



Transport Decarbonisation in Asia: A Glass Half-Full or Half-Empty?

A Primer for COP-29

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Executive Summary

The 2023 data on domestic transport CO₂ emissions in Asia and the Pacific paints a stark reality: emissions have reached a record-breaking 2.8 Gt CO₂, a 6.6% increase from 2022. This alarming increase outpaces all other sectors within Asia and regions, with Asia now matching Europe and North America's combined transport sector emissions. This surge underscores the urgent need for decisive action at COP29 to decarbonize the sector.

Asia's transport sector is pivotal in global emissions, contributing 40% of the total global transport emissions. Worryingly, the region's annual growth rate since the Paris Agreement has been twice the global average, making it responsible for 83% of the worldwide rise in transport emissions. While the transport sector's share of total fossil emissions in Asia is lower than the global average, it varies significantly across income levels, highlighting the diverse nature of the challenge. Emissions growth rates also differ between high-income and low- and middle-income economies, with the latter experiencing faster growth. This trend underscores the need for targeted interventions based on income levels.

Post-Paris Agreement, transport has emerged as a critical driver of emissions growth in Asia, particularly in 2023. Although its growth rate aligns with other sectors, its contribution to total emissions remains significant. Decoupling economic growth from transport emissions has seen mixed success in Asia. While high-income economies have achieved absolute decoupling, many others have only managed relative decoupling, highlighting the need for accelerated efforts to improve energy efficiency.

Road transport dominates emissions, accounting for 89% of the total. The composition of road transport emissions varies across income levels, with distinct patterns observed for light-duty vehicles and two-wheelers. This diversity calls for tailored emissions reduction strategies. Railways offer a glimmer of hope, with decreasing emissions despite significant infrastructure expansion.

Asia's transport decarbonization progress is lagging. Projections indicate a potential surge in emissions, driven by increased transport demand, particularly in freight. Urgent action is needed to overcome these challenges. Establishing a robust monitoring system with key performance indicators is crucial to track progress and inform policy decisions.

Ten emerging trends significantly influence transport emissions in Asia. These include:

1. Limited progress in reducing transport fossil fuel subsidies.
2. A significant transport infrastructure gap.
3. A widening gap between vehicle numbers and road capacity.
4. Asia is leading the electric vehicle revolution.
5. A bus crisis.
6. Stagnant bicycle trade.
7. A disproportionate climate burden on the Asian transport sector.
8. Slow renewable energy uptake in transport.
9. The Internet's complex impact on transport.
10. A significant increase in climate commitments, but insufficient long-term ambition for transport.

Policymakers can make informed decisions and course corrections by continuously evaluating these trends and leveraging improved data collection and analysis. This proactive approach is essential to ensure effective and adaptable strategies for curbing emissions growth and achieving the crucial decarbonization goals.

The COP29 discussions must prioritize addressing the urgent challenges facing Asia's transport sector. Bold and ambitious action is required to transition towards a sustainable, low-carbon transport system. The time for decisive action is now.

Tale of the Tape: Transport Emissions in Asia

1. Alarming Rise in Asia-Pacific Transport Emissions

The 2023 data on domestic transport CO₂ emissions in Asia and the Pacific region presents a stark reality for COP29 discussions. With emissions reaching an unprecedented 2.8 Gt CO₂, a worrying 6.6% increase or 174 Mt CO₂ compared to 2022, the region's transport sector now emits as much as Europe and Northern America combined. This alarming trend underscores the urgent need for decisive action to decarbonize transport in the Asia-Pacific region.

The Asia-Pacific transport sector plays a crucial role in global greenhouse gas emissions, accounting for 40% of global domestic transport sector carbon emissions. Since the implementation of the Paris Agreement, the region has seen annual growth twice as intensive as the worldwide average, contributing to roughly 83% of the global rise in transport fossil CO₂ emissions. This significant contribution underscores the urgent need for action to curb emissions in the Asia-Pacific region.

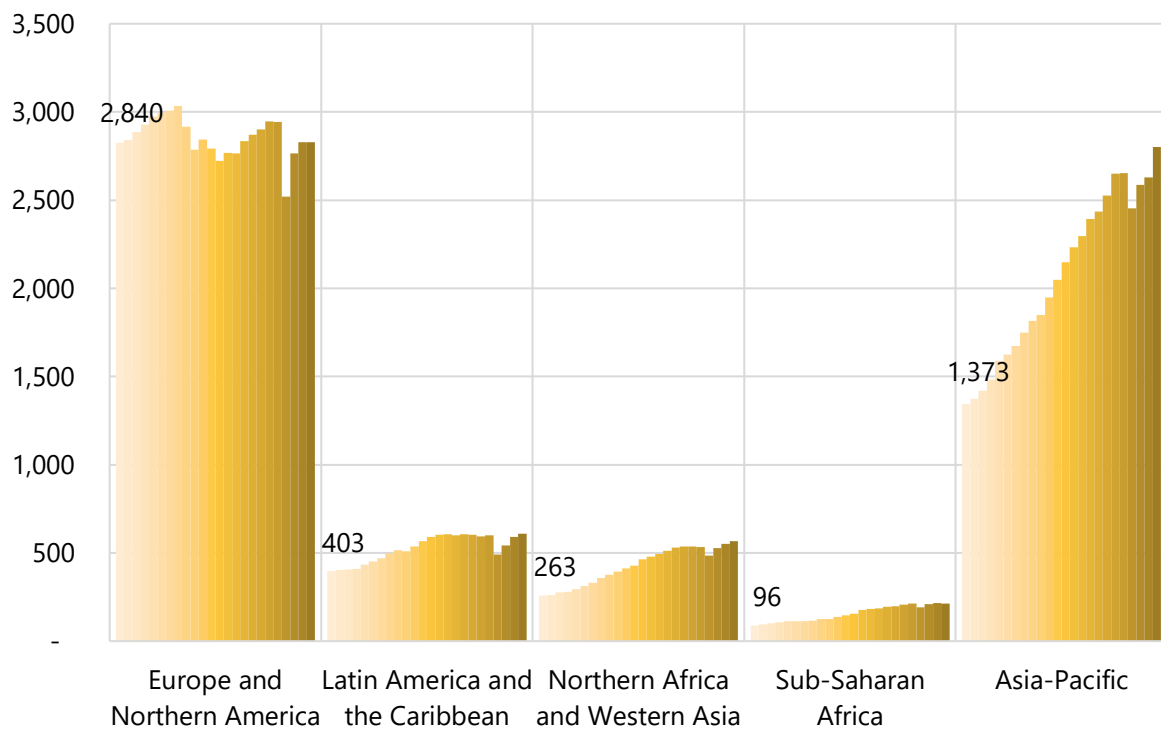


Figure 1: Domestic Transport CO₂ Emissions, 2000-2023, Million Tonnes of CO₂ Emissions

Source: (European Commission. Joint Research Centre & IEA., 2024)

2. Varying Emissions Landscape

Globally, the domestic transport sector represents 19% of total fossil CO₂ emissions, notably lower in Asia at 12%. However, the transport sector's share of total fossil emissions within Asia varies significantly depending on income levels. In Asian high-income economies, the transport sector contributes 19% of total

fossil emissions, mirroring the global average. In contrast, the transport sector in Upper middle-income economies contributes 10%.

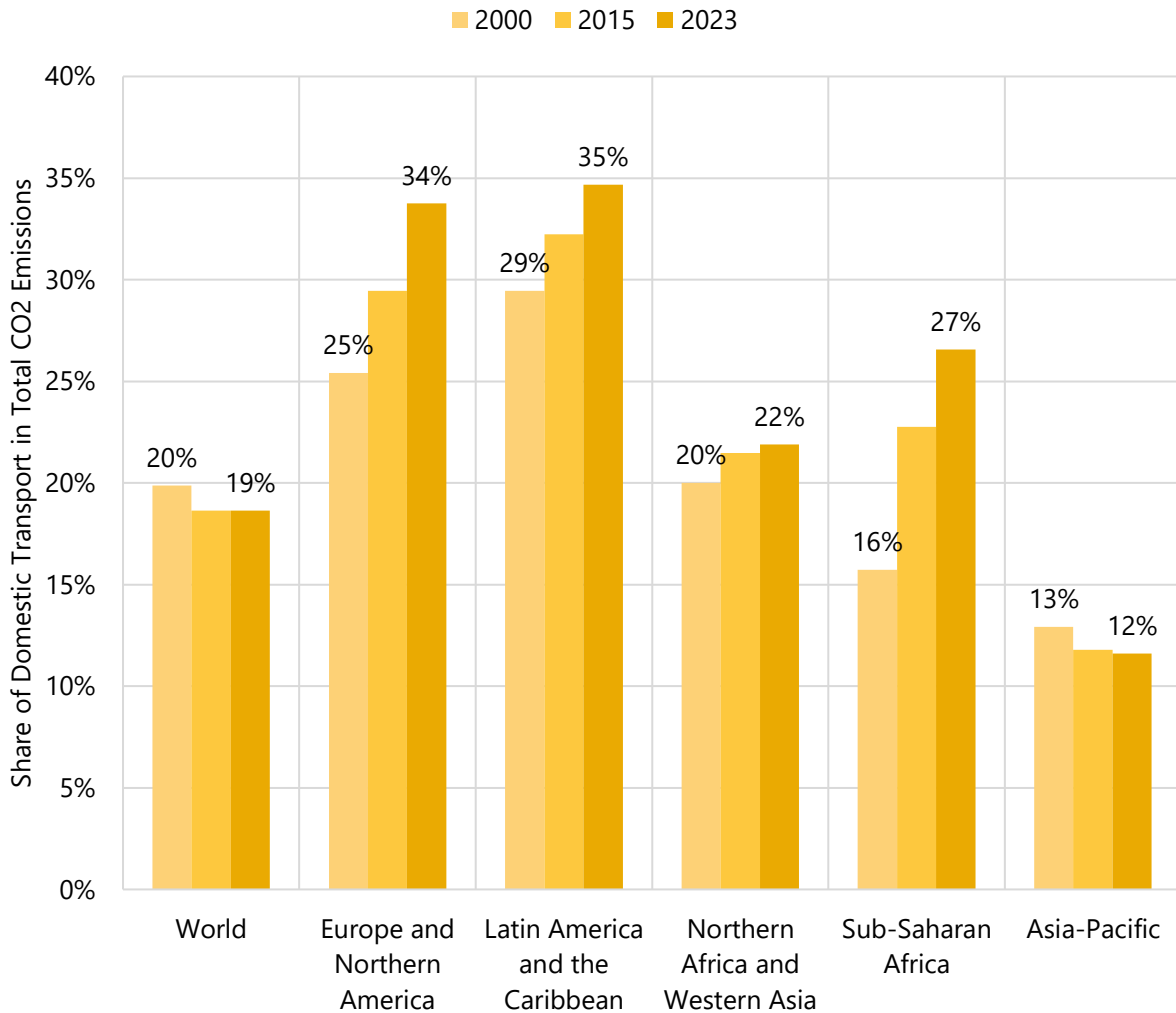


Figure 2: Share of Domestic Transport in Total CO2 Emissions

Source: (European Commission. Joint Research Centre & IEA., 2024)

3. Emissions Growth: A Tale of Two Asias

The emissions growth rate differs significantly between high-income and low- and middle-income Asian economies. The share of high-income economies in total transport CO2 emissions decreased from 36% in 2000 to 16% in 2022, suggesting their emissions growth intensity has been comparatively lower than that of upper and low- and middle-income economies.

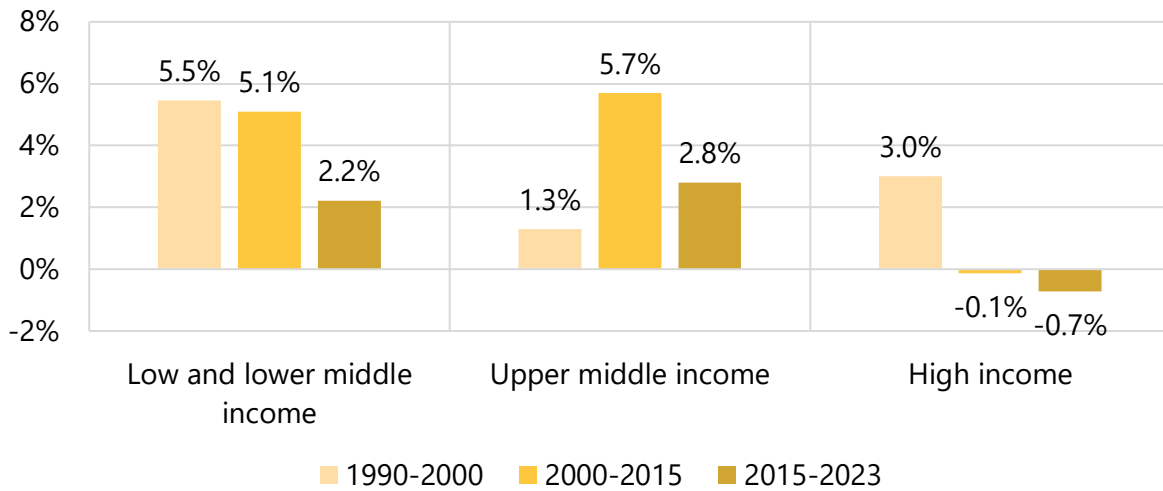


Figure 3: Transport Sector CO2 Emissions -Annual Growth

Source: (European Commission. Joint Research Centre & IEA., 2024)

Within Asia, distinct sub-regions have followed different growth trajectories. Transport-related carbon emissions surged between 2000 and 2018, then plateaued around 2018, with further disruptions from the COVID-19 pandemic. However, by 2023, the transport sector in most sub-regions had fully recovered and even surpassed 2018 levels, except for the Pacific sub-region.

