Comparing the Economic and Environmental Values of Diesel and Electric Buses for the University of Arkansas

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THE OBJECTIVE

With diesel buses largely being considered economically and environmentally unstable in today's world, emerging technologies have the opened the door to new alternative fuel methods to power public transportation. The electric bus claims to cut cost and reduce carbon emissions compared to diesel buses.

The objective of this study was to compare the economic and environmental values of diesel and electric buses implementing real world data from the University of Arkansas to identify which solution would be more sustainable for the University.

THE PROJECT

The first step in the project was to determine the cost of ownership between diesel and electric powered buses. By using data provided by the University of Arkansas' Department of Transportation, I was able to determine the cost of fuel and maintenance of the diesel buses currently used by the transit program. To determine that of the electric bus I used specifications of the Complete Coach Works' "Zero Emissions Propulsion System" electric bus and implemented those numbers into that of the current data from the University to find an estimated average.

In addition, I was able to determine the environmental impact of the two buses by taking the amount of fuel consumed by both the diesel and electric buses and multiplying that by the amount of carbon emissions released by one unit of energy to find a total.

Cost Description (per vehicle)	Diesel	Electric
Lifespan in years	14	14
Average Miles per year*	16,179	16,179
Average Fuel mileage (Miles per Gallon)/(Miles per kWh)	3.26	0.53
Average Fuel Cost per Unit (Gallon)/(kWh)**	$3.83	$0.069
Total Annual Fuel Cost	$19,007.84	$2,106.32
Annual Engine Oil cost*	$537.60	$0.00
Annual Transmission Fluid cost*	$212.50	$0.00
Annual Filter & Oil Disposal cost	$0.00	$0.00
Lifespan Cost Comparison (per vehicle)	**Diesel**	**Electric**
Total Fuel Cost	$266,109.81	$29,488.48
Engine Oil cost	$7,526.40	$0.00
Transmission Fluid cost	$2,975	$0.00
Brake Replacement cost	$7,100.00	$3,550.00
Engine Replacement cost	$23,000.00	$0.00
Transmission Rebuild cost	$9,800.00	$0.00
Filter & Oil Disposal cost	$0.00	$0.00
Initial Cost of Vehicle	$410,000.00	$575,000.00
Overall Estimated Lifespan Cost Per Vehicle	$726,511.21	$608,038.48
Total Estimated Lifespan Cost (25 Vehicle Fleet)	$18,162,780.25	$15,200,962.00

* - Based on 2013-2014 Figures and Prices
** - Based on EIA Gulf Coast Region Data for 2013

Carbon Emissions (per vehicle)	Diesel	Electric
Pounds (lbs) of CO2 per gallon*/kWh^	22.38*	2.14^
Average number of gallons*/kWh^ consumed annually	4,963*	30,526.4^
Pounds (lbs) of CO2 produced annually	111,069.30	65,326.50
Pounds (lbs) of CO2 produced over 14 year lifespan	1,554,970.20	914,571.00
Carbon Emissions (25 bus fleet)	**Diesel**	**Electric**
Pounds (lbs) of CO2 produced annually	2,777,733.28	1,633,163.21
Pounds (lbs) of CO2 produced over 14 year lifespan	38,888,265.92	22,864,284.94

THE OUTCOME

This study examined the economic and environmental values of two different fuel powered buses to determine which provides a more sustainable solution to the University of Arkansas. However, on a broad scale this study examined emerging technologies that could potentially bring a cheaper and cleaner source of public transportation to the masses creating a more sustainable future.

The results of the study determined a considerable decrease in cost and emissions from the electric bus compared to the diesel buses currently in use at the University. The hope of this study is to become a template not only for the University of Arkansas, but for universities and communities across the country to consider a shift in a more sustainable direction for public transportation in the future.

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