Initiatives to Improve Logistics Efficiency for Carbon Neutrality (CN) in ASEAN

Carbon Neutrality in Transportation Sector

ASEAN-Japan Energy Efficiency Partnership (AJEEP)

13 November 2025

Presented by:
Rio Jon Piter Silitonga
Senior Officer
Energy Efficiency and Conservation Department
ASEAN Centre for Energy (ACE)

Outline

01 Introduction of ACE and APAEC

02 ASEAN Transport and Logistics Landscape

03 ASEAN Frameworks to Improve Logistics Efficiency

04 Future of Low Carbon Fuel (Biofuel, H_2, SAF) Across Modes

05 Conclusion

About ASEAN Centre for Energy (ACE)

Think Tank

Identifying and surfacing innovative solutions

Energy Data and Knowledge Hub

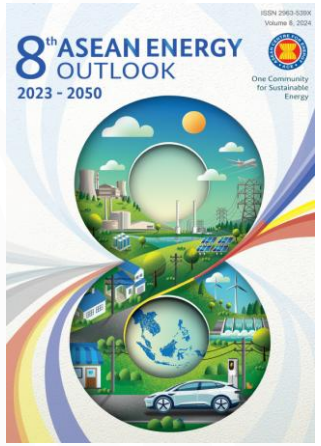
Provide a knowledge depository for AMS

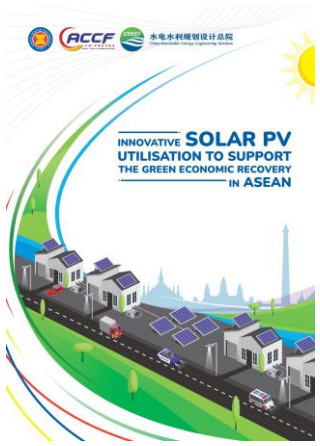
Catalyst

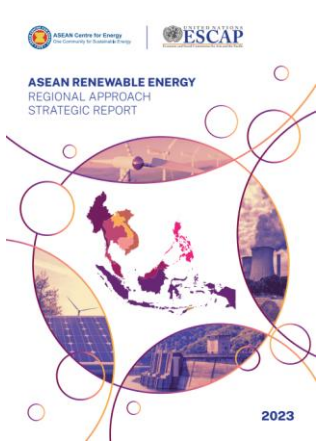
Unify and strengthen ASEAN Energy Cooperation and Integration

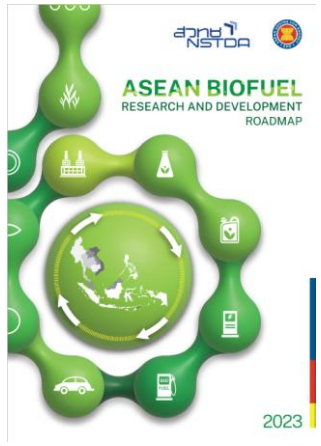
- Policies, Legal & Regulatory Frameworks and Technologies
- Policy and Research Analytics
- Energy Database
- APAEC Activities, including with DPs/IOs
- Secretariat

Research, publication, training, capacity building, workshop, policy exchange and recommendations, etc.









Overview of APAEC 2026-2030

ASEAN Community Vision 2045

Resilient, Innovative, Dynamic, and People-centred ASEAN

ASEAN Economic Community (AEC) Strategic Plans 2026-2030

ASEAN Energy Future 2045 - 20-year Theme/Vision

Secure, Resilient, and Interconnected Low-Carbon ASEAN Energy Future

Adopted during Special SOME 2025 (Jan 2025)

APAEC 2026-2030

5-Year Theme: Advancing Regional Cooperation in Ensuring Energy Security and Accelerating Decarbonisation for a Just and Inclusive Energy Transition

(Adopted during 42nd AMEM, Sep 2024)

Programme Areas of APAEC

PA 1 ASEAN Power Grid	**PA 2** Oil & Gas Connectivity, Security and Sustainability	**PA 3** Coal and Carbon Management	**PA 4** **Energy Efficiency and Conservation**
PA 5 Renewable Energy	**PA 6** Regional Energy Policy and Planning	**PA 7** Civilian Nuclear Energy	

"Enhance the adoption of EE&C for decarbonising end-use sectors through emerging innovative solutions, enhanced regional cooperation, and policy and standards harmonization"

Key Highlights

Background

APAEC Drafting Committee meetings and consultations conducted throughout Jan 2024 – Aug 2025, with 6 ADC meetings completed including consultations within SEB/SSN and with external experts and partners

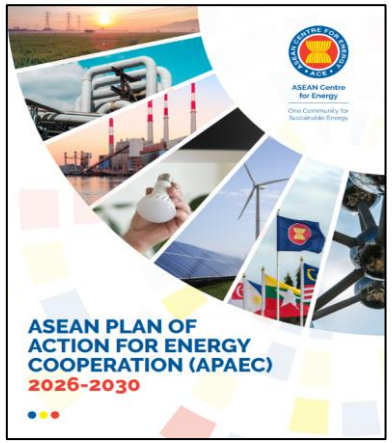
APAEC Aspirational Targets

- **30% RE Share** in Total Primary Energy Supply by 2030
- **45% RE Share** in Installed Power Capacity by 2030
- **40% EI Reduction** in Total Primary Energy Supply (based on 2005 level) by 2030

Document Status

Main content of APAEC 2026-2030 Document for Public

Endorsed by 43rd AMEM in Oct 2025



https://aseanenergy.org/publications/asean-plan-of-action-for-energy-cooperation-apaec-2026-2030/

