

State of Play – Transport and Air Pollution in Asia and the Pacific

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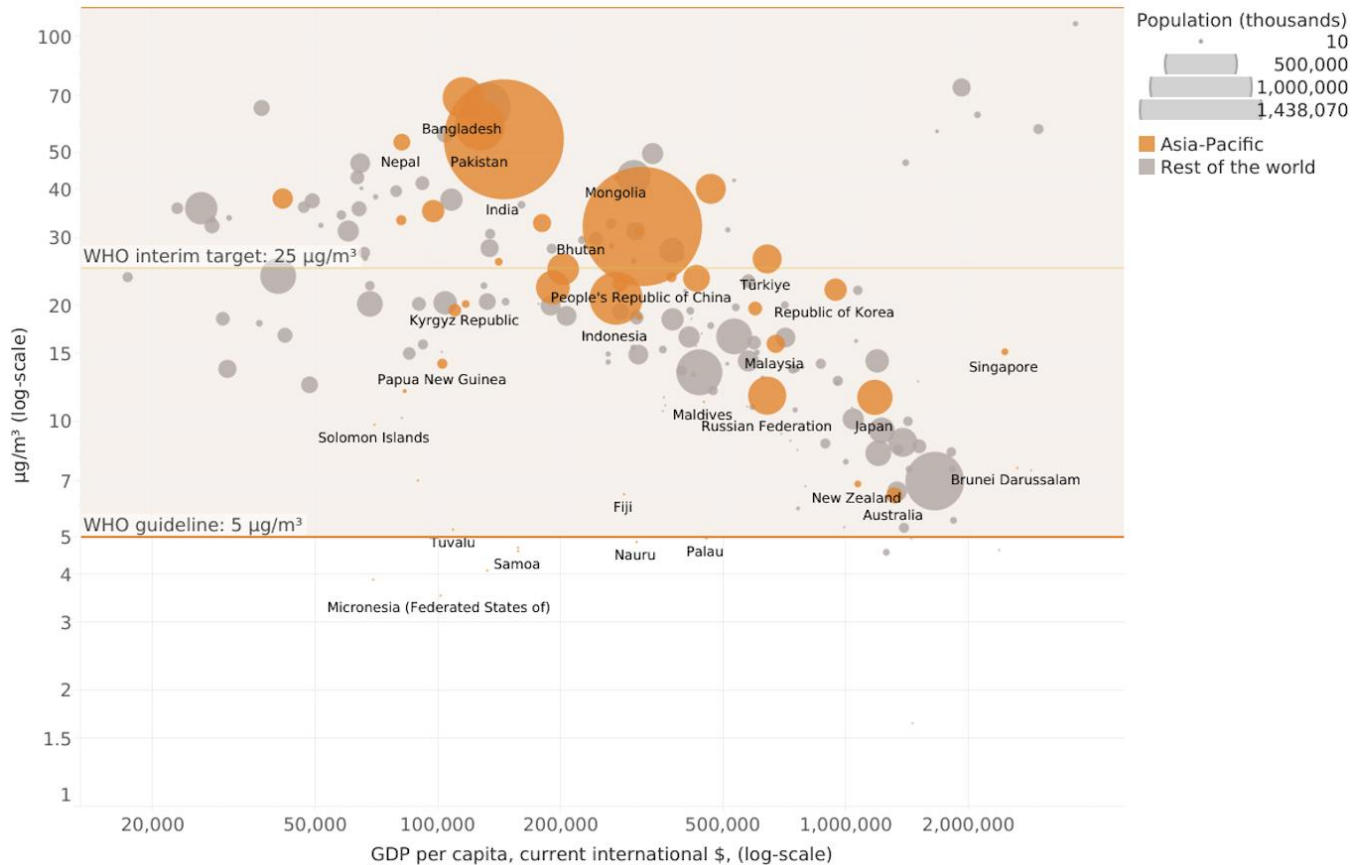
ATO Analytical Outputs

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1. The Air Pollution Burden is Severe and Concentrated

PM 2.5 population-weighted annual average exposure (2023)



4.7 million premature deaths attributed to ambient and household air pollution in Asia and the Pacific (World Bank, 2022).

77% of Asia's population was exposed to PM2.5 levels exceeding 25 micrograms per cubic meter, a decrease from 82% in 2010

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge.
Data based on State of Global Air (2024)



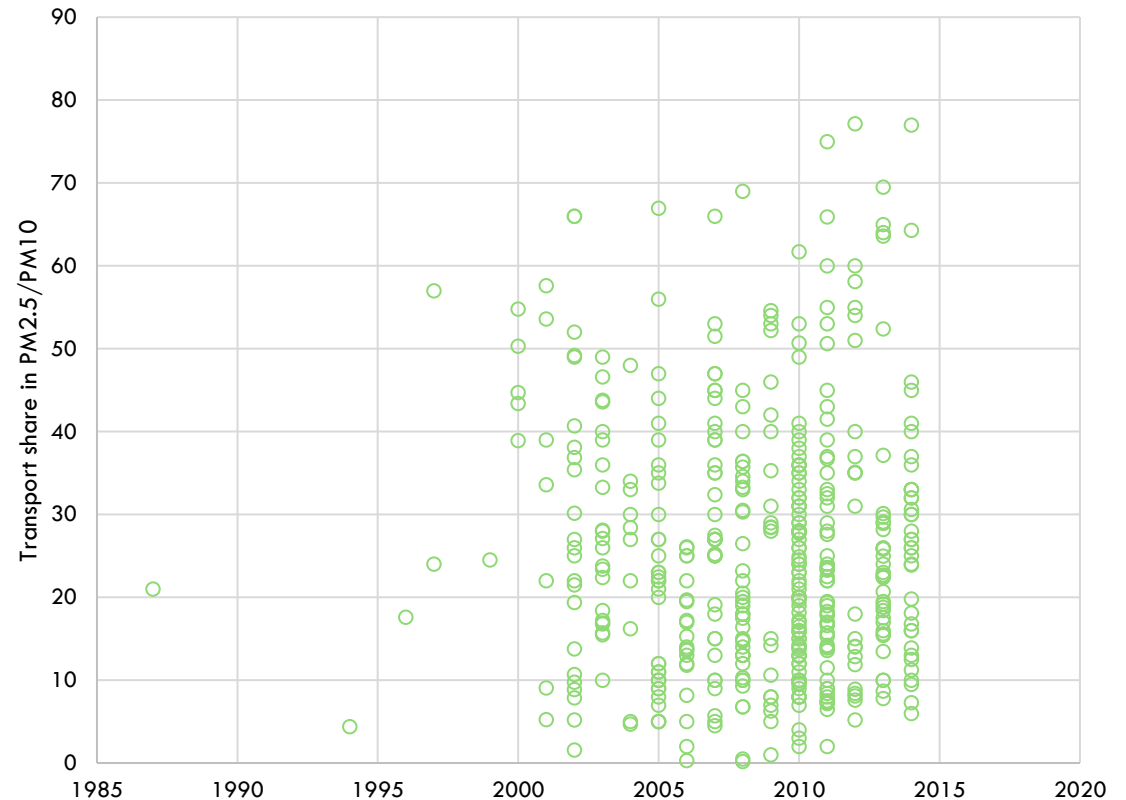
2. Transport is one of the Significant Sources of Air Pollution

