

Opportunities for a transition to soot-free and zero emission heavy-duty vehicles and fuels in ASEAN

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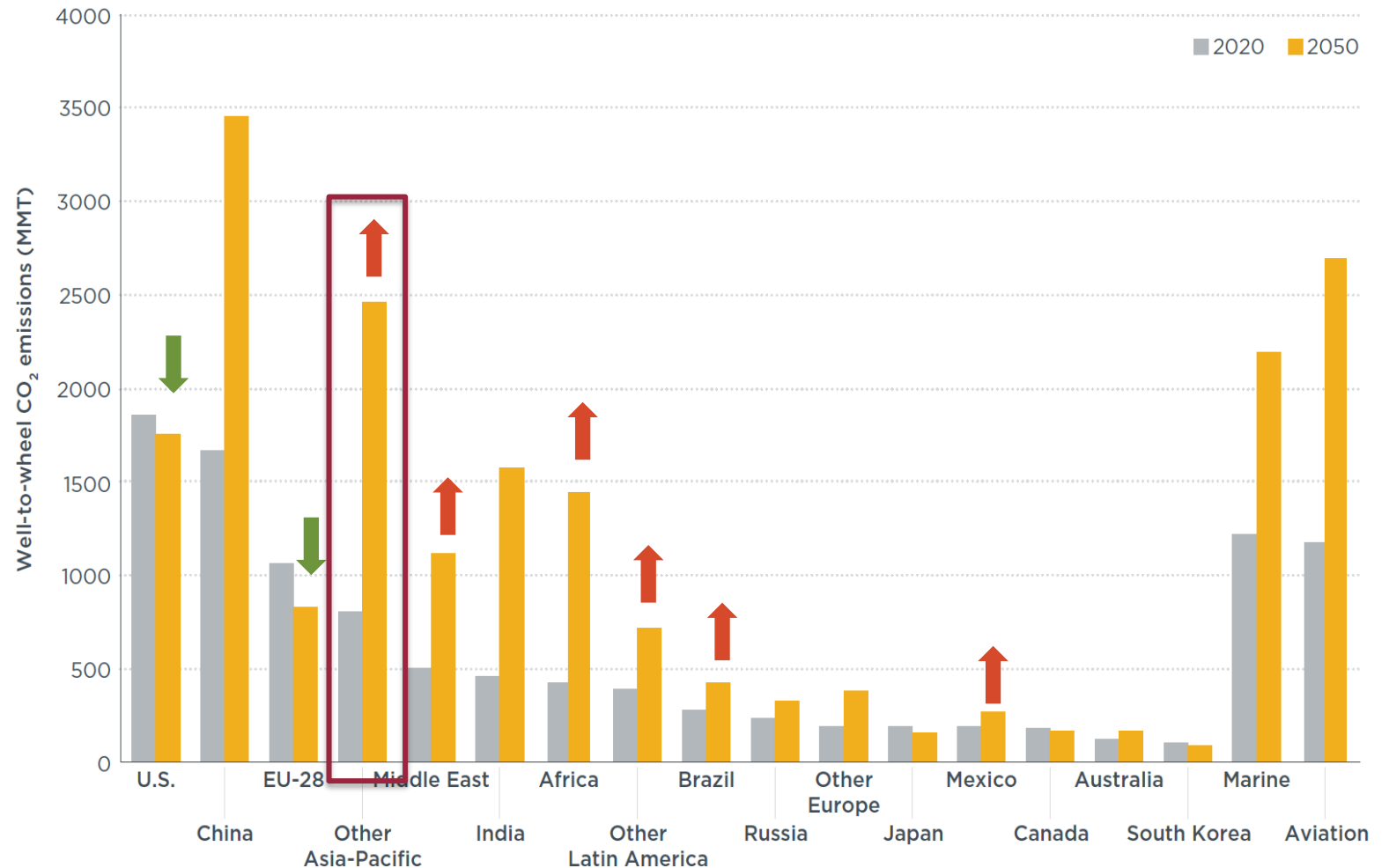
ICCT – ASEAN Regional Lead