APAEC 2026-2030 Outcome-based Strategies

Outcome-based Strategies

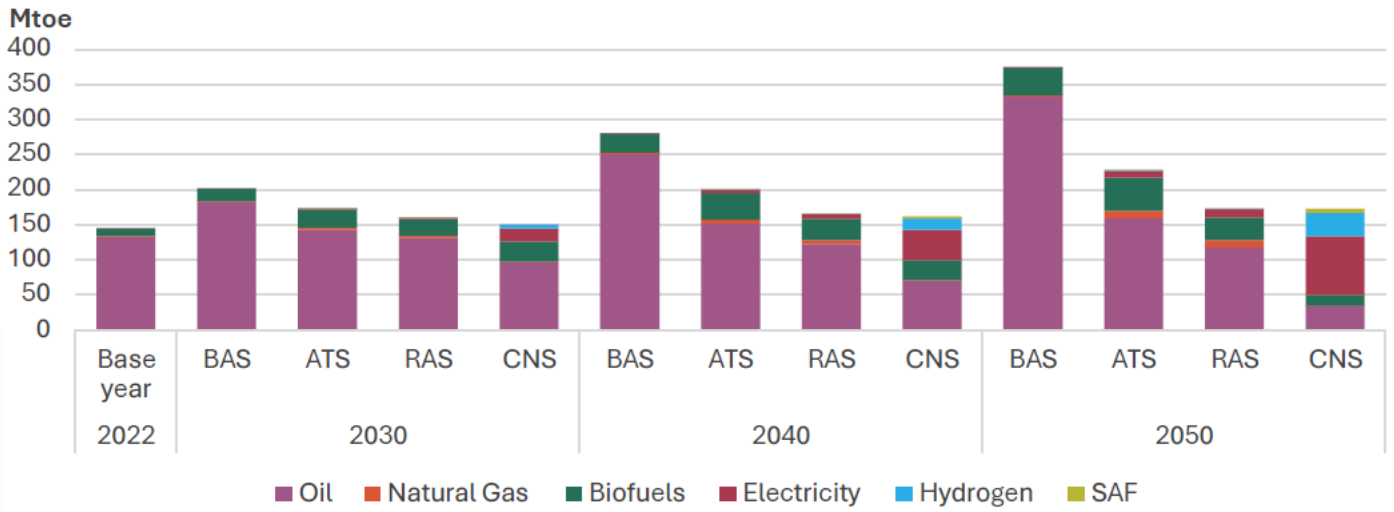
APG	OGCSS	CCTR	EE&C	RE	REPP	CNE
Strengthen APG bodies' capacity and coordination	Enhance role of TAGP	Advance responsible coal value chain	Increase the adoption of energy efficient appliances and equipment	Accelerate RE deployment for low carbon future	Advance ASEAN's energy profile	Promote role of nuclear energy
Enhance APG Planning and Infrastructure	Strengthen regional collaboration in O&G sector	Pave the pathway for coal in ASEAN's Carbon Neutrality	Accelerate the adoption of EE&C to encourage the realisation of ZEB	Accelerate RE integration for ASEAN's power sector	Bridge financial and investment gaps for ASEAN's energy transition	Enhance effective communication strategies for CNE
Expand Cross Border Power Trading	Pursue Green Diversification and Decarbonisation in O&G sector		Enhance EE&C to drive decarbonisation in the industry and agricultural sector	Advance RE applications in end-use sectors (transport, industry and building)	Advance cross-sectoral collaboration for a just and inclusive energy transition	Strengthen regional and international collaboration for nuclear energy
Drive a low carbon APG			Enhance fuel economies in the transport sector and promote electrification		Effective Implementation of APAEC	
			Promote innovative strategies to catalyse the accelerated adoption of EE&C technologies and measures			

Online Seminar
Transportation Sector

- Strengthen the regional fuel economies of light and **heavy-duty vehicles**
- Support fuel switching policies, incentives and initiatives to advance low-carbon vehicles, including electrification
- Raise awareness of transport system efficiency policies in the public transport, aviation, and maritime transport

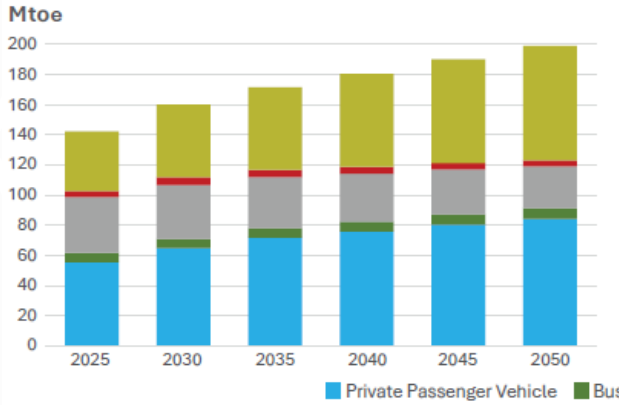
ASEAN Energy Demand in Transport Sector

Transport Consumption

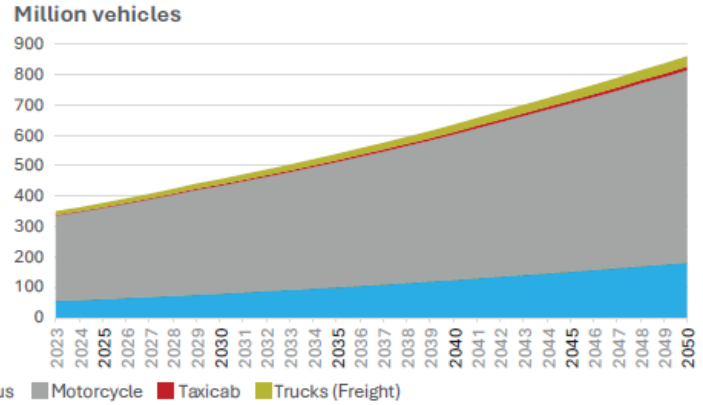


- Under the **Carbon Neutrality Scenario**, electrification in the transport sector is projected to account for nearly 49% of the sector's total final energy consumption (TFEC) by 2050.
- **Hydrogen** is anticipated to contribute around 19% of the total energy mix by 2050, while the share of sustainable aviation fuel (SAF) remains modest at approximately 3.2%

(a) TFEC Projection by Vehicle Type in Road Transport



(b) Number of Vehicles per Vehicle Type in Road Transport

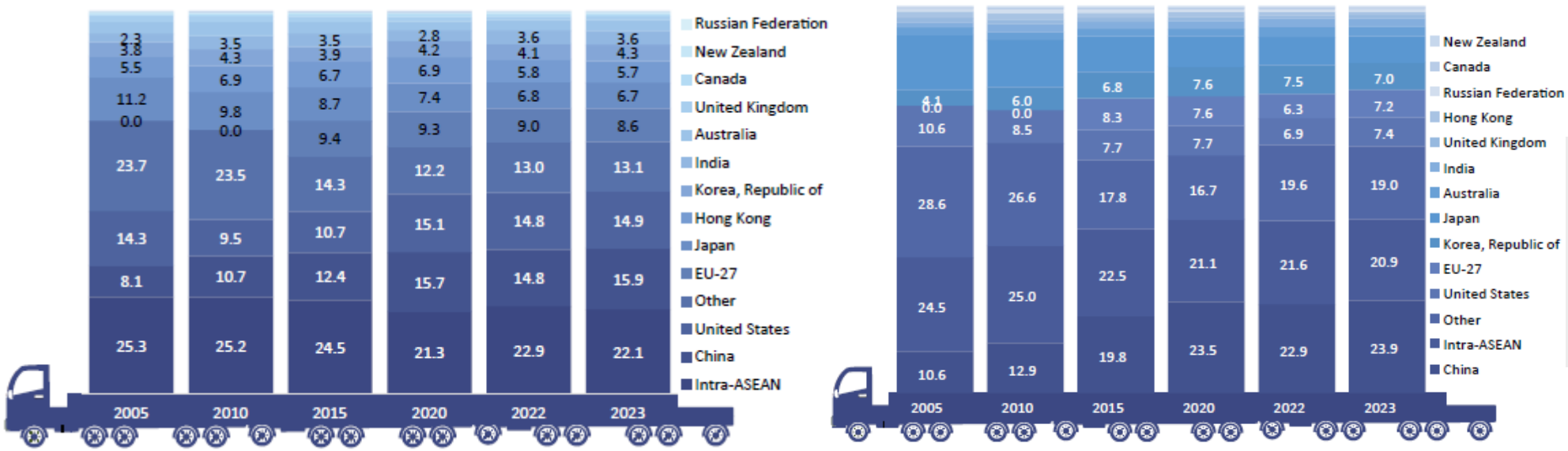


Note: End-use details (sectoral demand by vehicle type) cannot be reported for the historical year (2022). These details only appear at the beginning of the projection year (2023) and thereafter.

