

# Potentiality of Multi-Pathway Approach Toward Carbon Neutrality

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# Who We Are?

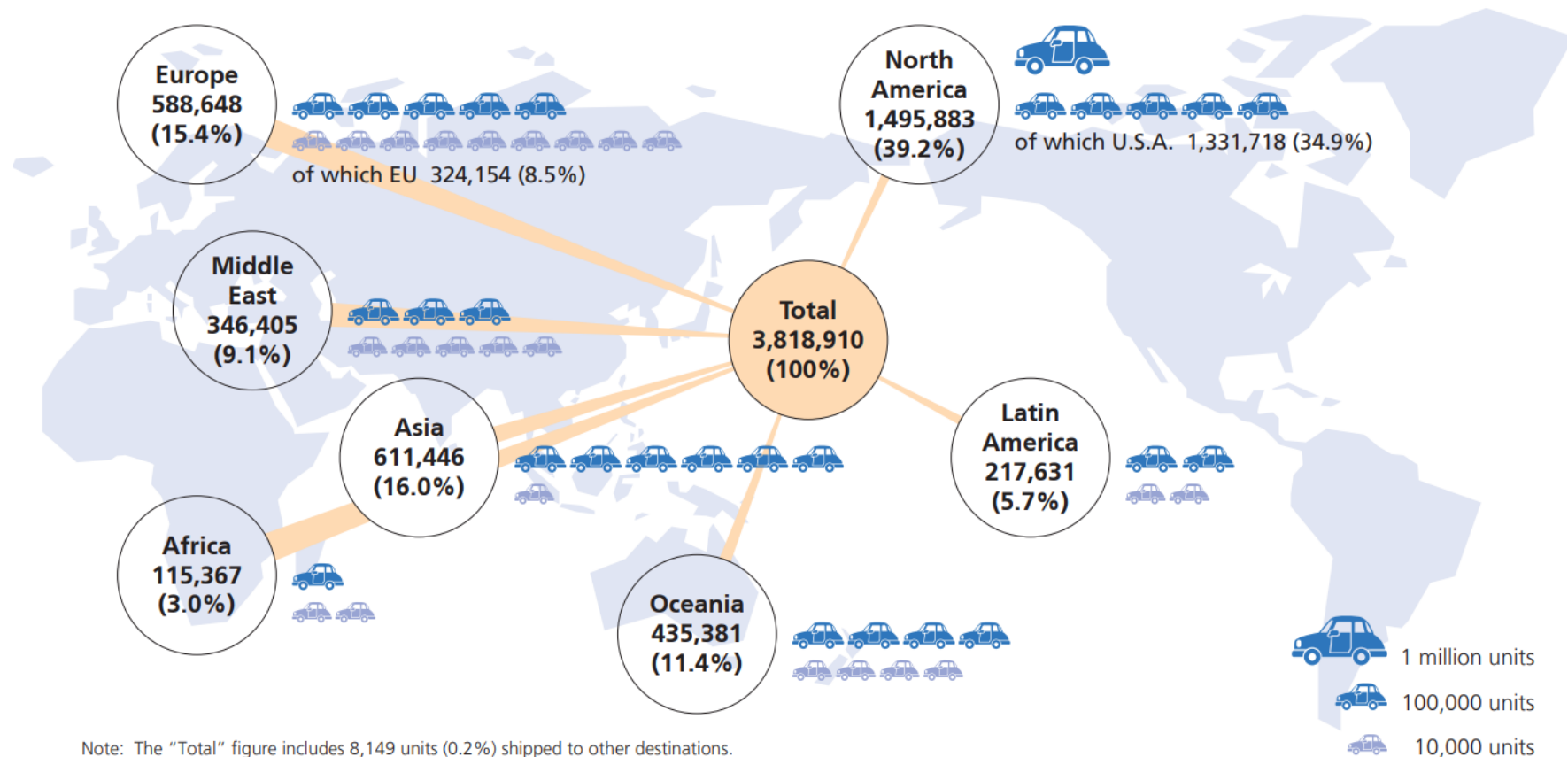
- JAMA (Japan Automobile Manufacturers Association, Inc.) is a non-profit industry association comprising Japan's 14 manufacturers of passenger cars, trucks, buses and motorcycles.

<b>Established</b>	April 3, 1967	
<b>Our Objective</b>	<ul style="list-style-type: none"> <li>• To promote the sound development of the automobile industry and contribute to social and economic welfare.</li> </ul>	
<b>Our Activities</b>	<ul style="list-style-type: none"> <li>• Conducts studies and surveys related to automobile production, distribution, trade and use.</li> <li>• Assists in the rationalization of automobile production, and helps establish policy for the development, improvement and promotion of production technology.</li> <li>• Establishes and promotes policies related to automobile trade and international exchange.</li> <li>• Carries out other activities involved in meeting its organizational objectives.</li> </ul>	
<b>Member Companies</b>	<ul style="list-style-type: none"> <li>• <a href="#">Daihatsu Motor Co., Ltd.</a></li> <li>• <a href="#">Honda Motor Co., Ltd.</a></li> <li>• <a href="#">Kawasaki Motors, Ltd.</a></li> <li>• <a href="#">Mitsubishi Motors Corporation</a></li> <li>• <a href="#">Nissan Motor Co., Ltd.</a></li> <li>• <a href="#">Suzuki Motor Corporation</a></li> <li>• <a href="#">UD Trucks Corporation</a></li> </ul>	<ul style="list-style-type: none"> <li>• <a href="#">Hino Motors, Ltd.</a></li> <li>• <a href="#">Isuzu Motors Limited</a></li> <li>• <a href="#">Mazda Motor Corporation</a></li> <li>• <a href="#">Mitsubishi Fuso Truck &amp; Bus Corporation</a></li> <li>• <a href="#">Subaru Corporation</a></li> <li>• <a href="#">Toyota Motor Corporation</a></li> <li>• <a href="#">Yamaha Motor Co., Ltd.</a></li> </ul>

# Who We Are?

- JAMA member companies produce and export vehicles worldwide.

