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Initiatives for Virtual Testing Using Digital Twins and Digital Authentication III.

- Comprehensive CO_2 reduction and new manufacturing system -

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This paper report details the environmental trends in CO_2 emissions, primarily in Europe and the United States.

In Europe, there are three main systems in place: ① a carbon tax on trade within the European Union, ② battery regulations, and ③ a digital product passport. Additionally, there are ④ off-cycle credits related to automobiles, which also apply to the United States. Regarding European regulations, implementation is already underway, with plans for system introduction starting in 2024, expansion to specific products in 2025, and full implementation from 2026 to 2030. With penalties expected to be substantial, urgent action is needed.

Regarding manufacturing, taking automobiles as an example, approximately half of the energy used in production is electricity. In Japan, approximately 70% of this energy is supplied by fossil fuels, a situation that lags behind Europe

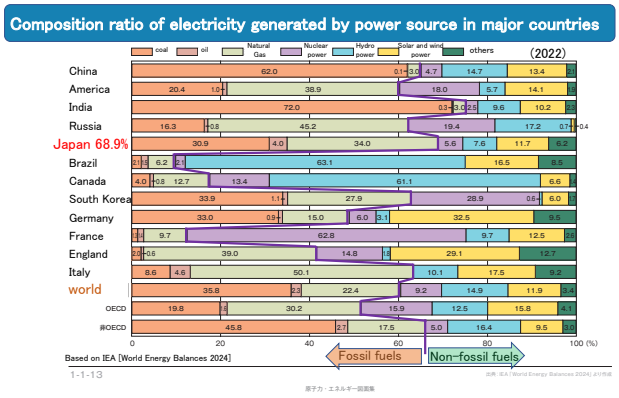

Fig.1 Composition ratio of electricity generated by power sourcing major countries

and the average of major countries. If CO_2 emissions per product were visualized and taxed, it would diminish competitiveness. On the other hand, electricity mix ratios vary regionally and cannot be easily changed. Therefore, as one of the proposed digital certification mechanisms, this committee proposed controlling the decarbonization-derived electricity and energy mix based on factory power load models and actual operating data to reduce CO_2 emissions per product.

Furthermore, regarding off-cycle credits for automobiles, Japan is expected to introduce them by 2030, Europe has already started implementing them as part of digital product passports, and the US is already doing so as a business in the form of emissions trading.

While greenhouse gas (GHG) reduction regulations in the automotive sector are being strengthened in various countries and regions, a challenge remains: standard tests (such as chassis dynamometer tests) do not adequately evaluate the CO_2 reduction effects of some technologies that are effective in actual driving conditions, resulting in a discrepancy between the measured CO_2 emissions and those in the real environment. To address this issue, the United States and Europe have introduced a system called off-cycle credits.

Off-cycle evaluation: Off-cycle credit evaluation is conducted using the following steps:

I. Model the CO_2 reduction effect of the technology
II. Verify with actual driving data or simulations
III. Apply to the regulatory authority
IV. Grant credits after approval

Off-cycle credits are emission reduction credits granted to technologies that have CO_2 reduction effects in actual driving conditions, even if these effects are not fully reflected in regulatory tests.

This content is precisely what the committee has been verifying and proposing, and we hope that the energy standards model, a result of the committee's work, will contribute to CO_2 reduction by assisting in the creation of off-cycle credit items.

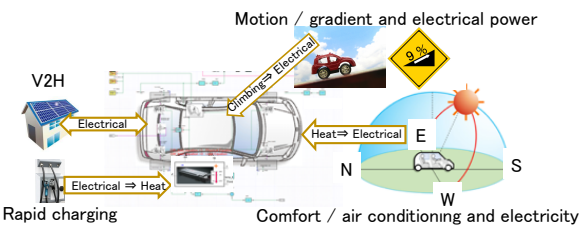

Fig.2 EV model for off-cycle credits