

Biodiesel Intercity Passenger Rail Revenue Service Trial

This is a research project supported by Amtrak and the Oklahoma Department of Transportation and funded by the Federal Railroad Administration (FRA)

Background

In 2005, the Oklahoma Department of Transportation (Okla. DOT) proposed to Amtrak the concept of using biodiesel blended fuel in the Heartland Flyer in lieu of #2 diesel. In previously conducted static locomotive engine testing, B20 (20% pure bio-fuel and 80% #2 diesel) has illustrated the following reduction in locomotive engine exhaust: hydrocarbons (HC) 10%, carbon monoxide (CO) 10%, particulates 15%, sulfates 20%. The biodiesel fuel used in this project is a blend based on a by-product of beef processing.

Biodiesel requires little to no engine modifications for utilization. However, two new engine assemblies were placed into P32-8 Locomotive #500 (the test engine) and detailed measurements taken so at the end of 12 months, any impact of biodiesel on valves and gaskets can be measured.

Amtrak will operate the Heartland Flyer exclusively with B20 for an approximate period of 12 months. The fuel port has a stencil indicating biodiesel should be used. The locomotive will continue to be fueled in Fort Worth by our existing fuel vendor using a B20 diesel fuel.

Objectives and Work Elements

The primary objective of the test program will be to evaluate the feasibility and effectiveness of utilizing biodiesel as an alternative fuel for passenger locomotives. The test program will focus on several elements:

Task 1: Revenue service trial of B20

Amtrak will operate the Heartland Flyer in normal passenger service while utilizing biodiesel blended (B20) fuel. Amtrak will measure and record the B20 fuel consumption of the engine, on a daily basis.

Task 2: Power Assembly Inspection, Analysis

Task 2 was completed prior to the commencement of revenue service testing. Amtrak will perform, at a minimum, pre- and post-revenue service test inspection and analysis of two power assemblies from the locomotive engine. The analyses will identify any and all adverse effects of the B20 fuel on engine components that are expected to be directly or indirectly impacted by the utilization of B20 fuel.

Task 3: Engine Exhaust Emissions Analysis

Following the 12-month revenue service test period, Amtrak will collect locomotive exhaust emissions data. Exhaust emissions from the locomotive will be analyzed in accordance with US EPA locomotive exhaust emissions federal test protocol. GE Transportation or another contract provider with equivalent capabilities will conduct the engine exhaust emissions testing and provide documentation of the results to be included in the final report.

Task 4: Miscellaneous Maintenance/Inspection/Test

Amtrak will perform analysis of the engine oil every 10 days for degradation and/or dilution. Amtrak will have the pure biodiesel, B100 fuel samples analyzed to determine that the fuel meets ASTM D6751 standards. Amtrak will subject the diesel fuel to be blended with the pure biodiesel (B100) to be tested monthly to ensure it meets ASTM D975 specifications and similarly the B20 blend will be tested monthly to determine conformance with ASTM D7467 specifications.

Budget Estimates

The Federal funding contribution for the implementation is \$274,000, from FRA Research and Development.

Assemblies Analysis

Start of Test

Two power assemblies were pre-inspected and initial parts measurements performed at the Amtrak Chicago Maintenance facility, including pistons and piston rings and connecting rod bearings

General engine condition will be evaluated to include engine cleanliness (rocker box and crankcase), visual inspection of locomotive, and review of operational history (oil consumption, fuel consumption, duty cycle, and other operational issues that can affect testing)

End of Test

The two power assemblies that were installed at the beginning of the test will be removed at the Amtrak Chicago Maintenance Facility and inspected. Pistons will be evaluated for wear and rated for deposit levels on the lands and in the grooves. Connecting rod bearings will be inspected for wear and photographed.

General engine condition will be evaluated. Engine cleanliness will be evaluated and rated for sludge. Review of operational history (oil consumption, fuel consumption, duty cycle, other operational issues that can affect testing).

Biodiesel Fuel Supply

The fuel supplier is Direct Fuels of Euless, Texas, a BQ9000 registered producer. The quality program is designed to promote the commercial success and public acceptance of Biodiesel and to help assure Biodiesel fuel is produced to and maintained at the industry standard, ASTM D6751.

Storage and handling:

- All material goes through filters at the time of production and then again as the material is loaded out onto trucks.
- All storage units are heated and mechanically mixed.
- If Biodiesel remains in a tank for more than a 30 day period, the lot is retested according to BQ9000 parameters for quality and stability to ensure quality.
- All trucks are inspected for cleanliness before loading with Biodiesel.
- All trucks are sealed after loading with Biodiesel.
- Certificates of analysis for the material loaded are distributed each time material is loaded out.

Quality control testing:

- All batches are tested to all critical parameters as defined in the BQ9000 program. We also test for water content, viscosity and carbon residue on every batch.
- Monthly, at least one batch is tested for metals content and sulfated ash.
- Semiannual testing of cetane and distillation parameters is performed.
- The onsite lab has testing capabilities for all ASTM Biodiesel standards except cetane and distillation.
- The Direct Fuels laboratory participates in the Biodiesel Round Robin crosscheck program organized by ASTM.

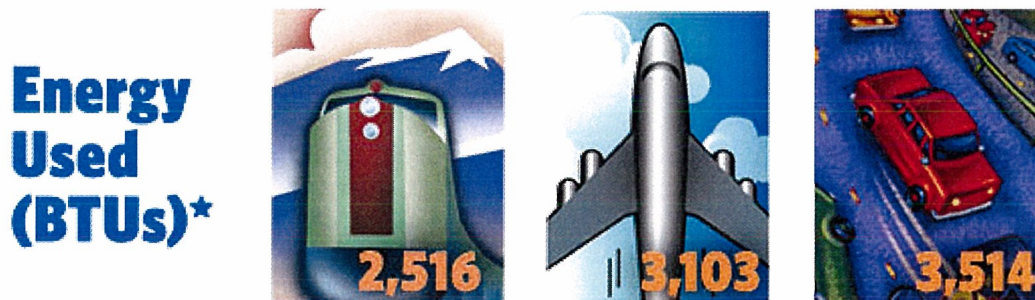
The feedstock comes exclusively from Texas.

Biodiesel Test Locomotive

Amtrak locomotive #500 is a General Electric P32-8 locomotive delivered to Amtrak in 1991 from the GE plant in Erie, Pa. Amtrak owns 18 of these locomotives used in mainline and switching service.

Amtrak Energy Efficiency

Traveling by rail contributes less per passenger mile to greenhouse gas emissions than either cars or airplanes. According to U.S. Department of Energy data, Amtrak is almost 20 percent more efficient than domestic airline travel and 28 percent more efficient than auto travel on a per-passenger-mile basis.



* BTU stands for British Thermal Unit, a standard unit of energy. Figures listed are from 2007 and refer to BTUs used per passenger mile.