Are We There Yet? Alternative Fuels for School Buses

By Dennis Lea and Deborah Carter

The Energy Management Institute (2009) warns that by as early as the second half of 2009, the price of all energy instruments will be higher than they were in the closing days of 2008.

Last summer, the price of diesel fuel approached or exceeded $5 per gallon in many regions of the United States. The price of diesel fuel recently dropped to less than $2 per gallon and then began to rise again because of the manipulation of production levels for crude oil and the tightening of production levels by U.S. refineries. Although no one can predict the future with 100% accuracy, it is a disturbing trend.

The United States now imports 70% of its crude oil demand, with that percentage expected to increase in the foreseeable future. During the past six months, the price of a barrel of crude oil has fluctuated from $150 per barrel to under $40 per barrel. Because of our country's dependence on foreign oil, we may have created a situa-

tion that severely impairs the transportation of students. Coupled with this is the emerging research on the effect of standard diesel fuel on children's health.

We discuss here three alternative fuel approaches: compressed natural gas (CNG), liquefied petroleum gas (LPG), and biodiesel (B20). It should be noted that the Energy Policy Act of 1992 identifies alternative fuels as LPG, CNG, ethanol, methanol, B20, electricity, coal-derived fuels, and hydrogen. The data presented will be based on the effect of using a conventional Type C school bus, the most commonly used bus type in the United States (Laughlin 2004).

Compressed Natural Gas

Compressed natural gas is a fossil fuel mostly composed of methane. Drilling for CNG occurs both on land and offshore. The majority of the natural gas used in the United States is from domestic sources. Although CNG consumption has increased, it is still a minuscule amount when compared with the demand for gasoline. Federal laws and executive orders have been passed with the primary goal of increasing the ability of the federal government to encourage growth in the use of CNG as an alternative source of fuel.

Fuel efficiency must be considered when analyzing and comparing the cost of an alternative fuel to another source.

Using CNG buses has significant environmental benefits. CNG engines can reduce harmful emissions by as much as 90% over diesel-powered vehicles (Yacobucci 2005). CNG is a light fossil fuel—it rises from the ground when released. It differs from diesel and other fossil fuels that are heavier than air and therefore create more toxic inhalation hazards, particularly to children whose lungs are developing (Solomon and others 2001). According to Brent Yacobucci (2005), a specialist in energy policy, natural gas is safer than gasoline: it is nontoxic, less ignitable, and dissipates into the air more quickly when released.

Although the benefits of CNG are enormous, it does have drawbacks. The initial cost for CNG school buses is greater than the cost of diesel buses. Blue Bird Corporation, an original manufacturer of school buses, sells a new CNG bus for approximately $17,000 more than its diesel equivalent (conversation with sales manager, January 28, 2009).

Another drawback to using a lighter gas such as CNG is that it requires infrastructure adaptations. Storage structures for vehicles can potentially trap the CNG and cause a combustion danger. Ventilation of the garage is necessary to reduce this risk.

The issue of refueling CNG buses must be analyzed. The refueling network for CNG buses is limited in the United States. A refueling infrastructure can be costly, with a starting price of $250,000. In addition, fuel costs on an energy-equivalent basis are lower for CNG than for diesel and LPG. CNG-converted buses will on average operate at a fuel efficiency level of 75% or 5 miles per gallon compared with diesel at 6.6 miles per gallon (Laughlin 2004).

According to the U.S. Department of Energy (2008), CNG was $1.42 less than standard diesel on an energy-equivalent basis. LPG was $1.56 more, and biodiesel (B20) was $0.46 more than standard diesel on an energy-equivalent basis.

Fuel efficiency must be considered when analyzing and comparing the cost of an alternative fuel to another source, such as standard diesel. Although CNG appears significantly less expensive than diesel, the overall loss in efficiency cuts into the cost benefits.

Liquefied Petroleum Gas

Liquefied petroleum gas is a fossil fuel also known as propane. It is used around the world more frequently than any other alternative fuel. The environmental benefits of using LPG are not as significant as those of compressed natural gas; however, they are still quite substantial compared with diesel fuels. LPG is a product of petroleum refining, and its use can reduce carbon emissions by up to 60% over diesel-fueled vehicles.

The storage of liquefied petroleum gas is similar to compressed natural gas. It is stored in pressurized containers that have been tested under rigorous conditions. Similarly, both CNG and LPG are odorless; therefore, an odorant is added to ensure recognition of leaks.

