A COMPARISON BETWEEN THE EMISSIONS OF SHUTTLE BUSES AND RIDE-SHARING FOR EVENT TRANSPORTATION SERVICES

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Introduction

With ever-increasing concerns regarding fossil fuel emissions and their effects on our climate, it is important to make environmentally conscientious decisions when planning your event transportation needs. Ride sharing has seen rapidly increasing prevalence in recent years, and this mode of transportation is often seen as a supplement or replacement for traditional shuttle buses. The fact that ride sharing is on-demand is an especially appealing feature to attendees, and one that leads many to believe it is an environmentally sensible option, but what are the true costs associated with this new transportation model?

Crunching the Numbers

Apart from the swelling in traffic congestion (and subsequent decreases in fuel efficiency) that result from thousands of wandering ride share vehicles, scientific analysis of vehicle emissions shows that even at peak efficiency, ride sharing still has a larger carbon footprint than traditional shuttle bus systems. At a first exterior glance, buses may come across as non-eco-friendly vehicles, and let's be honest, the diesel exhaust fumes don't smell like roses. Due to the smell of bus exhaust, it is easy to write them off as environmentally unfriendly, but once you break down the emissions generated to a per-passenger amount, the numbers tell a different story. Let's take a look.

In the table below, data retrieved from the EPA and US Department of Energy is analyzed for 3 different transportation options: Diesel buses, Biodiesel buses, and ride-sharing. While there are many other other modes of city transportation, such as light rail, city buses, taxis, and vehicle rental, these are not relevant for conventions and tradeshow planners, except in some limited circumstances (depending on the city). The calculations in the first half of the table show how much CO2e (CO2 equivalent) emissions are produced for each vehicle type per mile, inclusive of the two other main greenhouse gases, methane and nitrous oxide. It is no surprise that buses produce much more greenhouse emissions on a per-mile basis, but when adjusted for the number of passengers on board the vehicles in the second part of the table, buses actually produce around 35% less emissions per passenger across all occupant capacity utilizations (how much of the vehicle is filled up with passengers).

Another interesting result to note is that Biodiesel does not actually produce any fewer tailpipe emissions than traditional Diesel. B100 Biodiesel does produce less CO2 per gallon, but it also suffers from a 10% decrease in fuel efficiency because of its lower energy density, so there is no net gain when this factor is considered. Biodiesel does offer significant advantages when considering the entire fuel life cycle though. Since biodiesel is made from organic matter, the plants absorb CO2 as they grow, such that over the life of the fuel, CO2 emissions are reduced by as much as 74% over conventional diesel. Biodiesel does also produce less soot, carbon monoxide, and unburnt hydrocarbons. Unlike ethanol additives in gasoline, biodiesel is also generally considered to be a cleaner fuel to run, reducing maintenance costs.