## Motor Vehicle Exports By Destination In 2021

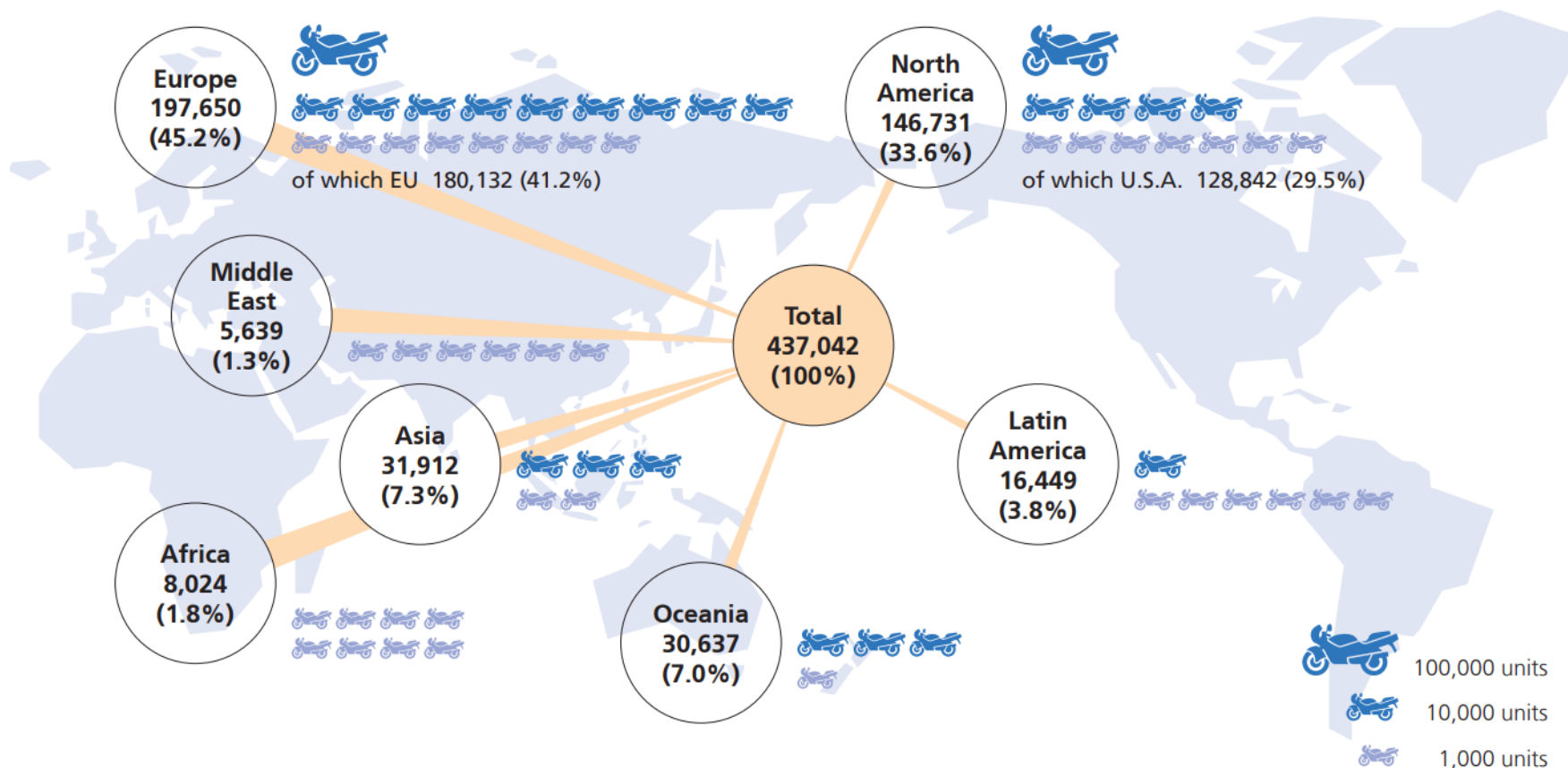


Source: JAMA

# Who We Are?

- JAMA member companies produce and export vehicles worldwide.

## Motorcycle Exports By Destination In 2021

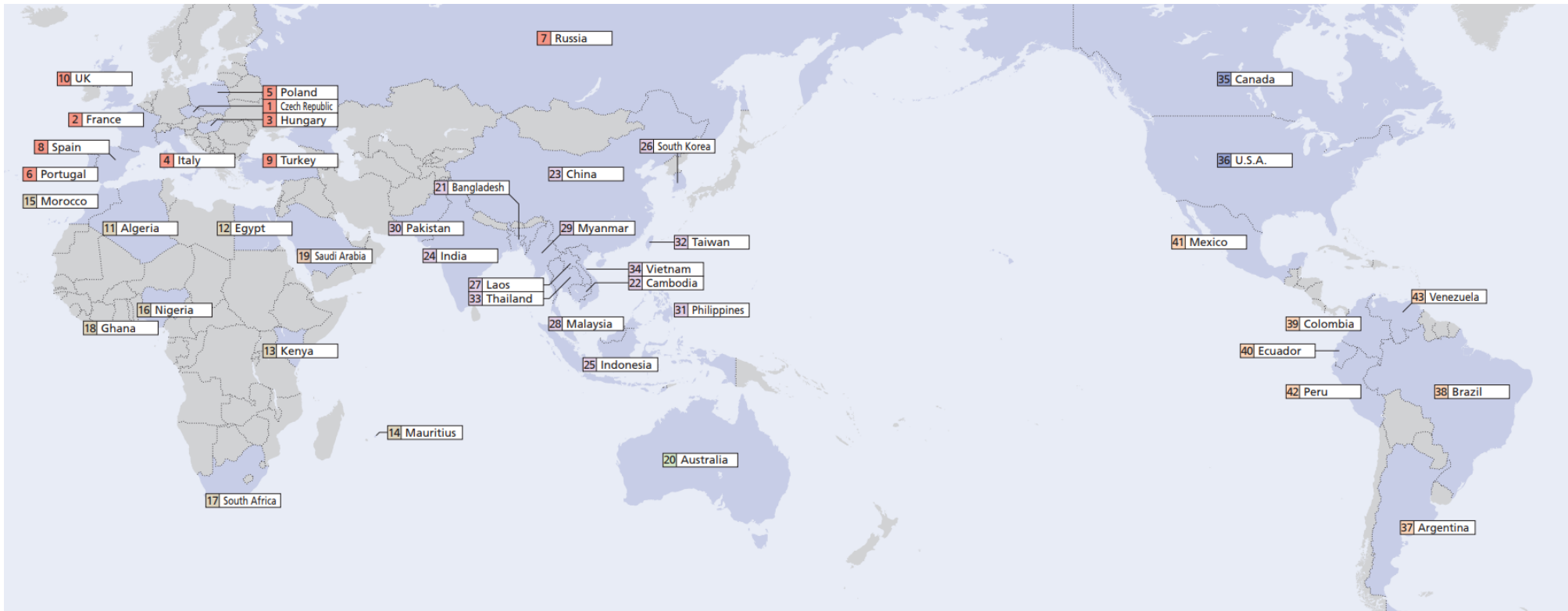


Source: JAMA

# Who We Are?

- JAMA member companies produce and export vehicles worldwide.

