**[*analysis of environmental effects of electric vehicle diffusion using the cge model*]**

[Jeongeun Lee, Seoul National University, +82-10-5059-8329, wivps@snu.ac.kr]

[Younmo Koo, Seoul National University, +82-10-2755-9849, yyounmo@snu.ac.kr]

## Overview

Countries around the world expect the effects of reducing greenhouse gas emissions, improving air quality, and developing industries through the spread of eco-friendly vehicles such as electric vehicles(EVs), but there are various views on whether this will actually work when considering the spillover effects from the spread of EVs. There are a number of studies that question whether greenhouse gas reduction is possible due to the spread of EVs (Hawkins et al., 2013; Woo et al., 2017), whether air quality improvement is possible (Tessum et al., 2014; Weis et al., 2016), and whether it contributes to economic development (Li et al., 2017; Osawa and Nakano, 2015). For example, Korean government has promoted to disseminate EV to reduce PMs(Particulate Matters) and GHG(Greenhouse Gas), but it is necessary to examine the environmental effects on the entire industry beyond the transportation sector only. Therefore, this study focuses on the socioeconomic and environmental effects of EV diffusion based on the CGE model.

## Methods

The change in demand in the transportation sector, which is estimated by the Discrete Choice model reflecting consumer preferences, is put into the CGE model to comprehensively analyse the impact on the overall industry, economy, and environment according to the future transport market changes. First, based on the Bank of Korea's 2015 input-output table, SAM(Social Accounting Matrix) was reorganized to reflect new technologies in the transportation market including EVs. Second, the air pollutants and GHG emission coefficients were derived according to the newly established matrix. Third, discrete choice analysis was put into CGE model to reflect changes in transport sector demand based on consumer choice. Finally, we analysed the ripple effects of policy scenarios based on factors affecting EV spread such as an increase in EV productivity, provision of EV subsidies, change in energy taxation.

## Results

Scenario results show that air pollutants and GHGs emissions from the transportation sector are reduced due to the spread of EVs, but emissions from the power generation and the primary metal industry associated with the battery industry are increased due to the production of electric vehicles. Increased demand for EVs leads to promote production of EVs, battery and non-ferrous metals and increases the amount of power used to charge EVs. On the other hand, falling demand for gasoline and diesel cars leads to a drop in demand for oil, leading to a decrease in engine manufacturing and petrochemical production, while decreasing GDP and consumer utility due to the spread of EVs. Therefore, increased production of EVs and coal for power generation increases the amount of greenhouse gases produced by coal use, but decreases in demand for gasoline, diesel and LPG due to decreased production and demand of conventional internal combustion engine cars lead to reduced greenhouse gas emissions. Especially when EVs supply is expanded, only the transportation sector can observe the effect of reducing air pollutants and GHGs, but the overall industry sees an increase in PM emissions generated during power and EVs production, resulting in an increase in net emissions.

## Conclusions

This research reveals that the calculation of emission of air pollutants caused by the spread of electric vehicles should consider the linkages among various industries not only the transportation sector. If the current industrial structure continues, the transportation sector’s policies to reduce emissions will instead increase the overall amount of air pollutants. Therefore, the first thing to be considered in the policy of EVs proliferation is the power generation structure and the production structure of EVs, which rely on coal-based thermal power generation as it is today, as the spread of eco-friendly vehicles can have a negative impact on the direct emission of fine dust, which will need to be improved and gradually expand the supply of EVs.

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