

Reduction Potential Analysis of Life-cycle CO₂ emissions through the Market Expansion of Eco-friendly Vehicles

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The expansion of automobile society has been one of the main causes of accelerating the global warming. According to International Energy Agency, the CO₂ emissions from the transportation sector accounts for 23% of the global CO₂ emissions in 2007 and transport CO₂ emissions are estimated to increase by more than 80% by 2050. For this background, eco-friendly vehicles such as Hybrid Vehicle (HV) and Plug-in Hybrid Electric Vehicle (PHEV) are expected to reduce CO₂ emission at driving phase due to their higher fuel efficiency. On the other hand, Kagawa et al. (2013) pointed out that, in manufacturing phase, the CO₂ emissions from these vehicles were larger than standard-size gasoline cars because these new technologies have a battery and more complex power distribution electronics than standard-size gasoline cars. When considering the CO₂ emissions at the manufacturing phase, introducing eco-friendly vehicles does not necessarily result in efficient reduction of life-cycle CO₂ emissions from automobile. To assess the reduction potential of life-cycle CO₂ emissions by the spread of eco-friendly vehicles, this study employed the Data Envelopment Analysis framework provided by Sueyoshi and Goto (2012) and assessed how efficiently the market expansion of eco-friendly vehicles would bring about the economic development and reduction in life-cycle CO₂ emissions simultaneously. We considered the number of newly registered gasoline vehicles, commercial vehicles, HV, PHEV, and EV in 40 countries from 2004 to 2014 provided by Marklines as inputs, economic scale of automobile market of these 40 countries estimated from the World Input-Output Database as desirable output, and life-cycle CO₂ emissions from these vehicles as undesirable output. The results showed the reduction potential of life-cycle CO₂ emissions from automobile through the spread of eco-friendly vehicles was considerably large especially in developing countries. This study argues the role of the vehicle policy in developing countries on global warming.