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Development of an Analysis Method for Long-Term CO_2 Emissions to Consider Integrated Approaches in the Automotive Sector (Second Report)

-Considering CO_2 Reduction Effect when Various Measurements were Introduced for Each Vehicle Type-

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The Japanese government announced its mid-term target of reducing greenhouse gas emissions by 26% by 2030 based on the 2013 level, in COP21. Furthermore, at the 2021 Climate Summit, the Japanese Prime Minister announced a 46% reduction of greenhouse gas emissions by 2030 and a target of zero by 2050. CO_2 emissions from the transportation sector in Japan accounted for 18.5% of total CO_2 emissions, of which the automobile sector accounted for 86.2%. The average in-use age of automobiles is over 12 years, and considering the lead time required for the diffusion of new technologies, it is necessary to implement measures as early as possible to achieve the middle and long term CO_2 emission targets. In a previous report, a CO_2 emissions analysis model was developed that considered integrated measures in the automotive sector by 2050 (estimation period: 1980 to 2050) and which estimated some scenarios in the automotive sector. However, the automotive sector as a whole was the focus in the previous report, and the effectiveness of measures for each vehicle type was not considered. The purpose of this report is to consider the effects of various measures by vehicle type that are based on the results of the scenario analysis results in the previous report.

The first case is set as the keeping the current regulation case (BaU). This case is not to improve fuel economy efficiency, exhaust emission or noise level of new vehicles, and price discounting of next-generation vehicles is fixed at the 2013 level. The second case is set as the technology advanced case (ADV). This case considers fuel efficiency improvement of conventional vehicles, efficiency improvement of next-generation vehicles, and price discounts due to the effect of mass production, for 2050. The third case is the integrated approaches case (INT). This case sets assumptions the same as the ADV case for advanced vehicle technologies, but also considers the effects of road improvement. The diffusion of autonomous driving systems, car sharing, and MaaS are considered. The fourth case is set as the enhanced measures case (MEA). This case sets having no sales of new conventional cars after 2035, but the other assumptions are the same as the INT case.

For the estimated Tank to Wheel CO_2 emissions for the automotive sector by 2050, CO_2 emissions of the BaU case in 2050 were reduced by 32% from the base of 2013 due to a decrease in the number of in-use vehicles and old vehicle replacement. CO_2 emissions of the ADV case in 2050 were reduced by 64%, considering fuel efficiency improvements of convention vehicles and the diffusion of next-generation vehicles. CO_2 emissions of the INT case in 2050 were reduced by 66%, reflecting the implementation of various traffic measures such as improvements of average speed, driving behavior and a modal shift to public transportation. The MEA case had no sales of new conventional vehicles after 2035, and other measures promoted further diffusion of next-generation vehicles. This case reduced CO_2 emissions by 75% in 2050.

The estimated results of CO_2 emissions in 2050 for passenger cars and trucks are shown in Figures 1 and 2. The CO_2 emissions reduction ratios are 55% for the ADV case, 13% for INT, and 32% for MEA for passenger cars. All scenarios show a certain effect. For trucks, the CO_2 emissions reduction ratios are 38% for the ADV case, 2% for INT, and 24% for MEA. Mini and small trucks show the same trend passenger cars, and middle and large trucks show the same trend as buses. The ADV and MEA cases show a certain effect for trucks.

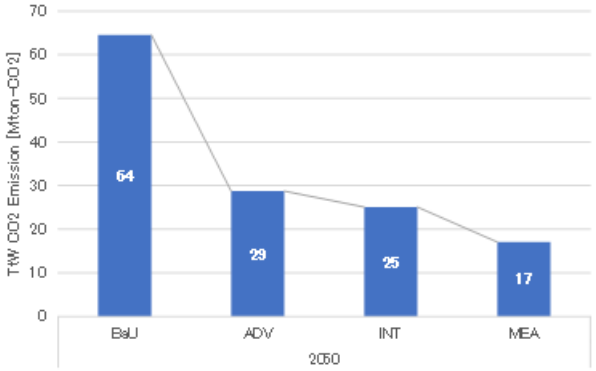

Fig.1 CO_2 Emission of Passenger Cars in 2050

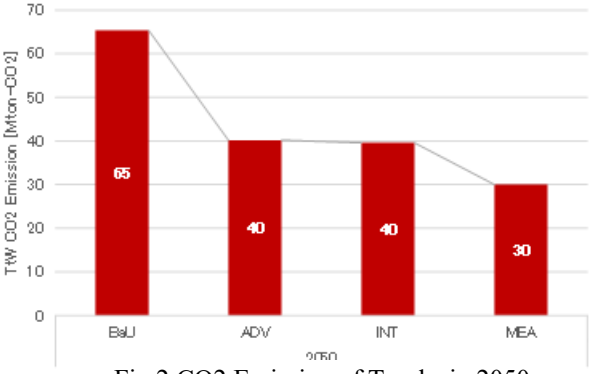

Fig.2 CO2 Emission of Trucks in 2050