The estimated health impacts associated with exposure to ambient PM2.5 resulted in monetary losses equivalent to 4.7% to 6.5% of global GDP in 2020. Asia accounts for 70% of the global transport sector's financial penalties (World Bank, 2025)

Mobile sources significantly contribute to air pollution and the associated impacts.

Diesel vehicles alone account for **72% of the road transport disease burden associated with PM2.5 and ground-level ozone** pollution in Asia and the Pacific (Anenberg et al., 2015)

Air pollution remains a leading environmental risk factor for mortality worldwide, contributing to an estimated 7.9 million deaths in 2023 - **roughly one in eight deaths**



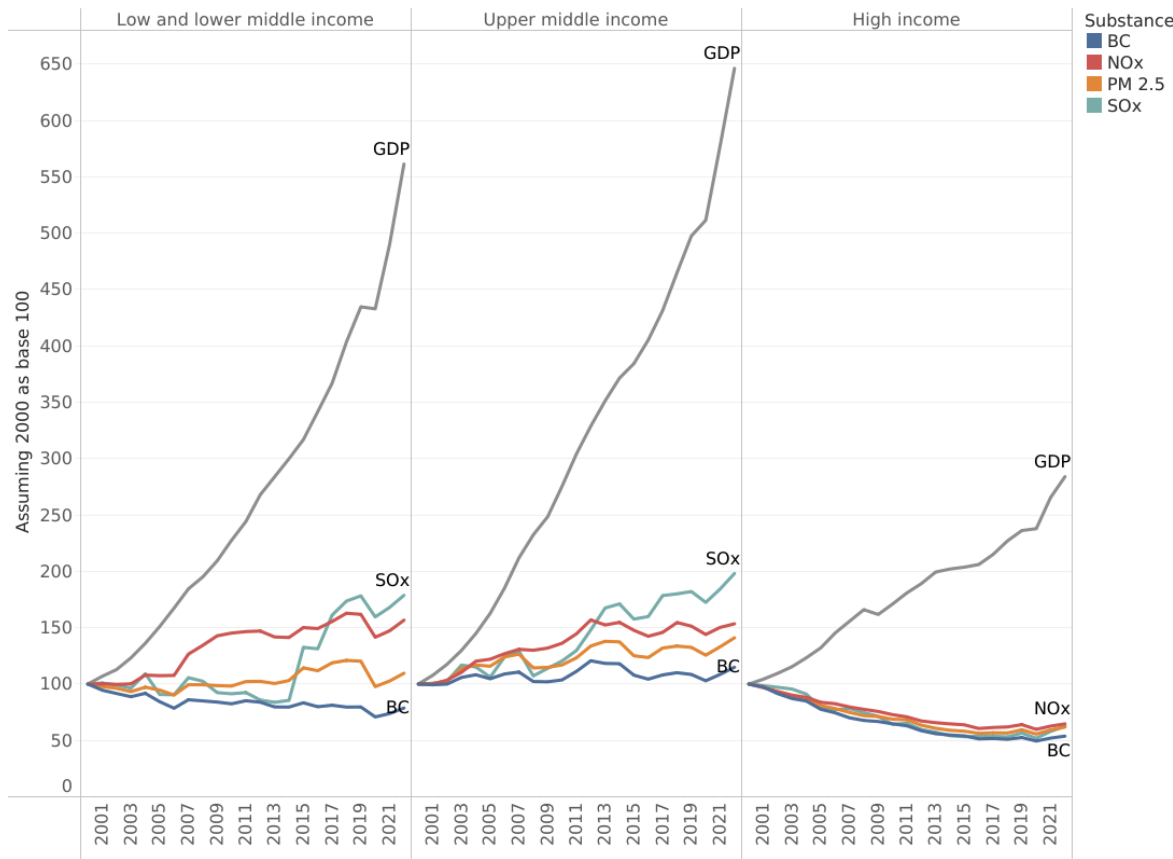
Transport share in ambient PM2.5/PM10 concentration

Source: ATO, 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Data based on State of Global Air (2024)



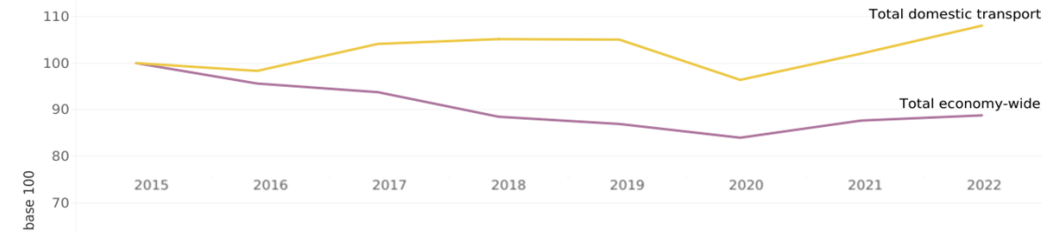
3. The Overall Transport Emissions Trajectory: Mixed Progress at the Regional Scale

Overall Transport Emissions Trajectories



Air pollutant emissions decoupling with GDP

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Based on European Commission et al. (2024) and World Bank (2025c)



PM 2.5 emissions trend for domestic transport vs. all sectors - Asia (2015 =100)

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Based on European Commission et al. (2024)

Transport emissions in Asia have grown more slowly than economic activity, indicating partial decoupling. Since 2000, GDP, infrastructure, and vehicle ownership increased rapidly, yet emissions rose only modestly (PM_{2.5} +0.9%, NO_x +0.7%, SO_x +1.8%) and black carbon declined (-0.5%).

