THE UNIVERSITY OF CONNECTICUT
CIVIL & ENVIRONMENTAL ENGINEERING

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MINIMIZATION OF CARBON FOOTPRINT OF TRANSIT AGENCIES BY ADOPTING ALTERNATIVE FUEL TECHNOLOGIES

ABSTRACT

The increasing trend in Greenhouse Gas (GHG) emission around the globe has been of broad and current interest for the past few decades. In the state of Connecticut, transportation is the largest contributor of GHG emission at about 42% of the total emission of 36.5 Million Metric Tons of CO_2 equivalent. Although buses comprise less than 1% of the total transportation emissions in the country, transit agencies are trying to reduce their carbon footprint by adopting alternative fuel technology buses. The overarching objective of this thesis is to aid transit agencies make more informed decisions regarding the process of replacing the diesel fleet with alternative technology buses to minimize GHG emissions. This study investigates the complete course of fleet replacement in a more realistic way incorporating various scenario analysis. The first part of this research provides a more user-friendly approach for a transit agency to document and analyze their current GHG emission footprint from both buses and facilities. The second part of the thesis analyzes the impact of introducing alternative fuel buses into an existing bus fleet on carbon footprint. It also includes life-cycle cost (LCC) analysis of those fleet replacement strategies. As a part of this study, a Python-based web tool was created to let the users (transit agencies) control for the input values, run multiple scenario analysis, and compare results. The final part of this thesis optimizes the fleet replacement schedule by minimizing the LCC of owning and operating a fleet of buses and required infrastructures and reducing GHG emission simultaneously. In all these studies, data from Connecticut Department of Transportation was used as a case study. The problems formulated and tools built in this thesis can help any transit and government agencies determine the most optimized solution to their fleet replacement problem under customizable constraints or desired set of outcomes.