## Geographical Distribution of JAMA Members' Overseas Production Bases



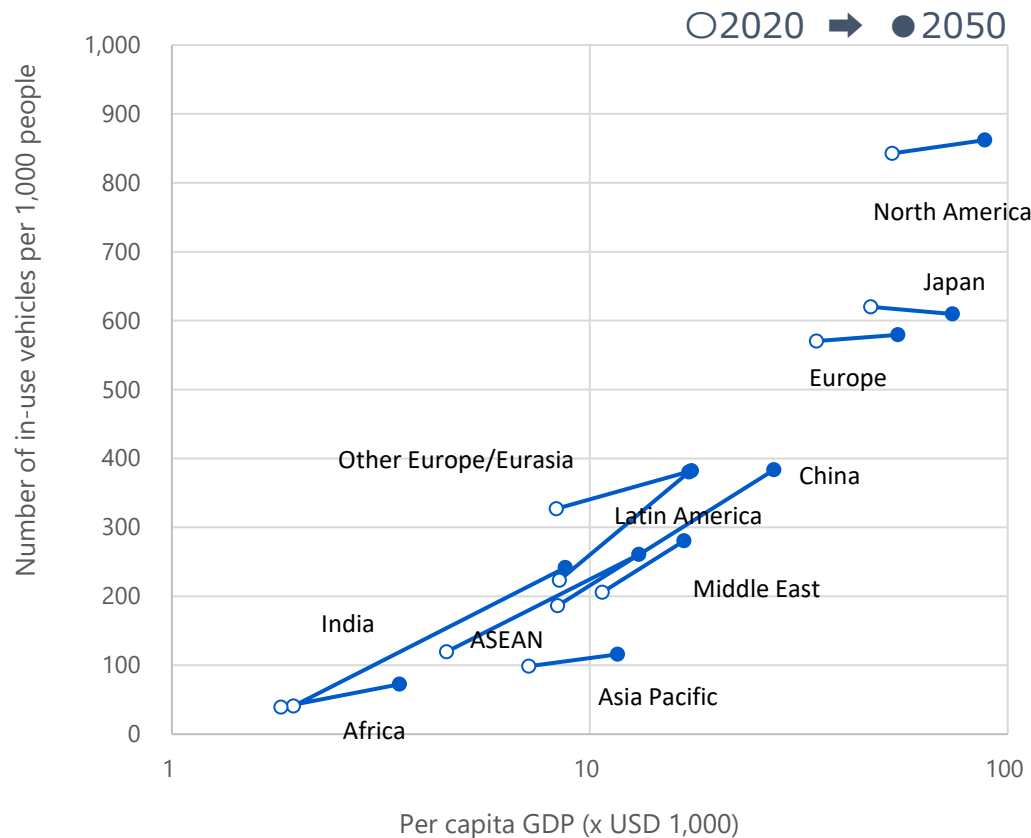
Source: JAMA

# Our Basic Concept on Carbon Neutrality

- **JAMA member companies** will make **maximum efforts towards carbon neutrality by 2050.**
- Our goal is carbon neutrality. It is essential to understand the issue correctly.
- it is the consumer who chooses the vehicles. We believe **that it is important to maintain diverse choices for diverse customers** and to expand choices further based on **technological neutrality.**
- **Region by region, a desirable pathway toward carbon neutrality is different** as energy and relevant situations are divergent.
- Based on the quantitative scenario analysis, JAMA believe that there is potential **not only for 100% BEVs**, but also for **a wide variety of electrified vehicles including HEVs and PHEVs and the use of carbon-neutral fuel (CNF)** for global CO2 emissions reduction in road transport **to be in line with the IPCC's 2050 1.5°C climate scenarios.**
- In such cases have its own challenges, **and the automotive industry needs to work together with all stakeholders to solve these challenges**, such as increasing renewable energy, developing charging and hydrogen refilling infrastructure, and developing a carbon-neutral fuel supply system.

# Regional Differences in In-Use Vehicle Fleet Growth

In-use vehicle fleet (excluding motorcycles) growth projections

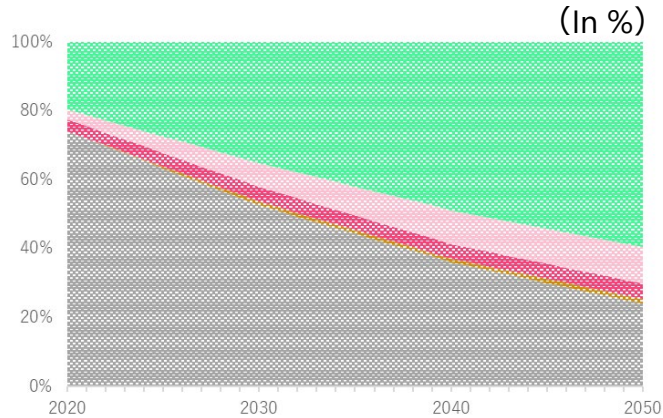


In-USE fleet Growth toward 2050 is remarkably different by each country/region.

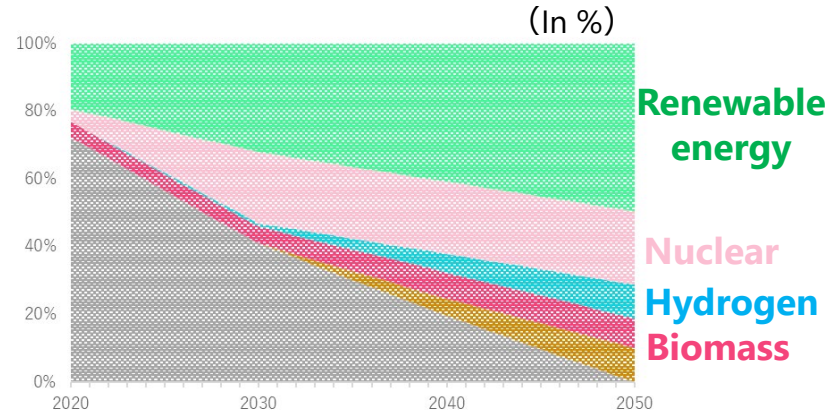
Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

# Regional Differences in Energy Mix

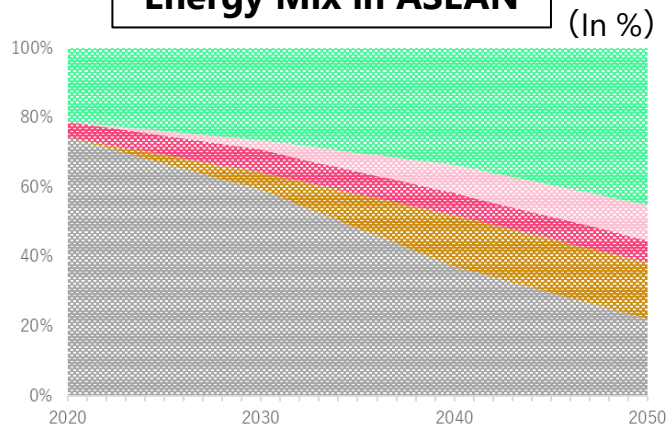
**Energy Mix in India**



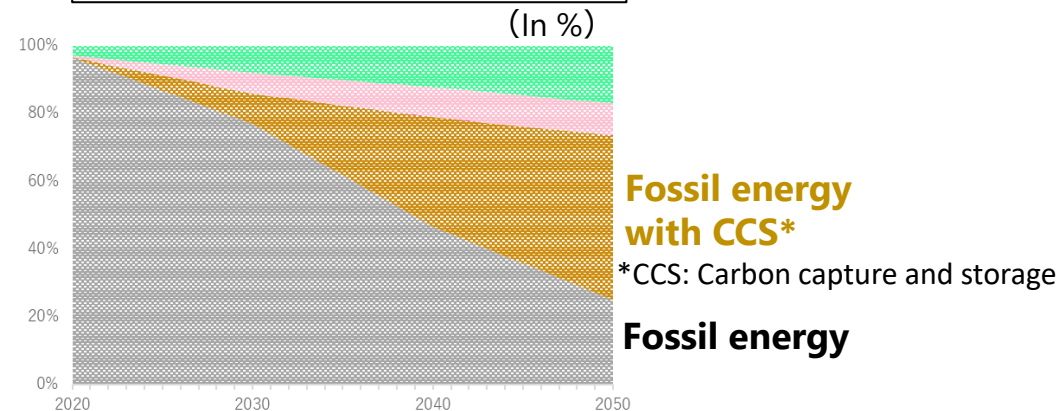
**Energy Mix in Japan**



**Energy Mix in ASEAN**



**Energy Mix in Middle East**



Energy mix and its strategy is different by country/region.

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA



# Scenario Based Analysis

- Taking into account **different circumstances between developed and emerging economies, JAMA commissioned the Institute of Energy Economics, Japan to analyze three scenarios** (in addition to a BAU scenario) .