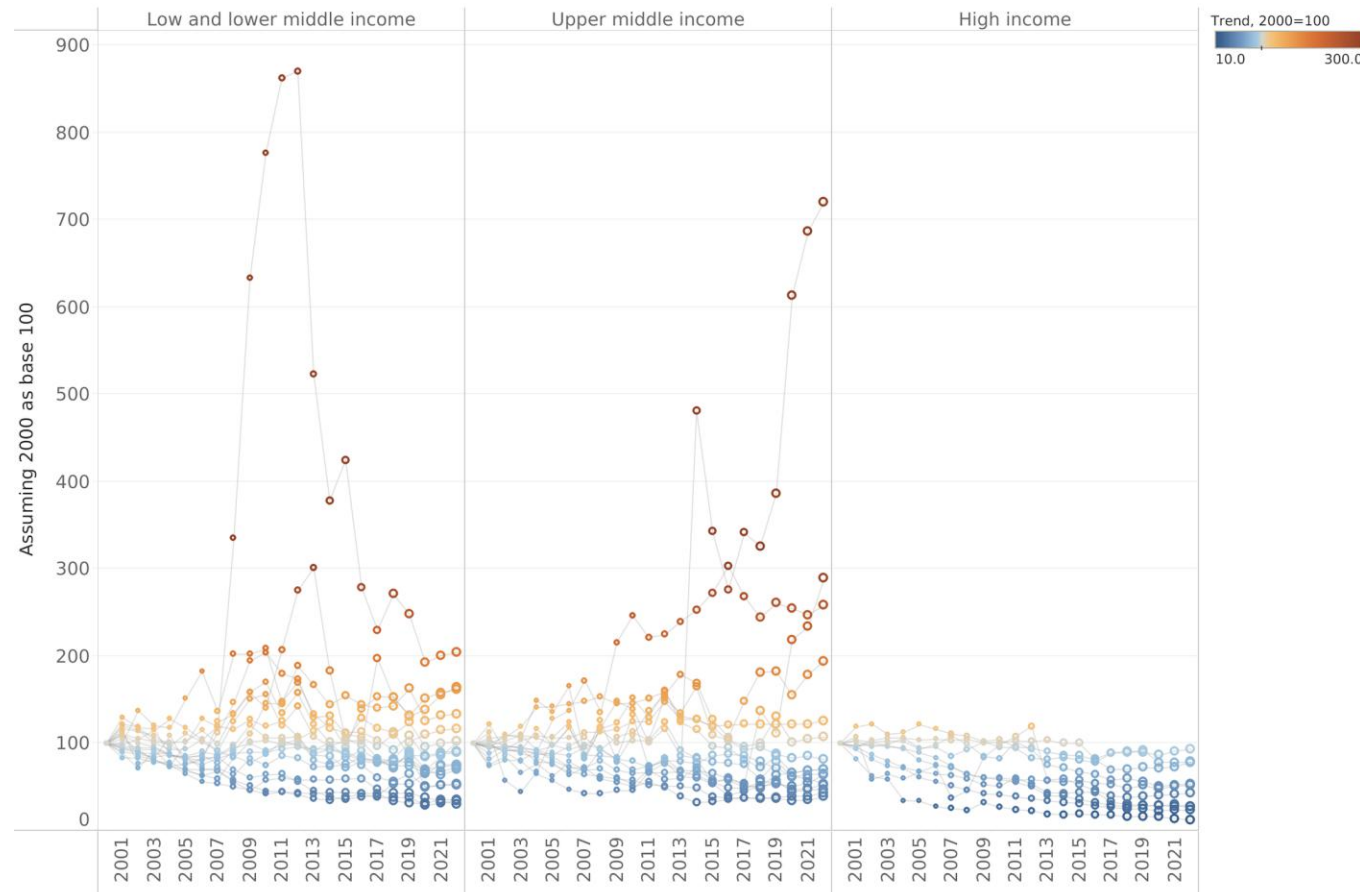
However, transport lags behind other sectors in reducing pollution. Between 2015 and 2022, transport PM_{2.5} emissions increased by 8.1%, while emissions from other sectors fell by 12.7%, highlighting the need for stronger action on transport air pollution.



4. Road Transport: The Success Story with Limits

Scaling Low-Emissions Transport: Where We Are and What Is Being Done

Road Transport : Success and its Limits



Road transport PM 2.5 exhaust emissions trend in Asia-Pacific countries, by income level (2000-2022)

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge.

Based on European Commission et al. (2024)

Between 2010 and 2022, road transport emissions of nitrogen oxides (NO_x) dropped by **0.4%**, **sulfur oxides (SO_x) by 0.6%**, and **Black Carbon (BC) by 2.5% annually** across Asia and the Pacific (EC, 2024)

