Options for Reducing Pollution from School Buses

Comparing Retrofit Technologies and Cleaner Fuels Options to Traditional Diesel School Buses and Fuels

Clean Fuel / Retrofit Options	Engine	Percent Reduction in Particulate Matter (PM)	Percent Change in Nitrogen Oxides (NO_X)[1]	Percent Reduction in Carbon Dioxide (CO_2)	Approximate Cost of Technology[2]	Fuel Requirements / Costs[2]
Ultra-Low Sulfur Diesel (ULSD) (15 parts per million sulfur)	New or Used Diesel Engine (best if used with a PM filter - see below)	-5 to -9% also, enables the PM filter technology to work	N/A	N/A	N/A	8 to 25 cents per gallon more than regular diesel (June 2006, ULSD will be required nationwide)
Diesel or ULSD / Oxidation Catalyst	New or Used Diesel Engine	-20 to -30% also reduces hydrocarbons by 50% and carbon monoxide by 40%	N/A	N/A	$1,500 to $2,500 (1-2 hour installation)	none, can be used with regular diesel, although us of ULSD will optimize performance
ULSD/ Particulate Matter Filter (PM filter)	New or Used Diesel Engine – 1995 or newer	-60 to -90% also reduces hydrocarbons and carbon monoxide by 60 to 90%	N/A	N/A	$5,000 to $9,000 (higher cost filters address exhaust temperature issues) (3-6 hour installation)	ULSD
Biodiesel (B20, B100) (B20: 20% biodiesel, 80% diesel) (B100:100% biodiesel)	New or Used Diesel Engine	B20: -10% also, B20 reduces hydrocarbons by 20% and carbon monoxide by 10% B100: -40%	Biodiesel increases emissions of NOx B20: +2% B100: +10%	Biodiesel has a closed carbon cycle as it is made from plants which absorb CO_2 B20: -15%[3] B-100: -78%[3]	N/A	B20 – 15 to 30 cents per gallon more than regular diesel[4] B100 – 75 cents to $1.50 per gallon more than regular diesel[4] (B-100 ma not be an option for cold climates)
Compressed Natural Gas (CNG)	New CNG Engine	-70 to -90% should use catalyst technology to reduce ultra fine PM, formaldehyde, and methane – otherwise, methane and aldehydes will be much higher	case studies[5] suggest about 60% reduction	case studies[5] suggest about 30% reduction this decrease may be more than offset by the increase in methane emissions (which have a global warming potential 21 times that of CO_2)	$30,000 more than for a Type D diesel bus significant additional cost to create special maintenance (new or rehab) and refueling facilities	cost of CNG fuel similar t regular diesel, but special re-fueling and maintenanc facilities are required

[1]NOx includes all oxides of nitrogen such as NO and NO_2

[2]Cost estimates based on anecdotal data from a variety of pilot projects

[3]From the National Biodiesel Board – based on a 1998 biodiesel lifecycle study, jointly sponsored by the US Department of Energy and the US Department of Agriculture. (Note: because the carbon dioxide released into the atmosphere when biodiesel is burned is recycled by growing plants, which are later processed into fuel, biodiesel has what is called a closed carbon cycle)

[4]From the National Biodiesel Board

[5]see SAE Paper 2002-01-0433 – Year-Long Evaluation of Trucks and Buses Equipped with Passive Diesel Particulate Filters, LeTavec, et al.

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