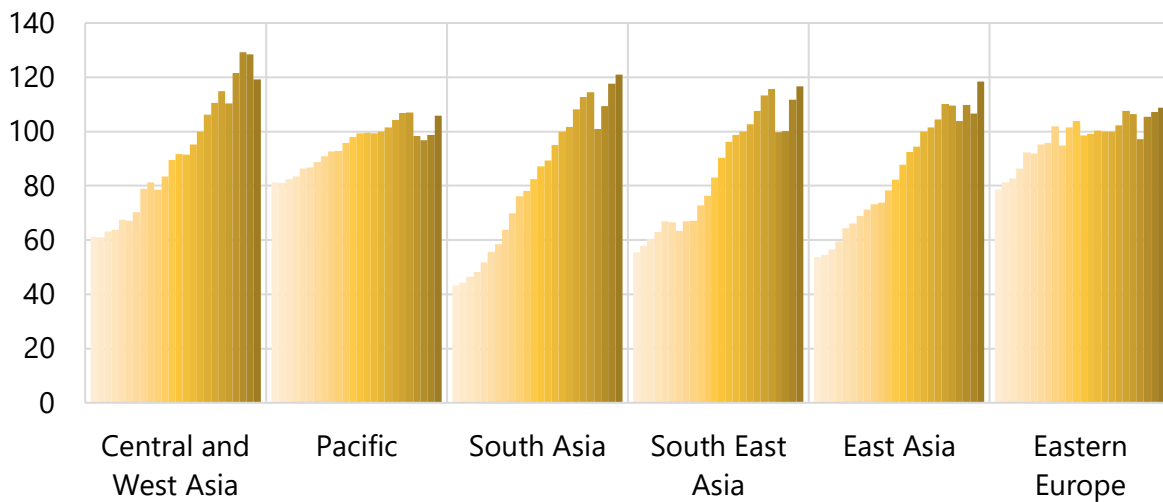


Figure 4: Transport CO2 Emissions, Assuming 2015=100

Source: (European Commission. Joint Research Centre & IEA., 2024)

4. Post-Paris Agreement: Transport Emerges as Key Emissions Driver in Asia

2023 witnessed a surge in emissions across all sectors in Asia, with transport being the most significant 6.6% relative increase. Despite being a rapidly expanding source of emissions, transport's growth rate aligns with that of the power and industrial sectors. As a result, transport's share of total emissions has remained relatively stable, hovering around 10-12% - a level consistent since 1970. Notably, since the implementation of the Paris Agreement, transport has become Asia's second-fastest growing emissions sector, surpassed only by the power sector. Overall, transport ranks as the energy sector's third largest source of emissions.

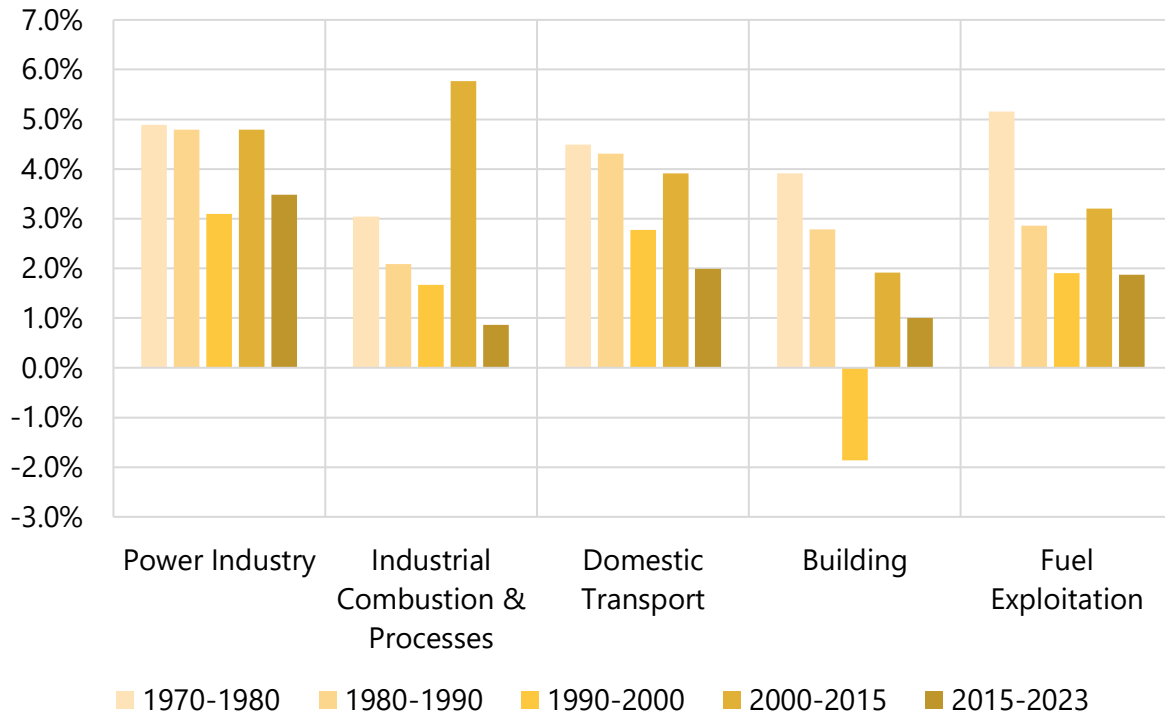


Figure 5: Asia, CO2 Emissions Growth

Source: (European Commission, Joint Research Centre & IEA., 2024)

5. Asia's Transport Emissions: Growth and Decoupling Trends Since the Paris Agreement

Following the Paris Agreement, Asian nations have experienced varying levels of success in decoupling their economic growth (GDP) from transport emissions. This mixed progress is attributed mainly to slow and uneven improvements in energy efficiency. Most of the region's high-income economies have achieved absolute decoupling, meaning their transport emissions have decreased even as their economies have grown. However, many upper-middle-income, lower-middle-income, and low-income economies have only attained relative decoupling. In these cases, transport emissions have grown slower than their GDP but have not yet decreased in absolute terms.

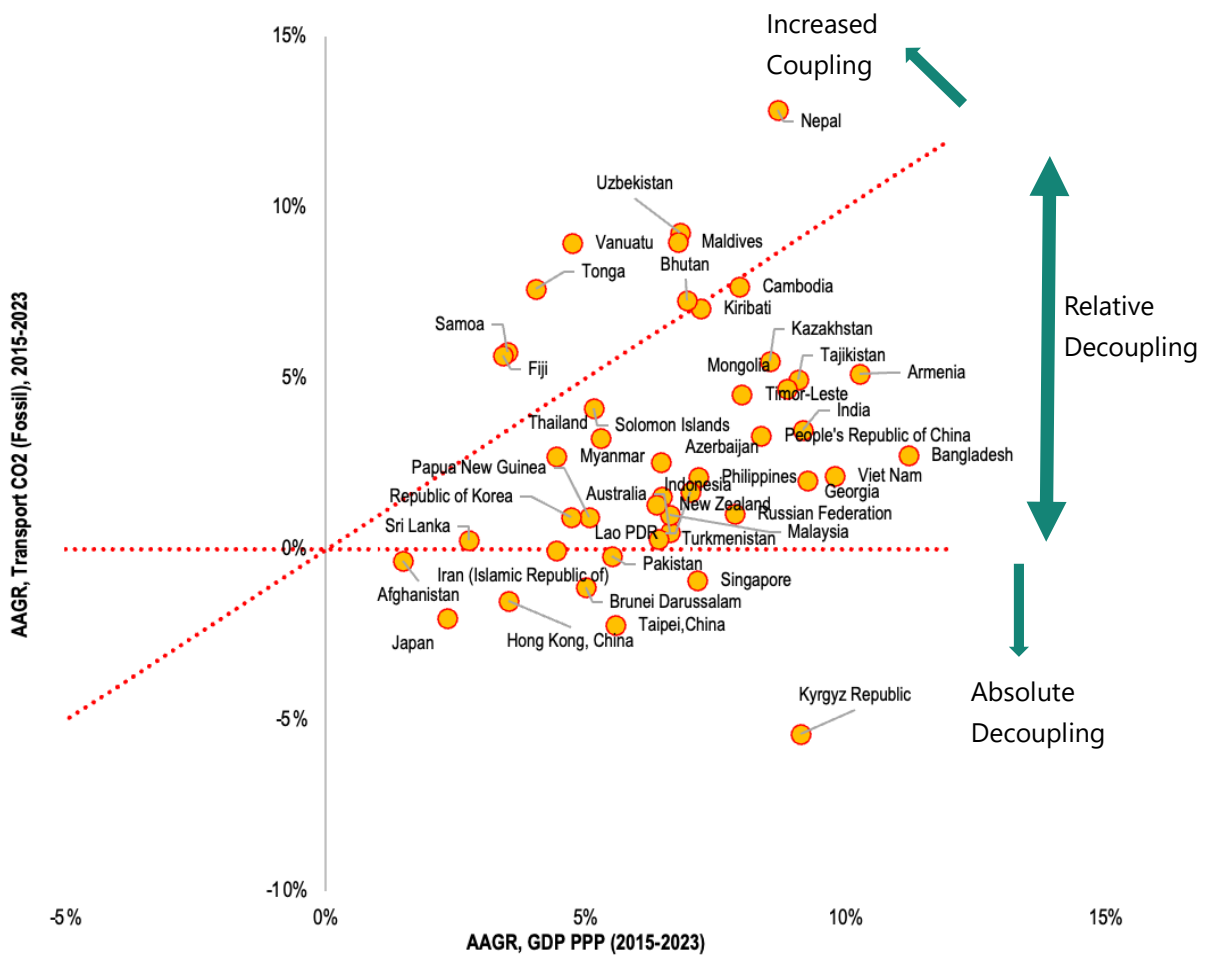


Figure 6: Annual average growth rate of transport CO2 (Fossil) emissions and GDP (PPP)

Source: (European Commission. Joint Research Centre & IEA., 2024)

6. Road Transport Dominates Emissions

In 2022, road transport remained Asia's primary source of transport-related carbon emissions, accounting for approximately 89% of the total emissions. Railways, domestic aviation, and inland waterways contributed considerably less, with shares of 1%, 5%, and 5%, respectively. Since 2000, fossil fuel emissions from road transport, rail transport, domestic aviation, and domestic navigation have increased annually by 3.2%, 0.7%, 2.9%, and 2.5%, respectively.

