Japanese Government's Efforts to Achieve Carbon Neutrality in the Automotive Sector

Carbon dioxide emissions in the transportation sector in Japan

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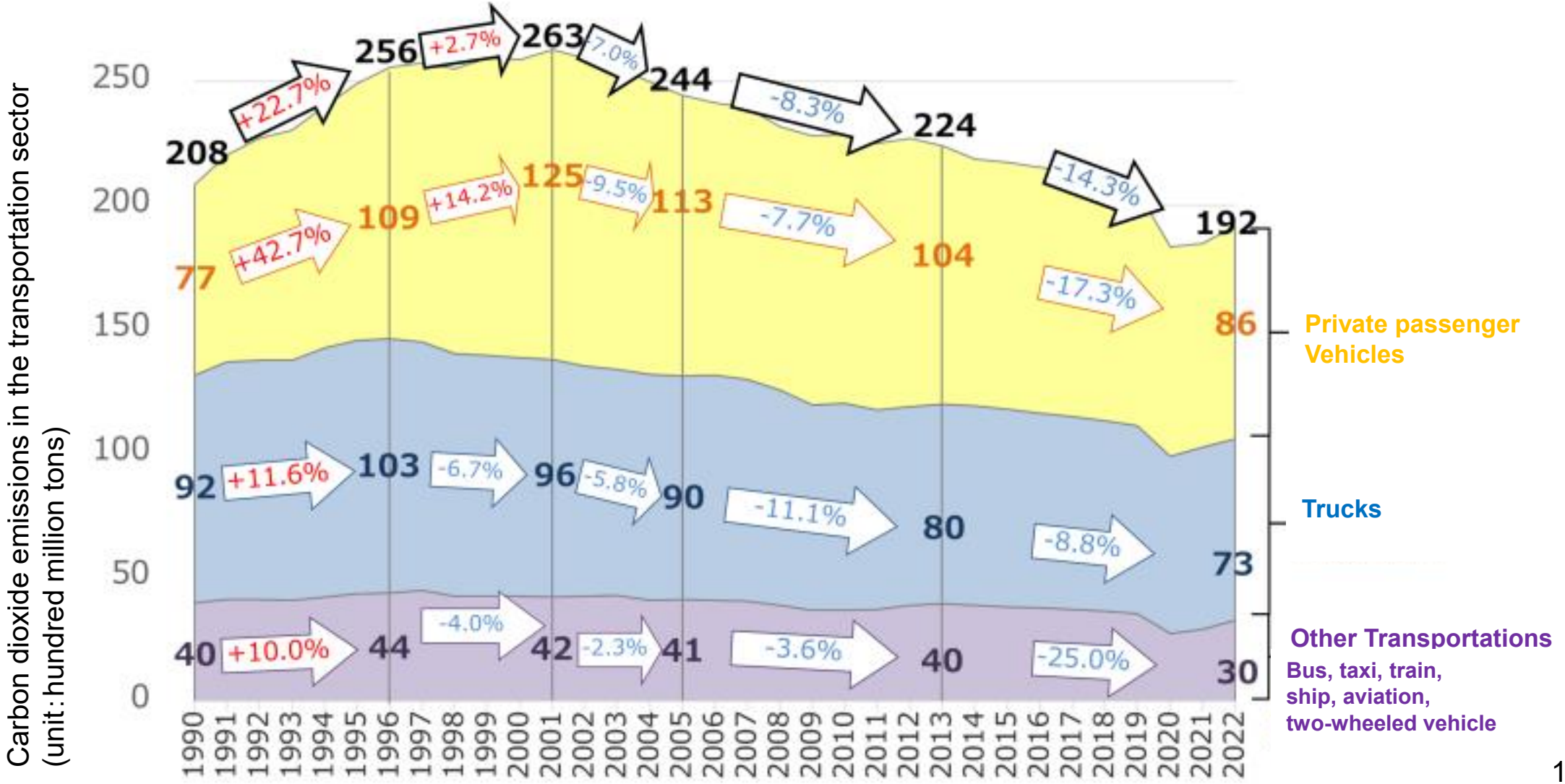
- Transportation sector including automotive sector has accounts for large amount of CO2 emissions, but in a downward trend since FY2001



Move toward a Carbon-Neutral, Decarbonized Society in 2050

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■ **Prime Minister's Policy Speech (October 26, 2020)**

The goal is to reduce overall greenhouse gas emissions to zero by 2050, meaning **a carbon-neutral, decarbonized society in 2050**.

■ **Green Growth Strategy for Carbon Neutrality in 2050 (June 18, 2021)**

【Next slide for details】

■ **Prime Minister's Policy Speech at COP26 World Leaders Summit (November 1, 2021)**

"With an aim to realizing a future where vehicles, the world's essentials, will become zero emission, **Japan will take advantage of all the available options of technologies**."

"Japan will develop next-generation batteries and motors, hydrogen, and synthetic fuels, which all hold the key to the spread of electric vehicles."