2050 Scenario Designation & Definition	BEV/FCEV Share of New Passenger Vehicle Sales			2050 Projected CNF Share in Automotive Fuel Mix [2020 FC*-Based]
	Worldwide	Advanced economies	Emerging economies	
Scenario 0 BAU <sup>1</sup>	BAU	←	←	←
Scenario 1 CNF: Wide use of CNF	40%	50%	25%	30% approx.
Scenario 2 BEV75: Wide electrified vehicle adoption	75%	100%	50%	20% approx.
Scenario 3 NZE: 100% BEVs/FCEVs (IEA NZE <sup>2</sup> scenario)	100%	100%	100%	7% (biofuel only)

\*FC: Fuel consumption

<sup>1</sup> BAU: "Business as usual" <sup>2</sup> IEA: International Energy Agency; NZE: "Net Zero Emissions by 2050"

<sup>2</sup> IEA: International Energy Agency; NZE: "Net Zero Emissions by 2050",

Energy mix projections in the study scenarios were based on energy mix data in IEEJ\_ATS, taking into account the energy supply situation worldwide.

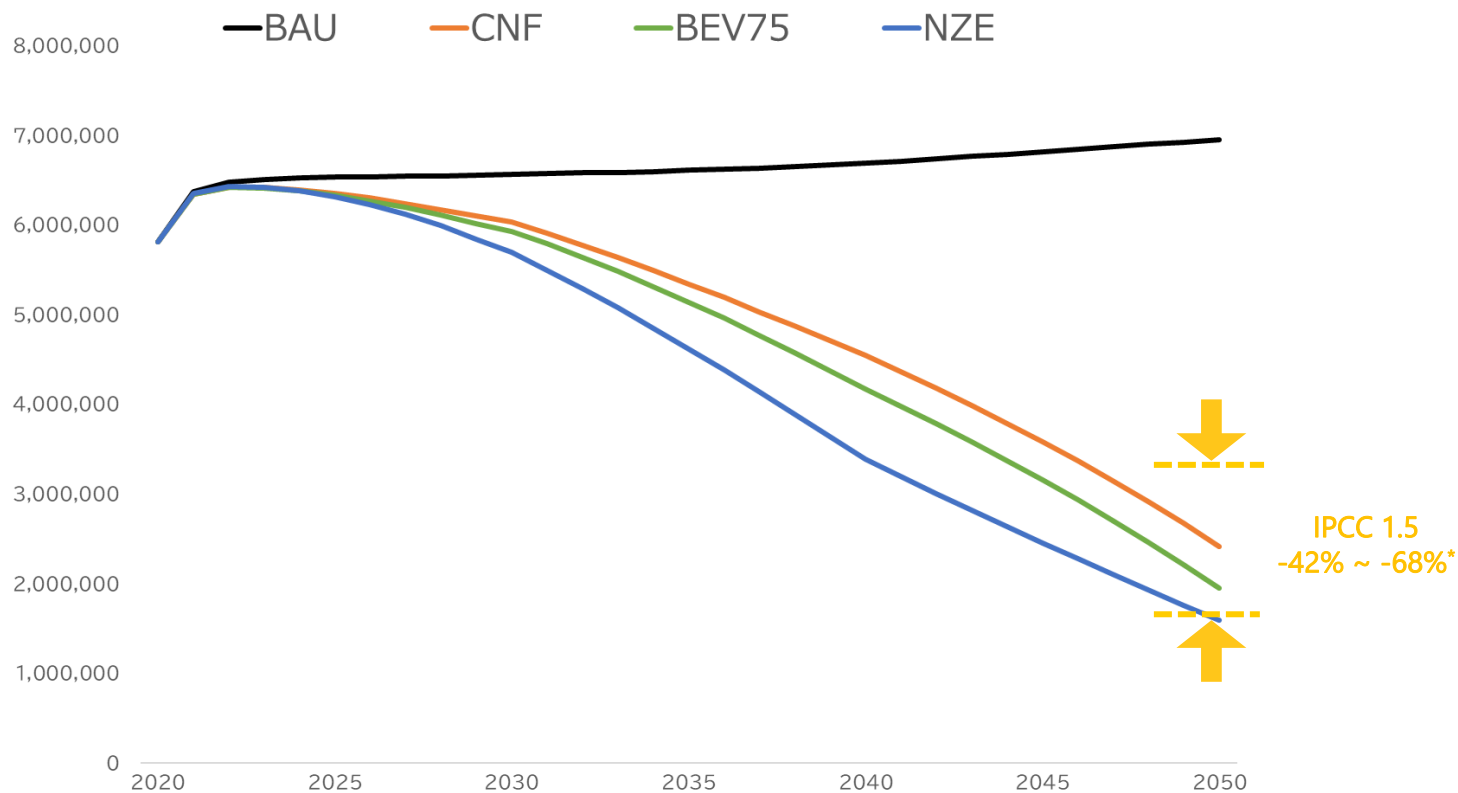
(IEA\_NZE does not include energy mix data by country/region.)

Advanced economies: Japan; North America; Europe; etc.; Emerging economies: India; ASEAN; Africa; etc.

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

# CO2 Emissions Worldwide 2020-2050, by Scenario

(KtCO<sub>2</sub>)

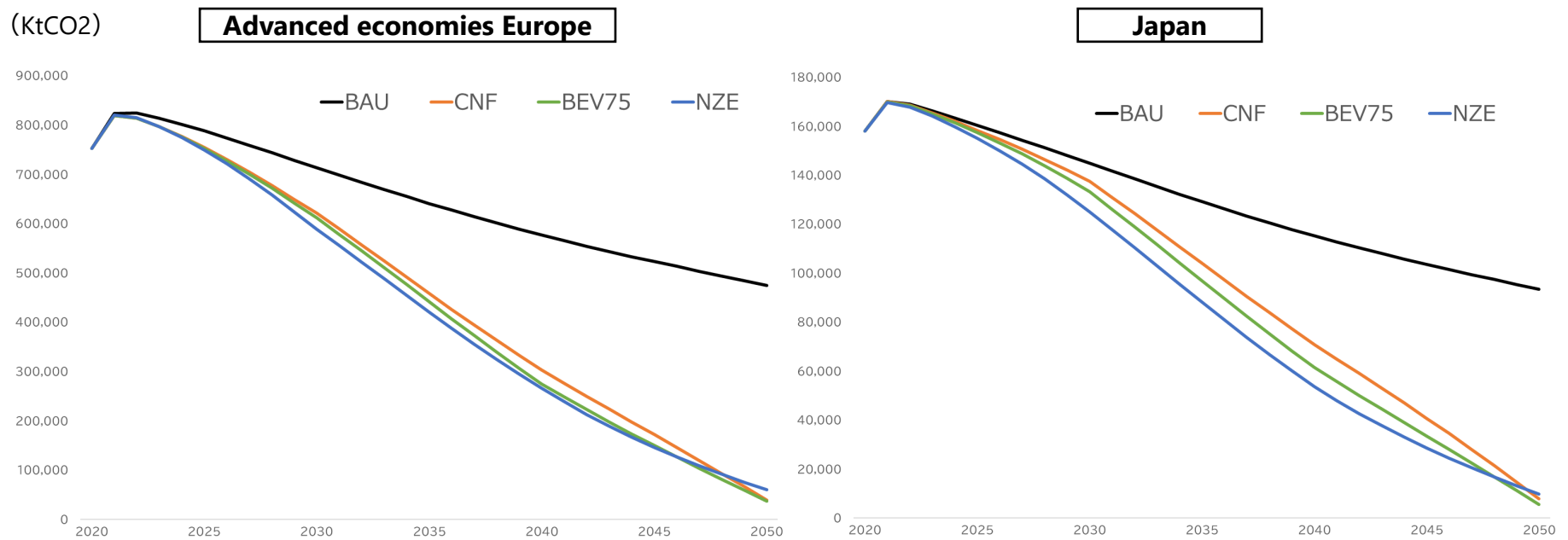


\*The range of -42% to -68% shown in this describes the upper and lower limits of a number of 1.5°C scenarios based on the scientific findings used by the IPCCAR6.

