



Photo by Dennis Schroeder, NREL 31480

School Districts Move to the Head of the Class with Propane

School districts across the country are under pressure to reduce their cost of operations and ensure their budgets are spent wisely. School bus fleets operate more than 675,000¹ buses in the United States, and many school districts have found the answer to their budget woes in the form of propane, or liquefied petroleum gas (LPG). Propane is a reliable, domestic fuel, and it's used in approximately 2% of school buses nationwide.



Unlike diesel engines, propane engines do not require advanced emissions controls and their related maintenance. *Photo from MotorWeek/Maryland Public TV, NREL 17180*



Propane's School Bus History

While propane has been used in buses for decades, recent technological advancements have made it more reliable than ever. Prior to 2007, all propane vehicles used vapor injection technology. In 2007, Blue Bird rolled out a propane school bus using direct liquid injection for the first time, and this was followed by Thomas Built Buses and Navistar. Liquid injection technology makes propane buses a more reliable option.

Since 2007, vehicle emissions standards have tightened for all vehicles. Propane vehicles meet these emissions standards without aftertreatment systems required for diesel vehicles. Because of this, and other reasons, many districts have found propane meets their criteria as an affordable, clean alternative.

Economic and Environmental Impacts

Propane is a domestic fuel created as a byproduct from crude oil refining and natural gas processing. Propane engines have simpler emissions controls, which allow them to meet U.S. Environmental Protection Agency standards. In addition, some school districts are reporting cost savings from reduced preventive maintenance such as oil changes (an effect also attributed to the fuel's clean-burning nature). Most significantly, propane also typically costs less than diesel fuel, particularly for fleets that work with their local propane marketers and equipment providers to install private

¹ Federal Highway Administration - Highway Statistics 2012, Table MV -10, fhwa.dot.gov/policyinformation/statistics/2012/pdf/mv10.pdf

fueling and get the most competitive pricing. Some states provide tax incentives, grant programs, and other incentives that reduce costs even further. For more information on such incentives, contact your Clean Cities coordinator or visit the Federal and State Laws and Incentives section of the Alternative Fuels Data Center (AFDC) at afd.energy.gov/laws.

Proven Cold-Weather Results

Reliability is paramount when students are waiting in the cold for their school bus. Propane engines operate the same as gasoline engines in cold weather and can warm up quickly.



Propane's typically lower fuel cost often helps fleets recover the initial incremental cost of vehicles more quickly. *Photo by Dennis Schroeder, NREL 31343*

Case Study:

Mesa Unified School District

Mesa Unified School District in Mesa, Arizona is an example of a fleet taking advantage of both the economic and environmental benefits of propane. In 2011, rather than invest in diesel buses, Mesa turned to propane after finding that buses equipped with diesel technologies such as diesel particulate filters experienced more breakdowns and costly repairs than the district's older diesel buses. The district transports 19,000 students a collective 36,000 miles per day, so reliability is a must.

The decision to purchase 90 propane buses has paid off, saving Mesa \$0.38 per mile with anticipated savings of \$3.2 million over five years. These savings are a combination of low propane pricing and reduced maintenance costs thanks to fewer oil changes and engine failures. The district also realized emissions inspections savings, as new propane vehicles are exempt from initial emissions inspections in Arizona. While the district's fuel prices change weekly according to the commodity price, a market cap insures the cost to fill Mesa's two 18,000-gallon tanks and one 1,000-gallon tank will remain at least 30% less than the cost of diesel fuel (without additional incentives that may lower the price further).

Jeanne Vandemark, Mesa's Director of Transportation, hopes to transition the school bus fleet of more than 500 to propane. Other districts in the Phoenix area have taken notice of these savings as well; 13 neighboring districts are now testing or running propane buses.

As Vandemark notes, "When you look at propane and you look at the facts, it is surprising that more fleets do not use propane buses. It's up to us to know the facts and educate others."

"At the end of the day, everyone wants to keep their own child safe, but we're responsible for caring for all the students. This is one reason why we use propane."



Mesa Unified School District (Mesa, Arizona) purchased 90 propane buses and anticipates saving \$3.2 million over five years. *Photo from Mesa Unified School District, NREL 34334*

"Propane is clean and runs well, and we would like more buses. We eventually hope to be switching to an entire propane fleet."

