AN ECONOMY-WIDE ANALYSIS OF ELECTRIFYING THE PASSENGER TRANSPORTATION: THE CASE OF TAIWAN

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Overview

Taiwan has announced the plan to phase out vehicles with internal combustion engines powered by fossil fuels (henceforth ICE vehicles) and replace them by electric vehicles (Executive Yuan, 2017). The motivation for this new policy is to reduce the air pollution, which comes from pollutants such as ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrogen dioxide, which are tracked by the Environmental Protection Administration (EPA) of Taiwan (EPA, 2017a). Air pollution is a serious problem worldwide. A recent study conducted by the World Health Organization (WHO) reveals that for the 1600 cities in different nations that were surveyed, only 12% of the urban population live in areas that comply with WHO air quality guideline levels, which means a lot of people are at risk of suffering from long-term health problems (WHO, 2018). In Taiwan, air pollution is likely a key factor that is responsible for a lot of premature death caused by lung cancer, which has become the deadliest cancer in Taiwan (Ministry of Health and Welfare, 2016). Within Taiwan, the three major air pollution sources are the transportation sector (mobile source), industrial and power sectors (stationary source), and pollutants from abroad—each source accounts for around one third of the pollution (EPA, 2017b).

To meet the new government goal, the government will replace all public buses and government-owned ICE vehicles with electric ones by 2030. Further, it will ban the sales of fossil-fuel-powered motorcycles and automobiles by 2035 and 2040, respectively (Executive Yuan, 2017). To promote the adoption of electric vehicles including motorcycles and automobiles, the government has provided incentives including exemptions of commodity taxes and certain license taxes on electric vehicles since 2012. As these incentives will expire in 2021, the government is working on a comprehensive legislative agenda, including more stringent air pollution standards and policies that support the development of infrastructure needed for electrifying the passenger transportation, in hope that the transition could be achieved as planned.

Currently Taiwan imports around 98% of its domestic energy supply (Bureau of Energy (BOE), 2015), with about 82% of its electricity supply coming from fossil-based generations (BOE, 2016). The government is pursuing the non-nuclear policy, which will no longer use nuclear power as an option when all existing nuclear power units in operation reach their designed lifespans in 2025. While the government is also planning to add and integrate more renewable generations to the power grid, fossil generations nevertheless are still expected to play crucial roles in Taiwan's national electricity supply (the government plans to have an energy mix with 50%, 30%, and 20% electricity outputs coming from gas-fired, coal-fired, and renewable generations, respectively, by 2025). Furthermore, additional demand for electricity from the electrification of passenger transportation is expected to make it harder for Taiwan in achieving its national determined contribution (NDC), which pledges to cut 50% of its business-as-usual (BAU) greenhouse gases (GHGs) emissions by 2030, since cutting emissions from the power sector could be essential in meeting the NDC as the power sector now accounts for more than half (around 52%) of Taiwan's national GHGs emissions (EPA, 2016).

In this paper, we would like to answer the following questions, 1) how could the policy of electrifying the passenger transportation affect the electric vehicle, the demand of fossil energy imports, and the electricity demand 2) What would be the implications of electrifying the passenger transportation on sectoral and national CO2 emissions , and 3). How fast electric vehicles may be widely adopted with different levelized costs in operating electric vehicles.

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