Aug 22nd , 2022



Background

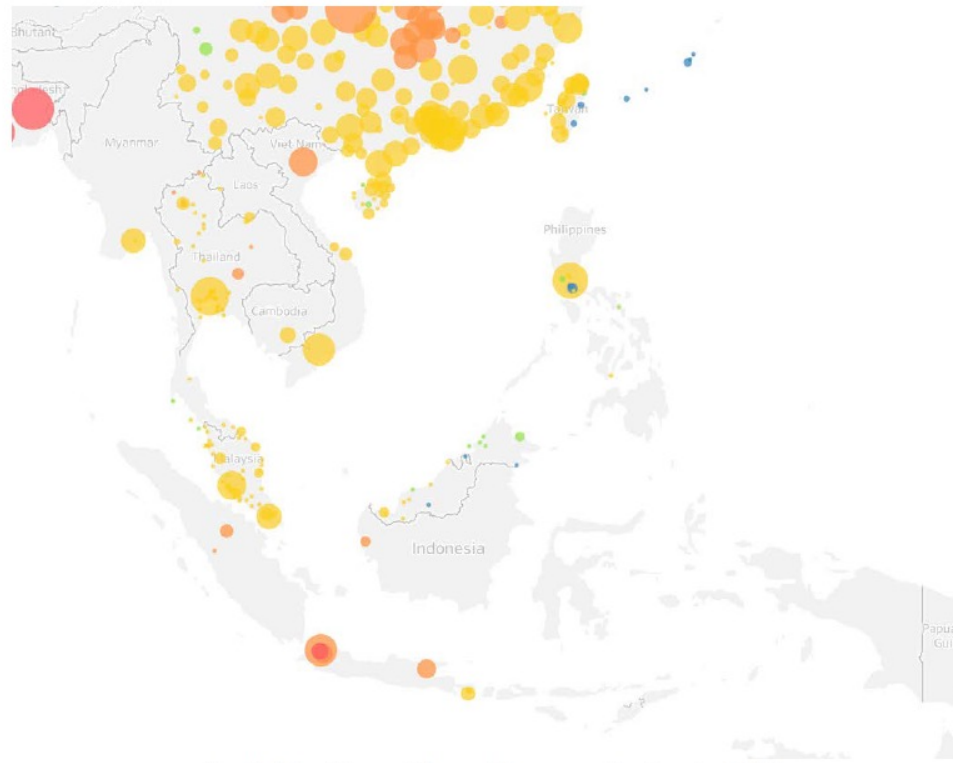
- Global transport CO_{2e} emissions will grow significantly until 2050 and is driven largely by emerging economies such as the Southeast Asian Region
- In 2020: ASEAN is the 4th largest GHG contributor
- In 2050: ASEAN GHG emissions would be second to China.



ASEAN cities are struggling with high levels of air pollution

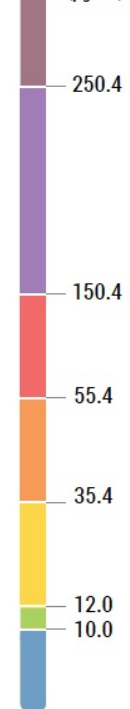
Most Polluted Regional Cities

Rank	City	2019 AVG
1	 South Tangerang, Indonesia	81.3
2	 Bekasi, Indonesia	62.6
3	 Pekanbaru, Indonesia	52.8
4	 Pontianak, Indonesia	49.7
5	 Jakarta, Indonesia	49.4
6	 Hanoi, Vietnam	46.9
7	 Talawi, Indonesia	42.7
8	 Nakhon Ratchasima, Thailand	42.2
9	 Saraphi, Thailand	41.3
10	 Surabaya, Indonesia	40.6

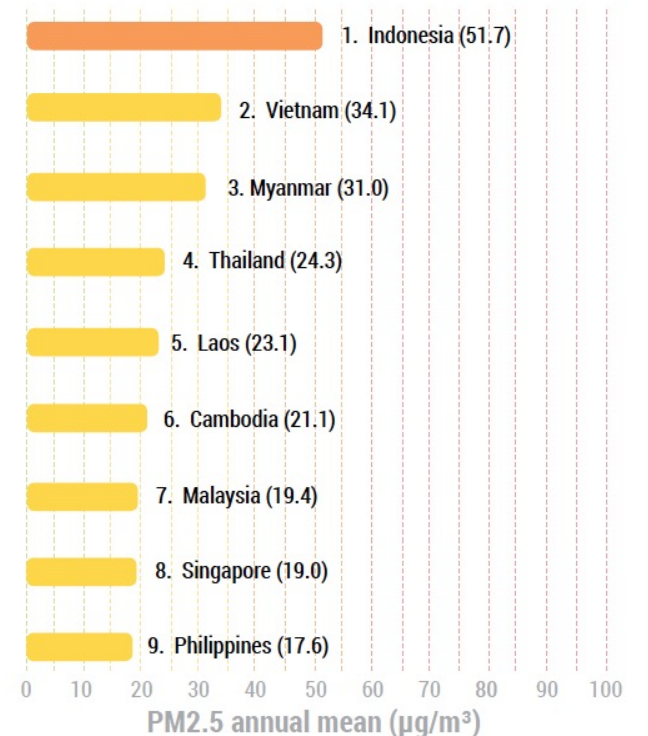


Available cities with real time monitoring in 2019

PM2.5
($\mu\text{g}/\text{m}^3$)



Country/Region Ranking



World class policies that drive soot-free and zero emission technologies

Tailpipe emission standards

- **Soot-free emission standards** (Euro VI, Bharat VI, China VI, EPA 2010)

Clean, low sulfur fuels

- **10 parts per million (ppm)** max sulfur for diesel and gasoline to enable soot-free emission standards

Vehicle electrification policies

- Policies to accelerate **electric HDV adoption** (Bus electrification mandates, fiscal programs, etc.)

Complementary programs

- Programs that address high-emitters, old vehicles, I&M.
- Low Emission Zones

What are soot-free and zero emission vehicle technologies?



Electric drive engines such as battery-electric, fuel cell, trolley-electric ...