Government Goals for Vehicle Electrification

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Green Growth Strategy for Carbon Neutrality in 2050 (June 18, 2021)
（Government Goals for Vehicle Electrification）

- Passenger vehicles
  - electrified vehicles(※) will account for 100% of new vehicle sales by 2035

    ※"Electrified vehicles" include Electric Vehicles, Fuel Cell Vehicles, Plug-in Hybrid Electric Vehicles, and Hybrid Electric Vehicles
- Commercial vehicles（over 8 tons）
  - an advanced introduction of 5,000 vehicles in the 2020s.
  - setting a target for 2040 electrified vehicle penetration by 2030.
- Commercial vehicles（8 tons or less）
  - electrified vehicles will account for 20-30% of new vehicles sales by 2030
  - electrified vehicles and decarbonized fuel vehicles will account for 100% by 2040

Measures to Promote the Dissemination of Next-Generation Vehicles

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- Promotion of the spread of next-generation vehicles with superior environmental performance by three major initiatives

Establishment of Fuel Efficiency Standards

Fuel efficiency standards

1. Passenger cars

- In 2020, the 2030 standards (EV and PHEV added to the scope) were established.

2. Heavy-duty vehicles

- In 2006, the world's first fuel efficiency standards for HDVs were established.
- In 2019, the 2025 standards were established.

Tax Incentives and Subsidies

Tax incentives

(e.g., eco-car tax reduction)

- Exemption for next-generation vehicles such as electric vehicles

Subsidy

- The subsidy is provided for the introduction of vehicles with high environmental performance.

*Quotes from JAMA
(Isuzu, ERGA EV)

International Harmonization of Regulations (WP29)

FCVs and EVs

- Adoption of these international standards as safety standards

a-LCA

- Leading the discussion to establish a fair and internationally harmonized LCA methodology.

United Nations (UN)

United Nations Economic Commission for Europe (UNECE)

World Forum for Harmonization of Vehicle Standards (WP29)

- Pollution and Energy（GRPE）
- .....

Fuel Efficiency Standards

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● Fuel efficiency standards were established based on the related Act

Light-duty Passenger vehicles

※Gross vehicle weight 3.5 tons or less

	Average fuel efficiency [FY2020 target → FY2030 target]
	17.6 km/L → **25.4 km/L** Strengthened by about 44. 3%

Light-duty Commercial vehicles

※Gross vehicle weight 3.5 tons or less

	Average fuel efficiency [FY2015 target → FY2022 target]
	14.5km/L → **17.9km/L** Strengthened by about 23.4%

Heavy-duty vehicles

※Gross vehicle weight over 3.5 tons

	Average fuel efficiency [FY2015 target → FY2025 target]
Bus 	5.71 km/L → **6.52 km/L** Strengthened by about 14.3%
Trucks/Tractor 	6.72 km/L → **7.63 km/L** Strengthened by about 13.4%

Promotion of development of next-generation heavy-duty vehicles

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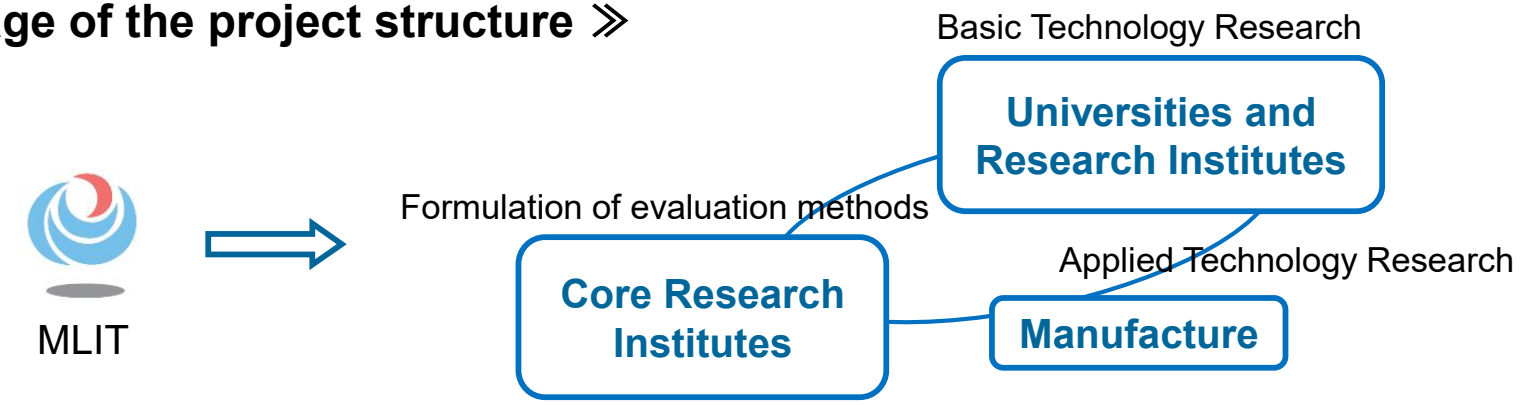
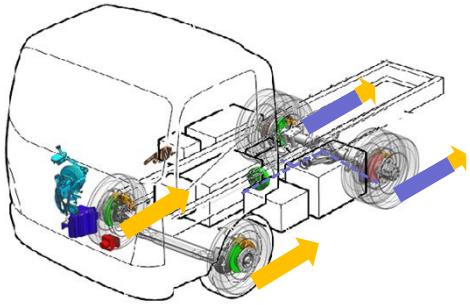
- Promotion of development of next-generation heavy-duty vehicles through collaboration between industry, academia, and government