- Private **Passenger Vehicle and Trucks (Freight)** are two main energy consumers in the sector under ATS
- In term of numbers, motorcycle dominates the road transport in ASEAN, highlighting the region as one of the largest market for two and three wheelers

Source: The 8th ASEAN Energy Outlook, 2024

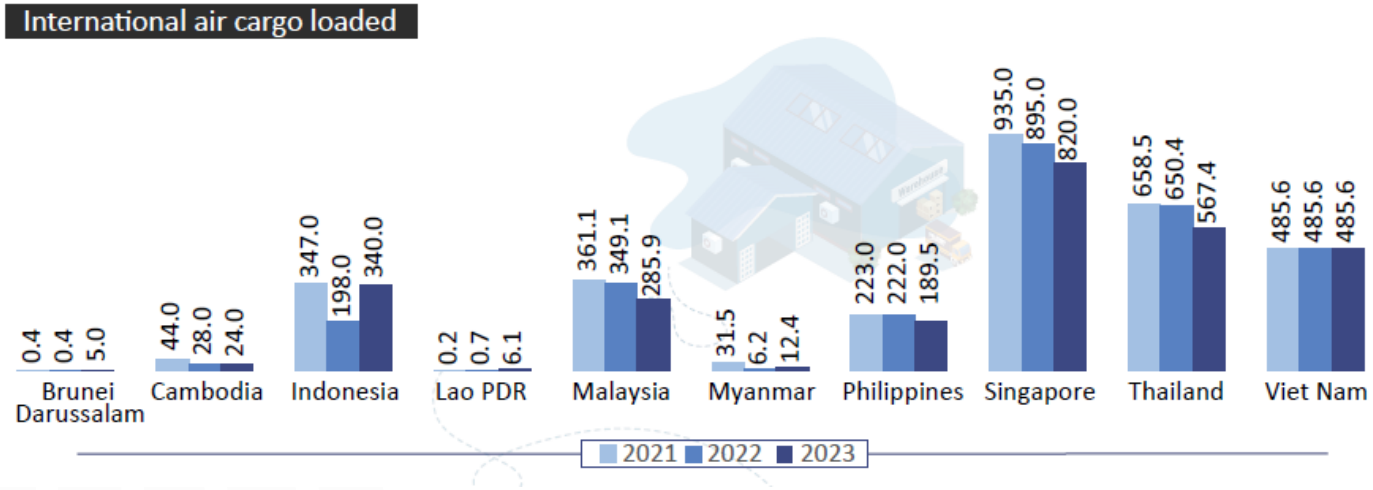
ASEAN Logistics Landscape



Share of ASEAN Exports (left) and Imports (right) by Trading Partners

- Intra-ASEAN Trade continued to be the largest contributor of ASEAN Total Trade, underscoring the importance of improving efficiency in logistics

Source: ASEAN Key Figures, 2024



- **Singapore** and **Thailand** as major distribution hubs of air cargo delivery in ASEAN, more than 50% of region's total international air cargo
- The figures are similar for air cargo loaded and unloaded
- Indonesia experienced substantial increase in air cargo by 2023, compared to the previous year

Source: ASEAN Key Figures, 2024

In thousand tons

ASEAN Logistics Performance Index (LPI) 2023

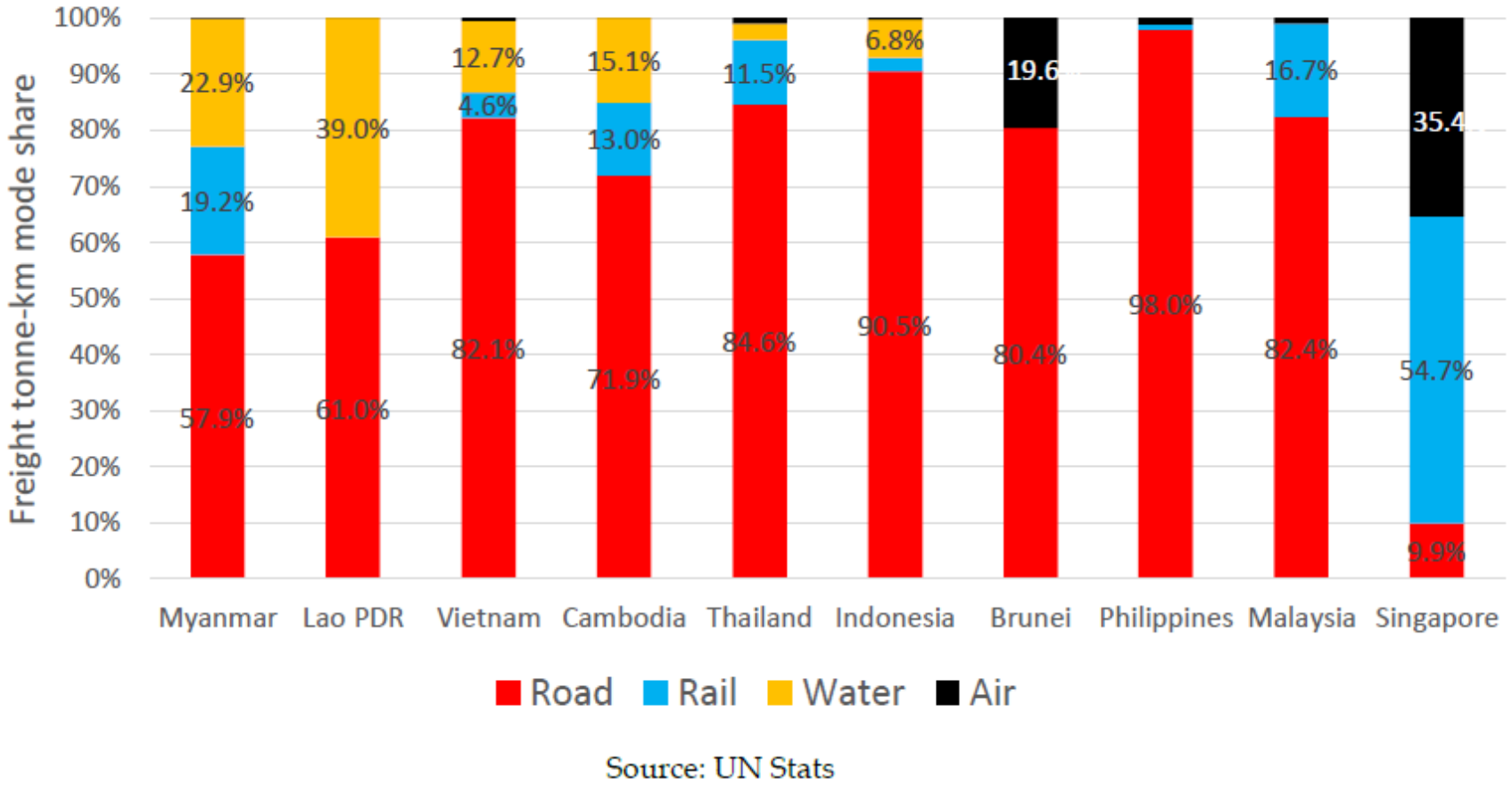
Country	LPI	Customs	Infrastructure	International Shipments	Logistics Competence	Timeliness	Tracking and Tracing
Singapore	4.3	4.2	4.6	4.0	4.4	4.3	4.4
Malaysia	3.6	3.3	3.6	3.7	3.7	3.7	3.7
Thailand	3.5	3.7	3.7	3.5	3.5	3.5	3.6
Philippines	3.3	2.8	3.2	3.1	3.3	3.9	3.3
Vietnam	3.3	3.1	3.2	3.3	3.2	3.3	3.4
Indonesia	3.0	2.8	2.9	3.0	2.9	3.3	3.0
Cambodia	2.4	2.1	2.2	2.3	2.4	2.7	2.8
Lao PDR	2.4	2.3	2.3	2.3	2.4	2.8	2.4
Brunei	2.7*						
Myanmar	2.3*						

