Comparative Analysis of Fuel Source Consumption and Economic Costs of Razorback Transit Among Alternative Fuel Sources Todd K. Knobbe

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ABSTRACT

Razorback Transit is the public transit system of the University of Arkansas-Fayetteville. This transit system serves the University of Arkansas community (population ca. 25,000) and residents of Fayetteville, AR (population ca. 75,000) with public transportation around the university campus and the city of Fayetteville throughout the year. This case study was a comparative analysis of fuel source consumption and economic costs for the University of Arkansas Razorback Transit System. Presently, Razorback Transit consists of 23 transit buses powered by diesel fuel. The FY 2012 diesel fleet was compared to scenarios replacing the current fleet fuel with B20 biodiesel, B100 biodiesel, Compressed Natural Gas, Liquefied Petroleum Gas, and Diesel-Electric Hybrids. The study had two primary foci: 1) fuel source data and 2) economic evaluation. Analyses of fuel source data included 1) Fuel Consumption, 2) Green House Gas Emissions (GHG), and 3) Fuel Efficiency and GHG Emissions per capita. Current and alternative fuels were compared in diesel gallon equivalency (DGE). Energy and GHG emissions per capita were compared using ridership data obtained from Razorback Transit. The second component of this study was an economic evaluation of the current transit system comparing economy of current fuel to alternative fuel sources. This economic evaluation examined average market prices (in diesel gallon equivalency), fuel cost of Razorback Transit, conversion costs, and cost per capita. Within this part of the study, the conducted analysis compared the current fuel cost to those of the proposed alternatives. Fuel costs were based on annual fuel expenditures relative to fuel source. All data used in the economic evaluation were from FY 2012. The data obtained and presented in this study can be used to evaluate the current diesel transit system and how it compares to alternate fuel sources, serving as a preliminary step in moving the University of Arkansas towards a more resilient and sustainable public transit system.

Problem

In FY 2012 Razorback Transit provided transportation for 1,980,283 people. 457,025 people (23%) were non U of A students. 128,387.11 gallons of diesel fuel were consumed during the transportation process. This amounted to a substantial \$417,761.30 in diesel fuel costs. 1,296.12 Metric Tons of Carbon Dioxide Equivalent (MTCDE) were emitted into the atmosphere during the FY 2012 by Razorback Transit. Alternative fuels are generally seen as greener modes of transportation^c. This case study was designed to compare the current diesel powered transit system to alternative fuels in search of a more sustainable and resilient fuel source.

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	U of A Mobile Combustion MTCDE	U of A MTCDE
MTCDE	4,122.00	150,784.00
Razorback Transit MTCDE	1296.118913	1296.118913
Percent	31.44%	0.86%

Fuel Source



Methodology

Fuel Source Consumption

• Each alternative fuel was converted into units of diesel gallon equivalency (DGE) based on British Thermal Unit (BTU) ratios and sources found in the literature.

• The initial fuel economy was adjusted to the DGE of each alternative fuel.

•Total fuel consumption was based on the fuel economy of each fuel in DGE and the total miles travelled in FY 2012.

•Greenhouse Gas Emission data for each fuel source was obtained from literature published by the Environmental Protection Agency (EPA). GHG emissions were reported in Metric Tons of CO2e. This was correlated with Total Fuel Consumption in each fuel scenario.

Economic Evaluation

•Alternative fuel prices (in DGE) were obtained from the Clean Cities Alternative Fuel Price Report published quarterly by the U.S. Department of Energy in 2012. These prices were used to calculate the total fuel cost based on total fuel consumption.

•Total Fuel Cost Per Capita is the result of total cost of each fuel source divided by the number of RT riders in FY 2012.

•GHG Emissions Per Capita is the result of the total MTCDE produced by each fuel source, in relation to DGE, and divided by the number of RT riders in FY 2012.

•Razorback Transit GHG emissions were compared to the Mobile Sector GHG emissions and the total MTCDE emitted by the University of Arkansas for the FY 2012. This data was provided by Sightlines.

Sustainability

Energy is the driving force of our world. This project compared the current diesel powered transit system to 5 alternate fuel scenarios. It incorporates the four major components of sustainability: Built systems, Managed Systems, Social Systems, and Nature Systems. This comparative analysis provides preliminary information in search of a more resilient and sustainable fuel source to power Razorback Transit.

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