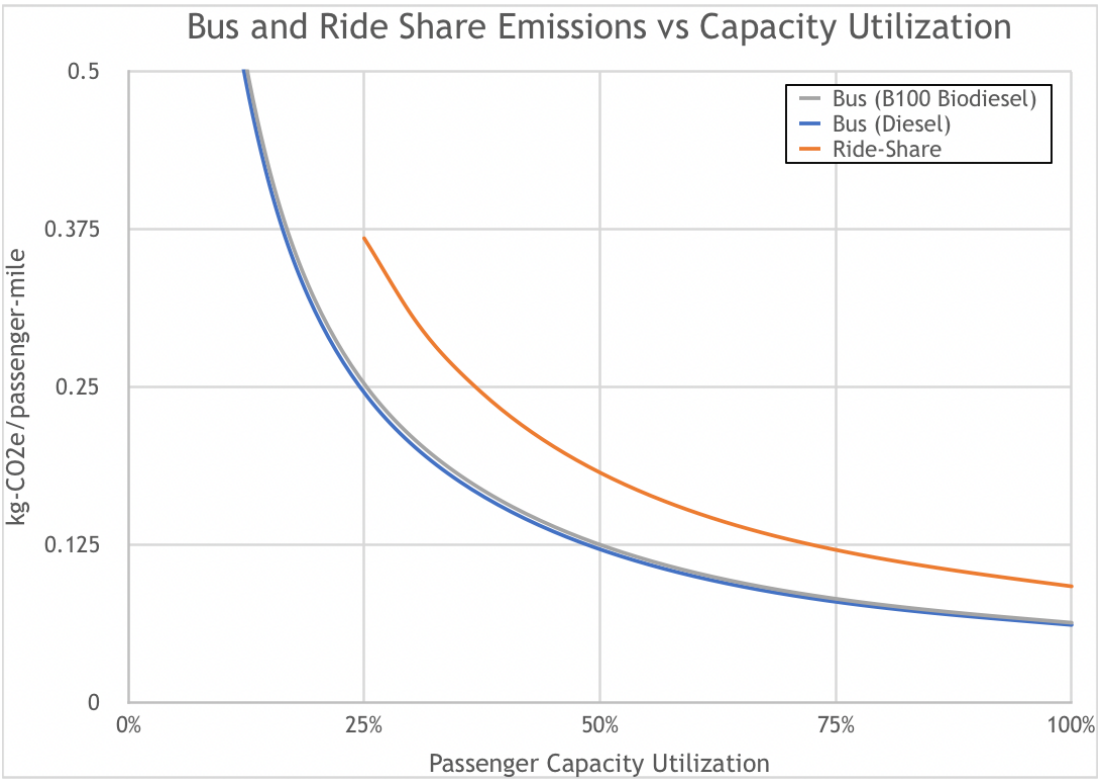
Bus vs Ride Share Emissions Comparison

	Bus (Diesel)	Bus (Biodiesel)	Ride Share (Gasoline)
CO2 Emissions (kg CO2/gallon)	10.21	9.45	8.78
Average Fuel Mileage (MPG)	3.025	2.7225	23.96
kg CO2/mile	3.3752	3.4711	0.3664
CO2e/mile (GWP of 1)	3.3752	3.4711	0.3664
g CH4 (methane)/mile	0.0051	0.005	0.0173
kg CO2e/mile (GWP of 25)	0.0001275	0.000125	0.0004325
g N2O (nitrous oxide)/mile	0.0048	0.005	0.0036
kg CO2e/mile (GWP of 298)	0.001430	0.001490	0.001073
Total emissions (kg CO2e/mile)	**3.3768**	**3.4727**	**0.3679**
Average Ridership (36%)			
Assumed passenger load	20	20	1.44
Emissions (kg CO2e/passenger-mile)	**0.1688**	**0.1736**	**0.2555**
Reduction in emissions from ride-sharing	34%	32%	
High Ridership (50%)			
Assumed passenger load	28	28	2
Emissions (kg CO2e/passenger-mile)	**0.1206**	**0.1240**	**0.1840**
Reduction in emissions from ride-sharing	34%	33%	
Low Ridership (25%)			
Assumed passenger load	14	14	1
Emissions (kg CO2e/passenger-mile)	**0.2412**	**0.2480**	**0.3679**
Reduction in emissions from ride-sharing	34%	33%	

Sources:
https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf
https://afdc.energy.gov/data/10310
https://www.fueleconomy.gov/feg/biodiesel.shtml

Graphical comparison

It may be easy to get lost in the information in the table above, but when plotted on a graph, the results are easier to decipher. The figure below shows the relationship between the CO2e emissions per passenger-mile (and the passenger capacity utilization of a vehicle (how much of the vehicle is occupied). Buses can hold up to 55 passengers, and ride-shares can hold up to 4 passengers (large capacity ride sharing is not analyzed as it is generally a small percentage of the ride share market for special events). It is clear to see that at all practical capacity utilizations, ride sharing results in more CO2e emissions. The very low capacity utilizations for buses with high CO2e emissions correspond to having less than 10 passengers, which is well below average ridership. With proper planning of shuttle bus routes and frequency, the number of buses with fewer than 10 passengers can be greatly reduced. Additionally, during peak hours of an event, it is very common for buses to be nearly or completely full, so the average overall passenger count is commonly around 20 (36% of bus capacity). To have lower CO2e emissions than this per passenger, the ride share average passenger count would have to be around 2.25 (56% capacity) or greater.



Conclusion

When considering the environmental impacts of transportation services for your event, data analysis shows that in comparison to ride-sharing, buses produce a significantly smaller carbon footprint, making them the most eco-friendly point-to-point transportation option for events. It is important to ensure that the buses are being properly utilized to maintain that efficiency though, and for that you need a professional and experienced team to organize them. Please reach out to reach out to ETS with any questions, and hopefully your next RFP!

Contact us

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- https://www.fueleconomy.gov/feg/biodiesel.shtml