(1) : very low performance ; (5) very high performance
**figures from 2018 since the data in 2023 are not available*

World Bank, 2023

Logistics Performance Index (LPI) is a benchmarking tool developed by the **World Bank** to measure a country's efficiency and effectiveness in logistics.

Mode of Transports for Logistics in ASEAN



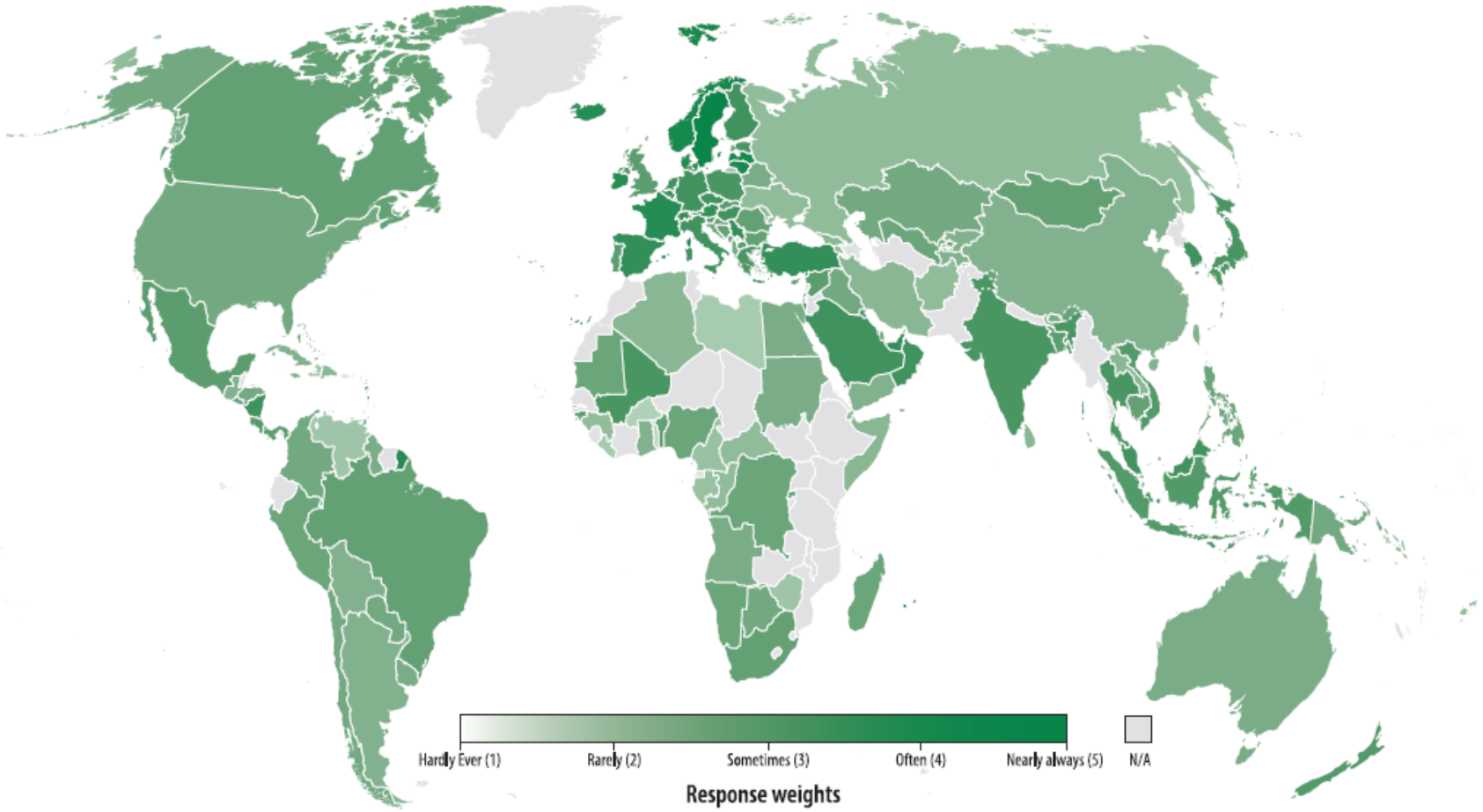
Source: UN Stats

- In the subregion, most of the freight is transported via roads, especially in the **Philippines and Indonesia where more than 90 per cent of the freight was transported via roads.**
- The only exception is **Singapore, where railways are used** extensively
- The demand for reliable, flexible, cost-effective, timely, and viable door-to-door freight services indicates a continuing **freight prioritisation of road infrastructure over railways and waterways**

Source: UN ESCAP, 2022

ASEAN Logistics Performance Index (LPI) 2023

Map A6.1 How often do shippers ask for environmentally friendly options (e.g., in view of emission levels, choice of routes, vehicles, schedules, etc.) when shipping to...?



IBRD 47157 | APRIL 2023

Source: 2023 LPI team.