≪ **Image of the project structure** ≫



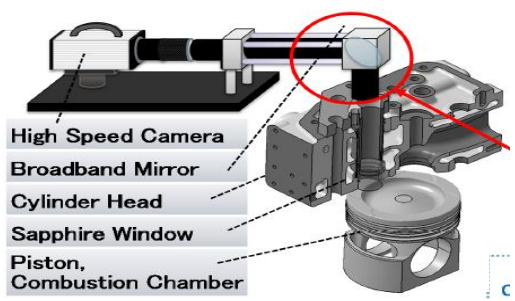
Electrification of heavy-duty vehicles

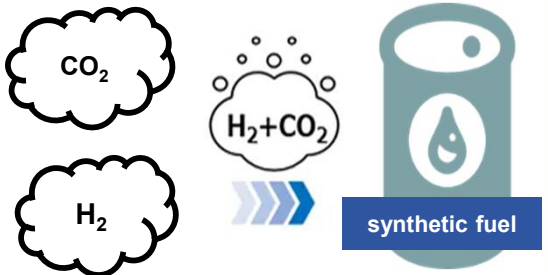
- ✓ Evaluation method for brake regeneration technology
- ✓ Methods for Measuring fuel efficiency of HFCVs



Practical application of carbon neutral fuels

- ✓ Evaluation Methods for Hydrogen Combustion Technology
- ✓ Impact assessment of synthetic fuel use





WP.29's contribution to Net Zero

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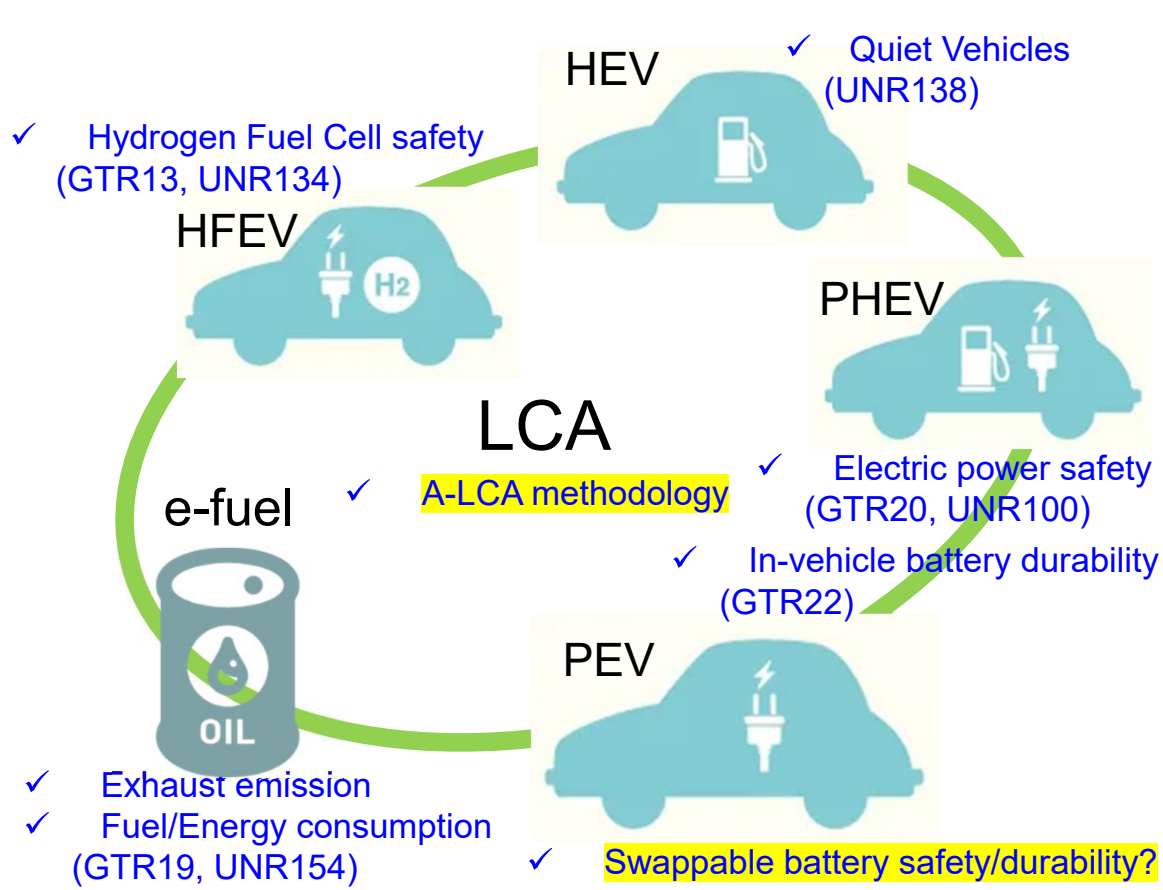
- In order to promote and spread new automotive technologies in a safe manner, it is important to promote standardization and its international harmonization.
- **The importance of activities in WP.29 was also addressed in the April 2024 G7 Transport Ministerial Declaration in Italy.**