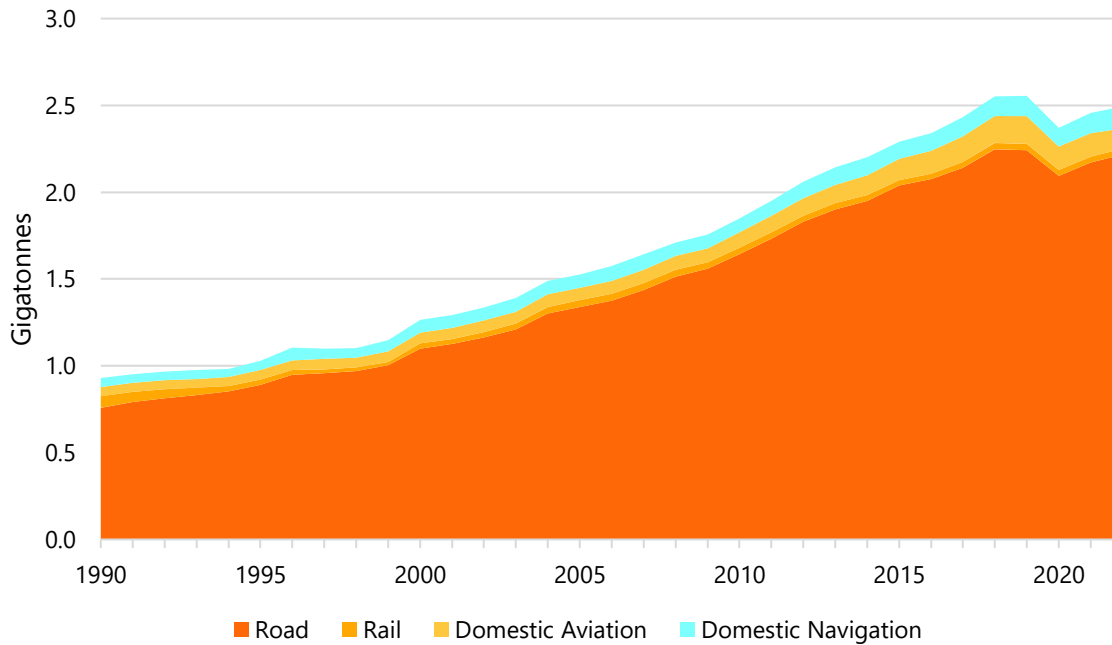


Figure 7: Transport fossil CO2 Emissions

Source: (Crippa et al., 2023)

7. Railways: A Glimmer of Hope

The railway sector is a notable exception to this upward trend. Fossil CO2 emissions from railways in Asia grew at an average annual rate of only 2% between 2000 and 2010 and then decreased at an average annual rate of -0.2% between 2010 and 2022. This reduction is particularly significant considering the substantial expansion of railway infrastructure by approximately 116 thousand kilometers in Asia between 2010 and 2021.

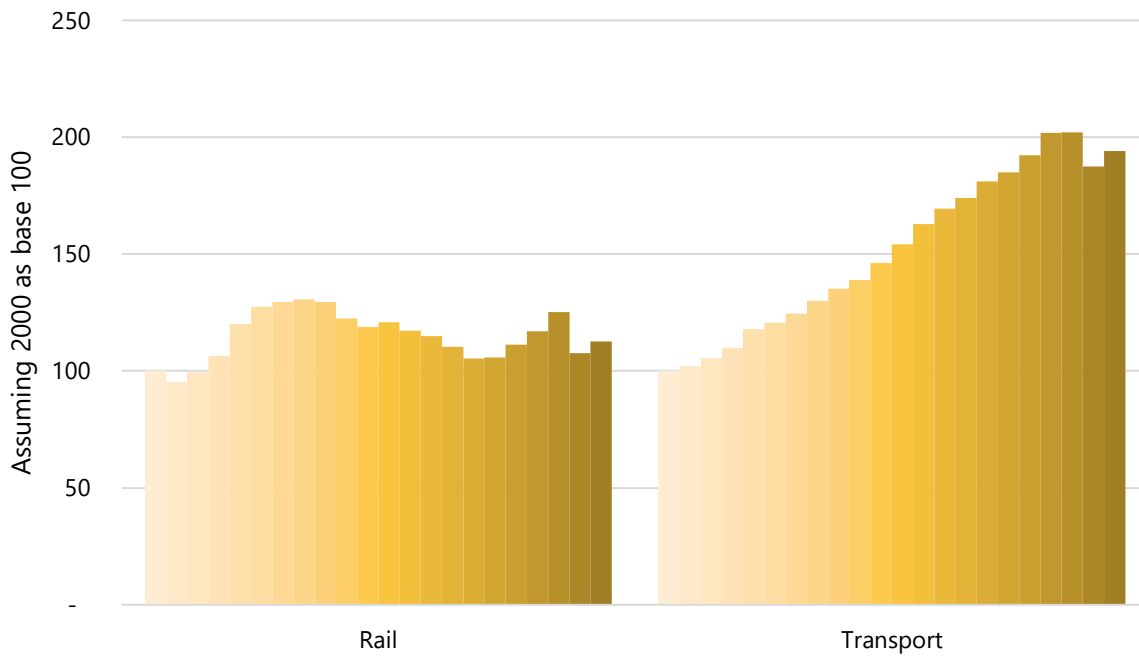


Figure 8: Fossil CO2 emissions 2000-2022

Source: (Crippa et al., 2023)

8. Road Transport Emissions: Diverse Patterns by Vehicle Type

The composition of carbon emissions from road transport in Asia reveals distinct patterns across different income levels. Light-duty vehicles, such as passenger cars, SUV's and taxis, consistently account for a significant share of road transport CO2 emissions. However, this share varies considerably, representing 55% of emissions in low- and lower-middle-income economies, 45% in upper-middle-income economies, and 41% in high-income economies. Two-wheelers' contribution, including motorcycles and scooters, also displays stark differences. While they account for a negligible 1% of emissions in high-income economies, their share rises to 4% in upper-middle-income economies and a substantial 14% in low- and lower-middle-income economies. These disparities highlight the diverse nature of road transport systems and the varying reliance on different vehicle types across income levels in Asia, which has important implications for targeted emissions reduction strategies.

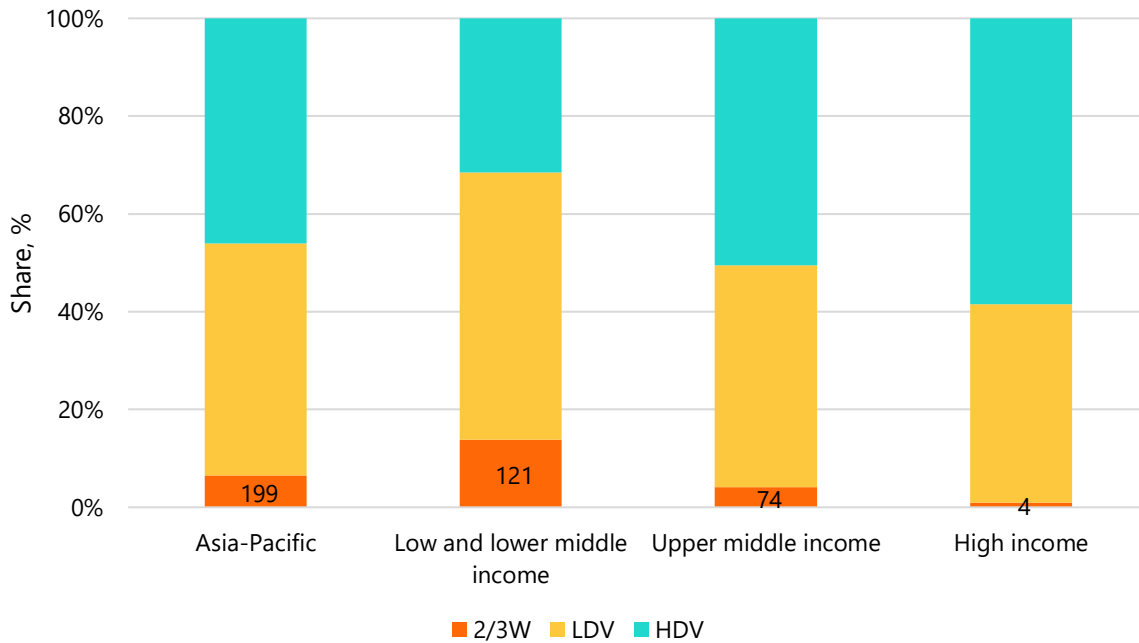


Figure 9: Road transport CO2 emissions share by sub mode

Source: (International Council on Clean Transportation, 2023)

9. Asia's transport decarbonization progress is lagging

Projections before the Paris Agreement painted a concerning picture, with transport CO2 emissions potentially reaching a staggering 7 Gt by 2050, primarily driven by low- and middle-income countries. While the Asian Transport Outlook's reference scenario suggests a less severe outcome, the current emissions trajectory indicates a high degree of incompatibility with scenarios that successfully achieve the Paris Agreement's climate goals.

This challenge is further compounded by the anticipated surge in transport demand, particularly in the freight sector. Current trends and policies point towards substantial transport activity growth, potentially outpacing population and infrastructure growth. Projections from the International Transport Forum and Asian Transport Outlook suggest that passenger and freight transport demand could double or even quadruple between 2020 and 2050. This alarming growth trajectory implies that Asia alone could be responsible for roughly half of the global increase in transport demand.

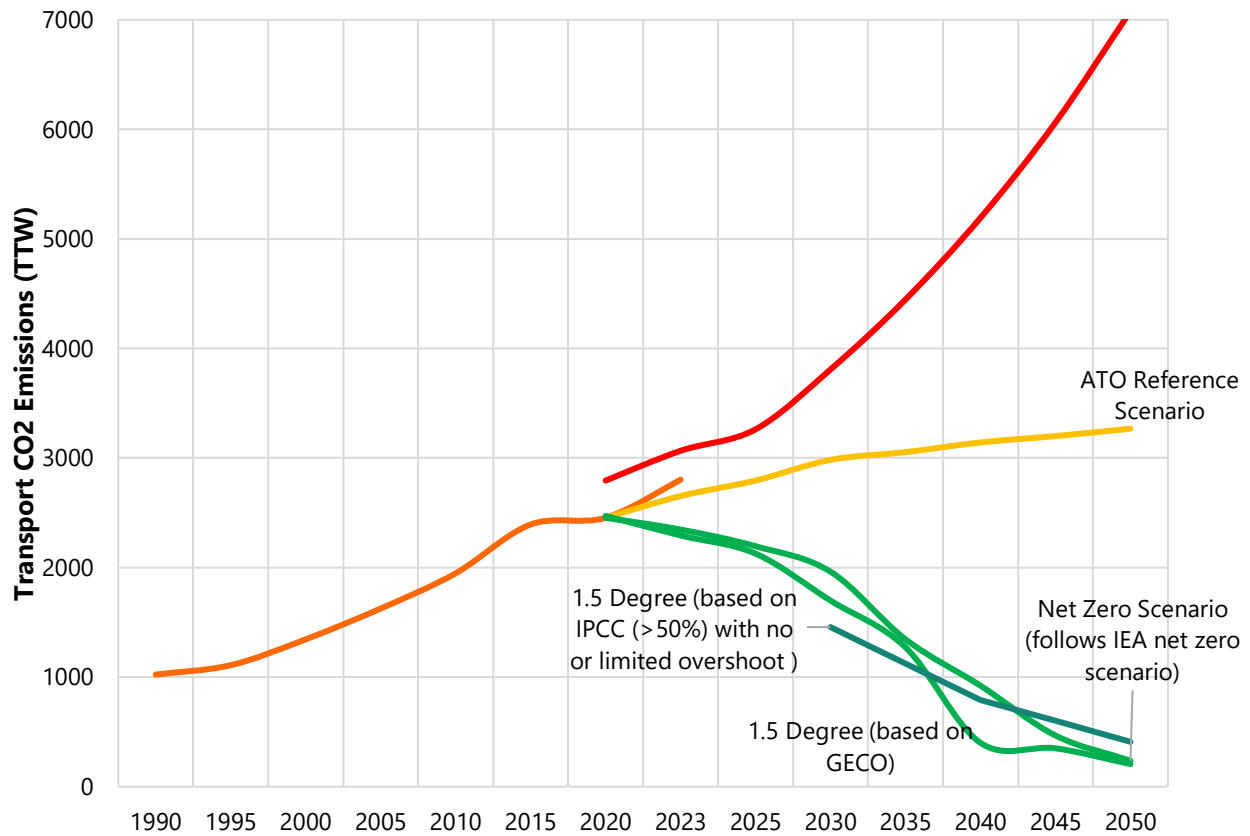


Figure 10: Transport CO2 Emissions in Asia

Source: ATO Estimates

The current trajectory of transport emissions in Asia poses a significant hurdle to achieving the essential decarbonization goals. Urgent and ambitious action is required to overcome this challenge. A crucial step in this direction is establishing a robust monitoring system focused on key performance indicators (KPIs). This system should track various aspects influencing emissions, such as changes in transport activity, modal share, fuel efficiency improvements, electric vehicle adoption rates, and the impact of policies and investments to decarbonize the transport sector. However, it's essential to acknowledge that data availability limitations, particularly at the individual country level, can pose challenges in identifying and tracking all relevant KPIs.

In the subsequent section, we utilize the available data to spotlight ten key emerging trends that are significantly influencing transport emissions in Asia. By continuously evaluating these trends and supplementing them with more profound insights garnered through improved data collection and analysis, we can equip policymakers with the tools to make informed, data-driven decisions and course corrections. This proactive approach will be essential in ensuring that strategies aimed at curbing emissions growth remain both effective and adaptable in the face of an ever-evolving landscape.

10. Transport Decarbonisation in Asia is left Behind

If we juxtapose the progress towards decarbonisation of the transport sector against the progress towards other important goals such as the reduction in transport air pollution loading and road safety fatalities, we see that there is progress being made towards achieving the latter goals, but the region is regressing in relation to the decarbonisation of the transport sector.

