TRANSIT TRAINING

FLORIDA DEPARTMENT OF TRANSPORTATION AND THE CENTER FOR URBAN TRANSPORTATION RESEARCH

FLORIDA MAINTENANCE TRAINING PROGRAM

CUTR
Center for Urban Transportation Research

Florida Department of Transportation

USF
UNIVERSITY OF SOUTH FLORIDA

SPECIAL EDITION:
Fuel Options for Florida Transit Forum

The fast-approaching implementation of new EPA emission guidelines for heavy duty engines and urban transit fleets has promoted the need for investigation and objective analysis of clean fuel options for Florida transit.

The Assessment and Evaluation of Alternative Fuel Options for Florida's Mass Transit Systems Study being conducted by the USF Center for Urban Transportation Research (CUTR) includes gathering data to develop recommendations for future polices and practices relating to urban bus procurement for transit agencies in Florida and includes interviews and surveys of transit agencies around the state. A total of 16 interviews conducted last summer led to CUTR's Fuel Options for Florida Transit Forum on March 8, 2005, facilitated by Stephen Reich, Director of CUTR's Transportation Program Evaluation and Economic Analysis Program and Principal Investigator for the study.

During the forum, representatives from biodiesel, hybrid electric, and ULSD industries addressed concerns about each fuel and provided up-to-date information on each. CNG experts from PSTA and LYNX provided their real-world perspectives gained from an impressive amount of hands-on experience. The following sections provide a summary of the information shared at the Forum for each fuel option.

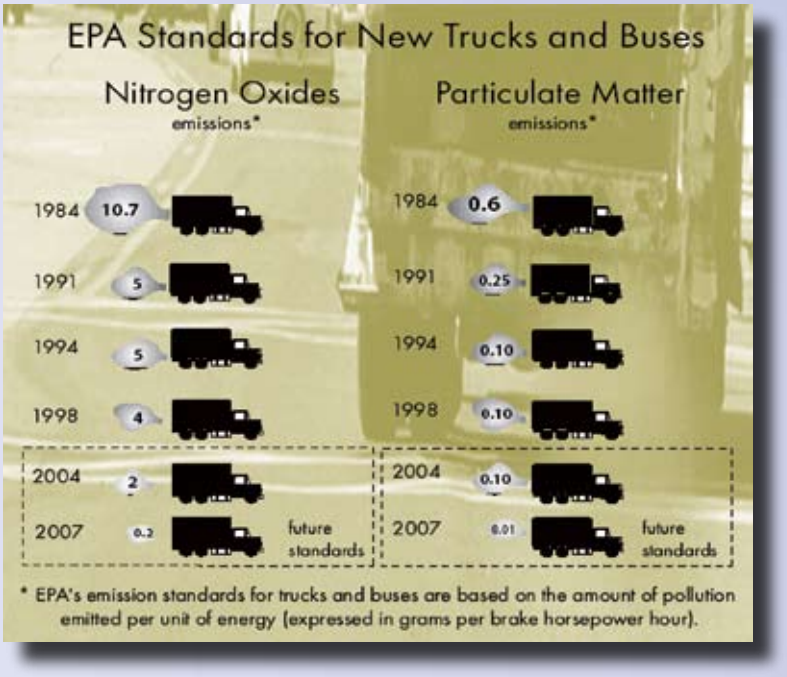
BIODIESEL

Donnell Rehagen, Director of Operations, National Biodiesel Board

Rick Fallin, USF Transportation Supervisor

(additional information from www.biodiesel.org)

Biodiesel is a cleaner-burning diesel fuel that comprises mono-alkyl esters (derived from vegetable oils or animal fats), is designated B100, and meets the specifications of ASTM D6751. Biodiesel Blend is a blend of biodiesel fuel with petroleum-based diesel fuel designated BXX, where XX is the volume percent of biodiesel. If a fuel does not meet ASTM D6751, it is not biodiesel. It is important to ensure that the fuel used meets the biodiesel specification.