G7 Italy Transport Ministerial Meeting

"The Future of Mobility: Ensuring Global Connectivity in an Uncertain World" (2024.4)

26. **We underline the importance of the UNECE's World Forum for the Harmonization of Vehicle Regulations (WP.29).** We intend to continue and strengthen the cooperative efforts in developing internationally harmonized safety and emissions regulations, and guidelines for vehicles, including automated, electrified and connected vehicles. **WP.29 also works cooperatively on issues related to decarbonization technologies**, including safety and battery durability of electrified vehicles and safety of hydrogen fuel cell vehicles, and GHG emissions assessment over the entire vehicle life cycle.

Life cycle assessment

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- It is essential to evaluate the entire life cycle assessment (LCA), so, **Japan proposed to make LCA a priority item for consideration at the Technical Subcommittee (GRPE) in November 2021** in WP.29.
- Discussions are underway to aim for agreement at WP.29 in March 2026.

A-LCA IWG (April 2024）

2. Objective

2.1. The IWG on A-LCA is an open structure which will enable the exchange of information and experiences on relevant regulations, policy measures and standardisation efforts. It is intended that the discussions will encompass all types of road automotive products with different technologies for energy pathways.

2.2. Methods of measurement of GHG emissions of automotive life cycles are not defined under either the 1958 Agreement or the 1998 Agreement. The objective of the IWG on A-LCA is to develop an internationally-harmonised procedure to determine the carbon footprint* of different technologies, also considering energy use for energy pathways and automotive types from production to use and disposal, as a resolution under the framework of WP.29.

2.3. This resolution can be used to help make policy and can encourage automotive industries to reduce carbon footprint*, also considering energy use. The methodology shall be developed respecting the principles of transparency and consistency. It shall also strike a balance between the accuracy and the workload considering the complex supply chain of the automotive industry.

TOR agreed at GRPE87

Fostering innovation for decarbonization

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- Demonstrations and studies are underway for energy management in local areas utilizing battery-swappable EVs and battery stations.
- There are no international regulations/ standards regarding safety or durability. (e.g. swappable batteries are not taken into account in UNR100 or GTR22.)
- **In Japan, <u>the CN Center was launched</u>** in January 2024 **<u>to develop international regulations/ standards to foster decarbonization technologies, including swappable battery systems</u>**.

Case Studies

✓ Mitsubishi Fuso Begins Demonstration for Commercial Trucks

*Quotes from the website of Mitsubishi Fuso Corporation

✓ ACM has developed its own manual battery-changing vehicle, “The ACM CITY ONE.

*Quotes from ACM corp. website

国土交通省
Ministry of Land, Infrastructure, Transport and Tourism

令和６年１月24日
物流・自動車局 車両基準・国際課

バッテリー交換式 EV の国連基準の策定をオールジャパンで推進します！

高い稼働率や経済性が求められるトラック等の商用自動車のカーボンニュートラル達成に向けて、我が国で開発・実証されるバッテリー交換式 EV 技術の国連基準化を目指し、オールジャパンで取り組みを推進します。

国土交通省では、これまで、カーボンニュート
性等に関する国連基準の策定を主導し普及を
しかしながら、商用 EV については、航続距
す。そのため、自動車メーカーや運送事業者等
可能なバッテリー交換式 EV の開発や実証が
今般、我が国で開発・実証が進められるバッ
（国連基準）の策定を実現するため、官民の
第１回会合を１月 31 日に開催します（詳
カーボンニュートラルセンターにおいて国内外
で行い、今年中にバッテリー交換式 EV の国
す。

Press Release for CN Center Meeting

経済産業省

Decarbonization of the automotive industry

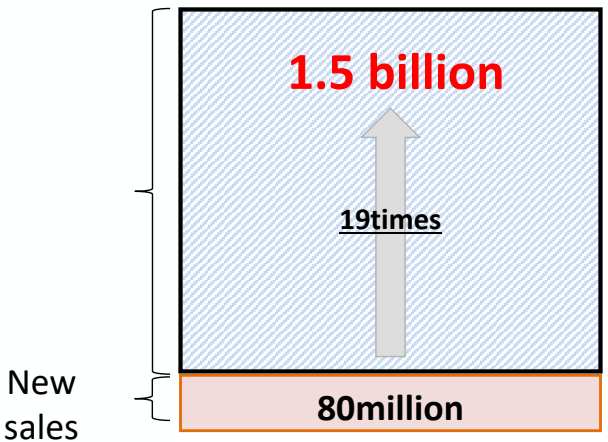
September 20th 2024

Importance of concept of “Vehicle Stock”

80 millions of vehicles are sold every year, whereas there are **1,500 millions of vehicles in the world**.

Focusing on **the emissions reduction from vehicle stock** can allow **holistic approachs and large policy flexibility** for each countries.

Vehicle Stock



(Sources) MARKLINES for new vehicle sales. FORIN for World Vehicle Ownership.

