

Alternative Fuels for Urban Transit:

Phase 1: Life-Cycle Assessment (LCA) of Alternative Fuel Buses

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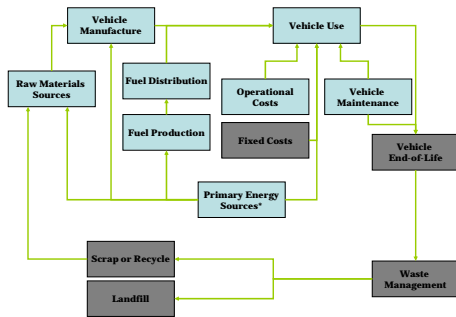
Introduction

Switching to alternative fuel buses will have long-lasting implications for the sustainability of a transit organization. We conduct a Life Cycle Assessment of three alternative fuel buses and a diesel bus using the method of EIO-LCA and focusing on costs and greenhouse gas (GHG) emissions.

Research Questions

- What is the difference in cost and GHG emissions over the lifecycle between diesel and alternative fuel buses?
- How do infrastructure investment, change in fuel prices, and change in demand affect the costs and GHGs of alternative fuel buses?

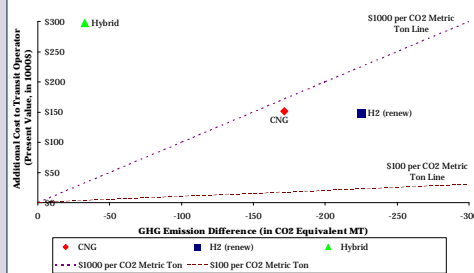
Scope of LCA



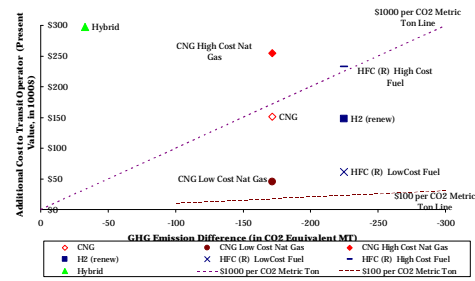
Life Cycle Assessment and Scenario Analysis:

Diesel, Hybrid, Compressed Natural Gas (CNG), and Hydrogen Fuel Cell (HFC) Buses

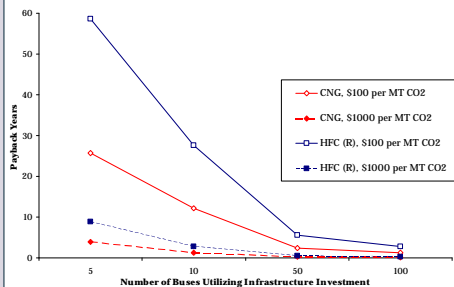
Alternative Fuel vs. Diesel Buses: Additional Costs and GHG Savings



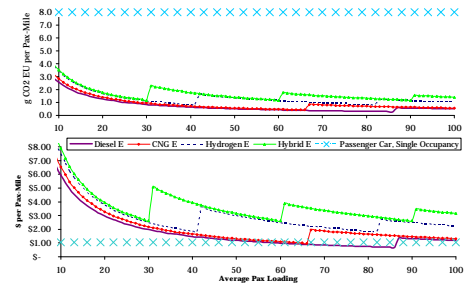
Alternative Fuel vs. Diesel Buses: Price changes for CNG and Hydrogen Fuel



Years to GHG "Payback" of Alternative Fuel Infrastructure



Cost and GHGs Per Passenger-Mile



We gratefully acknowledge the support of the Transportation Center, CCITT, and its director, Bret Johnson, who provided funding to attend this conference and present this work.



Conclusions

- Alternative fuel buses, especially Hydrogen Fuel Cell buses can result in significant GHG savings, if the hydrogen is produced using renewable sources.
- At projected future prices and with renewable sources of hydrogen, HFC buses have the lowest marginal cost (\$/GHG)
- At current prices, CNG and Hybrid buses are much more cost-accessible while still reducing greenhouse gas emissions.

•Infrastructure and level-of-service issues have significant impacts on lifetime costs and emissions of buses. Sustainable, cost-effective decision making requires holistic consideration of these and other factors.

Data Sources and Methodology

- Data on alternative fuel bus demonstration projects came from the National Renewable Energy Laboratory, U.S. Department of Energy
- LCA for some components was conducted using the Economic Input-Output Life Cycle Assessment (EIO-LCA) tool, Carnegie Mellon Green Design Institute, <http://www.eiolca.net>.