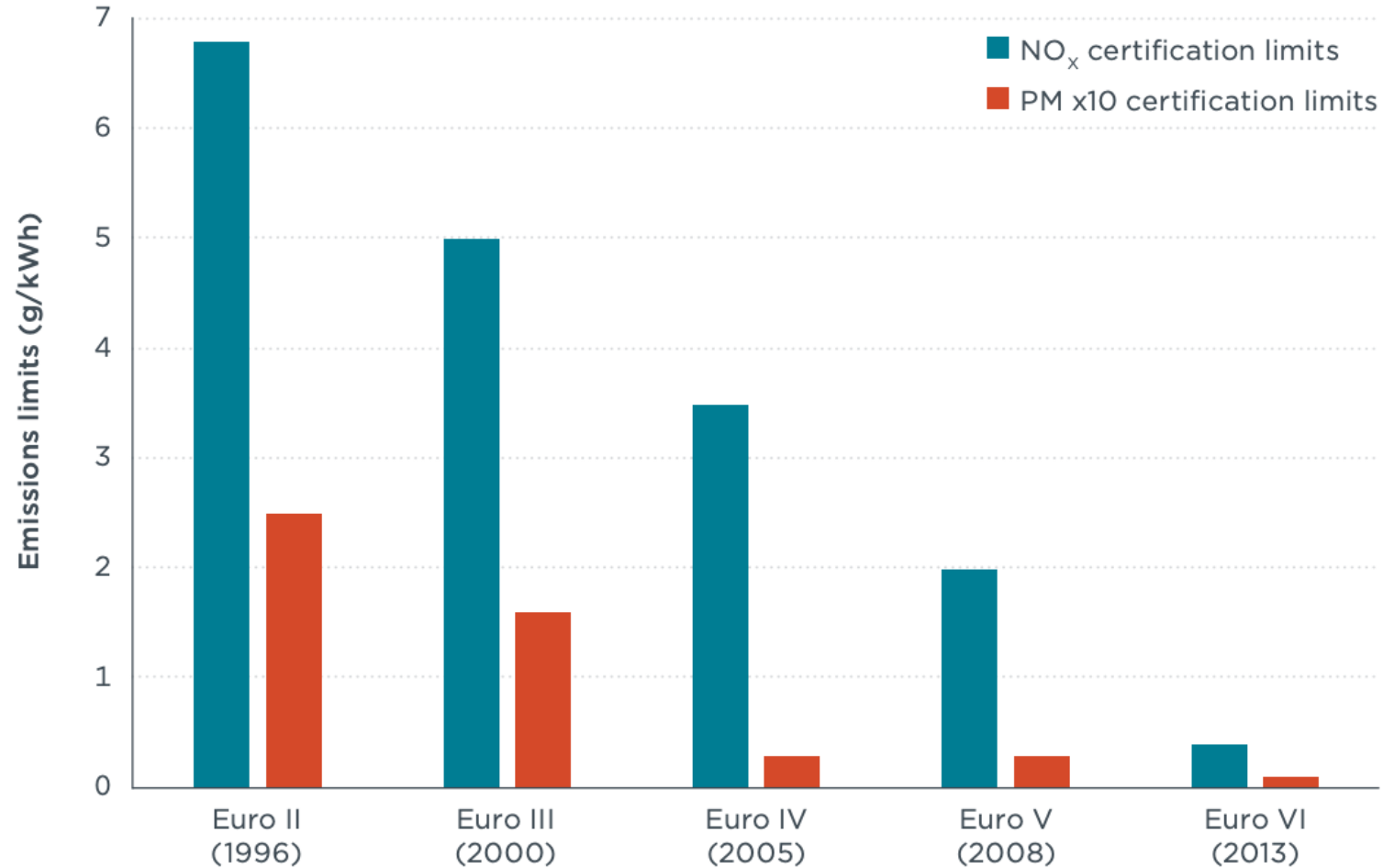


Euro VI gas engines



Euro VI Diesel engines and 10ppm S diesel

Heavy-duty vehicle emission standards



NO_x and PM emission standards for diesel engines used in heavy-duty vehicles

Diesel technology evolution according to emission standards



Euro III



Euro IV-V



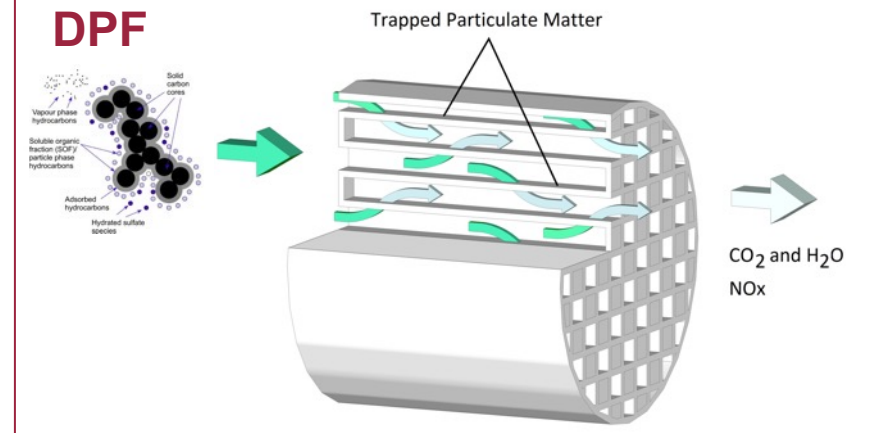
Euro VI



Aftertreatment emissions control

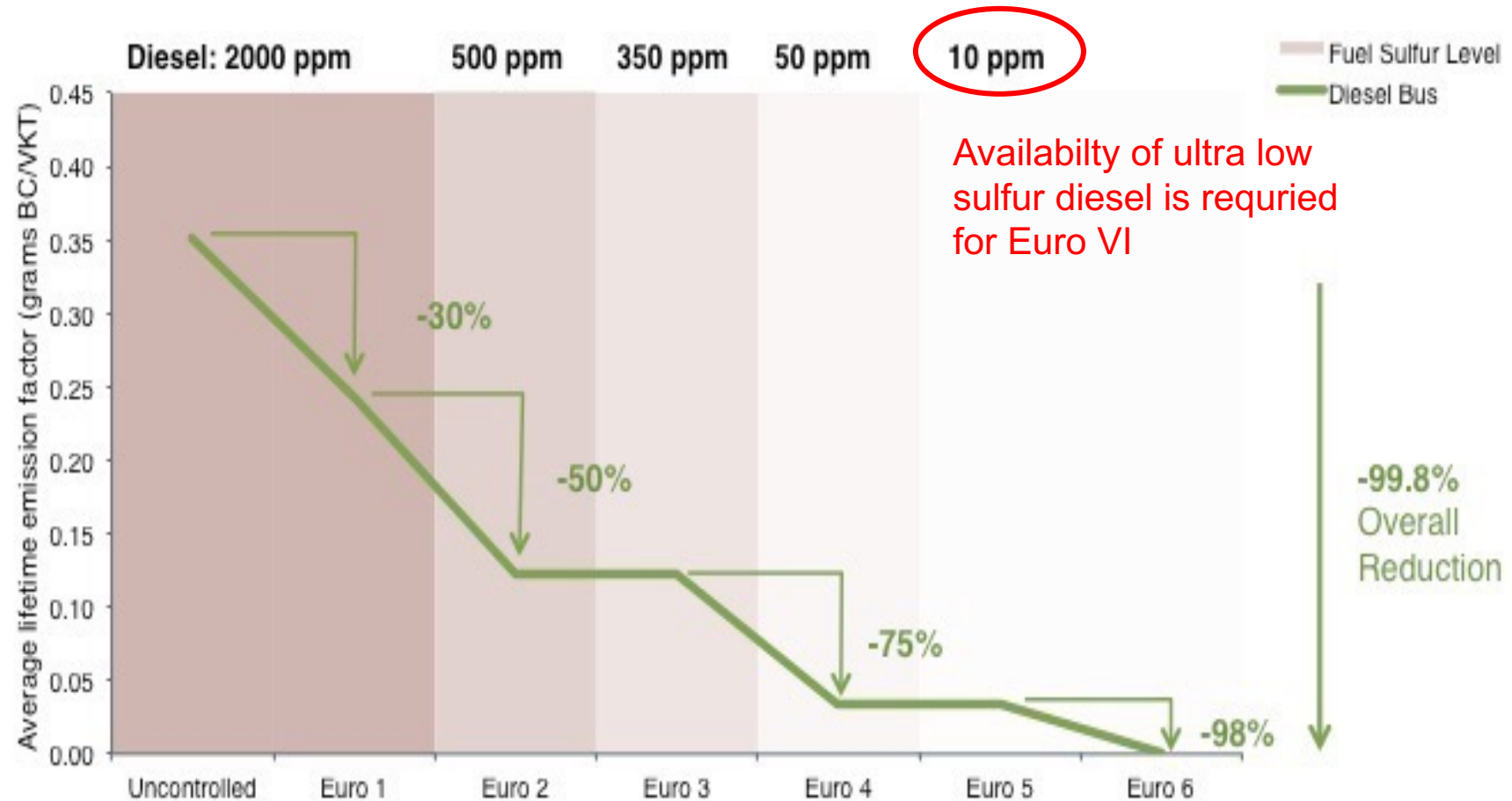
- Diesel oxidation catalyst (DOC)
 - CO (90%), HC (70%)
 - SOF, a component of PM (10-30%)
- Selective catalytic reduction (SCR)
 - NOx (85-95%)
- **Diesel particulate filter (DPF)**
 - PM (+98 %)
 - PN (+99 %)
 - CN (+99 %)

DPF



Soot free standards like Euro VI require ultra low sulfur diesel (S < 10 ppm)

Stages of Black Carbon Emissions Control Based on European Regulatory Approach for diesel HDVs