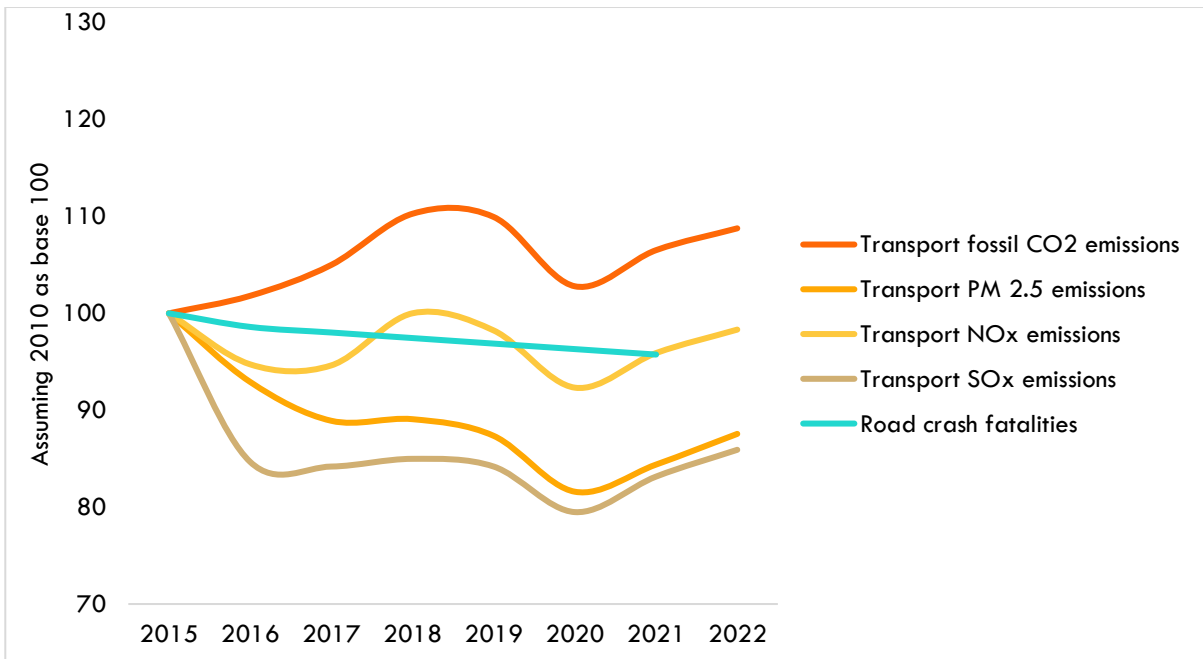


Figure 11: Transport Fossil CO2 vs Other Indicators

Source: (European Commission. Joint Research Centre & IEA., 2024 and ATO estimates)

Emerging Trends Shaping Transport Sector Decarbonisation and Adaptation in Asia

1. Trends in Transport Fossil Fuel Subsidies in Asia

Although Asia's share of global transport fossil fuel subsidies increased from 32% in 2010-2015 to 44% in 2015-2022, indicating more successful subsidy reduction efforts in other regions, Asian policymakers have made notable progress in curbing these subsidies within their transport sectors compared to other sectors. The transport sector's share of total fossil fuel subsidies in Asia decreased significantly from 22% in 2014 to 14% in 2022. This positive trend occurred despite the global surge in fossil fuel subsidies, which surpassed \$1 trillion in 2022 due to energy market disruptions and inflated international fuel prices.

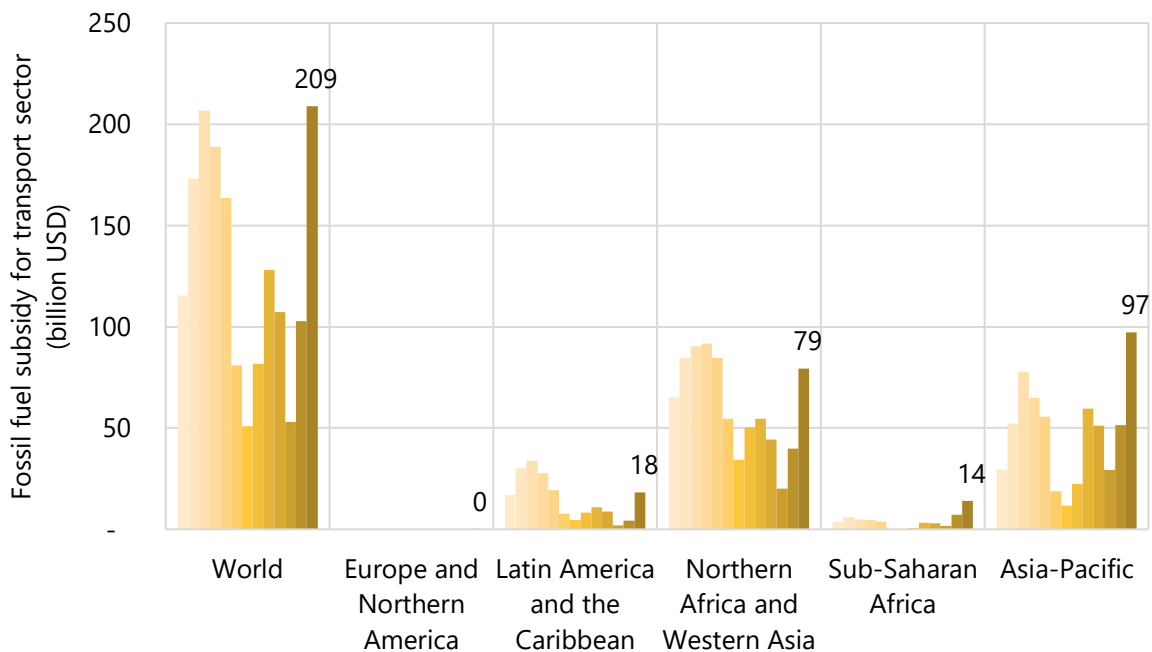


Figure 12: Fossil fuel subsidy for transport sector (billion USD) (2010 – 2022)

Source: (International Energy Agency (IEA), n.d.)

2. Transport Infrastructure Gap in Asia-Pacific

Despite housing over half of the world's population, the Asia-Pacific region possesses only 38% of global transport infrastructure, creating a significant gap. Although impressive road development has occurred in recent decades, with 10 million kilometers added, heavy rail and rapid transit expansion has lagged considerably, with only 100,000 km and 12,000 km added, respectively. While Asia has led global road construction and rail expansion since adopting the Sustainable Development Goals (SDGs) in 2015, this growth is unevenly distributed, leaving many subregions with inadequate infrastructure. Consequently, the region's rail infrastructure remains insufficient, with significantly lower per capita availability than Europe and North America.

The lack of access to transport, particularly in urban and rural areas, presents a major challenge, impacting over 1.8 billion people. In urban areas, only 4 out of 10 residents have convenient access to public transit, leaving approximately 1.4 billion people without efficient options. Though rapid transit investments have expanded networks, the gap persists. In rural areas, 18% of the population, or 400 million people, lack all-season road access, hindering connectivity and economic opportunities.

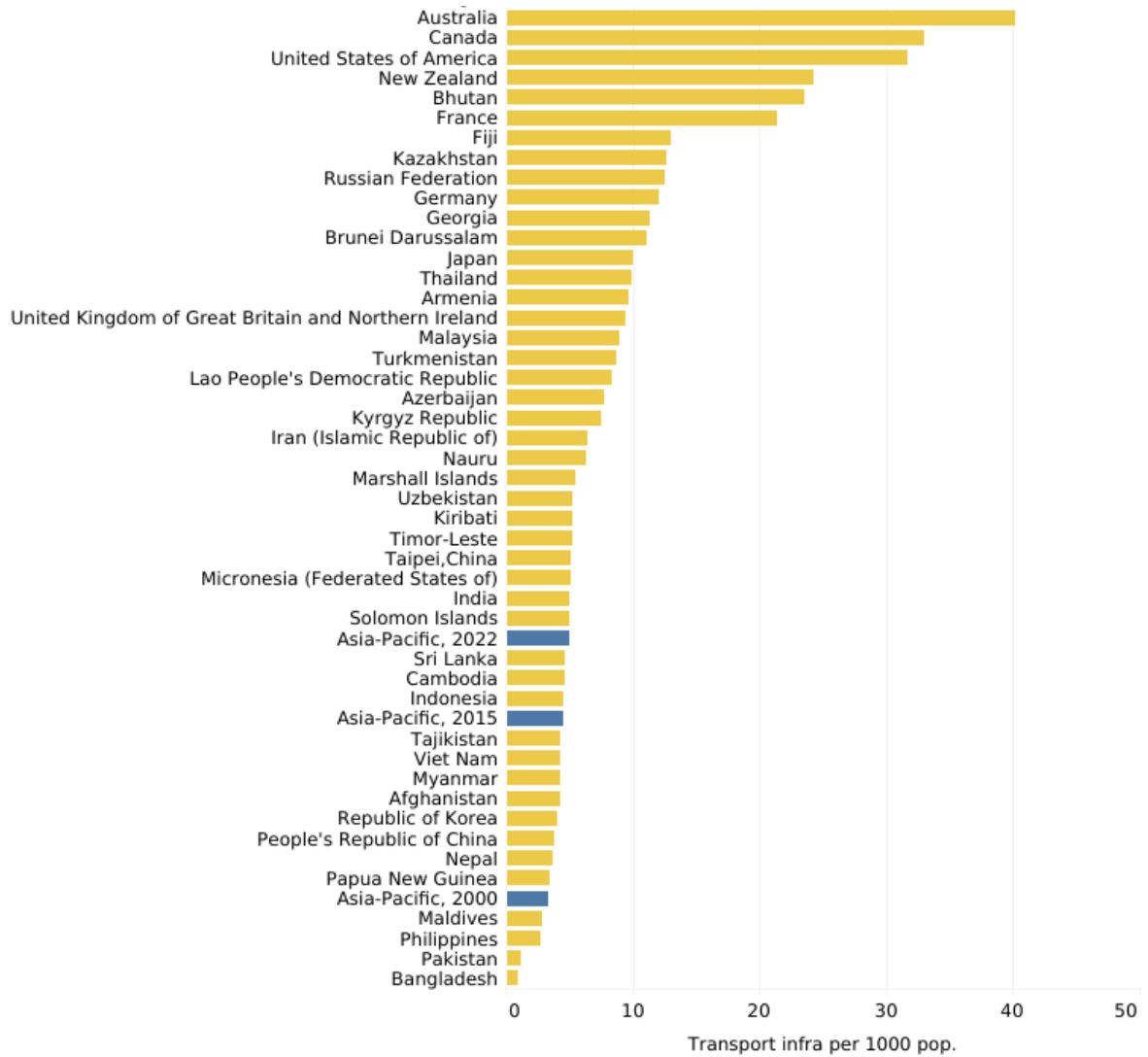


Figure 13: Transport infrastructure availability per thousand population (including road, heavy rail, HSR, and urban rapid transport)