The cost of a new LPG Blue Bird bus is approximately $14,000 more than the new diesel equivalent (conversation with sales manager, January 28, 2009). In fact, the retrofit uses a gasoline engine converted for LPG fuel. LPG-converted buses will on average operate at a fuel-efficiency level of 75% or 5 miles per gallon compared with diesel at 6.6 miles per gallon (Laughlin 2004).

On average, the cost of LPG exceeds the cost of standard diesel on an energy-equivalent basis. Fueling infrastructure for LPG is less expensive than CNG stations. Note that propane gas is the same type of gas piped into homes across the nation for heating and cooking. A large infrastructure for the delivery of LPG fuel already exists in the United States.

Biodiesel (B20)

Biodiesel is a synthetic fuel produced from fatty oils. It is made by combining standard diesel with a biodiesel most commonly in a ratio of 80% regular diesel and

20% biodiesel. The primary benefit of biodiesel fuel is that it can generally be used in vehicles without requiring any engine modifications.

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The cost of biodiesel is comparable or slightly more than standard diesel fuel. The use of biodiesel reduces emissions of carbon monoxide and particulate matter and increases nitrogen oxides. Using biodiesel improves the quality of air for students and others while the bus engine is running.

Grants and Tax Incentives

The use of alternative fuel is an issue being debated in the public policy arena. The consensus is that the federal government must be a leader in the development of alternative fuels.

Funding is available to replace or retrofit buses in order to protect the environment. In 2008, the Environmental Protection Agency's program Clean School Bus USA received $49.2 million to fund projects across the country. Certain types of dedicated alternative-fuel vehicles are eligible for federal credit. The Clean Cities program and Clean School Bus USA advocate for alternative fuels and are useful sources of information about grants and addition funding.

Tax incentives are available on the federal level in the form of tax credits. An example is a $9,760 tax credit for the model year 2007 Blue Bird Corp. LPG bus (IRS 2009). In addition, states across the nation offer tax incentives. For example, in 2008, the Missouri legislature passed a tax relief statute that gives tax credit to eligible applicants who install and operate a qualified alternative-fuel refueling property. The credit enables the applicant to receive $20,000 or 20% of the total cost, whichever is less. There is also an incentive related to fuel purchases. The Missouri motor fuel tax statute (2008) states that there will be no state motor fuel tax on alternative fuel used for school buses; instead, a nominal decal fee is charged for each bus.

Looking to the Future

America's annual oil consumption continues to increase and is projected to continue the upward spiral into the foreseeable future. Alternative-fuel options are available that are not only cheaper in some cases on an energy-equivalent basis but are also more environmentally friendly. Education leaders need to be concerned with both these facts. Incentives are necessary from federal and state governments to stimulate the move to alternative fuels to mitigate costs related to fuel systems and infrastructure requirements.

The question children invariably ask on long car rides, "Are we there yet?" could be asked concerning the journey to cleaner air. A reflective answer apparently is, "Not yet." We still have a way to go.

References

Energy Management Institute. 2009. Energy prices predicted to rise in 2009/2010—Energy hedging critical for companies with energy exp. Press release. www.energyinstitution.org/whatsnew/press-details.php?id=44.

Energy Policy Act of 1992. Public Law No. 109–776.

Internal Revenue Service. 2009. Clean fuel USA vehicles—Qualified alternative fuel motor vehicles. www.irs.gov/businesses/article/0,,id=201026,00.html.

Laughlin, M. 2004. Economic analysis of alternative fuel school buses. U.S. Department of Energy, Clean Cities, April.

Missouri Motor Fuel Tax of 2008. Public Law No. 142.803.

Missouri Tax Relief of 2008. Public Law No. 135.710.

Solomon, G. M., T. R. Campbell, G. R. Feuer, J. Masters, A. Samkian, and K. A. Paul. 2001. No breathing in the aisles: Diesel exhaust inside school buses. Natural Resources Defense Council, January.

U.S. Department of Energy. 2008. Compressed natural gas (relative to diesel). *Clean Cities Alternative Fuel Price Report*, October.

Yacobucci, B. 2005. Alternative transportation fuels and vehicles: Energy, environment, and development issues. CRS Report RL30758, Congressional Research Service, January 7.

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