- **Sustainability starts becoming more important (**reduce waste, idle time, emission) although is not directly measured in the index
- **Mounting pressure in air, road, and maritime transport to reduce logistics-related GHG,** especially from high performance countries
- To develop implementable **green logistics policies**
- Logistic issues may erode efficiency gains from industrial process

ASEAN Frameworks to Improve Logistics Efficiency

ASEAN Economic Community Blueprint
Towards Greater Connectivity, Efficiency, Integration, Safety, and Sustainability

ASEAN Framework Agreement on Multimodal Transport (AFAMT)
Establish an effective, efficient, integrated and harmonized transit transport system in ASEAN

ASEAN Single Aviation Market (ASAM)
Designated airlines from AMS to operate unlimited passenger and cargo services between member countries

ASEAN Framework Agreement on the Facilitation of Goods in Transit (AFAFGIT)
Transit goods will not be subject to unnecessary delays/restriction

ASEAN Single Shipping Market (ASSM)
Develop strategic maritime logistic corridors and implementation of IMO conventions

Framework on ASEAN Supply Chain Efficiency and Resilience
Cross-border harmonization, Non-Tariff Measures, Digital Supply Chains, Integration, Industrial Innovation, ASEAN Single Window

Master Plan on ASEAN Connectivity 2025 (MPAC)
Seamless logistics to lower supply chain costs and improve speed/reliability of supply chain in AMS

Source: ASEAN Economic Community Blueprint, 2025

Digitalisation and Smart Logistics for Decarbonisation

Strategic Framework: Three Pillars of Transformation

Demand Reduction

AI-optimised routing, consolidation, and modal selection reduce transport through digital efficiency improvements

Efficiency Gains

IoT, predictive maintenance, and autonomous technologies improve operational efficiency

Fuel Transition

Progressive substitution to SAF, biodiesel, hydrogen, and EVs decarbonizes remaining energy demand

These three pathways work synergistically to achieve significant transport energy demand reduction in ASEAN. The strategy is anchored in ASEAN Digital Masterplan 2025, Master Plan on ASEAN Connectivity 2025, and ASEAN Plan of Action for Energy Cooperation 2026–2030.

Source: several sources

Digital Innovation: ASEAN Single Window Success

The **ASEAN Single Window (ASW)** platform represents a transformative development in cross-border logistics, enabling electronic exchange of trade documents and certificates with measurable impact.

6M

Days Saved

Business operation days saved through digital documentation

$150M

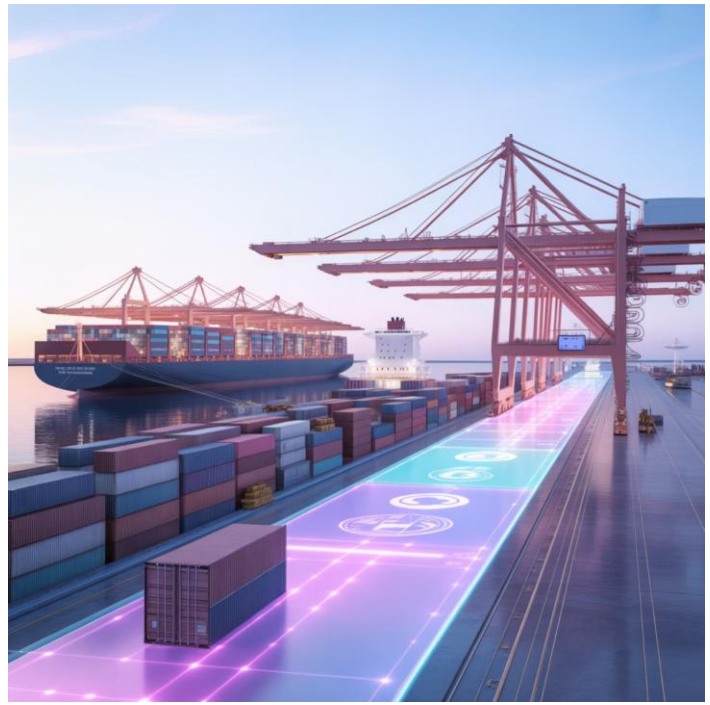
Cost Savings

Cumulative savings through e-Form D adoption

97%

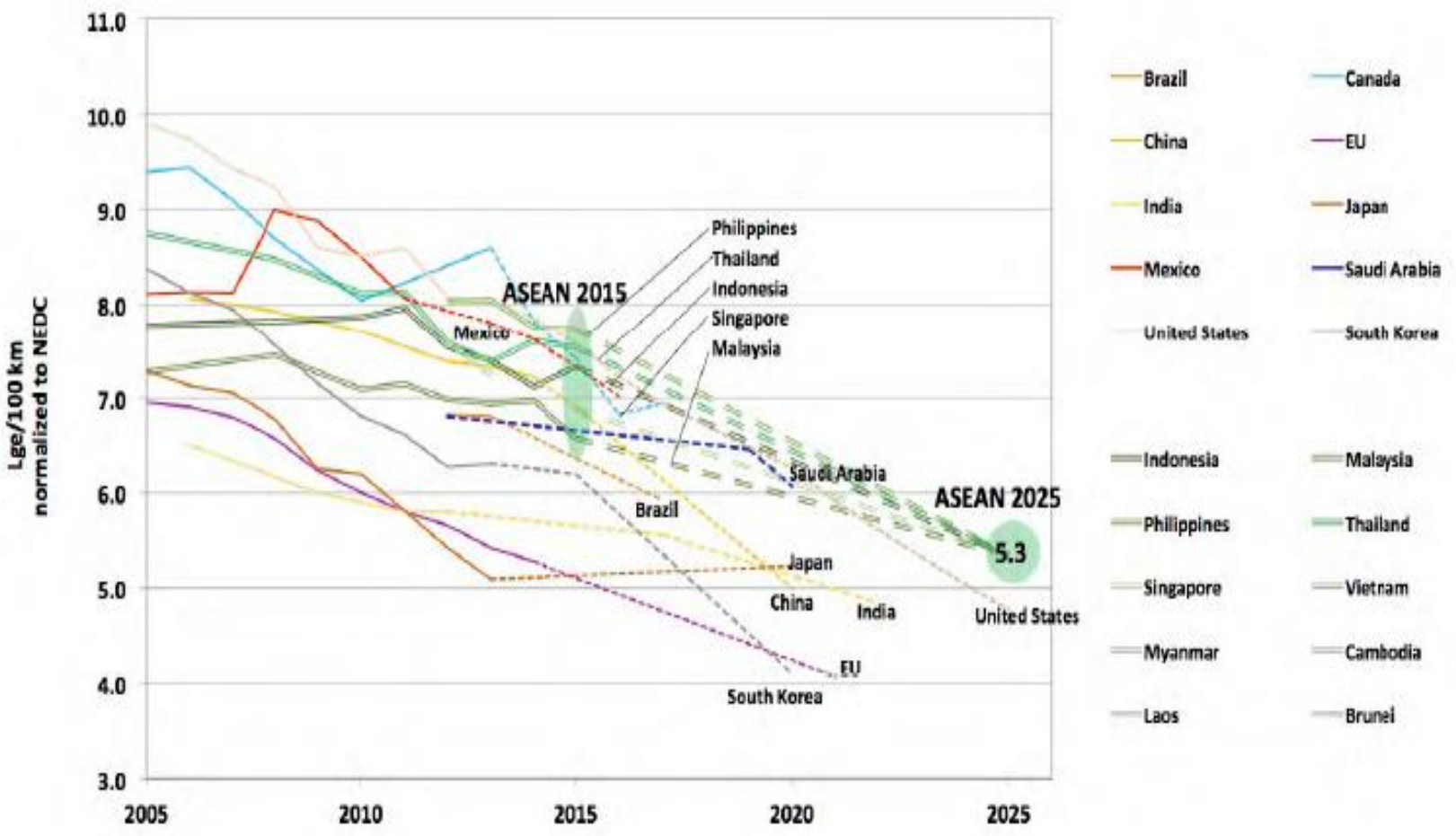
Time Reduction

Singapore reduced cargo clearance from 4 days to 15 minutes



Source: ASEAN Single Window Report and Singapore Customs (2023)