Holistic Approach/Policy Flexibility

New vehicle sales

- fuel efficiency for ICEVs , HEVs
- ZEV target
- Size of vehicle

Existing vehicles

- Establish proper used car market
- Replace less fuel-efficient vehicles
- CN fuels (Bio-fuels, e-fuels)

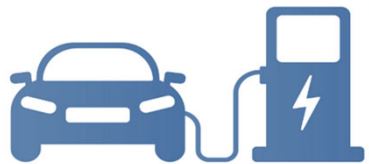
Transportation

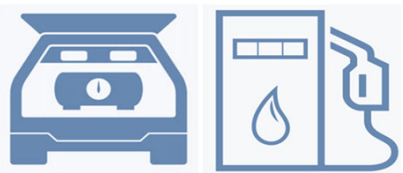
- Urban planning (reduce traffic jam)
- Modal shift, etc.

Decarbonization of road sector through a range of pathways

To achieve carbon neutrality in the road sector, it is important to pursue **a range of pathways**.

Energy sources		Powertrain		Infrastructure
CO2 Free electricity (renewable energy, nuclear power, etc.)	×	BEV、PHEV	×	➢ Charging infra-structure ➢ V2X
CO2 Free Hydrogen	×	FCV	×	Hydrogen stations
Carbon Neutral fuels (biofuels, e-fuel)	×	PHEV, HEV Flex-Vehicle	×	Gas Station





G7 Hiroshima Leaders' Communiqué

①We reaffirm our commitment to a highly decarbonized road sector by 2030 and **recognize the importance of reducing GHG emissions from the global fleet and the range of pathways to approach this goal** in line with trajectories required for keeping a limit of 1.5°C within reach.

COP28 First Global Stocktake (GST)

28. (g) Accelerating **the reduction of emissions from road transport on a range of pathways**, including through development of infrastructure and rapid deployment of zero-and low-emission vehicles;

G7 Climate, Energy and Environment Ministers' Meeting Communiqué (2024)

3.i) We recall the 2023 G7 Leaders' Hiroshima Communiqué and the CMA.5 Global Stocktake (GST) decision that calls on Parties to contribute to the global efforts accelerating the reduction of emissions from road transport through **a range of pathways** to achieve 1.5°C, ・・・

In this context, **we** recognize the need to keep on accelerating the reduction of emissions from road transport, and **note** the IEA analysis of tracking the progress on our efforts and emission reduction from vehicle stock, and **the opportunity that sustainable zero-emission vehicles and sustainably produced net-zero and low GHG emissions fuels** as part of an efficient decarbonization of the transport sector, provide for supporting a transition towards net-zero emissions by 2050.

Basic Policy and Target

The range of pathway

- ✓ Carbon Neutrality over the entire life cycle of automobiles by 2050
- ✓ Aim for **the range of pathways**, not limiting ourselves to specific technologies

Electrification

- ✓ **Passenger car : 100% electrified vehicles* in new sales by 2035**
  ***electrified vehicles: HEV, PHEV, BEV, FCV**
- ✓ Light-duty vehicles weighing 8 tons or less : **20-30% of new sales to be electrified vehicles by 2030**
- ✓ Heavy-duty vehicles over 8 tons : **introduce 5,000 units in the 2020s** in advance

Infrastructure development

- ✓ Install **300,000 chargers including** 30,000 fast chargers **by 2030**
- ✓ Establishment of about **1,000 hydrogen stations by 2030**

e-fuels

- ✓ **Commercialization of synthetic fuels by the early 2030s.**

Storage battery

- ✓ Increase **domestic manufacturing capacity to 150GWh** as early as possible **by 2030**

Promote penetration of Clean Energy Vehicles

Target: new sales / 100% **electrified vehicles*** by 2035. *BEV , FCV , PHEV , HEVs

Subsidy for purchase **CEV (= BEV,FCV,PHEV)**

Budget amount : 129.1 billion yen （=€797.5 million）

Subsidy amount (ex.)

※1€=161JPY

BEV

Max JPY 850k (=€5,250)

PHEV

Max JPY 550k (=€3,398)

K-car BEV

Max JPY 550k (=€3,398)

FCV

Max JPY 1,450k (=€8,958)

Develop Charging Infrastructure

Target: Install charging infrastructure to 300,000 plugs by 2030.

Three principals ① Improve user convenience, ② Ensure charging business sustainability , ③ Reduction of overall burden on society

Subsidy：36.0 billion yen（=€223.6 million）at FY2024./ bit-system

※1€=161JPY

Quick Charger

Max JPY 12,000k (=$745,342)

- As of Mar 2024, 10,128 plugs.
- **By 2030, 30,000** plugs to be placed in ;
  - Highway SA/PAs: 2,000-2,500 plugs
  - Roadside stations: 1,000- 1,500 plugs
  - SS: 10,000 plugs
  - CVS: 5,000 - 10,000 plugs
  - Dealers and automotive OEMs: 7,000-10,000 plugs

Nomal Charger

Max JPY 1,700k (=$10,559)

- As of Mar 2024, 30,195 plugs.
- **By 2030, 200,000 -350,000** plugs to be placed in ;
  - Public Destination Charging spot: 100,000 -150,000 plugs
  - Foundation charging at housing complexes: 100,000-200,000 plugs.