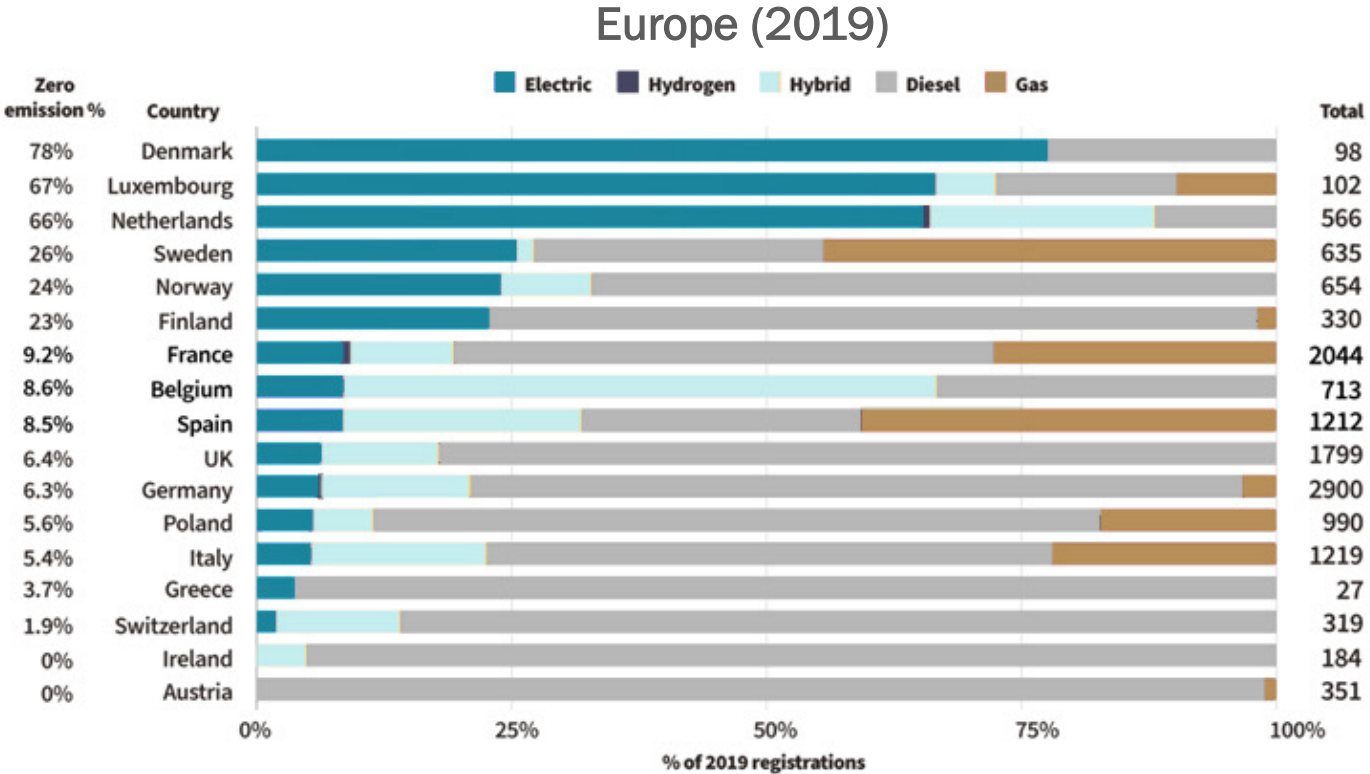


Source: COPERT Emissions Model

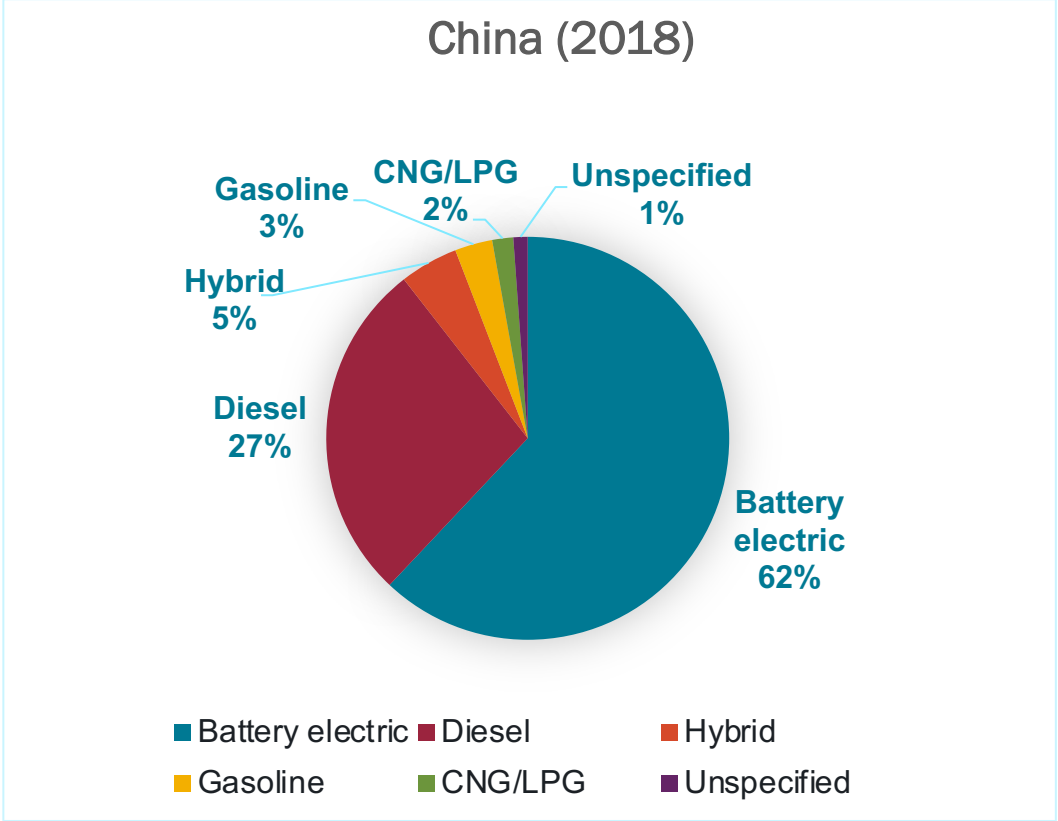
Vehicle electrification policies for HDVs