– Jeanne Vandemark,
Director of Transportation,
Mesa Unified School District



Photo from Eastern Carver County Schools, NREL 34336

Case Study:

Eastern Carver County School District

With temperatures dipping below freezing half the year, cold-weather reliability was an important factor for Eastern Carver County (ECC) School District in Chaska, Minnesota, when looking for alternative fuel buses. John Thomas, the Transportation Coordinator for ECC, worked with school bus service provider Student Transportation of America (STA) to test different bus options. Propane proved to be the most cost-effective option. It had a low capital expenditure, was reported to be reliable in all conditions, and in ECC's case, required no alterations to maintenance facilities.

STA worked with the district to provide Blue Bird propane buses for no additional cost as part of its normal contract replacement schedule. Fuel cost savings supported the initial capital expenditure for the buses. Working with propane marketer Ferrellgas, ECC installed fueling infrastructure in its fleet yard, which guaranteed low and consistent fuel prices as well as fuel availability. Through a joint contract and price sharing model, STA is allocated a set portion of the annualized fuel cost savings to offset the increased cost of the buses. ECC benefits from any remaining cost savings.

With the first 18 buses, STA and Blue Bird helped train ECC drivers and mechanics. The district saw a reduction in maintenance costs and drivers found that the buses had more horsepower and warmed up quickly. Initially, drivers had to educate parents who questioned the new buses; however, propane's excellent reputation, quieter operation, and increased reliability quickly eliminated concerns. The district purchased 14 more propane buses in 2012 and hopes to operate entirely on propane by 2017. For the 2013–2014 school year, the savings from these buses was about \$170,000. This funded wireless Internet throughout

the fleet, which allows parents to track the bus locations and helps take the classroom "beyond-the-bricks." This is important for travel to and from school, as well as sporting events. Several other districts in Minnesota are now running on propane as well.

As Thomas has told them, "I can't say enough about how much we have benefited. It really pays off."



After initially purchasing 18 buses, Eastern Carver County School District added 14 more in 2012. Transportation Coordinator John Thomas hopes for the fleet to be operating entirely on propane by 2017. Photo from Eastern Carver County Schools, NREL 34335

Learn More

Technician Training and Facility Modifications:

For technicians trained in spark-ignition engine systems, training for propane buses can be minimal. Often, the school bus or engine manufacturer will offer training specific to propane-fueled vehicles. Fleets should consult their local Authority Having Jurisdiction regarding any necessary facility modifications.

Fuel Pricing and Infrastructure: Propane can be delivered on site, where pricing is typically based on the volume used. Local propane marketers can not only provide fuel but expertise and technical assistance in establishing private fueling infrastructure. By consulting with a number of local fuel providers, fleets can establish a fuel contract that secures fuel at a fixed cost, regardless of seasonal commodity price or supply fluctuations. To obtain the best fuel price at public fueling stations, fleets should negotiate competitive pricing in advance. Fleets considering installing their own infrastructure should refer to “Costs Associated With Propane Vehicle Fueling Infrastructure” (afdc.energy.gov/uploads/publication/propane_costs.pdf). In all cases, your local Clean Cities coalition can be a valuable resource when considering fueling infrastructure.

Case Studies: A case study released in 2014 by Argonne National Laboratory examined five fleets with a total of 110 buses and found that some of the school districts saved nearly 50% on fuel and maintenance and recouped the incremental costs of the vehicles and infrastructure within three to eight years (afdc.energy.gov/uploads/publication/case-study-propane-school-bus-fleets.pdf). Find more case studies from around the country on the AFDC Case Studies page (afdc.energy.gov/case) and the Propane Education & Research Council website (propane.com/on-road-fleets).

About Propane: To learn more about propane as a vehicle fuel, visit the AFDC Propane page (afdc.energy.gov/fuels/propane.html). ■



Top: For technicians trained in spark-ignition engine systems, training for propane buses can be minimal. *Photo from Propane Education & Research Council*

Middle: Propane can be delivered on site, where pricing is typically based on the volume used. Local propane marketers can provide technical assistance in establishing fueling infrastructure. *Photo by Dennis Schroeder, NREL 31349*

Bottom: Visit the Alternative Fuel Data Center’s Case Studies page to see more examples of school districts successfully implementing propane. *Photo from Propane Education & Research Council*

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