Hydrogen and Fuel Cell Vehicle

◆ **Target:** Hydrogen consumption of about **80,000 tons/year by 2030**

◆ **Focus:** FCVs have a longer driving range and require less time to fill up in comparison with BEVs. So, **FCVs in commercial vehicles** are in focus. In addition, **hydrogen stations for large size trucks** are being implemented.

◆ **Demonstration**: Using the **Green Innovation Fund**, a small truck driving demonstration began in Tokyo and Fukushima in 2023. A large truck driving demonstration will begin on major highway in 2025 or later.

◆ **Budget** : 40.9 Billion yen (≒ $ 270.0 million)for **BEV/PHEV/FCV Truck, Bus and Taxi**.

FCV Small Truck

FCV Large Truck

Large-scale Hydrogen station

Expansion of the Combination of Decarbonized Fuels and High-performance Mobility Equipment

- Basic policy: Advancing global carbon neutrality through **the combination of decarbonized fuels (biofuels, e-fuel) and High-performance Mobility Equipment**
- **Aiming to Commercialize e-fuels by the early 2030s.**

●ISFM(2024, Japan and Brazil summit)

✓ The two leaders agreed to launch the **Initiative for Sustainable Fuel and Mobility (ISFM),** aiming at achieving carbon neutrality along with partners around the world by combining the decarbonized with the high-performance mobility equipment

Biofuels
e-fuel

×

PHEV, HEV
Flex-Vehicle

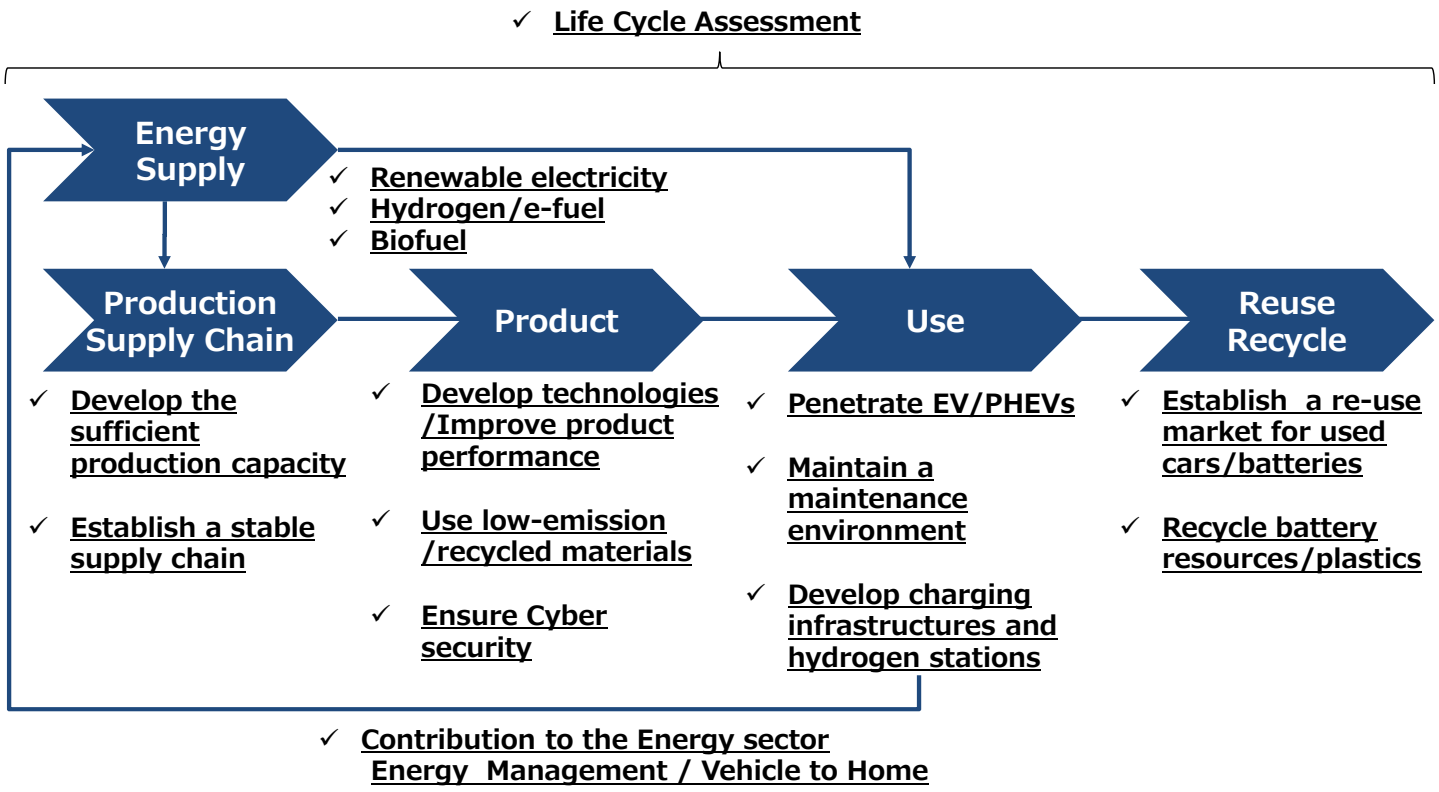
●E-fuels Dialogue

✓ The Berlin Declaration was agreed at this 2024 E-fuels Dialogue .

