

## **Barriers in Adoption and Operation of Electric Buses into the Existing Public Transit Network**

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### **Abstract**

Transportation has been identified as a major contributor in terms of increase in air pollution and related impacts resulting in climate change and global warming amongst other threats to the world and people. The nature of transportation related pollution has been caused by increasing motorization along with the absence of targeted policies especially in developing countries and frameworks for cleaner transportation options. Many types of measures to fight transportation related pollution are adopted globally including modal shift towards public transport, electrification, low-carbon fuels and energy vectors, demand management, innovation and up-scaling, and improved design, operations and planning of transport systems. Electrification of vehicles has been globally accepted as a transfer of high potential due to the absence of tailpipe emission and the possibility to generate electricity from renewable energy sources has more potential to make electric vehicles cleaner in an overall context. Sustainable transportation mainly comprises of development of public transit and transfer of private vehicle users to public transit modes. It is evident that public transit is one of the most preferred sustainable options in transport but it's contribution to the overall transport emission scenario is significant at present, especially in developing countries, due to higher modal share. The use of cleaner technology in public transport can make a substantial impact on the reduction in emissions. This study concentrates on public bus services and the replacement with or introduction of electric buses which is currently being initiated globally. The adoption of electric buses (e-buses) includes its set of positive outcomes but is a challenge in the initiation and implementation process. The adoption of e-buses is not an easy transition which is impacted by a number of barriers including high initial procurement costs, issues related to charging and related infrastructure development, still relatively new/novel in terms of technology, scarcity of skilled labour, unavailability of data amongst others. The outcome from the study with respect to the barriers and the related mitigation measures to facilitate adoption and operation of electric buses is attained via a comprehensive review of the available sources published including research papers, national/non-governmental reports and relating documents which discuss on the air quality levels especially in the urban context and the contribution of the transport sector to the overall air pollution ratio. This study identifies the barriers, elaborates the reasons behind the barriers and recommends mitigation strategies to accommodate these barriers in the best possible manner to ensure transition to electric buses can be facilitated in a smooth manner with no considerable impacts to any stakeholders. The infrastructure related to electric buses operation is a major part of operating a viable electric bus network. Thus, identifying the stakeholders and the related barriers in adoption and operation of e-buses, development of effective operational strategies and development of an efficient evaluation mechanism are important parts of the e-buses framework considered in this study. The study discusses the identification of the right technology & viable business models, the framework for the development of an optimization model for electric bus operation subject to resource constraints which include planning of routes,

development of schedules and charging intervals in compliance with the available infrastructure. Outcomes from the study are expected to facilitate and educate operators of electric buses in the public transit network with the positioning of electric buses in the right framework so that the service can be provided with no disruptions to adoption and operation along with the prime goal of maximizing the expected outcome of the total reduction of emission and promotion of e-buses in an economically viable manner.

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