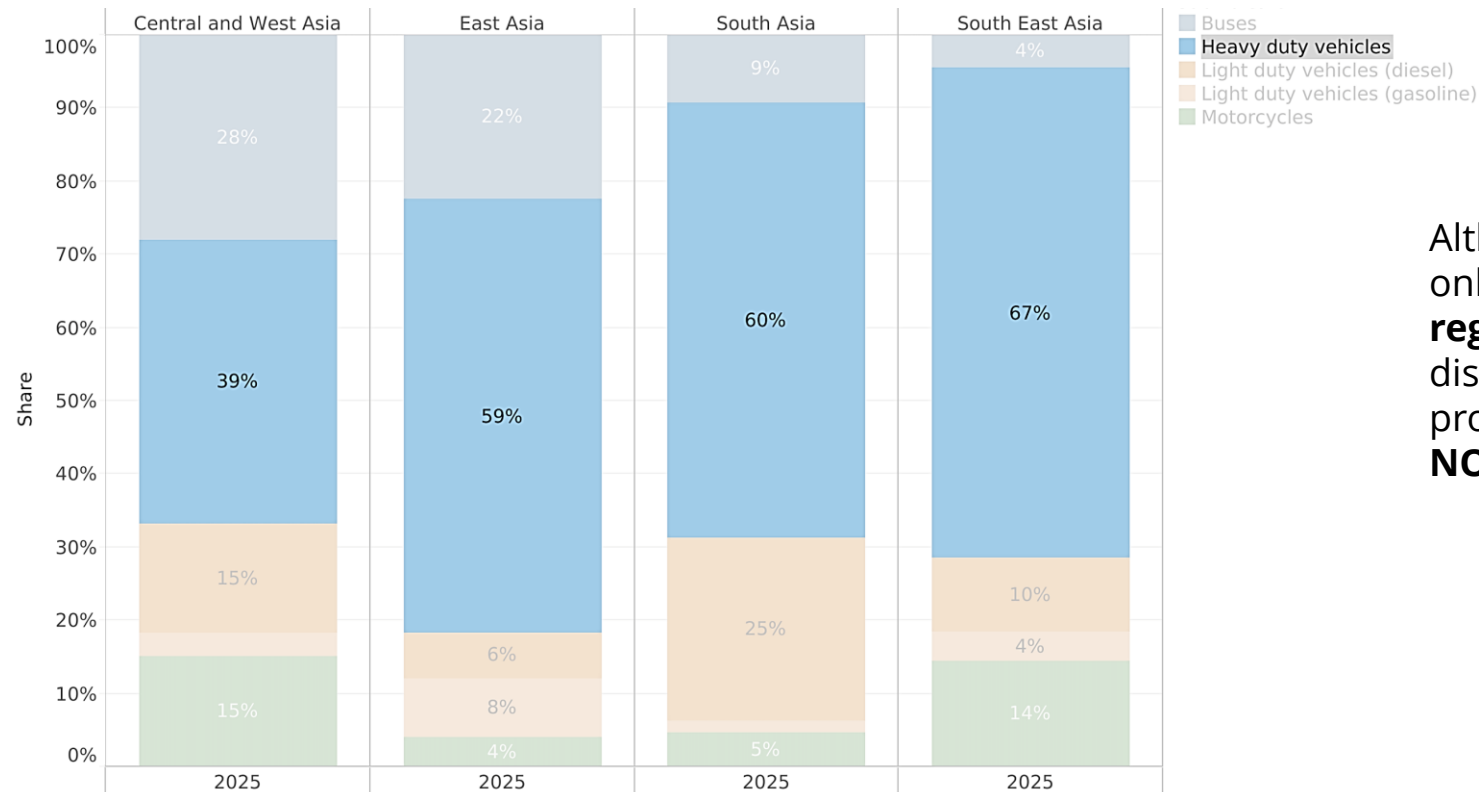
This occurred despite the road sector's vehicle fleet expanding by approximately **8% per year**.

However, progress has not been equal across the region.



5. The Importance of Heavy-Duty Vehicles

Importance of HDVs



Although HDVs are estimated to account for only **7% of all vehicle registrations in the region**, they are responsible for a disproportionately large share of emissions, producing about **57% of PM_{2.5} and 64% of NO_x emissions**

Road transport PM 2.5 emissions, share by vehicle type

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Based on IIASA (2025)



6. Vehicle Emission, and Fuel Quality Standards: Instruments of Change

Vehicle Emission Standards and Fuel Quality

Vehicle emission standards combined with fuel quality standards have been the **most effective policy instrument in Asia's fight against transport pollution**, driving rapid technological change in vehicle fleets and fuel supply.

As of January 2025 (UNEP, 2025):

- **20 Asian countries** had national sulfur limits of **50 ppm or less** for both diesel and petrol.
- **16 countries** had fully adopted **Euro 4/IV or higher vehicle emission standards**.
- **13 countries** were **working toward implementing or adopting low sulfur fuel standards**.
- **14 countries** had **not yet fully adopted Euro 4/IV or higher vehicle emission standards** for new vehicles.
- In 2010, only 9% of the Asian vehicle fleet was registered in countries adhering to Euro 4/IV or better standards. By 2025, this figure had increased to nearly 99%, meaning most new vehicles entering Asian markets today are theoretically several magnitudes cleaner than vehicles sold a decade earlier.





7. Used Vehicles

Used Vehicles

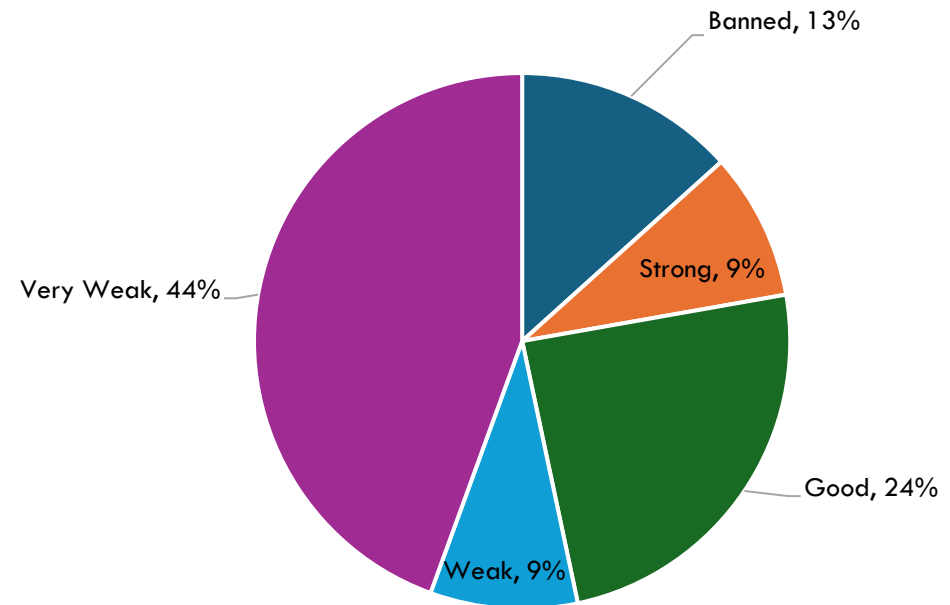
Around **3.7 million used vehicles** were shipped to low and middle income economies in Asia and the Pacific between 2015-2023

Despite stricter trade standards, **large vehicle markets mean millions of used vehicles remain in operation for many years.**

By December 2025, **47% of Asian** economies had banned or adopted “good” or “strong” policies on used light-duty and heavy-duty vehicle imports (UNEP)

Many countries **lack enforcement capacity, inspection infrastructure, and information systems** needed to verify compliance with import regulations.

