

Abstract

A Comparative Analysis of Conventional Internal Combustion Vehicle and Electric Buses in Austin, Texas

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This thesis project examines the life cycle and environmental impact of carbon dioxide (CO₂) and greenhouse gas emissions related to the city of Austin, Texas' transition from conventional diesel buses to electric vehicle buses. I utilized a life cycle assessment model derived from two data sources. I conducted a comprehensive literature review to analyze the energy intensity and greenhouse gas emissions of electric buses and used this information to estimate the effects and externalities of a municipal program that incentivizes individuals to change their form of transportation from private vehicles to public buses. Second, I obtained data from the City of Austin and Austin CapMetro and analyzed ridership and vehicles miles traveled (VMT) to estimate energy intensity, emissions per passenger mile traveled (PMT), and emissions per vehicle mile traveled. Because electric energy is derived from multiple sources, I considered various electricity production scenarios, including the Austin Energy mix, Electric Reliability Council of Texas's (ERCOT) electricity production makeup, and scenarios using combinations of renewables, fossil fuels and nuclear energy. The goal was to utilize Austin as an example

for other American cities that are considering a transition from diesel buses to electric buses.

The analysis showed that electric buses significantly outperformed their diesel counterparts, on a CO₂-equivalent basis, using every electricity mix that was evaluated, for the empty-load, half-load and full-load scenarios. For the electric buses, electricity mixes that used more renewable energy sources (i.e. wind, solar and hydropower) had lower emissions than other options, such as nuclear.

The results of this thesis project will be available to policymakers and other stakeholders who are engaged in decisions about enhancing the environmental sustainability of Austin's transit system. I hope that decision-makers within Austin Energy's and ERCOT's leadership will find this report valuable. I would like to share the results with other cities, in the hopes of encouraging transportation systems throughout the country to consider large-scale change to advance sustainability and mitigate the transportation-related aspects of climate change.



Dr. Michael Webber, Supervisor