Source: ATO visualization based on country official statistics, UIC, ITDP

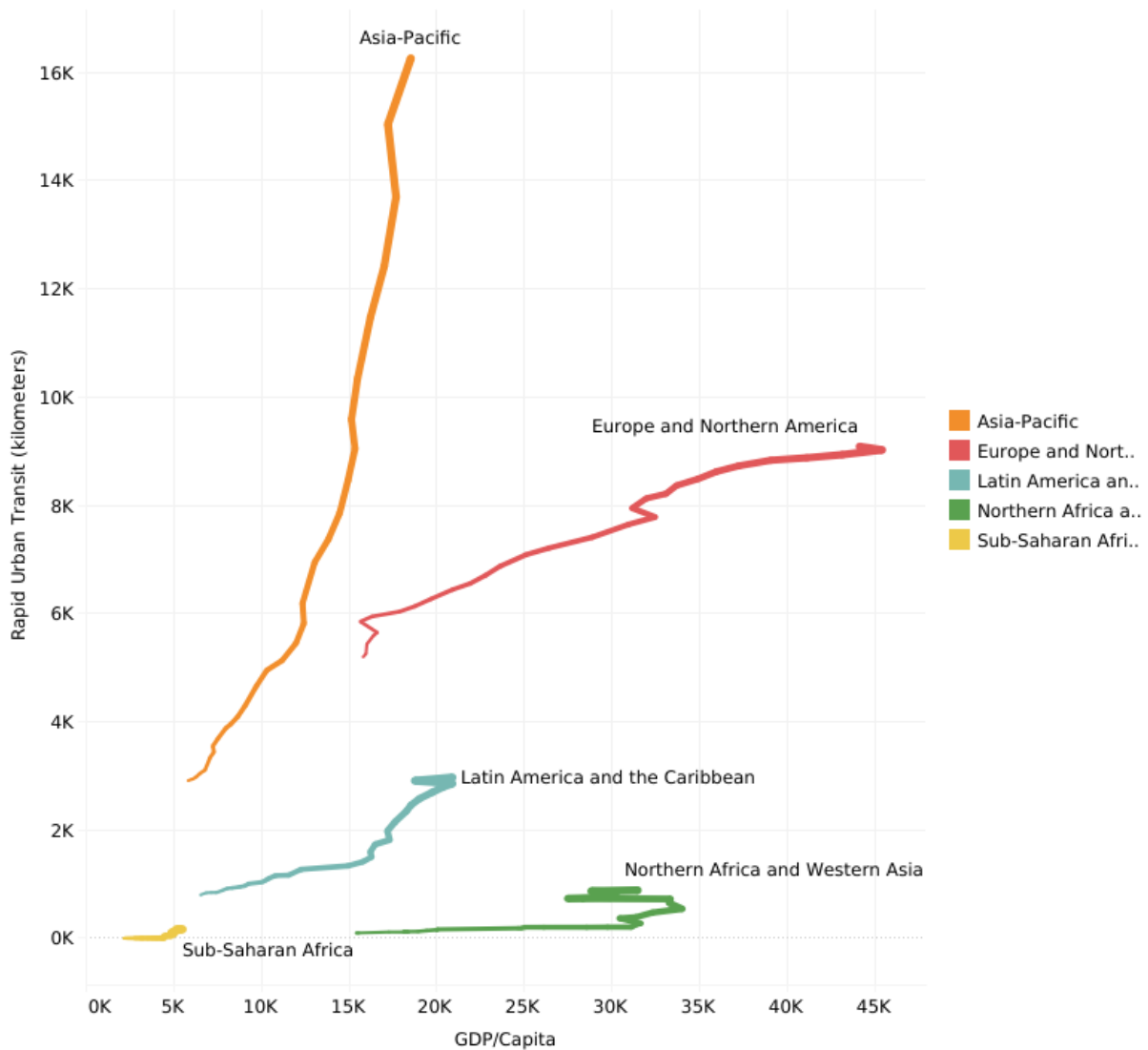


Figure 14: Rapid urban transit and GDP/ capita

Source: ATO visualization based on country official statistics

3. The Widening Gap: Vehicle Numbers vs. Road Capacity in Asia

Asia has witnessed a dramatic surge in vehicle ownership, with about 1 billion additional vehicles added to the roads between 2000 and 2023. Although road construction efforts have intensified, expanding at 2.5% annually since 2010, this growth is outpaced by the staggering 7.3% annual increase in vehicle ownership. Despite ongoing infrastructure development, the rapid rise in vehicles is placing immense pressure on existing road networks.

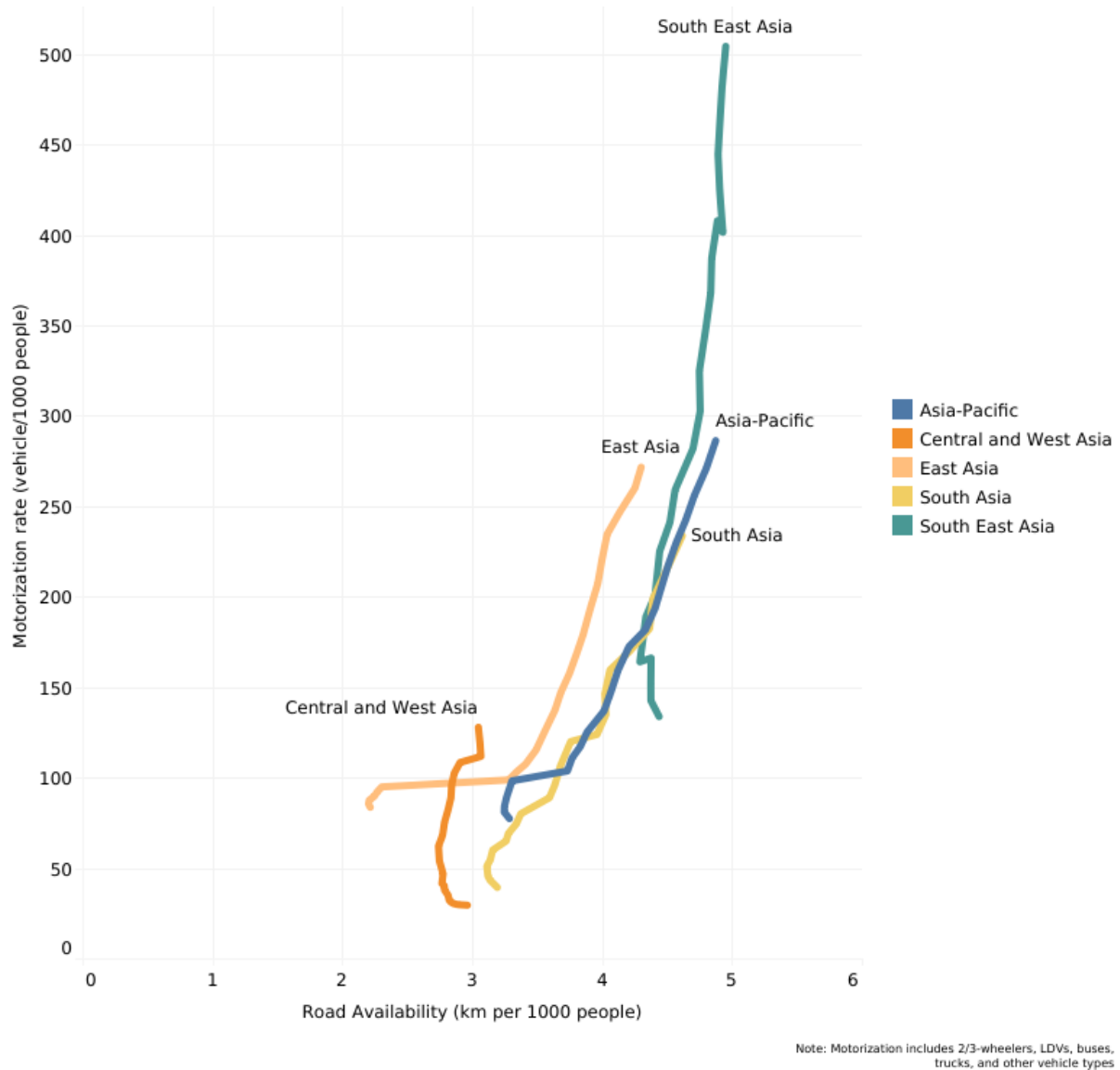


Figure 15: Motorization rates and road availability

Source: ATO visualization based on country official statistics

4. Asia: The Epicentre of the Electric Vehicle Revolution

Asia stands as the undisputed epicentre of the global electric vehicle (EV) revolution. The region has witnessed a phenomenal surge in EV adoption, accounting for an impressive 60% of the increase in electric cars and an overwhelming 90% of the growth in electric buses worldwide between 2015 and 2023. This trend is mirrored in Asia's flourishing EV trade, with imports increasing ninefold from \$3 billion in 2017 to \$27 billion in 2023. Furthermore, Asia commands a dominant position in EV exports, holding a 34% share of the global market in 2023. While a significant portion of this trade involves two- and three-wheelers with lower economic value, underrepresenting the actual intensity of growth, it's worth noting that Asia is estimated to be home to roughly 90% of the world's electric two- and three-wheelers. These further cements its leadership in the shift towards electric mobility. China, in particular, has been a critical driving force, spearheading the adoption of electric cars and buses across the region.

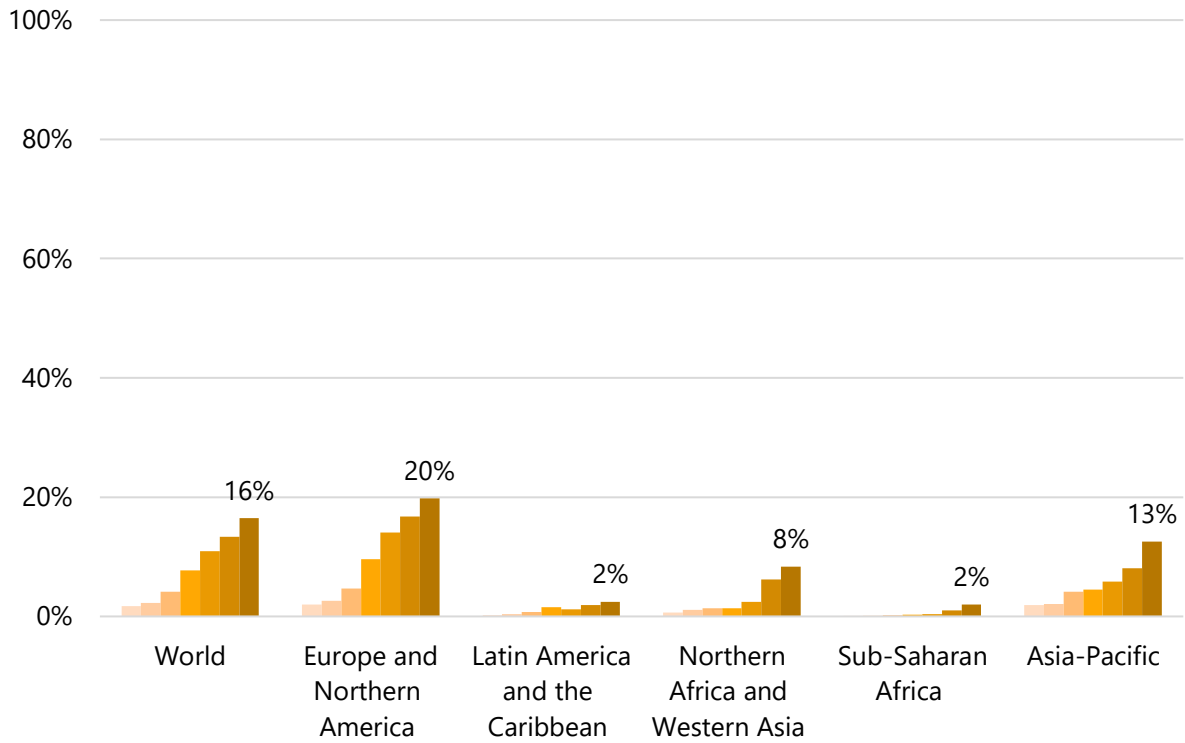


Figure 16: Share of Electric (including hybrid) in road vehicle imports (2017 – 2023)

Source: (International Trade Centre, n.d.)

Asia's dominance in the EV revolution extends beyond mere trade figures. The region demonstrates high readiness for a full-scale transition to electric mobility. Increasing supportive policies, robust financing mechanisms, infrastructure creation, and widespread access to EV technology have created a fertile ground for the rapid expansion of the electric vehicle market. This comprehensive ecosystem positions Asia at the forefront of the global shift towards sustainable transport.