●Three advantages of using e-fuels

①reducing GHG emissions from a wide range of sectors, including **the global vehicle stock**
②their ease of **storage and transport**
③utilizing **existing fuel infrastructure**

Key factor of Sustainability for automobile industry



Ministry of the Environment
Japan

Decarbonization of the Automotive Sector

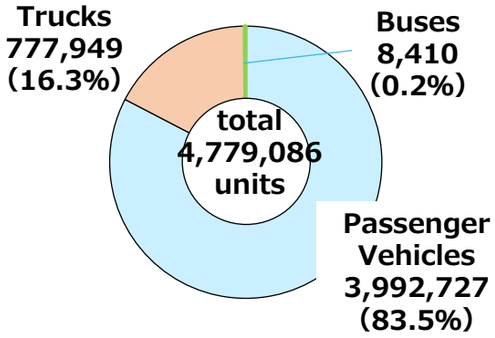
Decarbonized Mobility Projects Office,
Environmental Management Bureau,
Ministry of the Environment, Japan

Sept. 20th, 2024

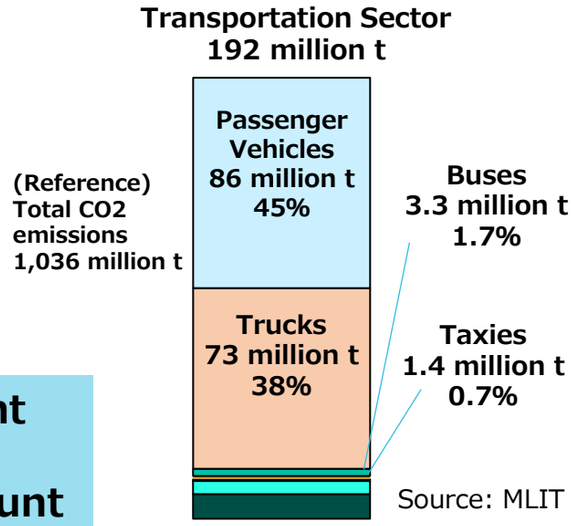
Ministry of the Environment's initiatives to achieve carbon neutrality in the automotive sector

- Ministry of the Environment (MOE) is working to achieve carbon neutrality in the automotive sector, in cooperation with Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT), **with a particular focus on initiatives for commercial vehicles**.
- MOE is supporting the acceleration of introducing commercial electrified vehicles through technological development, demonstrations, and subsidy system.

New vehicle sales by vehicle type and composition in 2023



CO2 emissions in the transportation sector in FY2022



✓ **Commercial vehicles account for less than 20% of new vehicle sales, but they account for nearly 40% of CO2 emissions in the transportation sector.**

Source: Japan Automobile Manufacturers Association, Inc. "Japan Automotive Industry 2024"

MOE's Approach

Technological Development and Demonstration

Swappable Battery EVs

Hydrogen ICE trucks

Electric/Hydrogen ICE construction machineries

Social Implementation

Electrification of Trucks, Buses etc.

Swappable Battery EV Development and Demonstration Project

■ For making effective use of existing vehicles currently on the market and creating a bridge to mass production of EVs, MOE is conducting development and demonstration project of **modifying existing vehicles to swappable battery EVs utilizing renewable energy**.

Challenges of adopting EV

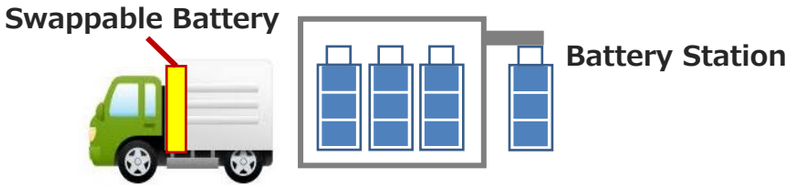
- Operating rate deteriorates because of **long charging time**.
- In “last one-mile delivery”, carriers often leave and return all at once. **Power peak and electricity cost will rise significantly** due to fast charging at the same time.
- **High installation and construction costs** ex.) Quick charger is required for each vehicle.

