The Economic and Environmental Consequences of the Electric Vehicle Transition in India

Topic: Input-Output Analysis: Sustainable Production and Consumption Policies - III
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Over the past decade a worldwide, collaborative resolution towards promoting environmentally sustainable business strategies and products has been witnessed with the pro-active participation of developed and developing countries. Such global partnerships have been promoted and solidified by the United Nations through resolutions such as the SDG 2030, Paris Declaration on Electro-Mobility and Climate Change, 2015 and the most recent being the COP27 event 2022 in Egypt. In pursuit of decarbonization strategies, the global automobile industry has been confronted with structural changes brought forth by the advent of the Electric Vehicles (EVs) revolution.

To this end, India is pursuing a â€˜twin-transition trajectoryâ€™ with the expansion of RE sources in the power sector and the expansion of EV in the transport sector. This decarbonization strategy is aligned with Indiaâ€™s global commitment towards SDG 2030 goals 7, 11 and 13 and the long-run target of net-zero emissions by 2070 announced during COP26 in Glasgow, UK 2021. There is tremendous scope for the adoption of EVs in the Indian automobile market, which is the seventh-largest commercial vehicle manufacturer, fifth-largest car manufacturer and the largest two-wheeler manufacturer in the world. The government has also announced an ambitious long-term target of achieving a 30% share of EV sales by 2030. Despite increasing policy push for EV adoption, its share in the Indian automobile market remains negligible. As of 2022, the total EV sales constitute only 0.61% of the registered motor vehicles in India, thus highlighting a steep gap to be covered in the next eight years to achieve the target.

The EV battery is the most important component of an EV, constituting 35-50% value addition. The Lithium (Li)â€“ion batteries are the optimal choice for EVs because of declining cost prices, advanced manufacturing technology, higher lifespan, low weight and high energy storage potential. Currently, China has a market monopoly over Li-ion batteries, with 70% production capacity for cathodes and 85% for anodes and half of the lithium, cobalt and graphite processing and refining capacity in the world. Given this scenario, India is expected to depend on China for raw materials supply for EV battery manufacturing. Nevertheless, with the easy availability of low-cost labour and the governmentâ€™s incentivisation to encourage capital investment in the industry, the country is expected to witness significant economic impact by steadily increasing its battery manufacturing capacity.

With increasing EV sales, the burden on the power sector is also expected to increase in the long run-in order to meet the EV battery charging demand. As a result, not only the charging infrastructure needs to be properly planned, but the source of energy supply will determine the environmental burden on the country. Currently, almost 75% share of electricity generation is from coal-fired Thermal Power Plants which is largely attributed to the ease of access to coal. However, India aims to change the course of the power generation mix by expanding the share of solar energy, targeted at 280 GW capacity by 2030. Thus, the decarbonization strategy of the road transport sector will be determined by the synergy between the potential of EV penetration, complemented with EV charging infrastructure from clean energy sources.

The macroeconomic impact of EV battery manufacturing has been given minimal importance in Indian or global EV literature. While studies on the synergy between EV charging and electricity mix are prevalent in literature, the resulting environmental cost of power generation and air pollution

from coal-TPPs and the net-macroeconomic impact has not been explored.

Given this backdrop, this study aims to fulfil the following objectives,
i. To estimate the macroeconomic impact of EV battery manufacturing using the Indian Supply-Use Table 2018-19.
ii. To estimate the energy and environmental burden of EV battery charging in different electricity mix scenarios, published by the Central Electricity Authority, Ministry of Power, Government of India.
iii. To quantify the environmental cost of EV battery charging and estimate the Environmental-adjusted GDP contribution using the System of Environmental and Economic Accounting (SEEA) framework.

Preliminary results indicate an overall positive macroeconomic impact on total output, GDP and employment of 0.83%, 0.18% and 0.29%, respectively. The highest inter-industry impact is observed in mining and mineral sectors such as copper, manganese and bauxite which need to be incentivised for ramping up domestic production. Solar-powered EV battery charging vehicle leads to 96% lower CO2 emissions compared to coal power with the elimination of SOx and NOx emissions. Thus, a simultaneous decarbonization strategy for the power and transport sector will be mutually beneficial, with the ultimate goal of achieving carbon neutrality in the