Zero emission transport is the final goal. This transition has started with e-buses



New urban buses registered in 2019 >8 tonnes Gross Vehicle Weight with ZE% being the sum of electric and hydrogen buses divided by the total. Trolley buses are not included in the electric bus data but make up a small amount of annual new registrations (49 in 2019)



Source: ICCT Databases

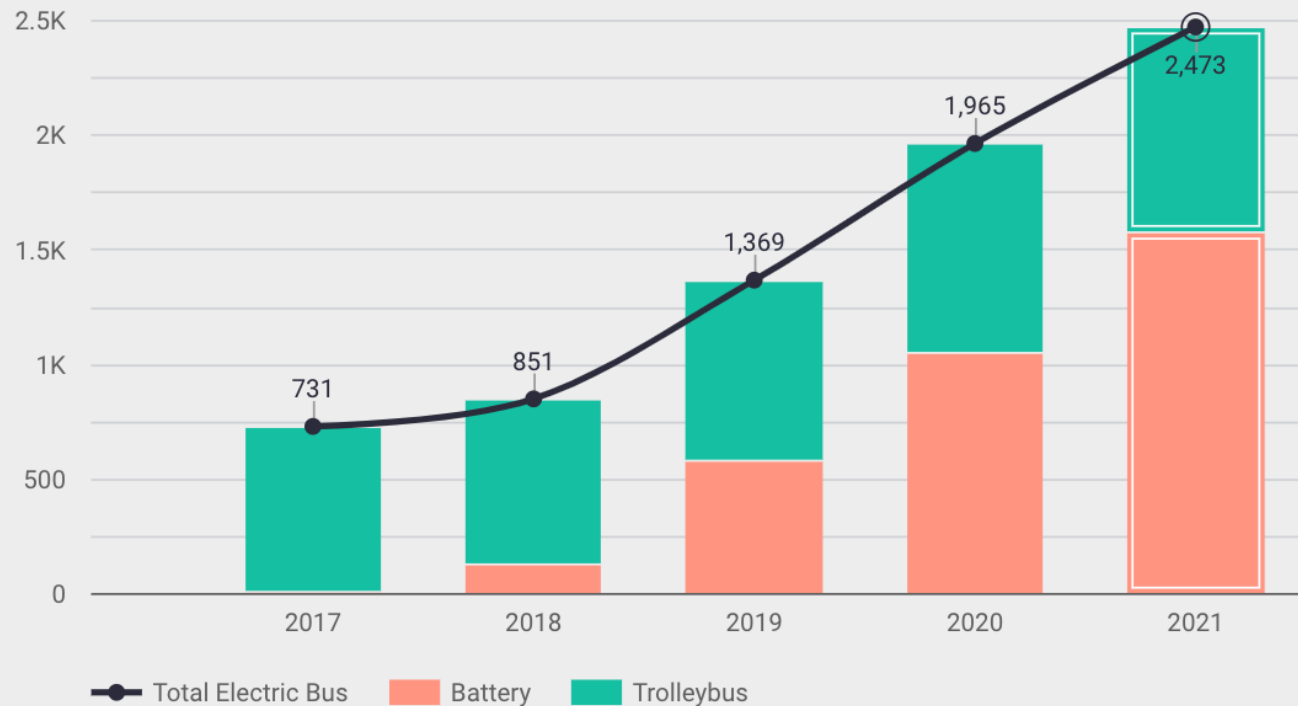
Source: <https://www.transportenvironment.org/press/denmark-luxembourg-netherlands-lead-way-emissions-free-buses>



Zero emission bus market in Latin-America is growing

~2500 Zero emission buses in total in 2021

Total of electric buses



Bogota : 1061 E-buses



Chile : 806 E-buses in operation



E-bus deployments in ASEAN countries are starting

SOCIETY

Electric buses help improve public transport quality of Hanoi

Since the first electric buses were put into operation in Hanoi in December 2021, the number of bus routes using smart electric buses in the city has increased to eight, contributing to enhancing the quality of public in the capital city.

VNA - Friday, July 22, 2022 12:28 <https://link.gov.vn/uUOMfZHV>

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An electric bus in Hanoi (Photo: courtesy of VinGroup)