- **High introduction costs (vehicle price) making it difficult to recover the investment.**

*From interviews with delivery companies

Benefits of replacing to swappable battery EV

✓ **It is possible to replace the full-charge battery at any time in short time.**



✓ **By separating car body and battery, the delivery company can purchase only the car body.**

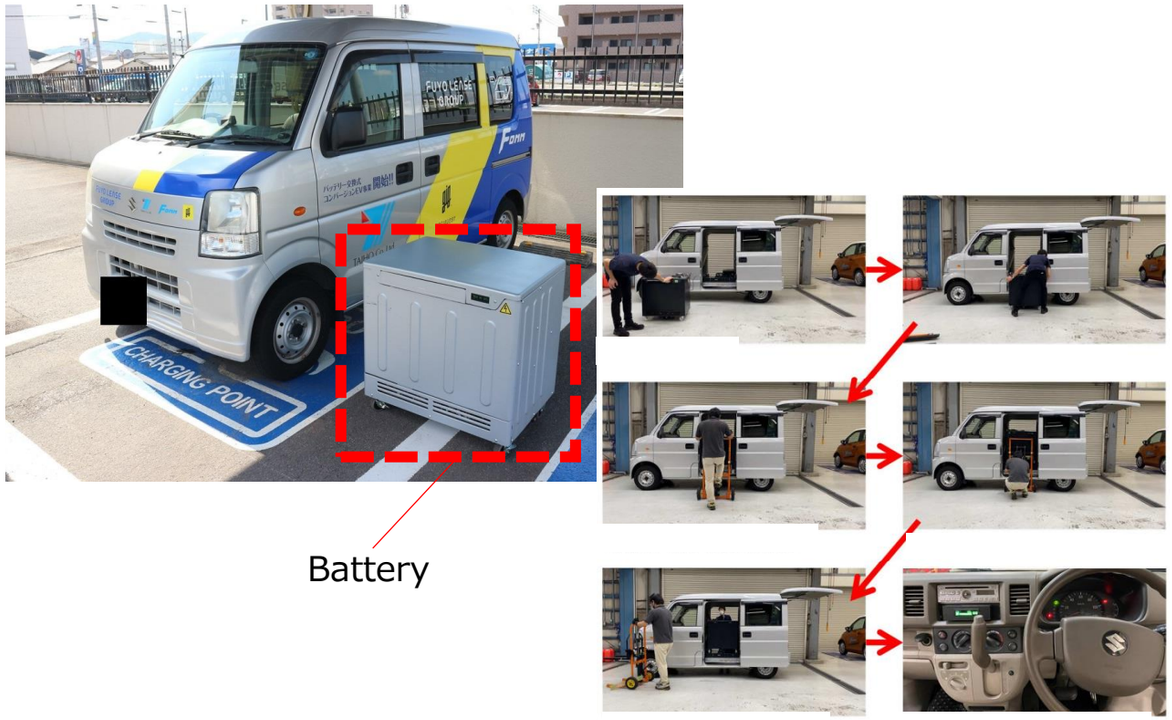
✓ Battery station can be used as an emergency power in the event of a disaster.

Development and Demonstration Project started from FY2021

Swappable Battery EV Development and Demonstration Project - Examples (1)

FOMM Corporation (FY2021 - FY2022)
With Marubeni Cooperation and Sowakai Co., Ltd.

- Development of **simplified modification of existing compact vans and "container-type batteries" that operate independently as storage batteries.**
- Demonstration of delivery with a daily driving distance of about 20 km to 60 km.



Battery installation procedure

ITOCHU Corporation (FY2021 - FY2024)
With Isuzu Motors Limited, JFE Engineering Cooperation, HKS CO., LTD., and FamilyMart Co., Ltd.

- Development of **modification of small-size trucks, battery packs that can be used with battery modules of multiple manufacturers as well as used battery modules, and automatic swapping battery stations equipped with solar PV**.
- Demonstration of fixed time and route delivery for convenience store with a daily driving distance of about 90 km (30 km × 3).

A battery being taken out from the swapping station

Swappable Battery EV Development and Demonstration Project - Examples (2)

ACR., Ltd. (FY2022 - FY2024)
With Yamato Transport Co., Ltd. and Sumitomo Mitsui Trust Bank, Limited

- Development of **modification of walk-through vans*, batteries with standardized sizes and electrode shapes, and a continuous monitoring system for battery SOH**.
- Demonstration utilizing solar PV for delivery services.

Battery

*A truck in which the driver's seat and the loading platform are integrated so that it is possible to move directly from the driver's seat to the luggage compartment.

Toyota Tsusho Corporation (FY2023 - FY2024)
With TOYOTSU LOGISTICS SERVICE CO.,LTD. and AZAPA Co., LTD

- Development of **modification of mini trucks and vans that operate with the same standard battery, and swapping battery stations with a "Station to Home" function**.
- Demonstration for the delivery of agricultural products with an estimated daily driving distance of about 70 km.

Battery

Next Step for Swappable Battery EV Development and Demonstration Project

- Through the project, modification of multiple vehicle types and adopting swappable battery EVs in various use cases of delivery while utilizing renewable energy are demonstrated.
- **For accelerating social implementation, swappable battery EV was added to the scope of subsidies for electrification of commercial vehicles from this spring.**
- MOE will continue to contribute to solving issues toward the spread of swappable battery EVs (ex. consideration of standards for related technologies etc.) by accumulating case studies while cooperating with relevant organizations.

Commercial Vehicle Electrification Promotion Project
(METI/MLIT/MOE cooperation project)

Truck

EV truck EV van FCV truck



Taxi

EV taxi PHEV taxi FCV taxi



Bus

FCV bus EV bus


Swappable Battery EV




Ministry of the Environment
Japan