ASEAN Fuel Economy for LDV 2018-2025



- At the moment, we only have **ASEAN Fuel Economy Roadmap** for the Transport Sector 2018-2025: with Focus on **Light-Duty Vehicles. This includes** Light Commercial Vehicles (LCV) for cargo transport with a Gross Vehicle Weight of no more than 3,500 kg
- The average LDV fuel consumption per 100 km in ASEAN is 7.2 litres of gasoline equivalent (LGe) in 2015, slightly above global average
- Goal by 2025 is **to achieve 26% reduction in average fuel consumption per 100 km**, compared to 2015 (5.3 LGe/100km)
- Developing **Heavy-Duty Vehicles (HDV) fuel economy is more complicated**: vary conditions of (long haul on highways and urban delivery stop-and-go), the use of trucks, configuration (with refrigerator box, carbo, flatbed, etc)
- **Half-loaded trucks affect efficiency**. Thus, improving logistics is equally important

Source: ASEAN Fuel Economy Roadmap 2018-2025

ASEAN Initiatives

Sustainable Infrastructure:

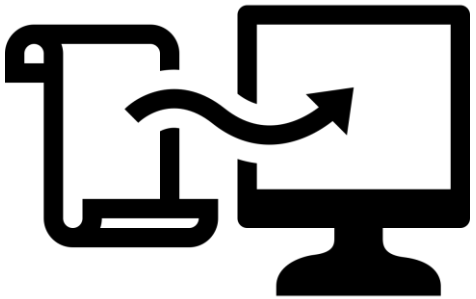
- ASEAN Highway Network (AHN), Singapore Kunming Rail Link (SKRL) → modal shift
- Establish priority pipeline of potential ASEAN Infrastructure Projects
- Platform to measure and improve infrastructure productivity

Seamless Logistics

- Identify key priority trade lanes or economic corridor (maritime and land)
- Identify key commodities to monitor and examine on the key trade routes
- Prioritise key trade lanes or economic corridor (AI optimized)
- Develop supply chain framework for assessing “chokepoints”

Exploring the application of technology in customs to facilitate the release and clearance process

- Pilot to estimate reduction in GHG emission to promote climate smart trade facilitation
- Digital supply chain including electronic records, cloud-based, RFID, revolving around integrating Fourth Industrial Revolution (4IR)



Source: MPAC 2025 and Framework on ASEAN Supply Chain Efficiency and Resilience

ASEAN Initiatives

ASEAN Regional Strategy on Sustainable Land Transport : Green Freights and Logistics

- Logistics optimisation, e.g. by reducing empty hauling, or implementing logistics centres and freight exchanges.
- Modal shift from road to rail and waterways and maritime transport. Promote green freights corridors to enhance multimodality and minimize impact of freight activity
- Greening of trucks, by improving efficiency, low rolling-resistance tyres, alternative fuels, and eco-driving. Labelling scheme that recognizes freight forwarders' environmental performance

International Framework Global Logistics Emissions Council (GLEC) and ISO 14083 can be adopted and harmonized in regional level for comparable tCO2/tonne-km

AVOID – SHIFT – IMPROVE (ASI) for freights and logistics: Reduce empty trips, waiting time, move to rail, cleaner fuels, electrification

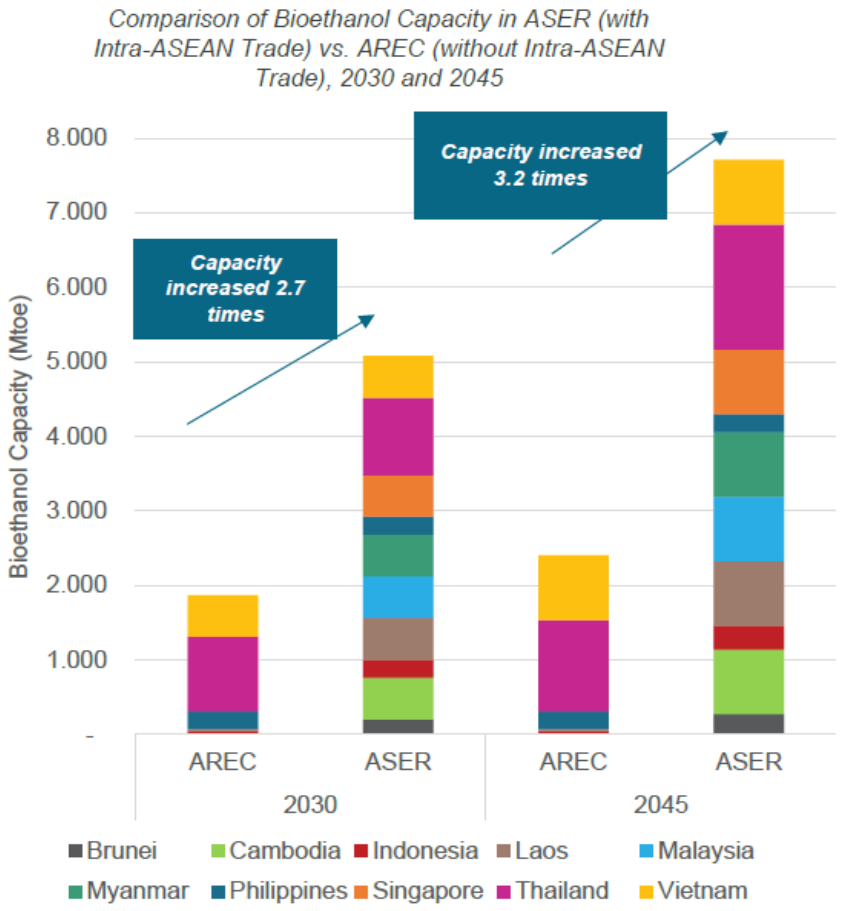
Unlock green economy for accelerating decarbonization of regional supply chains