In all three scenarios, CO<sub>2</sub> emissions worldwide are in line with the IPCC's 2050 1.5°C climate scenarios.

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

# CO2 Emissions in Advanced Economies 2020-2050, by Scenario

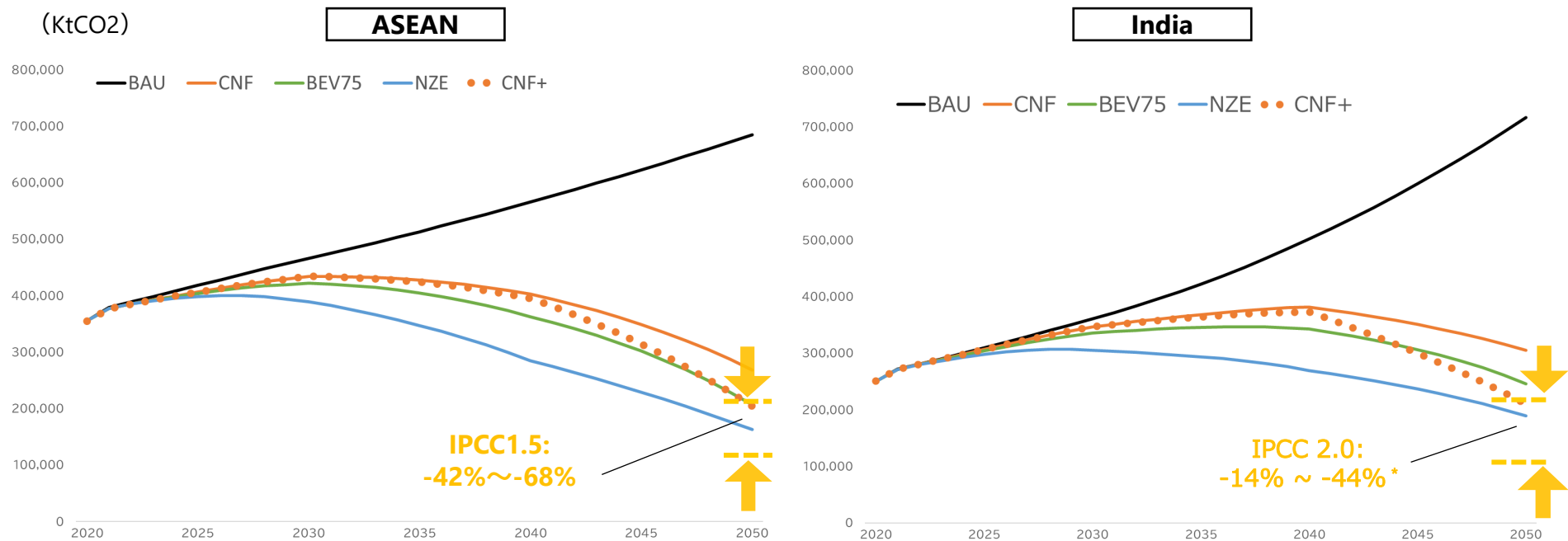


All scenarios (excluding the BAU scenario) demonstrate the potential in advanced economies for carbon neutrality in automotive transport by 2050.

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

# CO2 Emissions in Emerging Economies 2020-2050, by Scenario

In many emerging economies, vehicle sales volumes and BAU emissions are expected to rise significantly.



\*The range of -14% to -44% shown in this describes the upper and lower limits of a number of 2.0°C scenarios based on the scientific findings used by the IPCCAR6.

Note: The CNF+ scenario assumes that CNF supply is 1.25 times greater than in the CNF scenario, has a 40% (approx.) instead of 30% share (approx.) in the fuel mix and that most of the increase will be supplied to Africa, the Middle East, India, and ASEAN where the supply of decarbonized energy is a major challenge.

A 1.25 increase in carbon-neutral fuel supply compared to the CNF scenario will make it possible for CO2 emissions in emerging economies to be in line with the IPCC's 1.5<sup>2</sup>°C scenarios for 2050.

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

# Summary of Study Findings in the analysis

Context	CO <sub>2</sub> Emission Levels in 2050
<p><b>Worldwide</b></p>	<ul style="list-style-type: none"> <li>• Findings show that the study's three scenarios (excluding the BAU scenario) demonstrate the potential for global CO<sub>2</sub> emissions reduction in automotive transport to be in line with the IPCC's 2050 1.5°C climate scenarios. <small>IPCC: Intergovernmental Panel on Climate Change</small></li> <li>• The IEA's NZE scenario is premised on one pathway towards carbon neutrality, but the JAMA study confirms that there are <b>other pathways, comprising a wide variety of electrified vehicles including HEVs and PHEVs and the use of carbon-neutral fuel (CNF).</b></li> </ul>
<p><b>Advanced economies</b></p>	<ul style="list-style-type: none"> <li>• The study's three scenarios demonstrate the <b>potential</b> in advanced economies <b>for carbon neutrality in automotive transport by 2050.</b></li> <li>• <b>To that end, however, in addition to decarbonized electricity, the supply of carbon-neutral fuels for in-use vehicle fleets will be necessary.</b></li> </ul>
<p><b>Emerging economies</b></p>	<ul style="list-style-type: none"> <li>• <b>In many emerging economies,</b> vehicle sales volumes are expected to rise significantly.</li> <li>• If the amount of CNF in the automotive fuel mix in 2050 can be increased to a level equivalent to 40% (approx.) of global automotive fuel consumption in 2020, it will be <b>possible for CO<sub>2</sub> emissions</b> in emerging economies <b>to be in line with the IPCC's 1.5&lt;sup&gt;2&lt;/sup&gt;°C climate scenarios for 2050.</b></li> </ul>

Source: Transitioning to Carbon Neutrality by 2050: A Scenario-Based Analysis, JAMA