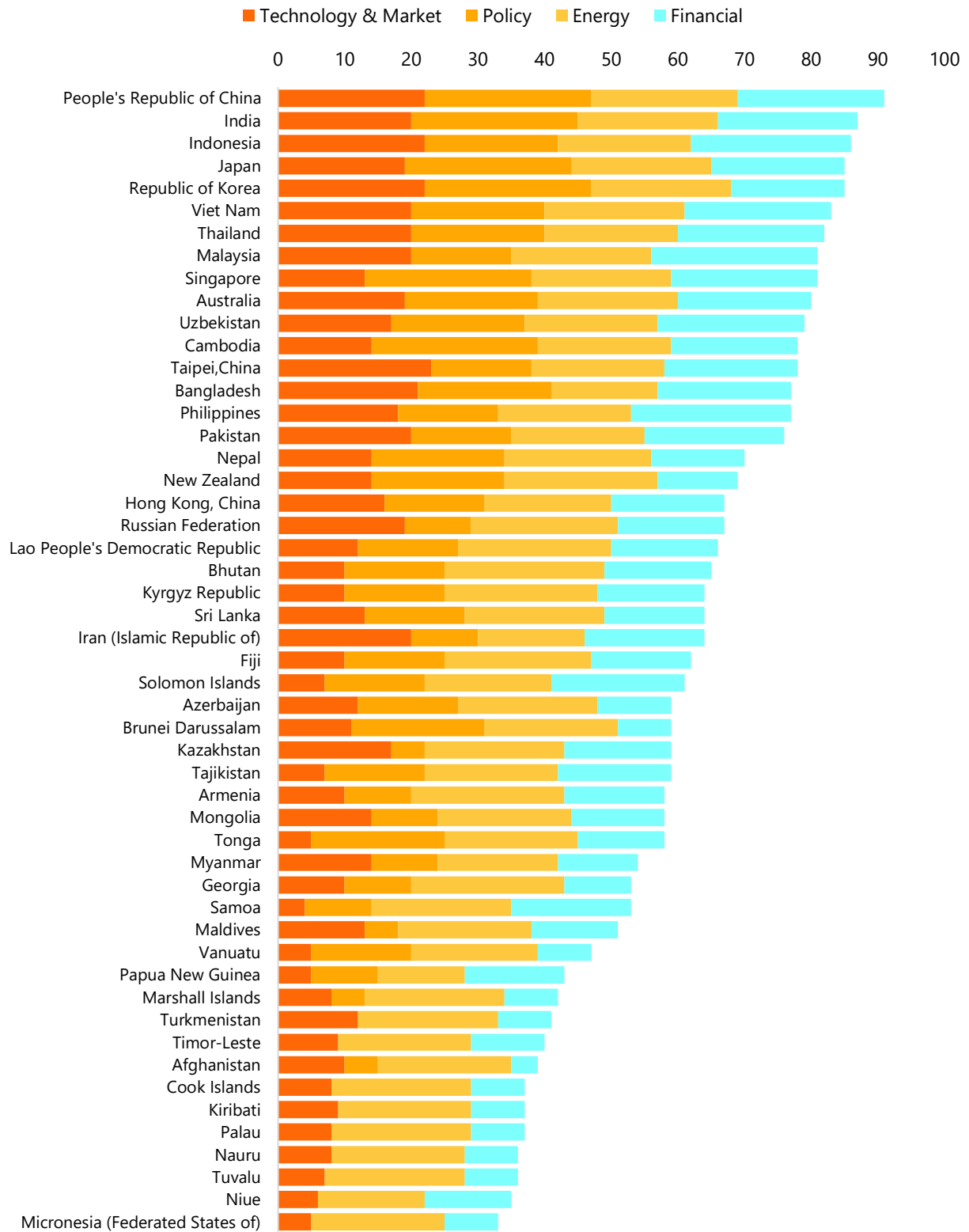


Figure 17: E-mobility Readiness Index

Source: ATO analysis of UNEP Index using latest data

5. Bus Crisis

The transport sector in Asia is facing a stark bus crisis, highlighted by a contrasting trend compared to other vehicles. Following the Paris Agreement, production figures between 2015 and 2022 reveal a concerning 44% decline in bus manufacturing, while other vehicle production increased by 3%. Imports between 2015 and 2023 further illustrate the disparity, with a 7% growth in bus imports dwarfed by a 53% surge for other vehicles. Despite these challenges, bus registrations between 2015 and 2022 saw a moderate increase of 16%, indicating a growing demand unmet by production and import levels. Meanwhile, other vehicle registrations experienced a substantial 56% rise. This data paints a picture of a bus sector struggling to keep pace with the growing transportation needs in Asia, calling for urgent attention and investment to avoid a deepening crisis.

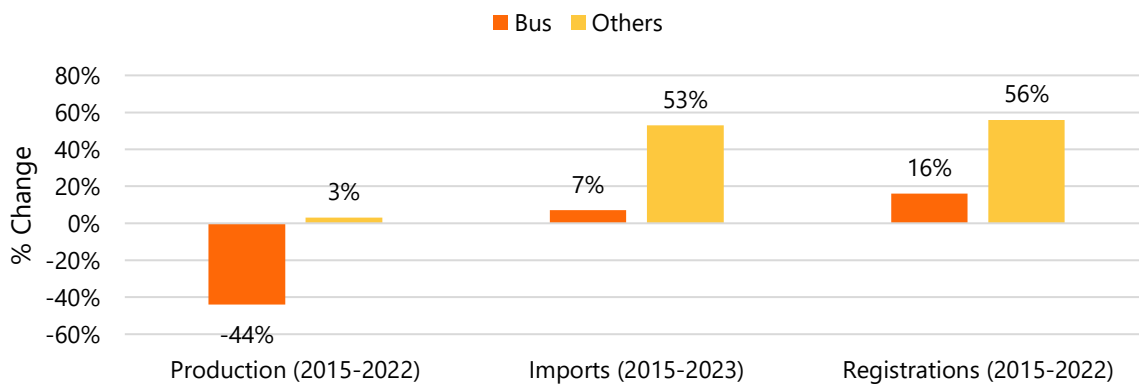


Figure 18: % Change in Production, Importation, Registration (bus and other vehicles)

Source: (International Trade Centre, n.d.; OICA, 2024)

6. Stagnant Bicycle Trade

Unlike the motorized vehicle sector, the bicycle trade in Asia has struggled to rebound from the COVID-19 pandemic. While motorized vehicles have significantly recovered, bicycle imports have only experienced a marginal 1.4% growth since the Paris Agreement in 2023. Furthermore, bicycle exports have taken a significant hit, plummeting by 17%. This stark contrast highlights the challenges faced by the Asian bicycle industry in regaining its pre-pandemic strength.

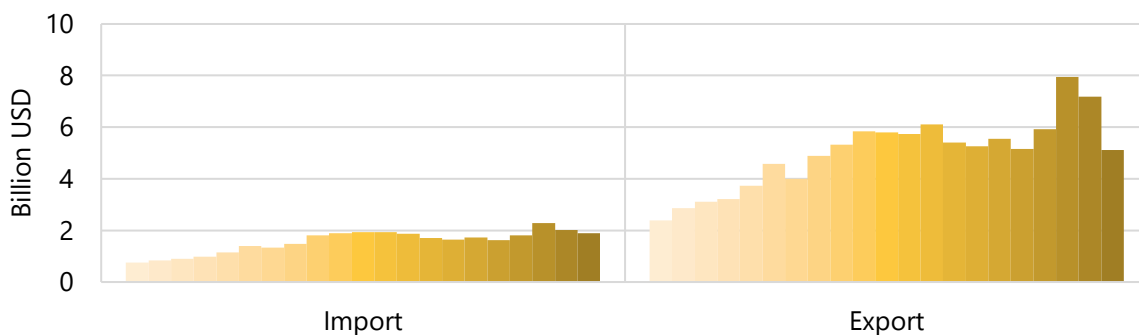


Figure 19: Asia bicycle trade (2003 - 2023)

Source: (International Trade Centre, n.d.)

7. Asia's Disproportionate Climate Burden

Despite possessing nearly 38% of the world's transport infrastructure, Asia faces a disproportionate impact from climate and natural hazards, enduring an estimated 60% of the annual damage caused by these events. The potential average annual losses to transport infrastructure in Asia ranges to as low as less than a million USD up to 24 billion USD reaching as high as 0.4% of the country's GDP. Within the transportation sector, railways are particularly vulnerable. Although they constitute only about 2% of the total infrastructure, railways shoulder a substantial burden when it comes to estimated economic losses due to climate hazards, accounting for 25% to 39% of the average annual economic loss.

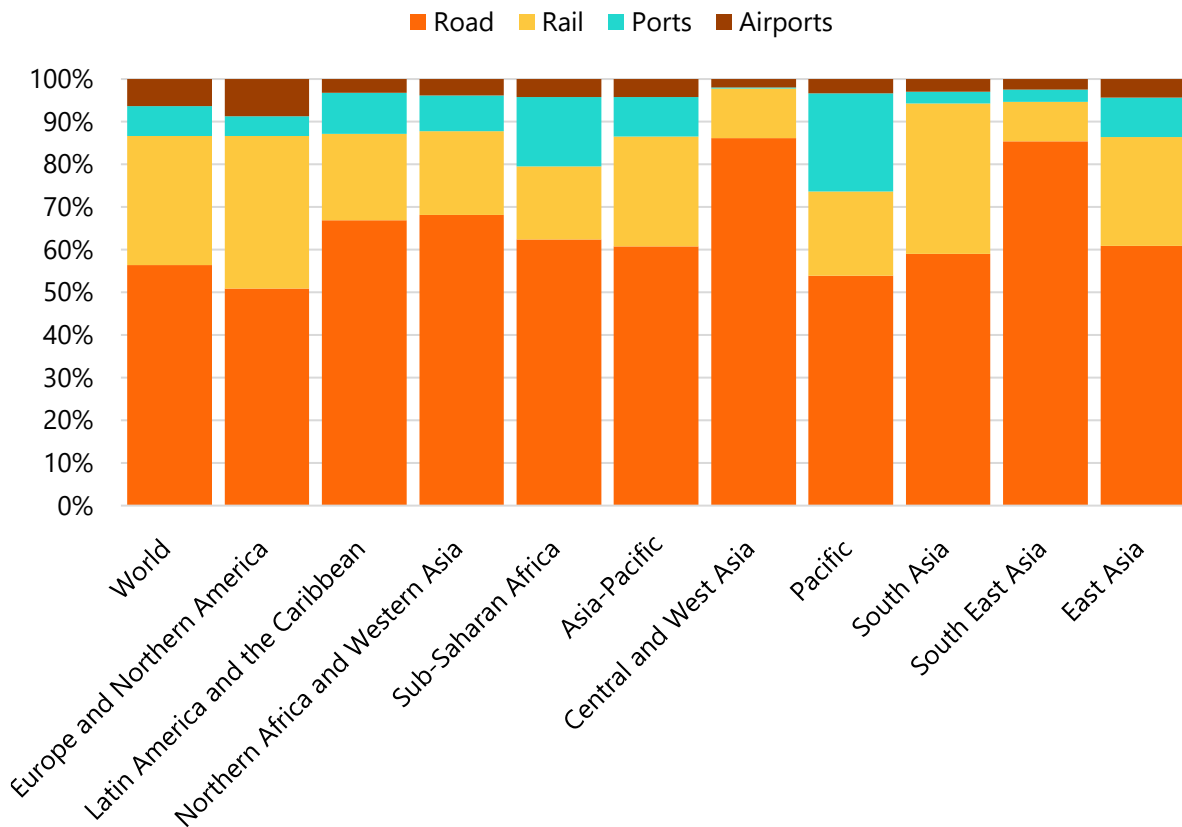


Figure 20: Multi - Hazard Expected Annual Damages to Transport Infrastructure distributed by mode

Source: (CDRI, n.d.)

8. Slow Renewable Uptake in Asia-Pacific Transport

The Asia-Pacific region saw a minor increase in the use of renewable energy for transport, reaching a mere 3% in 2021, up from 1.6% in 2015. The transport sector continues to lag behind other sectors in terms of energy diversification despite the availability and potential of alternatives such as electrification, renewable hydrogen, biofuels, biomethane etc.

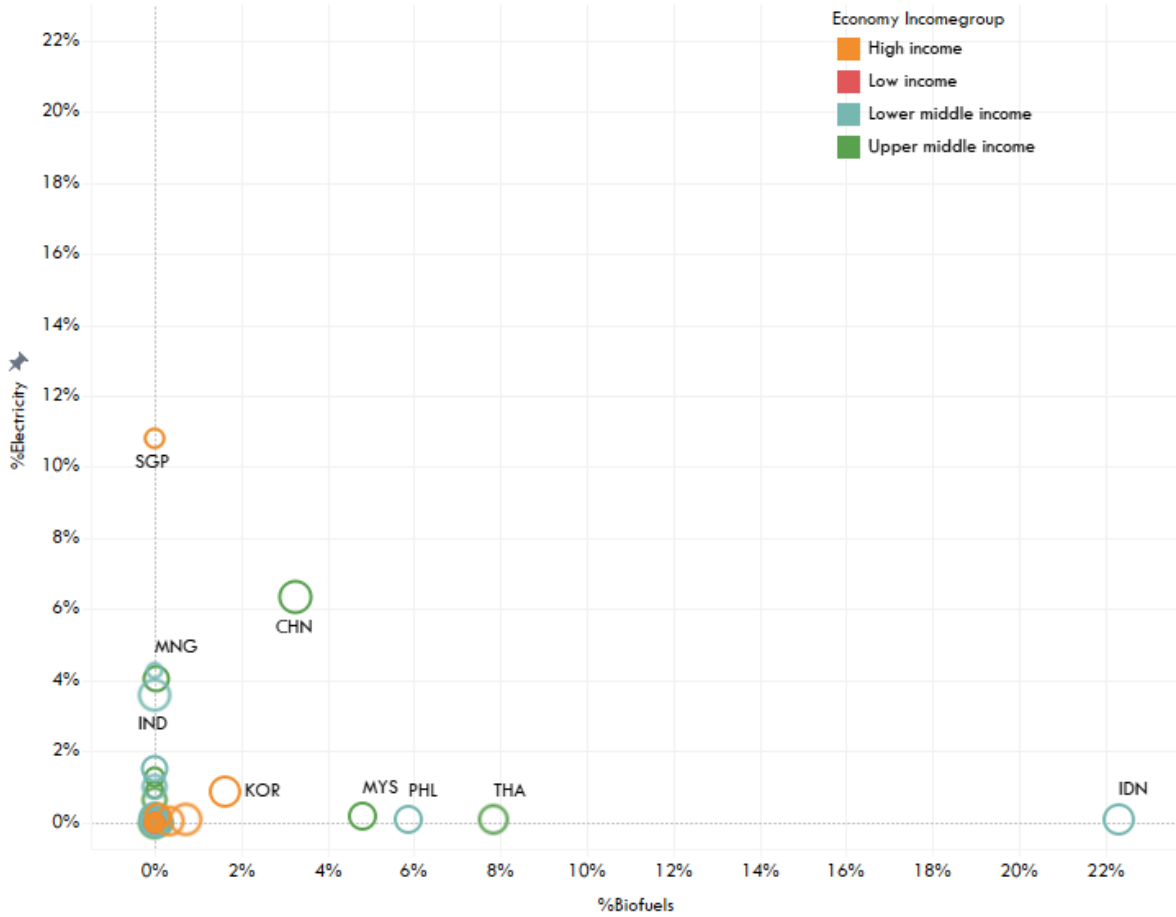


Figure 21: Transport energy consumption - share of electricity and biofuel

Source: (IEA et al., 2024)

The Asia-Pacific region lags the global average in utilizing renewable energy for electricity generation, achieving only 29.5% compared to the global 35%. This disparity underscores the region's slower shift towards clean energy sources for power production. Despite this, there has been progress, with the average grid emission factor decreasing from 635 gCO₂/kWh in 2015 to 581 gCO₂/kWh in 2022.