Low Carbon Fuels to fast-track biofuels adoption

Source: MPAC 2025 and Framework on ASEAN Supply Chain Efficiency and Resilience

Future of Low Carbon Fuel Across Road, Maritime, and Air Transport

Intra-Region Biofuel Trade to Unlock Potential



- Trade integration lowers total system costs by matching demand with least-cost supply, reducing import dependence and strengthening ASEAN's energy security.
- If ASEAN countries collaborate and trade bioethanol instead of each producing it independently, the regional system saves about **USD 120 million for every Mtoe of bioethanol produced** by 2045.
- Biodiesel trade volumes narrow as rising domestic mandates absorb more supply, while intra-ASEAN trade enables new bioethanol exporters to emerge, diversifying production beyond Thailand and the Philippines.
- This transformation is underpinned by the ability to reallocate feedstocks across borders, directing them to where new plants can operate most efficiently. The next step is to examine how feedstock trade flows enable these new producers to scale up and sustain output, providing the backbone of ASEAN's integrated bioethanol supply chain.
- While regional biofuel trade can enhance resilience and competitiveness, it also requires navigating important trade-offs. Countries must weigh domestic priorities. Countries also need to manage feedstock volatility, as cross-border trade may amplify price swings and impact local farmers

Source: ASEAN RE Long-term Roadmap, 2025

Future of Low Carbon Fuel Across Road, Maritime, and Air Transport

Maritime Transport Initiatives in ASEAN

Table 1: Southeast Asian ports in the world's top 50 container ports, by volume, 2023

Global rank	Port name	Country	Cargo volume (million TEU)
2	Singapore	Singapore	39.01
11	Klang	Malaysia	14.06
15	**Tanjung Pelepas***	**Malaysia**	**10.48**
16	**Laem Chabang***	**Thailand**	**8.87**
25	Ho Chi Minh City	Vietnam	7.40
26	Tanjung Priok	Indonesia	7.29
33	Hai Phong	Vietnam	5.57
34	**Cai Mep***	**Vietnam**	**5.48**
36	Manila	Philippines	5.21
49	Tanjung Perak	Indonesia	4.10

TEU = twenty-foot equivalent unit

* P4I has ongoing initiatives at Tanjung Pelepas, Laem Chabang and Cai Mep ports, as well as at Map Ta Phut and Bangkok ports in Thailand.

Source: Lloyd's List, *One Hundred Ports 2024*, Lloyd's List, 2024.

Source: P4I, 2024

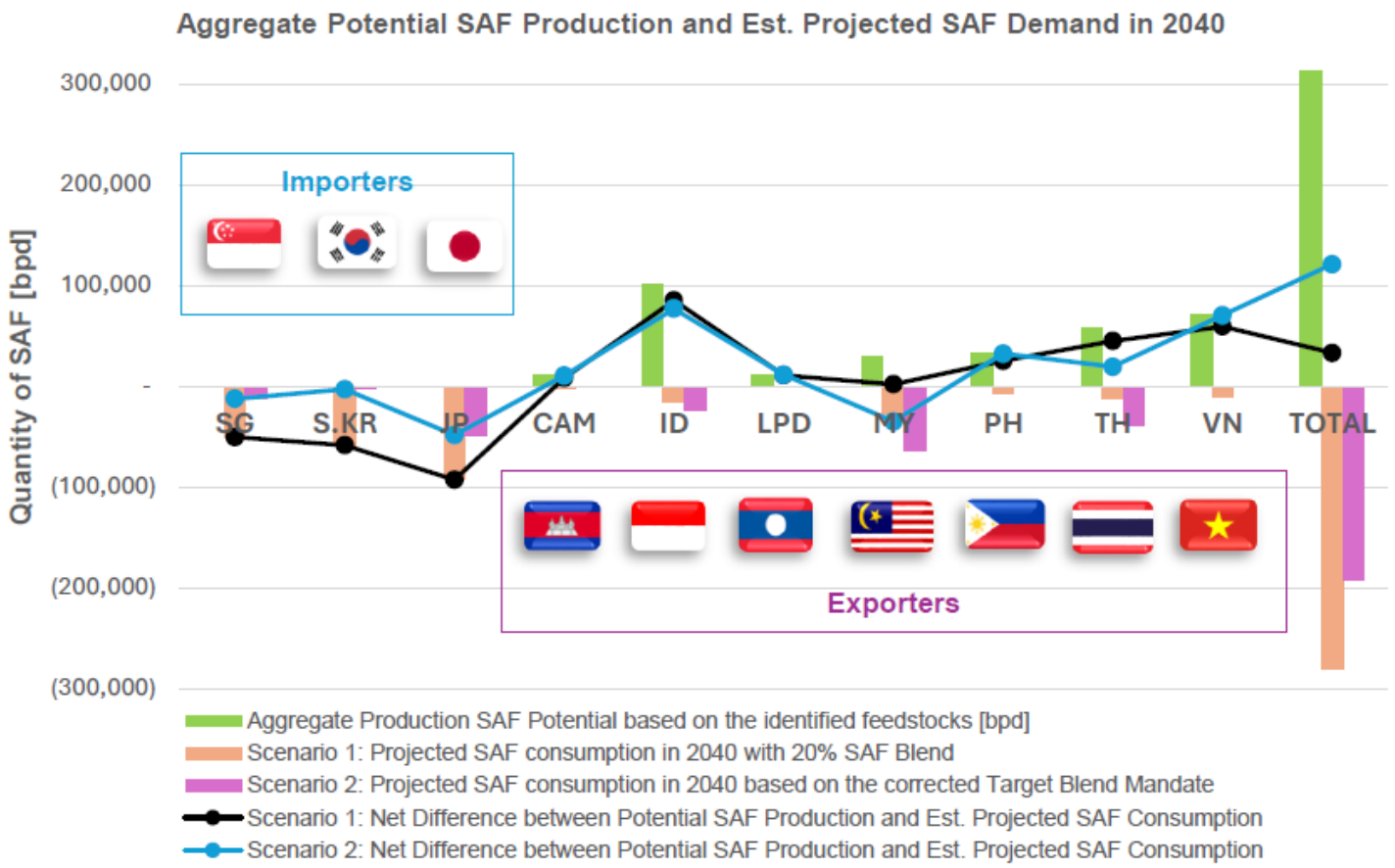
- Strait of Malacca and Singapore: 1/3 of world's crude oil transit
- 300 ships pass through the strait of Malacca every day
- International Maritime Organization (IMO) target: to reduce the total annual GHG emissions from international shipping by at least 70%, compared to 2008. Reach net-zero by 2050
- **ASEAN MTWG TOWARDS SUSTAINABLE MARITIME TRANSPORTATION, ASEAN GREEN SHIP STRATEGY**

Technical and Operational Measures

- Initiative: Malaysia Green Bunkering, Green Corridor in ASEAN, Maritime Singapore Green Plan 2030, Green Port Project TH (automated quay cranes, RTGs, Port Community System)