Bangkok Post

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THAILAND | GENERAL

City readies up to 1,000 e-buses

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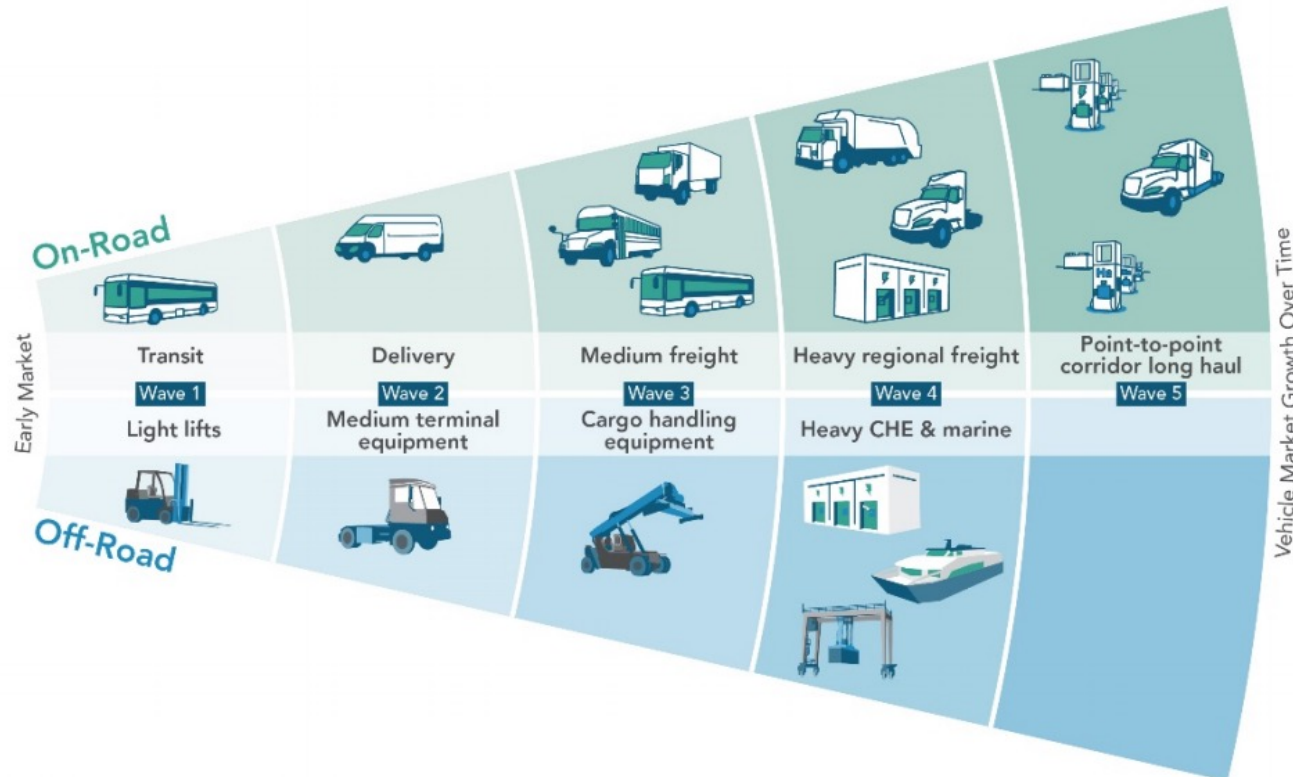
\$0 Online Listed Equity Trade Commissions*

*Disclosure
charles SCHWAB

Electric buses are parked at the National Monument (Monas) Square in a ceremony marking their service with municipal land transport operator Transjakarta on March 8, 2022. (Antara Photo)

Thirty Electric Buses Hit the Streets of Jakarta

Buses is the starting point for HDV electrification but there is potential in other segments



Market Progress Over Time

Similar drivetrain and component sizing can scale to early near applications

Expanded supply chain capabilities and price reductions enable additional applications

Steadily increasing volumes and infrastructure strengthen business case and performance confidence

California's government vision for HDV growth:

- Battery electric transit buses
- Battery electric shuttle and school buses;
- Battery electric delivery vehicles;
- Battery electric garbage trucks;
- Battery electric regional trucks
- Battery electric or fuel-cell long-haul cargo trucks

Source: https://ww2.arb.ca.gov/sites/default/files/2020-11/appd_hd_invest_strat.pdf

Policy actions to accelerate ZEV transition



Phase-out targets: Setting a vision and market signal



Binding regulations: Ensuring model availability and supply



Financial incentives: Making ZEVs cost-effective today



Charging infrastructure: Maximizing ZEVs' convenience



Consumer awareness: Building understanding of ZEVs' benefits

What are the challenges and opportunities to accelerate soot-free and EV adoption in ASEAN?

Adopting policies that drive soot-free and zero emission technologies

Soot-free progress: state of vehicle emission standards and fuels in select ASEAN countries

Country	Emission standards (LDV)	Emission standards (HDV)	Fuel quality (S) standards	Comments
Brunei Darussalam	Euro 4		50ppm	
Cambodia	Euro 4		50ppm	
Indonesia	Euro 4 (2018)	Euro 2 Euro 4 (starting 2022)	50 – 2000 ppm	- Various grades/ quality of gasoline and diesel fuel - Widely available diesel fuel has 2000ppm Sulfur
Laos	ND	ND	ND	- Input required
Malaysia	Euro 2	Euro 1	10ppm (diesel)	- Vehicles mostly Euro 4 (gasoline) and Euro 3 (diesel)
Myanmar				- Has plans to adopt Euro 4
Philippines	Euro 4 (2016)	Euro IV (2016)	50ppm	- Has plans to adopt Euro 6/VI but with undetermined timeline
Singapore	Euro 6	Euro VI	10ppm	
Thailand	Euro 4 (2012)	Euro IV	50ppm	- Euro 5/V in 2024 and Euro 6/VI by 2025
Vietnam	Euro 4 (2017)	Euro IV	50ppm	- Euro 5/V by 1 Jan 2022 and Euro 6/VI in period of 2025-2030