Limited data transparency is another barrier:



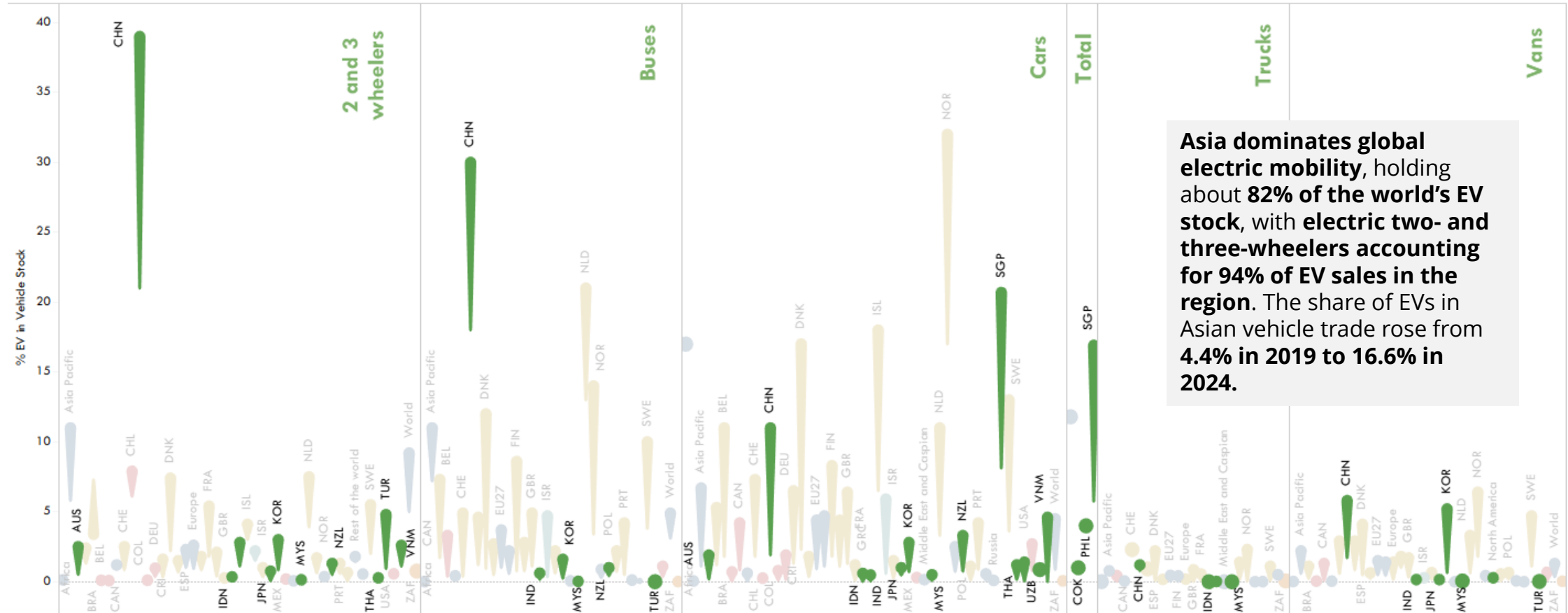
Used Vehicle Regulations-2025, 45 Economies

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Based on UNEP (2024)



8. Two Sides of the E-mobility Transition: Vehicles and Grids

Electric Mobility: Fleets



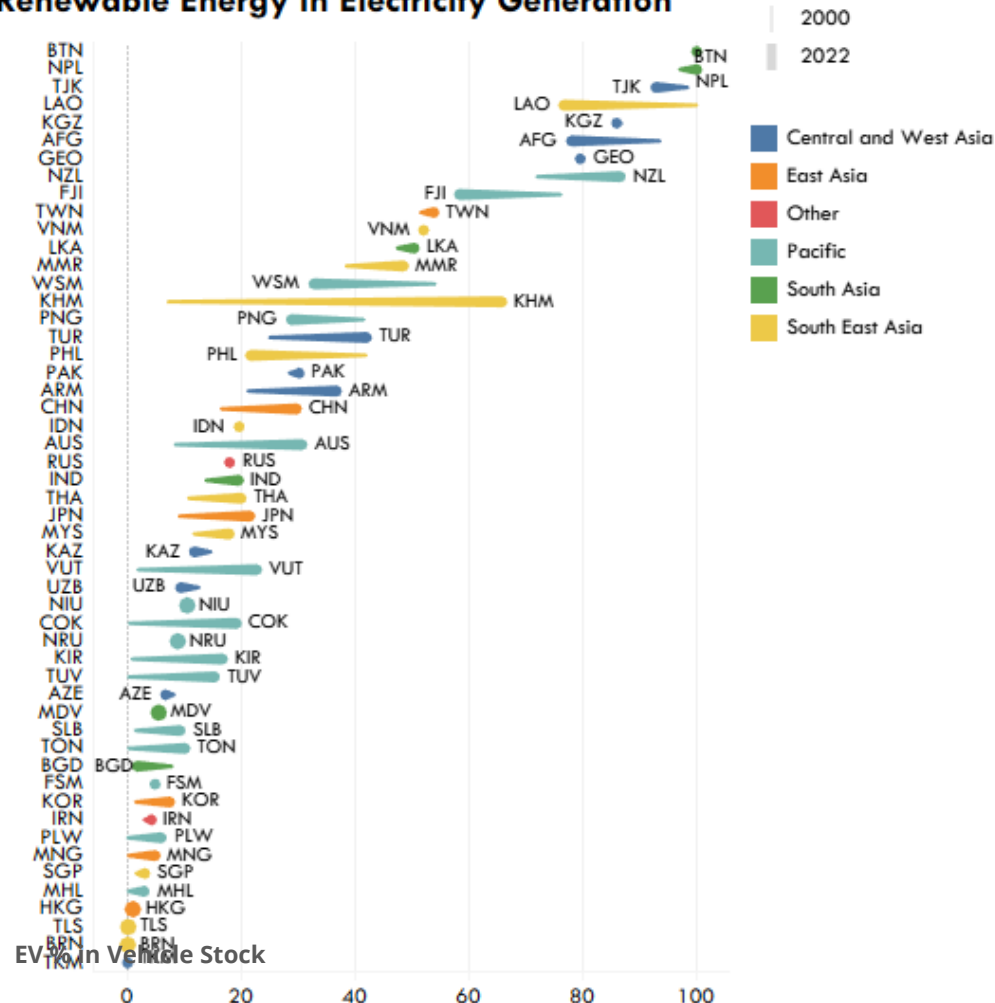
Asia dominates global electric mobility, holding about 82% of the world's EV stock, with electric two- and three-wheelers accounting for 94% of EV sales in the region. The share of EVs in Asian vehicle trade rose from 4.4% in 2019 to 16.6% in 2024.

