Low-Carbon Fuels as a Key Element and Carbon Reduction Opportunity in Achieving Net-Zero in Taiwan's Transportation Sector

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The transportation sector contributes approximately 23% of global greenhouse gas emissions, with nearly 70% of those emissions originating from road transport. Consequently, the transportation sector is regarded as one of the top priority targets in the global push toward net-zero emissions. Taiwan's carbon reduction strategies for the transportation sector primarily focus on promoting vehicle electrification and decarbonization. These strategies include accelerating the adoption of electric technology in the new vehicle market (through subsidies for electric vehicle purchases and setting market share targets for electric vehicle sales) and facilitating the use of electric vehicle (by increasing the availability of charging facilities and improving regulations and standards for charging infrastructure deployment). While important, this emphasis overlooks the carbon reduction potential of existing fuel-powered vehicles, which will continue to emit greenhouse gases in the coming decades. Notably absent from Taiwan's strategies are low-carbon fuels, which could offer significant carbon reduction benefits in the short-term.

Despite strong policy efforts, the adoption rate of electric vehicles in Taiwan remains limited. As of 2024, electric cars in Taiwan account for only 0.91% of the total vehicle fleet, while electric motorcycles make up just 5.03%. Although the goal is set for fully electrify all new vehicle saled by 2040, it will take several decades to completely replace gasoline-powered cars and motorcycles. Therefore, the transportation sector must explore more diverse pathways for reducing carbon emissions.

The introduction of low-carbon fuels is recognized as an effective solution for reducing emissions in the transportation sector. Many countries have adopted ethanol-blended fuels, such as E10 (a blend of 10% ethanol with gasoline). The U.S. Environmental Protection Agency has approved E10 for use in vehicles manufactured before 2001, while E15 is approved for light-duty vehicles produced after 2001.

Similarly, the European Union and the UK have begun implementing E10 as the standard fuel for vehicles.

According to our estimates, analyzing the fuel-use (also known as tank-to-wheel) phase of vehicles, E10 can reduce greenhouse gas emissions by approximately 7.3% compared to traditional 95-octane unleaded gasoline. In the context in Taiwan, if all vehicles were to switch to E10, this could result in an annual reduction of approximately 2.02 million metric tons of CO2 equivalent emissions, effectively bridging the gap in Taiwan's 2025 carbon reduction target for the transportation sector. This demonstrates that low-carbon fuels can provide tangible support in achieving short-term carbon reduction goals in Taiwan's transportation sector.

Our research further indicates that, in certain cases, vehicles using E10 fuel can outperform electric vehicles in terms of both greenhouse gas emissions and fuel costs. Based on the latest regulatory tests for vehicle fuel economy, the greenhouse gas emissions of electric vehicles are not necessarily lower than those of fuel-powered vehicles. Taking into account Taiwan's electricity emission factor, an electric car with lower energy efficiency may generate more greenhouse gas emissions than a fuel-efficient gasoline car. Additionally, in some instances, the fuel costs of electric cars may also surpass those of fuel-powered vehicles.

E10, as a cost-effective solution, can immediately deliver carbon reduction benefits without requiring the replacement of existing cars, and can remain effective for decades. Therefore, we recommend that while promoting vehicle electrification and decarbonization, Taiwan's transportation sector should also incorporate low-carbon fuels (such as E10) into its carbon reduction strategies. This approach not only helps achieve short-term carbon reduction targets in the transportation sector but also provides an economical and efficient pathway for reducing emissions from in-use fuel-powered vehicles, thereby sharing the responsibility for emission reductions.