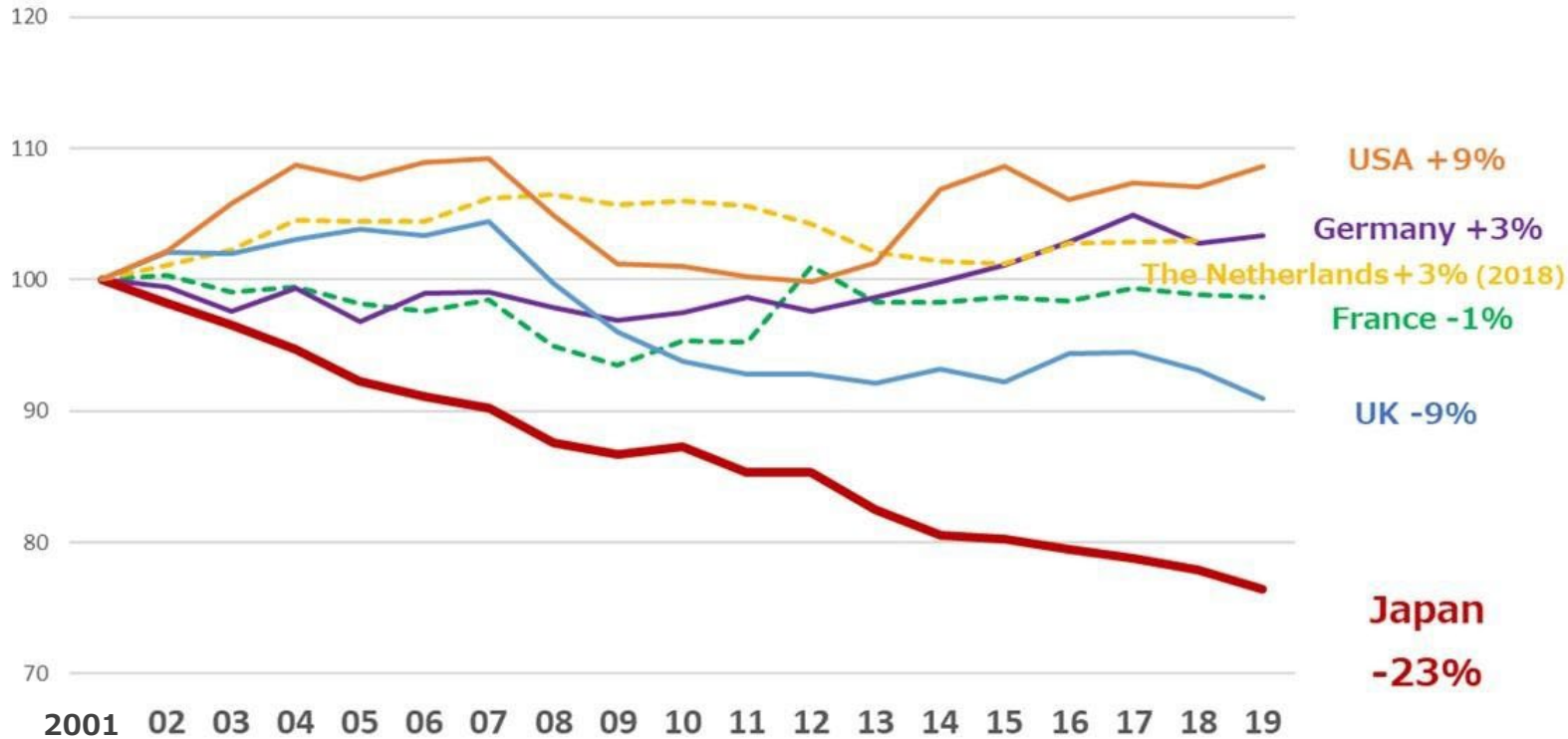
# Our Resolution

**JAMA member companies, together with their global stakeholders, will make maximum efforts towards carbon neutrality by 2050 by developing technologies to further reduce automotive CO<sub>2</sub> emissions so that they can provide optimal choices for consumers in countries/regions worldwide.**

# Appendix

# International comparison of CO2 emissions by automobiles

The reduction of CO<sub>2</sub> emissions by 23% is significantly larger than other countries. The Japanese automotive industry has an advantage in having led the reduction efforts.

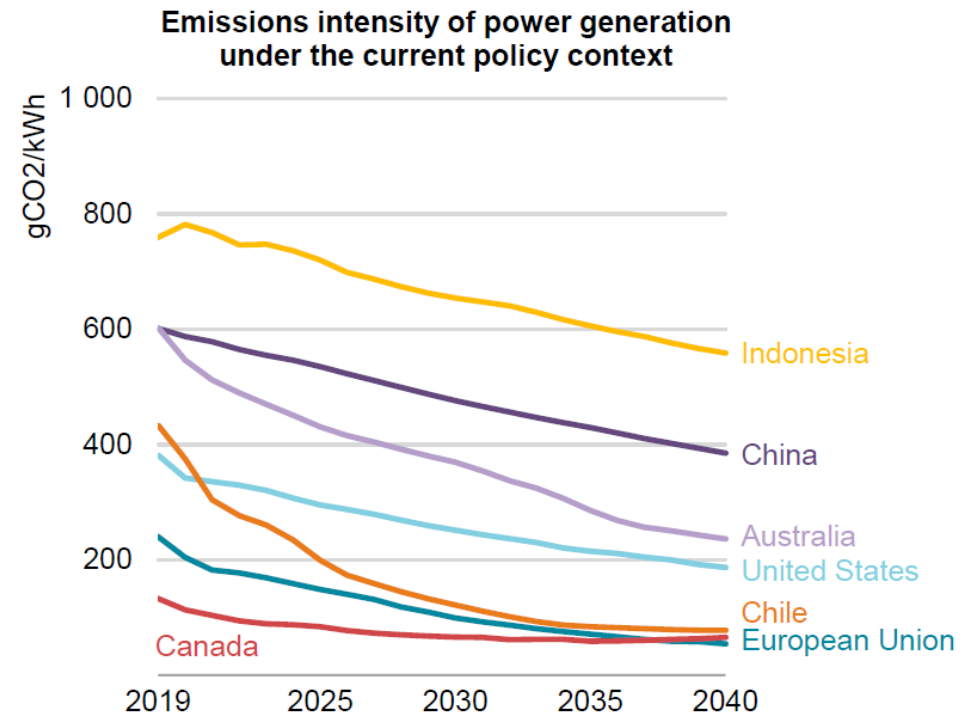
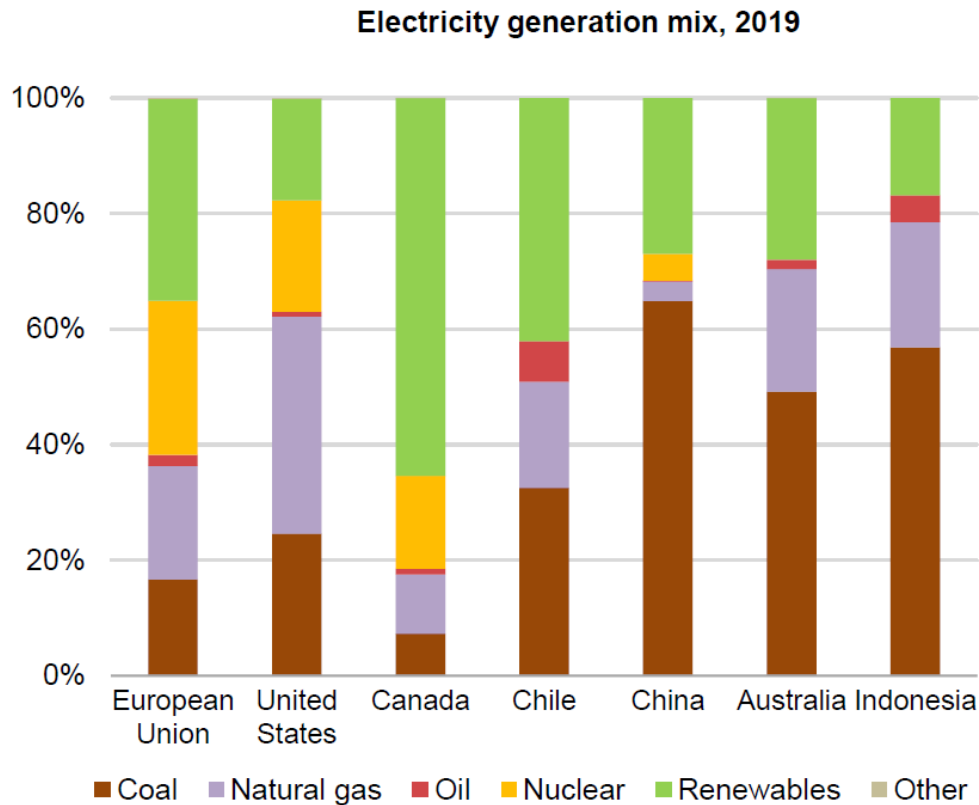