EV % in Vehicle Stock

Source: Mejia & Gota (2024), based on various sources

Electric Mobility :Grids

% Renewable Energy in Electricity Generation



Air quality gains from electrification remain limited because electricity generation in many Asian countries is still coal-intensive. A similar pattern occurred in railways: although **rail electrification increased from 42% (2010) to 66% (2024)**, emission reductions were modest due to the carbon-intensive grid, which only began decarbonizing around **2015 at about -1.4% per year**.

Governments across Asia are promoting electric mobility through a range of policy targets, including **EV market share targets for vehicle sales, electrification goals for public transport and logistics fleets, long-term adoption targets for passenger cars and heavy vehicles, development of national EV ecosystems, and pilot deployment of electric buses and other electric public transport services**.

Source: ATO. 2025. COP Tracker 2025. Based on data from IRENA



9. Emergence of Non-Exhaust Road Transport Emissions

Non-Exhaust Road Transport Emissions



Non-exhaust emissions are becoming a major source of road transport pollution. From brake and tire wear and road dust, their share of transport PM_{2.5} in Asia rose from 7% (1970) to 13% (2022) and now accounts for 38% of PM_{2.5} and 53% of PM₁₀ from the road sector.

Policy responses in Asia remain limited. While new standards elsewhere regulate brake and tire emissions, most Asian measures focus on road dust control such as street sweeping, washing, and dust-suppression vehicles.

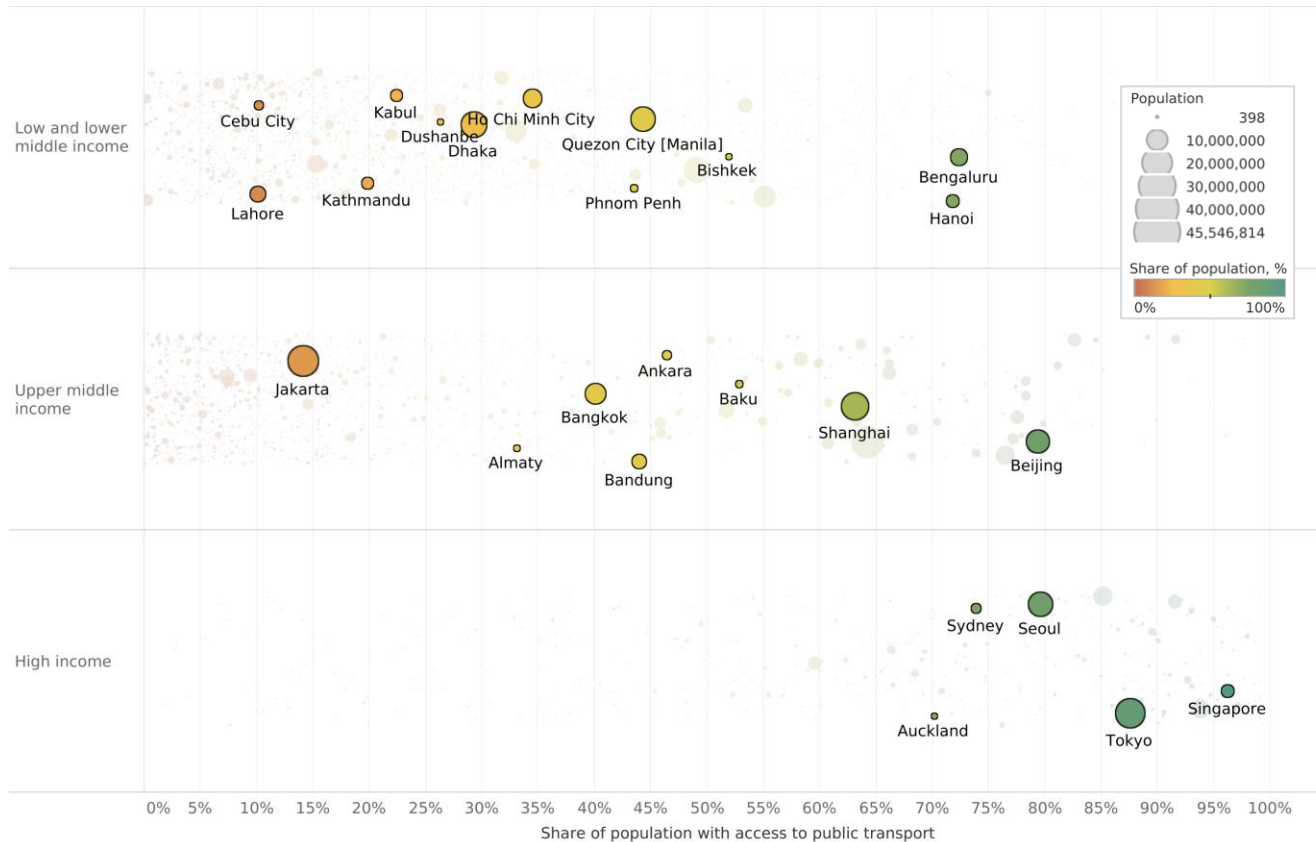
Road transport PM 2.5 emissions, share by vehicle type

Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge. Based on European Commission et al. (2024)



10. Public Transport Interlinkages with Air Pollution

Public Transport & Air Pollution



Public transport is critical for reducing transport air pollution, yet access remains limited—about **1.4 billion urban residents** in Asia-Pacific lack convenient transit access, constraining shifts away from private vehicles.

Limited transit access is driving higher-emission travel patterns, with many cities seeing increases in motorcycle and car use and declines in walking and cycling, worsening urban air pollution exposure.

Transit infrastructure is expanding rapidly in the region, accounting for **72% of added** rapid transit infrastructure since 2010, but it still serves only a small share of the region's ~3,300 urban centers, limiting its air quality benefits.