Future of Low Carbon Fuel Across Road, Maritime, and Air Transport

Sustainable Aviation Fuel (SAF) potential to slash air freight's emission

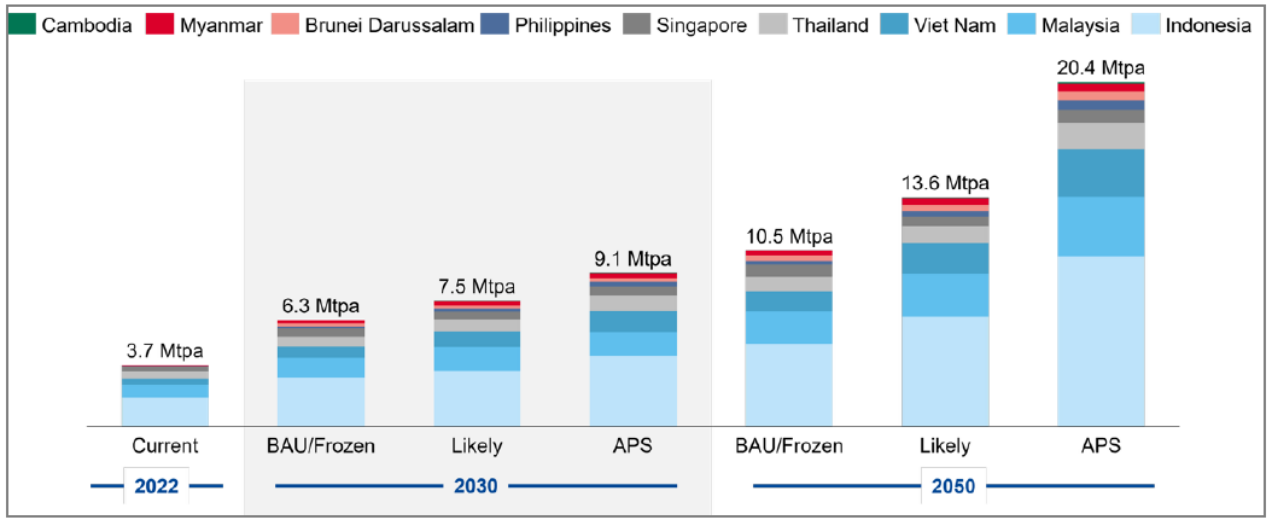


- In both Scenarios, there is a possibility of a **surplus of Sustainable Aviation Fuel (SAF) within ASEAN**, excess supply could potentially be distributed
- **Hydroprocessed Esters and Fatty Acids (HEFA**) technology, which converts renewable feedstocks like waste cooking oils, vegetable oils, and animal fats into aviation-grade fuels
- SAF Mandates:
  - Cambodia, Lao PDR, Myanmar, Vietnam : No official SAF Mandates
  - Indonesia 35% SAF blending by 2050
  - Malaysia 47% SAF blending by 2050
  - Philippines: PAL target 1% SAF blending by 2026
  - Singapore 3-5% SAF blending by 2030
  - Thailand: No official mandate, but Thai Airways target 60% blending by 2050

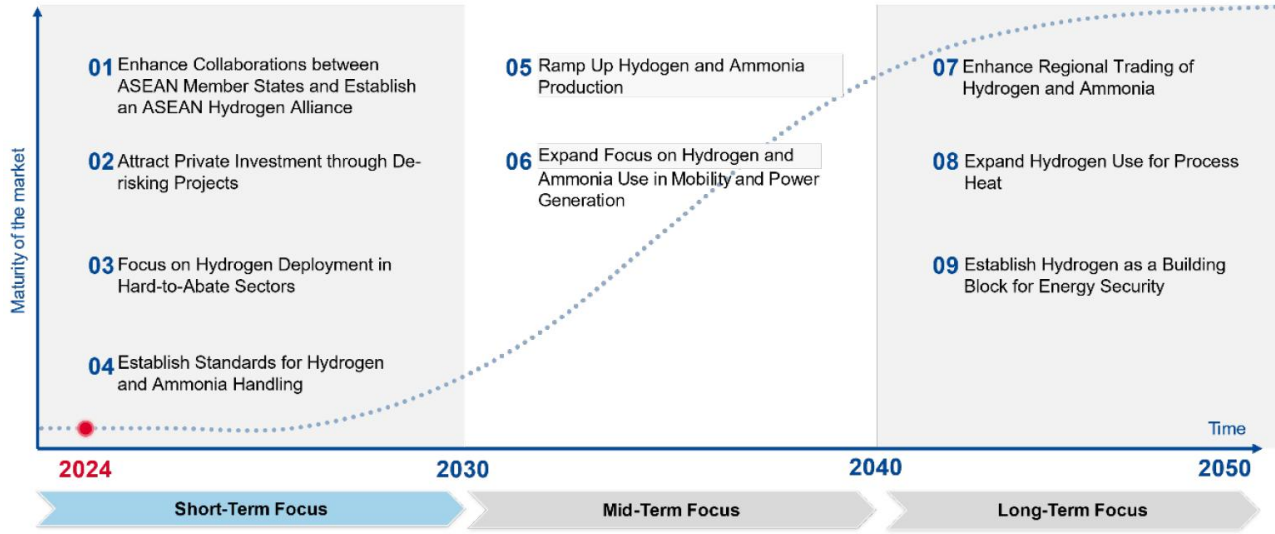
Source: Promoting the Production of Sustainable Aviation Fuels from Agricultural Waste in the ASEAN Region, ASEAN Secretariat, 2025

Future of Low Carbon Fuel Across Road, Maritime, and Air Transport

Hydrogen Role in ASEAN



APS = announced pledges scenario, BAU = business as usual scenario, Mt p.a. = million tonnes per year.



Hydrogen demand would remain varied across AMS, with Indonesia, Malaysia, and Viet Nam emerging as the key players (Figure 3.4). Indonesia would lead in hydrogen consumption across multiple sectors, driven by its large industrial base and ambitious decarbonisation targets. The country's demand for hydrogen in ammonia production, methanol, and electricity generation would grow substantially, with the APS indicating a potential rise to over 4.9 Mt for ammonia alone by 2050

Source: ACE/ERIA, 2025

Conclusion

ASEAN intra-trade is significant contributor of total trade where Singapore, Malaysia and Thailand as major cargo hub delivery

Singapore is leading in the Logistic Performance Index (LPI), showcasing advanced and maturity of Infrastructure, timeliness, tracking and tracing

Most of the freights are transported via roads in the region, underscoring the importance of urban road transport, fuel economy, and first/last mile delivery strategy

Numerous framework exist in ASEAN to support sustainable freight, including sustainable road transport and supply chain efficiency

Several initiatives are under discussion/development: promote modal shift from road to rail, greening and labelling trucks/forwarders, prioritise key trade lanes/corridor, green freights corridor

Key backbones: intra-region biofuel, green shipping in maritime, Sustainable Aviation Fuel, and hydrogen development

ASEAN Centre for Energy
One Community for Sustainable Energy

To know more about the latest ACE Publications, those are available for download from:

aseanenergy.org/publications

For further information or to provide feedback, please contact ACE at **secretariat@aseanenergy.org**

ASEAN Centre for Energy

@aseanenergy

ASEAN Centre for Energy

@aseanenergy

ASEAN Centre for Energy

Thank You