EV-HDV Electrification goals in select ASEAN countries

Country	EV production and use targets
Thailand	<ul style="list-style-type: none"> ▪ By year 2025, 30% of vehicle use and 10% of vehicle production ▪ By year 2030, 50% of vehicle use and 30% of vehicle production ▪ By year 2035, 100% of vehicle use and 50% of vehicle production
Vietnam	<ul style="list-style-type: none"> ▪ Period 2022-2030, focus on promoting the production, assembly, import of EV ▪ By 2040, step by step limit and stop the production, assembly, and import of vehicles used fossil fuels for domestic use ▪ By 2050, 100% of road motorized vehicle will be powered by electric and green energy ▪ Having EV uptake targets for electric buses and electric taxis in urban area
Indonesia	<ul style="list-style-type: none"> ▪ By year 2025, 20% of vehicle production to be EV or hybrid ▪ By year 2030, Stock target 2 M for PC electrified and 3 M for MC electrified ▪ By year 2035, Under Low Carbon Emission Vehicle Program (LCEV) <ul style="list-style-type: none"> ○ For 4-wheeler: Production 4,000,000 = Domestic usage 2,500,000 and Export 1,500,000 ○ For Motorcycle: Production 10,750,000 = Domestic usage 9,000,000 and Export 1,750,000
Philippines	<ul style="list-style-type: none"> ▪ The roadmap targets to achieve 21% EVs of total vehicles in the country by 2030 with focus on public transportation, and 50% by 2040. ▪ The Electric Vehicle Association of the Philippines (EVAP) has revised its growth target for e-vehicle adoption in the country from 300,000 units by 2030 to 1.0 million units in anticipation of incentives for the sector, clearer regulations, and growing awareness on the benefits of using EVs.

Overview of EV adoption policies in select ASEAN countries

	Thailand	Vietnam	Indonesia	Philippines	Malaysia
EV Program	✓	✓	✓	✓	✓
EV Targets	✓	✓	✓	✓	✓
Manufacturer incentives for EVs	✓	-	✓	✓	✓
EV Incentives/ subsidies	✓	✓	✓	✓	✓

Source: KMUTT, *Current Profile of Transport Electrification in ASEAN Countries*

- ASEAN countries are already taking policy steps to ensure the acceleration of EV uptake.
- Most of these are explicitly directed towards motorcycles, cars and buses. Most of the HDV segment is not included or at least is not explicit.

Challenges and opportunities on soot-free adoption in ASEAN

Fuel quality availability

- Develop a roadmap for a transition to S10 ppm diesel.
- Justify refinery upgrades with cost and benefits analysis – hidden cost of delays
- Fuel importing countries can easily update fuel quality import requirements and plan for a short-term transition. More than 82% of the market of refined diesel is S10 ppm.

HDV Emission standards

- Develop a roadmap for a transition to Euro VI.
- Ensure industry participation and set reasonable lead-times (2-4 years depending on local conditions)
- Leapfrogging to Euro VI is recommended. If the country is at Euro IV today, there is no need to go through Euro V.
- More than 85% of HDV production today meets Euro VI standards. The technology is readily available in the market
- Countries that import used HDVs: adopt age and Euro standard limits

Challenges and opportunities to accelerate Electric HDVs in ASEAN countries

EV targets for e-HDVs

- Adopt electrification targets for HDVs
- Political statements should be used to set HD ZEV sales targets that align with climate goals, are legally binding, are unambiguous,
- Phase-in timelines can start with transit buses, then light commercial, heavy commercial and long-haul.

Supply measures for e-HDVs

- Legally-binding vehicle regulations should drive the adoption of zero-emission HDV technology; require, using long-term targets, that manufacturer produce an increasing number or percentage of HD ZEVs each year;
- Recognize differences in cost, emission footprints, and technology readiness among vehicle segments

Incentives measures for e-HDVs

- Fiscal incentives such as purchase subsidies and tax deductions reduce the cost gap with conventional vehicles.
- Incentive programs should be tailored to close segment-specific gaps in cost parity, have a revenue-neutral source of funding, and undergo regular review and revision to reflect technology development and cost changes.

Infrastructure for e-HDVs

- Governments are well-positioned to coordinate among stakeholders and to lead the development of infrastructure roadmaps, ensuring that build-outs align with vehicle electrification targets.
- Governments should set policies to incentivize private sector investment while targeting public sector investment strategically where it is most needed in the early stages of market development

Fleet purchase requirements for e-HDVs

- Fleet purchase requirements create market demand for zero-emission products that can further drive the supply of HD ZEVs, and should be applied to public fleets of buses and trucks as well as large private fleets,
- Purchase requirements should be aligned with targets and regulations for individual HDV segments.



How can ASEAN Secretariat support this process?

- Fostering harmonization for Euro VI/6 standards in vehicles
- Support harmonization of fuel quality imports for road transport in the region.
- Support harmonization of EV technical specifications (e.g., charging equipment).
- Favoring special tariffs for cleaner vehicles and fuels during trade policy discussions
- Favor EV vehicles and their components policy incentives (tariffs) during trade discussions in the region

Thank you!

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