Road transport PM 2.5 emissions, share by vehicle type

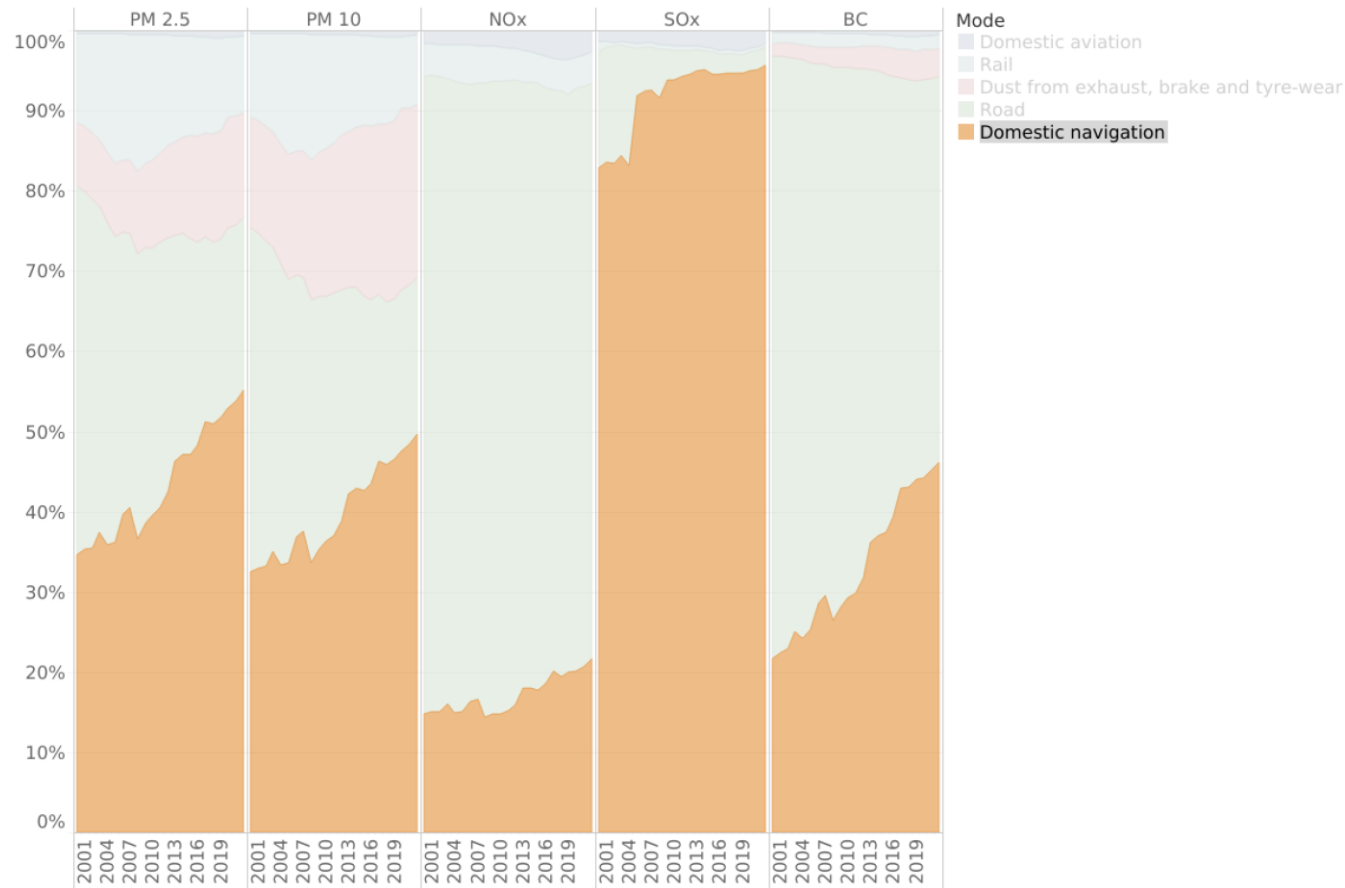
Source: ATO. 2026. Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge.
Based on data from CIESIN (2023)



11. Domestic Shipping: Asia's Transport Emissions Blind Spot

Scaling Low-Emissions Transport: Where We Are and What Is Being Done

Domestic Shipping Emissions



Domestic shipping has become a major and largely unregulated source of air pollution in Asia-Pacific. Since 2000, emissions from domestic shipping have grown by about 3% annually for PM_{2.5} and black carbon and 2.5% for NO_x and SO_x. It constitutes: **95% of SO_x, 55% of PM_{2.5} and 46% of black carbon** transport emissions of the region.

Limited availability of low-sulfur marine fuel, weak bunkering infrastructure, lack of cleaner alternatives, and misaligned incentives—where ports bear the costs but surrounding communities receive the health benefits—have slowed the transition to cleaner domestic shipping fuels.

Share of domestic navigation in air pollutant emissions from transport in Asia
Source: ATO analysis and visualization based on European Commission et al. (2024)



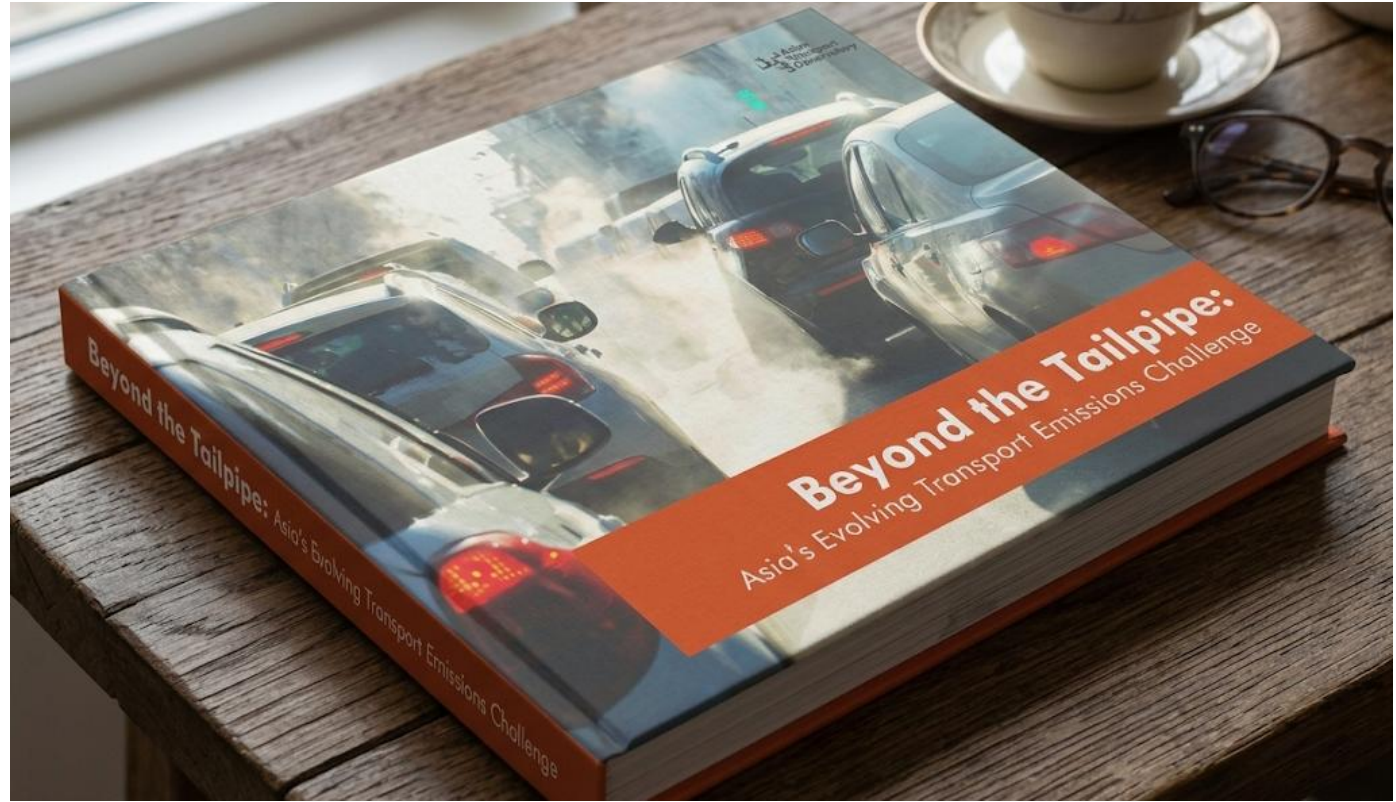
What We Do Not Know?