Biodiesel Performance

- Integrates into existing petroleum infrastructure
- High Cetane (>50 vs 42)
- High lubricity (>6000g vs 3100g SLBOCLE)
- BTU content (120,000 BTU/gal vs 126,000)
- Cold flow (3-5°F >soy-based B20)
- Flash point (a min of 260°F vs 150°F)

The use of biodiesel fuel requires little or no modification to the engine or the fuel system and, in general, requires no changes to the standard storage and handling procedures used for petroleum diesel. Biodiesel does have a solvent effect on deposits accumulated on tank walls and pipes from previous diesel fuel storage. Initially, this may clog filters, necessitating more frequent filter changes. The fuel should be stored in a clean, dry, dark environment. Acceptable storage tank materials include aluminum, steel, fluorinated polyethylene, fluorinated polypropylene and Teflon; use of copper, brass, lead, tin, and zinc should be avoided.

Rick Fallin of the University of South Florida in Tampa implemented the use of blended biodiesel for USF's Bull Runner shuttle service. His only problem was a lack of readily-available supplies of biodiesel, which resulted in discontinuing the use of B20. This issue has been shared by many desiring to use this fuel.

To promote the production and subsequent use of biodiesel, Congress passed a federal excise tax credit that provides for one penny per percent of agri-biodiesel blended with diesel fuel and one-half penny per percent of other biodiesel blended with diesel fuel. The tax credit will be taken at the blender level and is structured to benefit all consumers (taxable and tax exempt markets). The tax incentive could lower the price of B20 by 20 cents per gallon. Because of today's high cost of crude oil, the biodiesel market could grow substantially.

In the past, industry capacity has been a concern. Currently, production is up to 150 million gallons/year and, as more biodiesel plants are implemented, capacity could double within 12-18 months or less. Growth in the use of low-blend biodiesel is projected for the highway diesel market due to the positioning of biodiesel for use as a lubricity additive for ULSD. Currently in Florida there are biodiesel plants in Lakeland and Jacksonville, with one in Port Everglades to open this year.

HYBRID ELECTRIC

EP40/50 Program—Allison Transmission

Robert R. Tejchma, EP40/50 Program Manager

General Motors's (GM) first hybrid system, the EP40/50 hybrid propulsion system, was designed, developed and patented by GM-Allison. The EP System Configuration consists of power electronics, energy storage system, ECU, engine, and drive unit. The drive unit has two-mode compound, split parallel hybrid architecture with two 100hp AC Induction Motors (electrically variable transmission).

The Allison Energy Storage System is completely integrated and has been adapted specifically for commercial vehicles. The Control System (ECU) is a hybrid system designed and developed by Allison that utilizes GM pickup truck electronics.

Currently, cost is the primary obstacle to building a sustainable hybrid bus market. The initial capital outlay per bus ranges between $480-500,000. Anticipated future costs include $30-40,000 for replacement of the battery pack (current battery life: 6 years) and an estimated cost of $40,000 for potential replacement of the drive unit after 6 years. Many transit agencies estimate that the cost of hybrid bus technology would have to be 50% of current prices before they could buy.

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Visit us online at the FMTP website,
www.cutr.usf.edu/research/fmtp/fmtp.htm

Designer: Wendy Teague

Benefits of the EP 40/50 Technology (per Allison)

- Demonstrated fuel economy and emission reduction when compared with CNG and diesel. (The Allison Es System has a slight fuel economy edge over the Allison EP System. King County Metro transit agency, Seattle, has observed a 52% improvement in fuel economy.)
- Demonstrated lower NOx and PM emissions when compared to CNG and diesel.
- Reduction in costs associated with maintenance, brakes, engine and transmission oil.
- Smoother, more powerful acceleration.
- Reduction in propulsion system noise.
- Higher MMBF compared to conventional vehicles.
- No reported battery module failures.

The steps Allison believes are necessary to achieve a sustainable hybrid market include government funding of the differential costs between hybrid and diesel buses, development of a reasonably priced 12-year battery, reductions in the size and weight of battery and power electronics, ongoing improvement of fuel economy and emissions, and an increase in component volumes.

GM projects their hybrid car program, set to launch in 2007, will help decrease the cost of hybrid technology for buses. The technology for both is very similar, enabling higher levels of production that will subsequently lower hybrid-related production costs.

Battery Development—EnerDel, Inc.

