

International and Domestic Trends of Environmental Regulations on Vehicle

- Towards Carbon Neutrality -

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In the face of climate change issues, there have been growing global trends for “carbon neutrality,” which means balancing between emitting carbon and absorbing carbon from the atmosphere in carbon sinks. In 2015, 196 parties adopted the Paris Agreement at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. Furthermore, to achieve this long-term temperature goal, countries aim to reach the global peaking of greenhouse gas emissions as soon as possible to achieve a climate-neutral world by mid-century. In Japan, in October 2020, the Government committed the carbon neutrality in 2050, followed by "the Action Against Global Warming" in October 2021, which raised the target of a 46% reduction of greenhouse gases (over 2013 year). On the other hand, the transportation sector has a 19% share of whole CO₂ emissions in Japan, and about 90% of CO₂ emissions from the transportation sector consist of road transportation (i.e., owner cars, trucks, and buses). That is why Japan needs to take comprehensive actions such as promoting vehicle electrification, improving fuel efficiency, and optimizing vehicle utilization by users. In this context, this paper introduces recent activities and prospects of policies by the Japanese Government and approaches by the United Nations regarding automotive environmental regulations that contribute to carbon neutrality.

First, the Japanese Government sets in the "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" (published in June 2021) the concrete target regarding vehicle electrification as with other major countries during the past few years. As for the passenger vehicles, the share of electrified vehicles (EV, FCV, PHEV, and HEV) newly introduced in the market is to be 100% by 2035. Moreover, as for the commercial vehicles, it states that the share of electrified vehicles newly introduced in the market is to be 20 - 30 % by 2030 and is to be 100 % (including the vehicles that utilize decarbonizing fuels) by 2040 for vehicles whose weight are equal to or less than GVW 8 ton, while the target is to be set by 2030 for vehicles whose weight are more than GVW 8 ton.

Second, the Japanese Government enforces fuel efficiency regulations based on the Act on Rationalizing Energy Use to improve the fuel efficiency of vehicles. This regulation considers the prospect of technology development based on the best fuel efficiency technology (top-runner method) for each vehicle type/weight category. The newest standards in the Act are FY2030 standards for light-duty passenger vehicles, FY2022 standards for light-duty freight vehicles, and FY2025 standards for heavy-duty freight vehicles (see Table 1), all of which were discussed and agreed upon in the previous advisory body. In particular, the FY2030 standard for light-duty vehicles is noteworthy in that (1) it includes EV and PHEV into the scope of regulation, and (2) it introduces the concept of Well-to-Wheel (WtW). The WtW means considering not only the energy consumed when a vehicle is in use but also the energy consumed before it is supplied to a vehicle (e.g., CO₂ emissions in electricity generation, electricity loss in transmission and charge). This concept enables us to compare the fuel efficiencies of EVs and PHEVs with conventional vehicles from the perspective of technology neutrality.

Third, the World Forum for Harmonization of Vehicle Regulations (WP29) in the United Nations also addresses environmental issues by developing global regulatory frameworks. One of the recent hottest topics at the Working Party on Pollution and Energy (GRPE) is a standard on battery durability. In March 2022, WP29 adopted the global technical regulation that makes battery deterioration levels visualized to exclude coarse batteries and provide reliable information to users. WP29/GRPE will continue to discuss this regulation to review/sophisticate the requirements and expand vehicle type scope. Another critical topic is the concept of life cycle assessment (LCA), which assesses the whole CO₂ emissions not only in the phase of vehicle use but also in the phase of manufacturing and recycling/scraping vehicles and in the phase of producing and transmitting fuel. In this LCA concept, CO₂ emissions from vehicles depend on the extent of the de-carbonization of electricity and fuel. In other words, the ban on conventional vehicle sales is not simply equal to carbon neutrality. It is essential to develop a fair and internationally aligned LCA method from this perspective. Japan is expected to continue to contribute to these agendas in the UN for realizing carbon neutrality and a sustainable society.

Table.1 Fuel Efficiency Regulations According to Vehicle Type

Light-Duty Passenger Vehicle		Heavy-Duty Vehicle	
	Average Fuel Efficiency Standard (FY2020 Target → FY2030 Target)		Average Fuel Efficiency Standard (FY2015 Target → FY2025 Target)
Light-Duty Passenger Vehicle	17.6 km/L → 25.4 km/L Strengthened by 44.3%	Route Bus (GVW over 3.5 ton) 	4.77 km/L → 5.01 km/L Strengthened by 5.1%
Light-Duty Freight Vehicle		General Bus (GVW over 3.5 ton) 	6.07 km/L → 7.18 km/L Strengthened by 18.3%
	Average Fuel Efficiency Standard (FY2015 Target → FY2022 Target)	Truck (GVW over 3.5 ton) 	7.10 km/L → 8.13 km/L Strengthened by 14.5%
Freight Vehicle (GVW under 3.5 ton)	14.5km/L → 17.9km/L Strengthened by 23.4%	Tractor (GVW over 3.5 ton) 	2.84 km/L → 2.94 km/L Strengthened by 3.7%