Source: JAMA

**Japan's approach has been achieving more CO2 reduction**



# Electricity generation mix and emission intensity projection

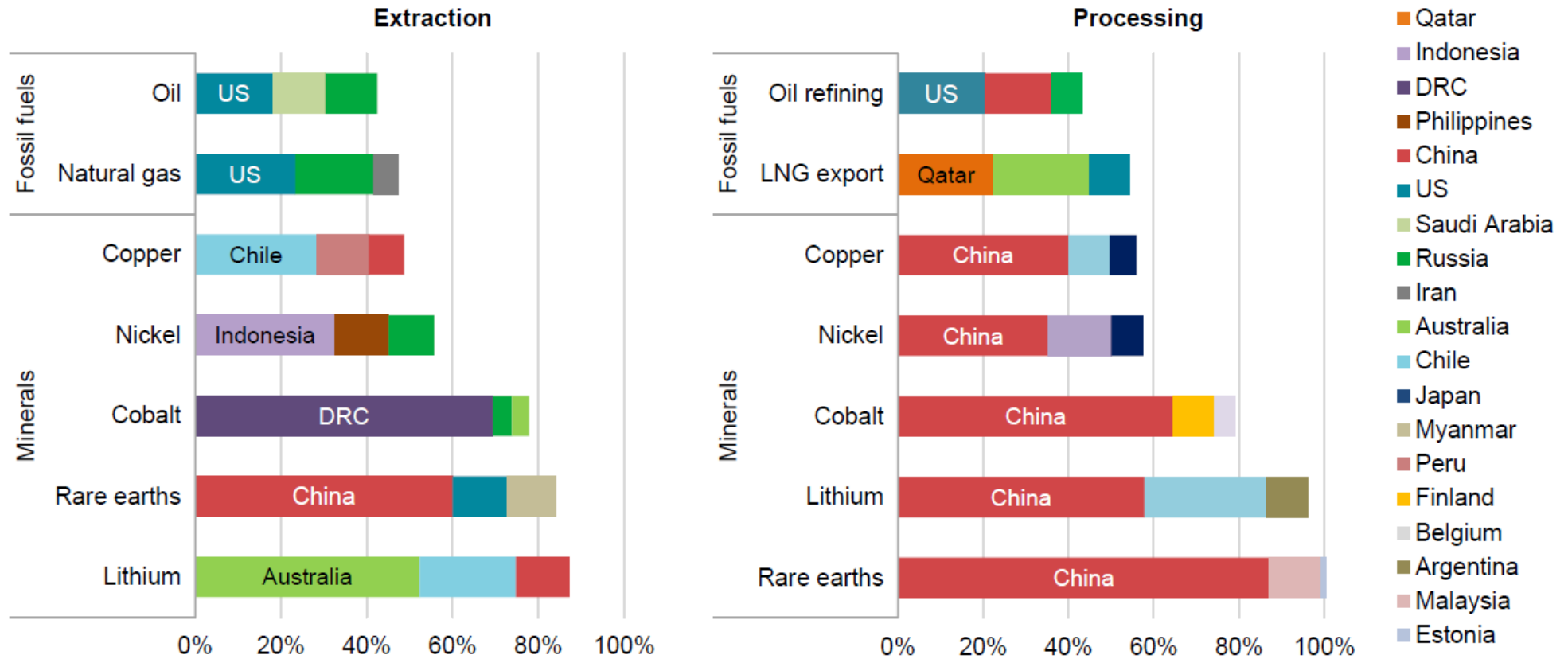


Source: IEA The Role of Critical Mineral in Clean Energy Transition, March 2022

**EU and Canada have competitive advantage in terms of low carbon electricity**

# Share of selected minerals necessary for electrification

Share of top three producing countries in production of selected minerals and fossil fuels, 2019



Source: IEA The Role of Critical Mineral in Clean Energy Transition, March 2022

**Limited number of countries have significant market share**

## 2.9 Fuel Mix and CNF Supply: Assumptions

Based on IEEJ study data, the potential CNF share in the automotive fuel mix in 2050 is estimated to be approximately 30 to 40% of total automotive fuel consumption in 2020.

### Synthetic fuel supply

- Taking into consideration various perspectives, JAMA also made estimates and confirmed that potential supply volumes will be almost the same as in the IEEJ study data.
  - The International Air Transport Association (IATA) has issued a “2050 net zero” declaration and estimated that 449 billion liters of sustainable aviation fuel (SAF) will be necessary by 2050.\*
  - JAMA estimated synthetic fuel supply volumes by assuming 1/3 to 1/2 of the amount of SAF will be produced by the Fischer-Tropsch (FT) process, which yields high rates of SAF while producing gasoline and diesel as byproducts (Shulz-Flory distribution).
- Since synthetic fuels are a byproduct of sustainable aviation fuel (to be “net zero” by 2050), JAMA confirmed that synthetic fuel carbon intensity becoming “zero” by 2050 is possible.

### Biofuel supply

- JAMA confirmed potential supply volumes based on data in the IEA’s “Energy Technology Perspectives.”
- With the U.S. corn ethanol industry association having confirmed that corn ethanol can be carbon-neutral by 2050, JAMA confirmed that biofuel carbon intensity becoming “zero” by 2050 is possible.

\*SAF estimates: <https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/>

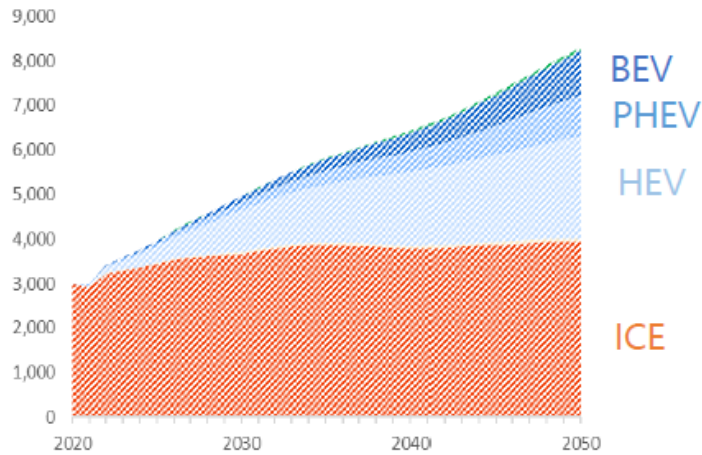
CNF supply volume in the CNF scenario is based on the assumption that 1/3 of the 449 billion liters of SAF will be produced by the FT process.

CNF supply volume in the CNF+ scenario is based on the assumption that 1/2 of SAF will be produced by the FT process (for a 50% increase in synthetic fuel supply volumes and a 25% increase in total CNF supply volumes compared to the CNF scenario), consistent with IATA’s estimates. The additional supply of CNF in the CNF+ scenario is allocated to Africa, the Middle East, India, and the ASEAN region where decarbonized energy supply poses a major challenge.