Dr. V. Evan House, Engineering Director/ Primary Batteries

EnerDel is a new company dedicated to the development of lithium batteries for use in systems solutions. When developing these batteries, issues related to safety are of critical importance. Three levels of proven protection include cell design, electronic control, and thermal shielding case materials. To obtain greater power, voltage and energy, multiple cells are stacked in parallel or series designs to form a battery module. Battery cells are put through various safety tests including short circuit, overcharge, discharge and vibration/shock.

HARTline, Tampa

Edward Bart, Director of Maintenance

Three Gillig 40ft buses with Allison EP40 electric drives recently were introduced into the HARTline fleet. Although too soon to comment on performance or related problems, as the buses go through more testing and service time, HARTline will share its experiences with those interested in learning more about this hybrid technology. Future analysis by HARTline will include brake wear, fuel economy, fuel selection, battery life and EPA diagnostics-Cummins.

ULTRA LOW SULFUR DIESEL

The new EPA emission requirements for heavy-duty engine and urban bus fleets will result in significant reduction in emissions and can be achieved using ultra low sulfur diesel (ULSD) in combination with particulate traps. It is projected that, with this combination, as much as a 90% reduction in particulate matter, carbon dioxide, and hydrocarbons can be achieved; only a 10-20% reduction can be achieved by using ULSD alone.

Diesel refineries are faced with having to invest in major changes to existing facilities, new construction, and/or substantial upgrades to existing equipment in order to produce large quantities of ULSD. The capability of ULSD to move successfully through the pipeline system presents major challenges to the industry. As different types of products (gasoline, low sulfur diesel, diesel and jet/kerosene) move through the system, they abut each other; turbulent flow minimizes interface and creates a favorable sequencing, reducing contamination and downgrade. However, research and findings related to this process when using ULSD have indicated that ULSD requires a more conservative cut then cuts based on gravity. Otherwise, what results is an increase in surface interface that promotes contamination and downgrade (for example, ULSD to LSD) that can lead to a significant loss of ULSD.

Today, many refineries use a hydro-treating process to lower sulfur content in fuel. It is generally believed that this process will be used to meet the 15ppm specification set by the EPA. To do this, the process will need to be intensified to cause a reduction in the trace components, nitrogen and oxygen, which serve as natural lubricity. It has also been suggested that the addition of a high lubricity agent, such as biodiesel, could eliminate excessive engine wear. In the initial phase-in period of ULSD, there is some leeway for the continued use of LSD.

ULSD has the same energy and performance as LSD. The only difference is the amount of sulfur. ULSD should neither affect the performance of engines, nor affect engine warranty, per major equipment manufacturers. However, cost is a major concern, especially until ULSD distribution is fully in place.

COMPRESSED NATURAL GAS

Russ Billingsley, Lead Maintenance Supervisor, PSTA
George Groot, Safety & Training Supervisor, PSTA
Joe Cheney, Interim Director Operations/Maintenance, LYNX

The Florida experience with CNG transit supports this key indicator of success: transit agencies that have invested in fleet inventory primarily composed of CNG buses have greater opportunity for success than those agencies having only a small percentage of CNG vehicles incorporated into their predominantly diesel-based fleets. This success indicator is largely due to the safety and maintenance requirements associated with CNG bus technologies that are not necessary to meet when using diesel-based transit technology.

LYNX and PSTA have done considerable testing and comparison of CNG buses with like diesel buses. Both agencies experienced approximately a 65% increase in the cost of CNG operations over diesel and found CNG engine parts and engine labor costs to be considerably higher than diesel.

LYNX data shows CNG to be 56 times more costly, with engine parts costing $0.01 per mile, compared to the diesel counterpart at $0.0017 per mile. Labor costs for both agencies were considerably higher for CNG buses than diesel—LYNX costs averaging 15 times greater.

Not only are there higher operational costs with CNG, but there are also higher vehicle acquisition costs and start-up costs. The implementation of CNG in transit operations brings with it significant expenses related to fueling infrastructure, retrofitting of existing bus facilities with safety equipment, and installing and/or procuring maintenance tune-up and diagnostic equipment.

Benefits of using CNG include reductions in levels of emissions, decreases in the amount of diesel fuel needed, reductions in spill containment and impact, and lower fuel costs per mile.

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