Major data gaps limit effective transport air pollution policy. Reliable data on non-road transport—especially domestic shipping and inland waterways—remain scarce, including information on vessel activity, fuel use, and real-world emissions.

Current evidence on transport’s pollution impact needs to be improved. Differences in source apportionment methods, gaps between laboratory and real-world vehicle emissions, and limited fleet renewal data make it difficult to accurately estimate transport’s contribution to air pollution.

Stronger data, modelling, and integrated analysis are needed. Better methods are required to attribute health impacts, evaluate policy benefits, and incorporate co-benefits such as climate mitigation, safety, and economic gains into decision-making.

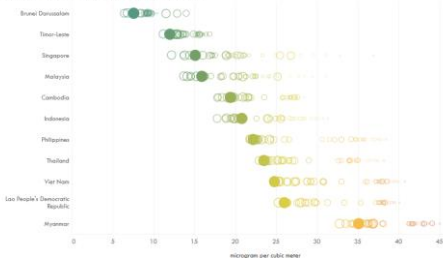
Beyond the Tailpipe: Asia's Evolving Transport Emissions Challenge



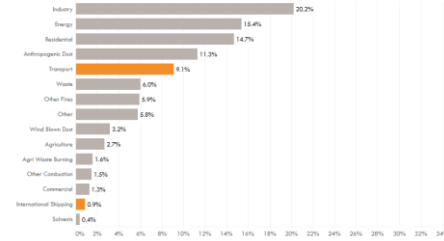
<https://asiantransportobservatory.org/analytical-outputs/beyond-the-tailpipe-asias-evolving-transport-emissions-challenge/>

ATO Transport and Air Pollution Profiles

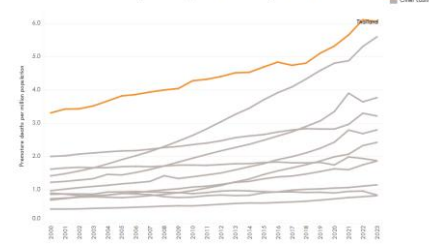
Ambient particulate matter (PM 2.5) concentration



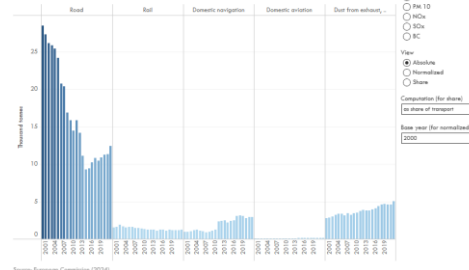
Ambient PM 2.5, share by source



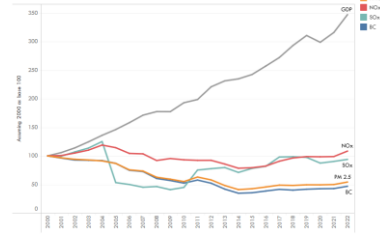
Premature deaths due to occupational exposure to diesel engine exhaust



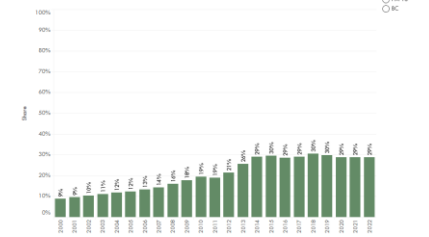
Transport air pollutant emissions



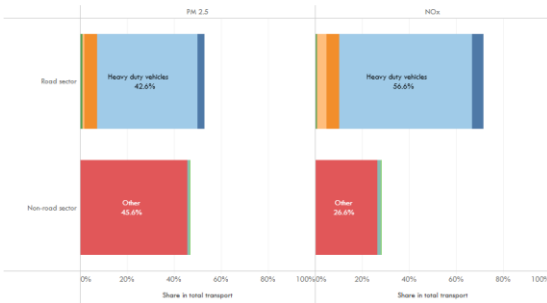
Transport air pollutant emissions



Dust from exhaust, brake and tyre-wear, as share in road PM 2.5 emissions



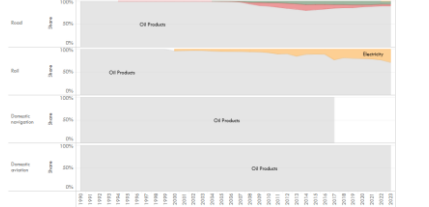
Air pollutant emissions, share by mobile source



Health cost of air pollution



Transport energy consumption (by source)



<https://asiantransportobservatory.org/analytical-outputs/transportairpollutionprofiles/thailand-transport-air-pollution-profile-2026/>

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