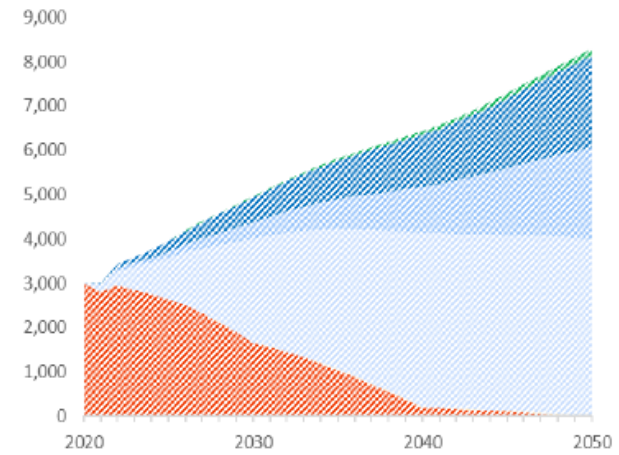
# New Passenger Car Sales (ASEAN)

(x 1,000 units)

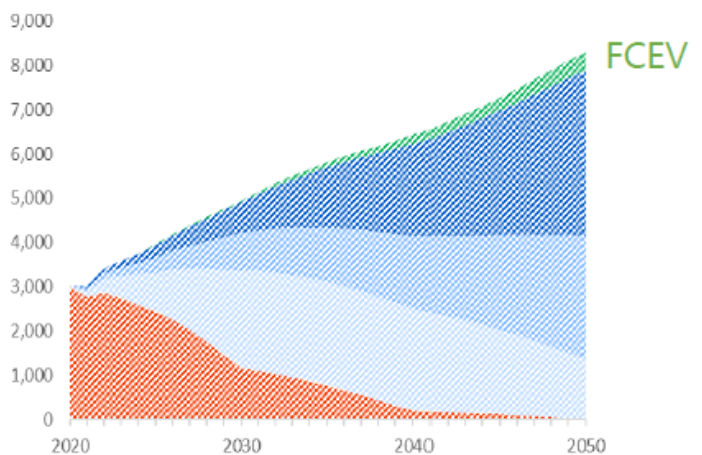
BAU



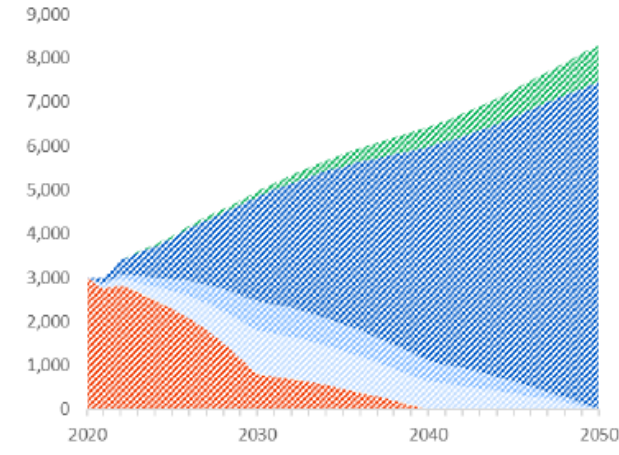
CNF



BEV75



NZE

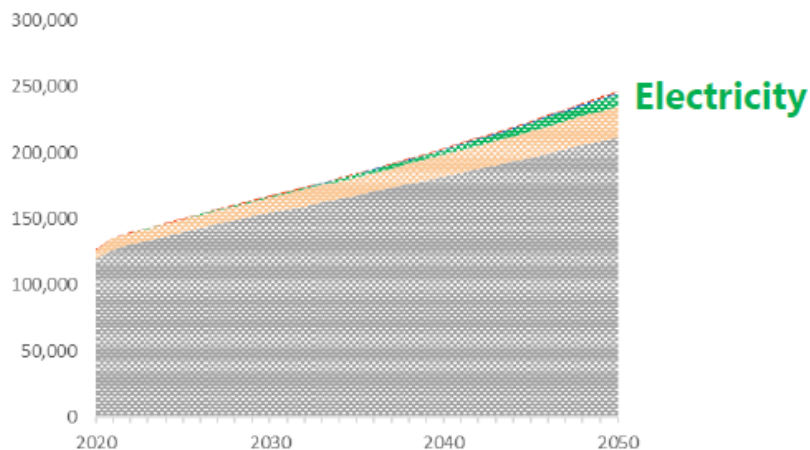


Source: JAMA

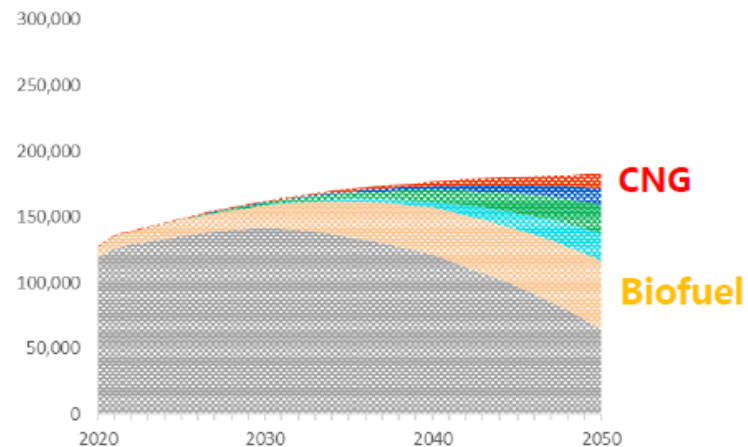
# Automotive Fuel Mix (ASEAN)

(In ktoe)

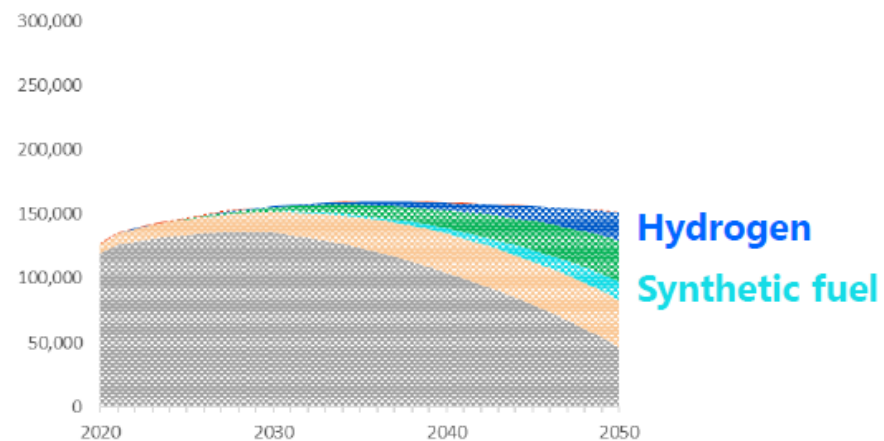
BAU



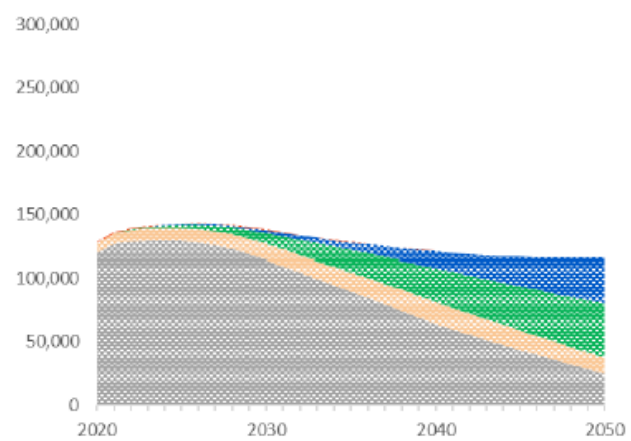
CNF



BEV75



NZE



Source: JAMA