

A Lifecycle Analysis of the Corporate Average Fuel Economy Standards in Japan

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Due to the increasing severity of climate change, the Paris Agreement was adopted in December 2015 under which countries decided on carbon dioxide (CO₂) emissions reduction targets with the aim of holding the increase in the global average temperature to within 2°C above pre-industrial levels (United Nations Framework Convention on Climate Change: UNFCCC, 2015). To achieve this target, Japanese government will adopt the Corporate Average Fuel Economy Standard (CAFE standard) to reduce the energy consumptions and CO₂ emissions in the transport sector, that account for about 20% of CO₂ emissions in Japan. For this study, we estimated the CAFE standards and CAFE targets of seven Japanese domestic automobile manufacturers and evaluate whether manufacturers have achieved these estimated CAFE targets. Furthermore, we proposed an analysis framework for estimating what impact the introduction of the CAFE standards in Japan will have on motor vehicle-derived lifecycle CO₂ emissions including the manufacturing, driving, and disposal of vehicles. We estimated the life-cycle CO₂ emission intensities per passenger vehicle in manufacturing, during travel, and in disposal were estimated using the Embodied Energy and Emission Intensity Data for Japan Using Input-Output Tables. Moreover, we estimate the utility of the holding vehicles. As a result, we found the following: (1) automobile manufacturers can maximize their sales under the constraints of the CAFE standards, but vehicle sales plans based on sales maximization will lower their CAFE standard scores. (2) Economically optimal automobile manufacturer behavior "striving to achieve CAFE standards while maximizing sales" will increase the manufacturers' overall carbon footprint and actually worsen the environment. Even though, based on the estimated optimal sales patterns for each company where fuel efficiency for the vehicle models sold is improved 20%, the overall carbon footprint for all seven companies would be approximately 53 million tons, a 1.2-fold increase over their 2015 carbon footprint.