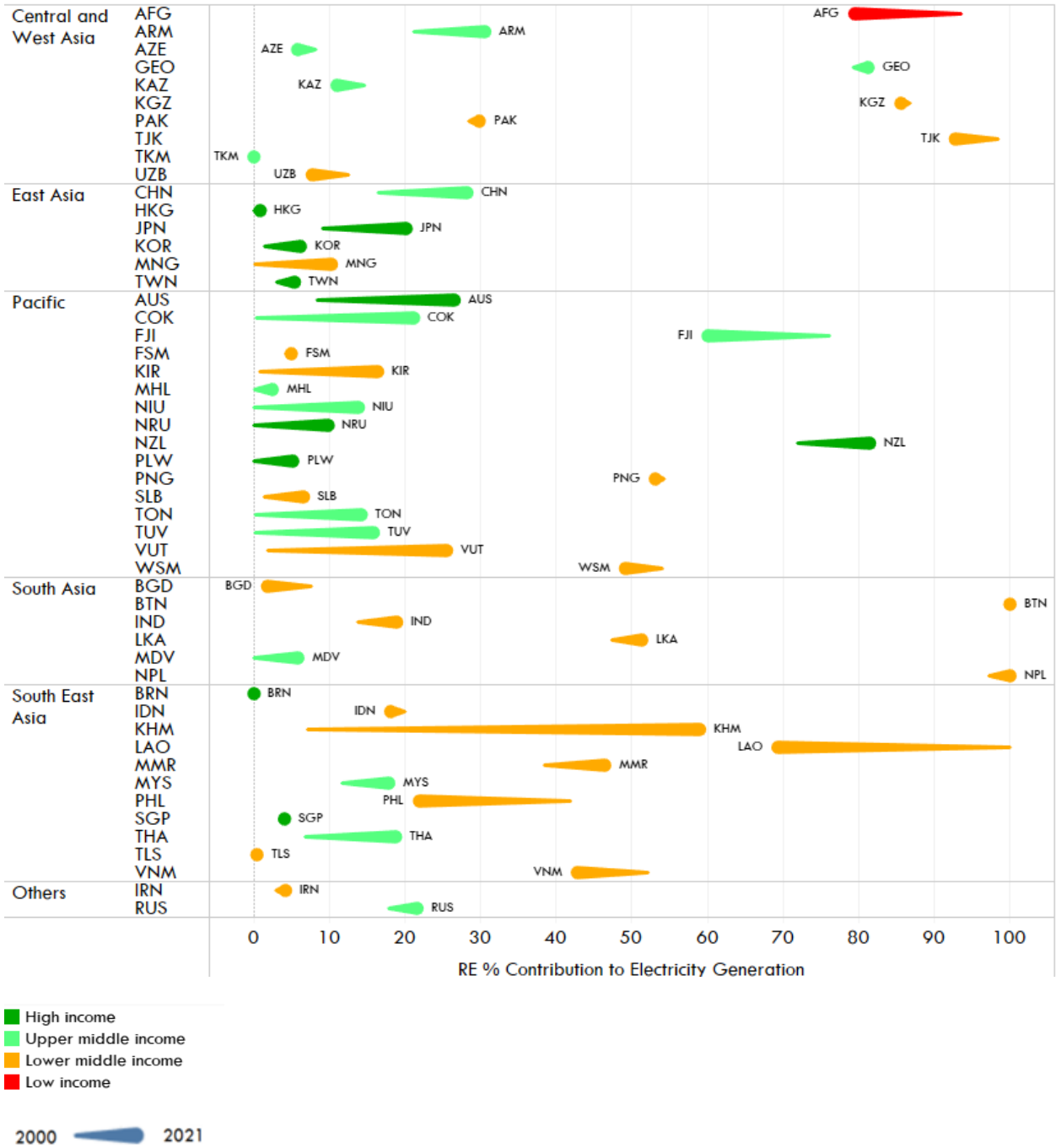


Figure 22: Share of renewables in electricity generation (2000 – 2021)

Source: ATO visualization based on (International Renewable Energy Agency, 2024)

9. Asia's Internet Boom: Reshaping Transport

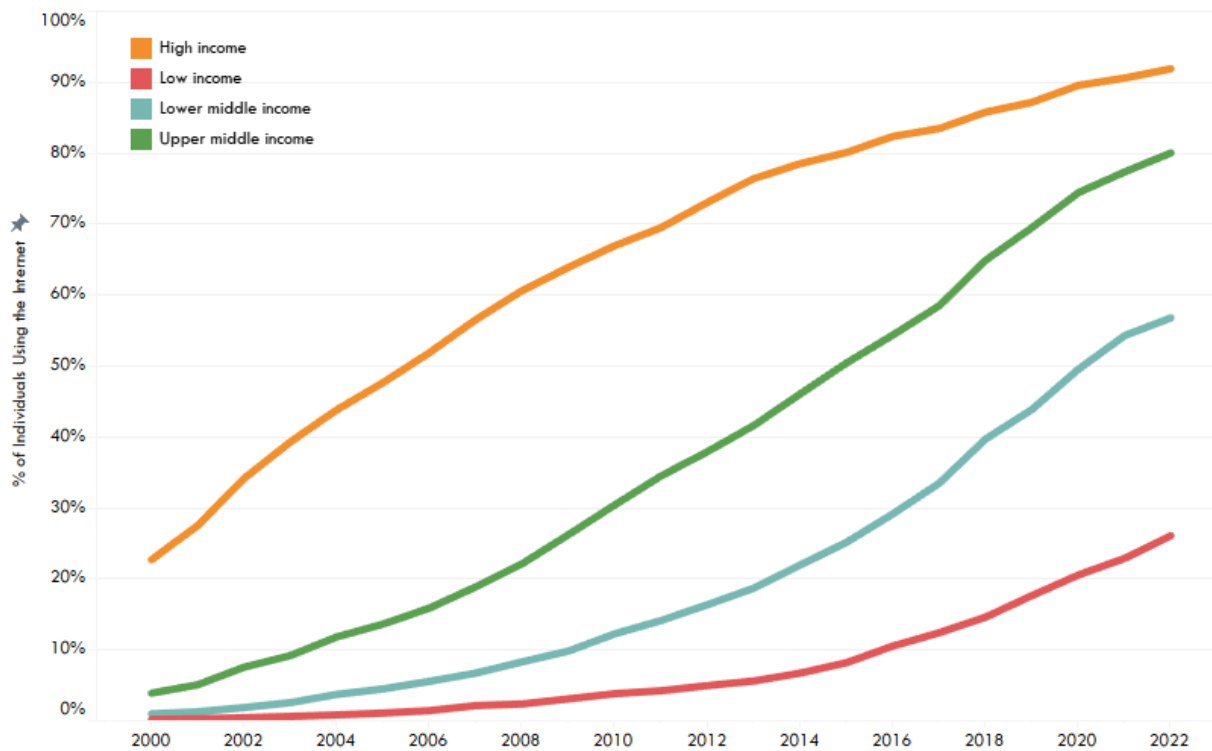


Figure 23: Percentage of individuals using the Internet

Source: (ITU, n.d.)

Asia has seen a dramatic increase in internet usage, from 9% in 2000 to 71% in 2022. This digital revolution is transforming transport in complex ways. The internet enables remote work and online services, potentially reducing travel demand. Telecommuting is gaining traction, with estimates suggesting nearly 15% of Asian jobs could be done from home, easing urban congestion and pollution. The rise of e-commerce and online delivery platforms has fuelled urban freight traffic. While 25% of the global population over 15 shopped online in 2017, only 22% did so in Asia, indicating growth potential and its associated impact on transport.

10. Asia's Climate Turnaround: Can Transport Catch Up?

The Asia-Pacific region has witnessed a dramatic shift in its commitment to addressing climate change. In 2015, less than 1% of the region's population resided in countries with ambitious long-term climate goals. However, by 2024, this number increased to a remarkable 93%, highlighting a substantial increase in climate ambition.

Despite this progress, the transport sector in Asia-Pacific still lags in terms of long-term climate mitigation efforts. Currently, only 10% of the region's population lives in countries with explicit greenhouse gas emission reduction targets for the transport sector outlined in their Nationally Determined Contributions (NDCs). However, there is a silver lining: at least 76% of the population resides in countries with indirect transport-related targets with various intensities within their NDCs.

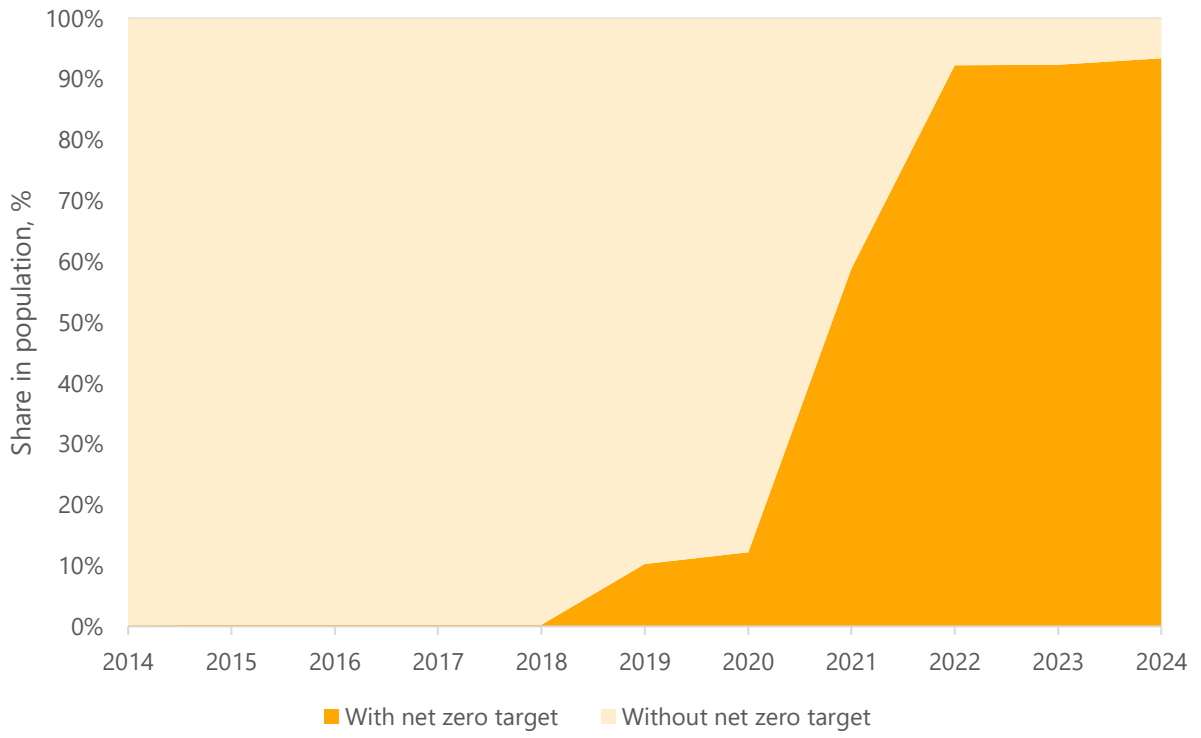


Figure 24: Asian countries with net zero targets, share in population

Source: ATO Visualization based on ATO's policy tracker

The Way Forward

In conclusion, the 2023 data on Asia's transport CO₂ emissions reveals a stark reality: the sector is a major contributor to the climate crisis, with surging emissions and a lagging decarbonization progress. Urgent and decisive action is needed at COP29 to reverse this trend. The ten emerging trends, ranging from persistent fossil fuel subsidies to a slow uptake of renewable energy, further underscore the complexity of the challenges ahead. To achieve a sustainable transport future in Asia, a multi-faceted approach is required:

