: Short-haul tractor-trailers

- Tractor-trailers account for 21.9% of total HDV market in ZEVTC members
- Short- and regional-haul (<250 km/day) ZE products are approaching commercialization in US and EU
- TCO parity within the next decade, as early as 2025 for short-haul tractor trailers
- **Recommendation: 100% ZE sales by 2035**

A battery-electric Freightliner eCascadia tractor truck



Image source: <https://californiahvip.org/vehicles/freightliner-ecascadia-battery-electric-truck/>

Long-hauler tractor trailers: an important segment for HDV decarbonization

- Long-haul ZE products are approaching range-limited commercialization
- TCO parity will be reached in the next 10-15 years depending on market
- High daily driving distance and large payload requirement require dedicated infrastructure (high-power charging or hydrogen refueling)
- **Recommendation: 100% ZE sales by 2040**

A Hyundai Xcient fuel-cell electric tractor truck