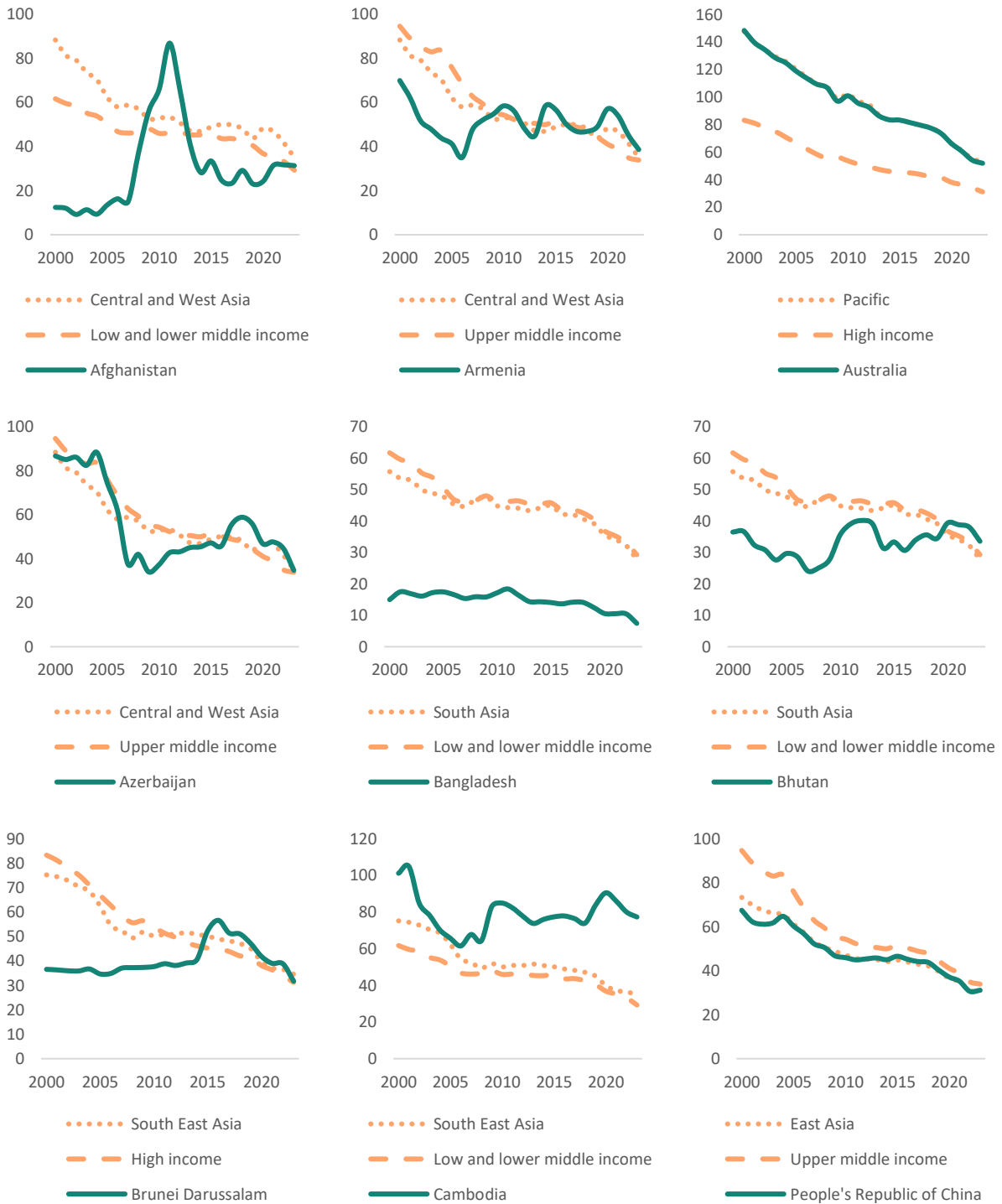
- **Robust Monitoring:** Establishing a robust monitoring system with key performance indicators (KPIs) is crucial for tracking progress and informing decision-making.
- **Policy Action:** Implementing ambitious policies to promote sustainable transport modes, improve fuel efficiency, and accelerate the transition to electric vehicles is essential.
- **Investment:** Significant investments in sustainable transport infrastructure, including public transport, cycling, and walking facilities, are needed.
- **International Cooperation:** Collaboration between countries, sharing best practices, and technology transfer will be critical in achieving decarbonization goals.

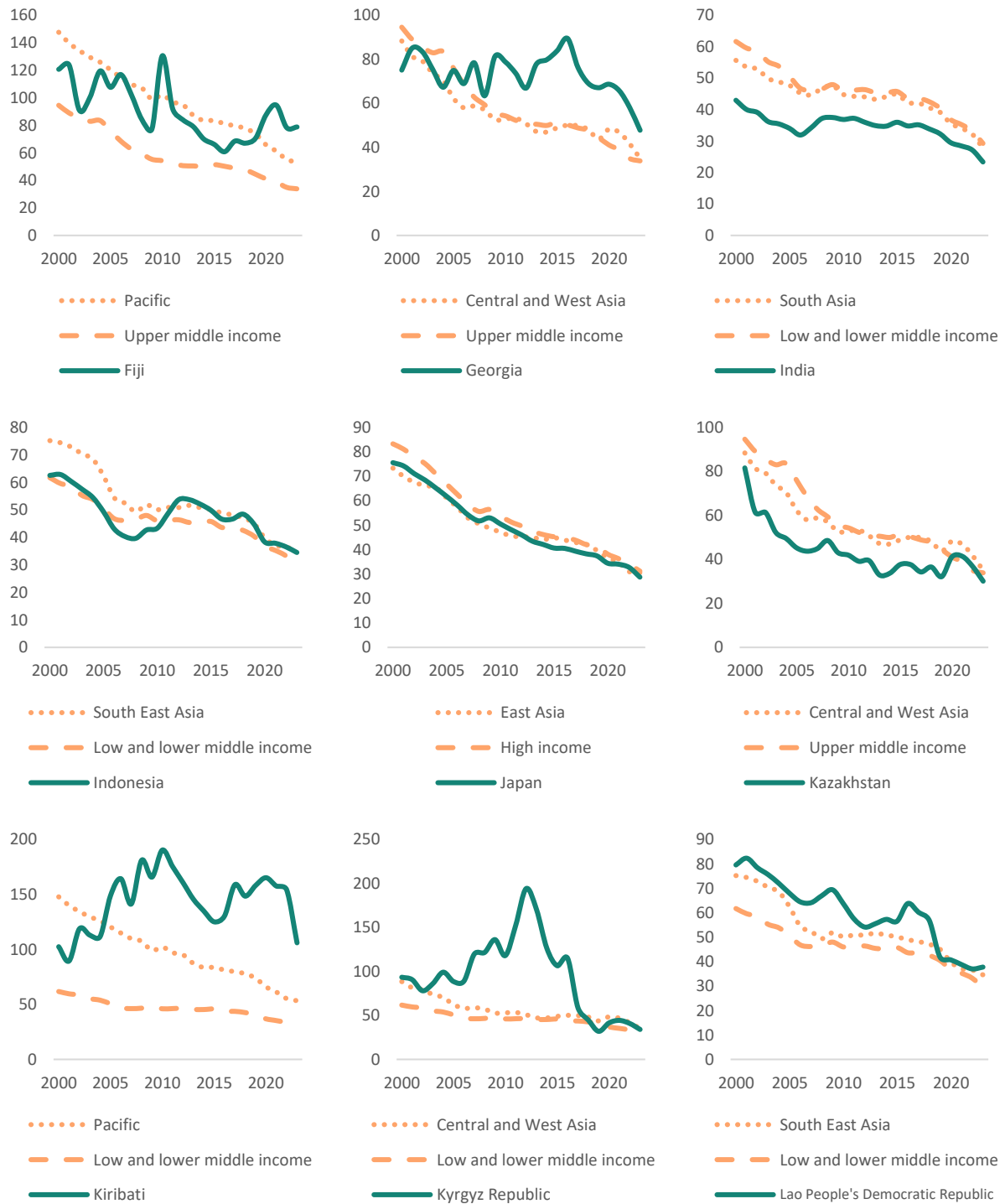
The COP29 discussions provide a crucial opportunity to address the urgent challenge of transport emissions in Asia.

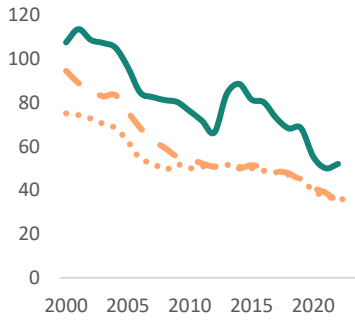
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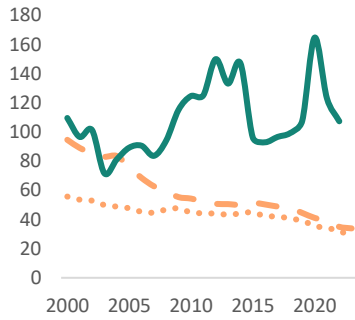
Annex: Transport CO2 Intensity (gCO2 per USD of GDP)



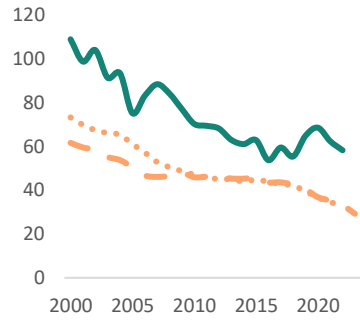




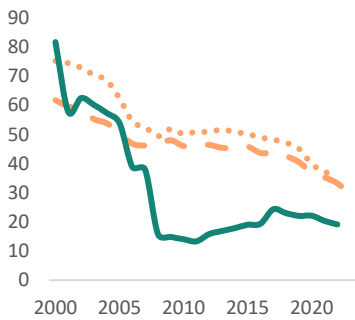
..... South East Asia
 - - - - Upper middle income
 ——— Malaysia



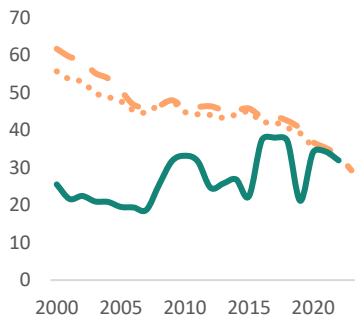
..... South Asia
 - - - - Upper middle income
 ——— Maldives



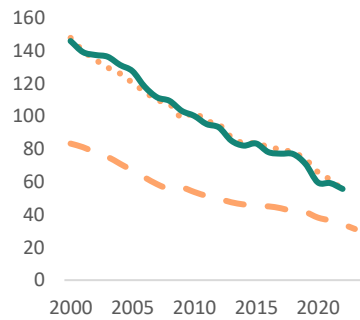
..... East Asia
 - - - - Low and lower middle income
 ——— Mongolia



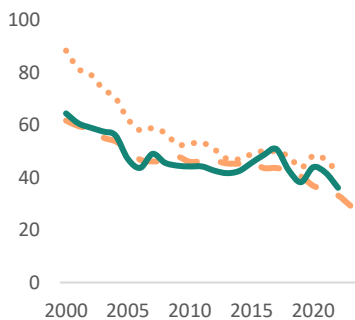
..... South East Asia
 - - - - Low and lower middle income
 ——— Myanmar



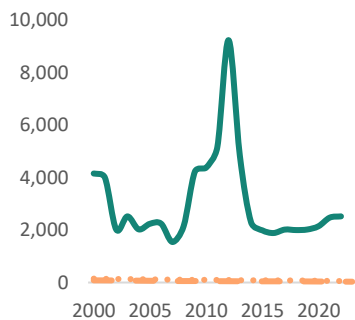
..... South Asia
 - - - - Low and lower middle income
 ——— Nepal



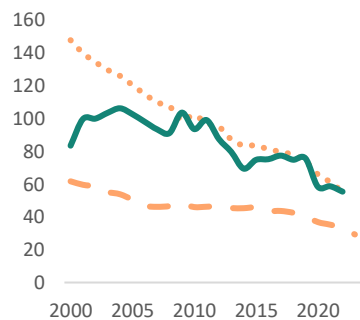
..... Pacific
 - - - - High income
 ——— New Zealand



..... Central and West Asia
 - - - - Low and lower middle income
 ——— Pakistan



..... Pacific
 - - - - High income
 ——— Palau



..... Pacific
 - - - - Low and lower middle income
 ——— Papua New Guinea

