



**The Deer Valley School District** in Phoenix, Arizona, began using biodiesel in 1999 following a state mandate that school districts use alternative fuel vehicles to curb air pollution. In a total fleet of 250 vehicles, 140 school buses and 5 maintenance trucks run on biodiesel. These vehicles will travel 2.5 million miles annually in Deer Valley.

The buses use a B20 blend of biodiesel mixed on site by school district staff; the other vehicles run on B100. Vehicles run on both reused oil and virgin biodiesel, depending on suppliers and availability, with no apparent differences in performance. While the school district spends more money on fuel, its alternative fuels program receives state grant money. The district also encourages surrounding school districts to use biodiesel so they can order bulk quantities at a reduced price.

A blind pilot study in Deer Valley revealed that school bus drivers noticed performance increases with biodiesel. They were baffled, however, by what they perceived as the smell of hot dogs throughout the day—apparently from biodiesel made from used cooking grease.

For more information, call Bill Kohn at (602) 467-5072.

# Clean Alternative Fuels: Biodiesel

One in a series of fact sheets

In 1895, Dr. Rudolf Diesel developed the “diesel” engine with the intention of running it on a variety of fuels, including vegetable oil. In fact, when Diesel demonstrated his engine at the World Exhibition in Paris in 1900, he used peanut oil as fuel. Since that time, however, the diesel engine has been modified to run on petroleum-derived fuel (petrodiesel) because historically it was the least expensive fuel available.

Today, the diesel engine is still capable of running on “biodiesel” fuel, which can be produced from a variety of renewable sources, including soybean oil, canola oil, sunflower oil, cottonseed oil, and animal fats. These sources can be obtained from agricultural feedstocks or by recycling used oil such as cooking grease. Most biodiesel produced in the United States is made from soybean oil due to this feedstock’s abundance.

Biodiesel is usable in its pure form, known as “neat biodiesel” or B100. In addition, it is available in various blends with petrodiesel, the most common of which is known as B20 (20 percent biodiesel and 80 percent petrodiesel). It is also used in smaller percentages as a lubricating fuel additive.

## AVAILABILITY

The biodiesel industry is continually expanding. In 1996, only 2 companies were registered as biodiesel suppliers; in 1999, that figure had climbed to 13. Together, these companies have invested millions of dollars in developing biodiesel manufacturing plants. In addition, two major U.S. vehicle manufacturers have

begun biodiesel research initiatives.

Biodiesel is one of the only alternative fuels usable in any conventional diesel engine with little or no modification to the engine or fuel system. More than 40 federal and state fleets are already using biodiesel blends in their existing diesel engines.



## EMISSIONS CHARACTERISTICS\*

Actual emissions will vary with engine design; these numbers reflect the potential reductions offered by a biodiesel blend (B20) and pure biodiesel (B100), relative to conventional diesel.

- Reductions in carbon monoxide emissions of 10 percent (B20) and 50 percent (B100).
- Reductions in particulate emissions of 15 percent (B20) and 70 percent (B100).
- Reductions in total hydrocarbon emissions of 10 percent (B20) and 40 percent (B100).
- Reductions in sulfate emissions of 20 percent (B20) and 100 percent (B100).
- Increases in nitrogen oxide emissions of 2 percent (B20) and 9 percent (B100).
- No change in methane emissions using either B20 or B100.

\* Estimates based on biodiesel’s inherently “cleaner” chemical properties with an engine that takes full advantage of these fuel properties.

To encourage its use, most major diesel engine manufacturers have affirmed that using B20 in their equipment will not void their warranties. Although B100 is also usable in any diesel engine, its use might void warranties.

According to the National Biodiesel Board (NBB), biodiesel can be made available in every state, even if no fueling stations exist. Suppliers can deliver fuel anywhere in the country, either in pure or blended form. Farmers often order biodiesel through cooperatives. A list of fuel marketers can be obtained by contacting NBB.

## AFFORDABILITY

B100 can be purchased for \$1.95 to \$3 per gallon, depending on the feedstock and the supplier. In general, B20 costs 30 to 40 cents more per gallon than conventional diesel. Although biodiesel costs more than petrodiesel, fleet managers can make the switch to alternative fuels without purchasing new vehicles, acquiring new spare parts inventories, rebuilding refueling stations, or hiring new mechanics. In addition, buying biodiesel in bulk quantities decreases the fuel's cost.

## PERFORMANCE

Biodiesel maintains the same payload capacity and range as conventional diesel, and provides similar horsepower, torque, and fuel economy. Biodiesel has a higher cetane number than conventional diesel, which increases the engine's performance. It also serves as a high-quality lubricant

and can enhance the life of heavy-duty engines.

Biodiesel vehicles can have cold start problems relative to petrodiesel, but this is more of an issue for B100 than B20 fuels. For example, B20 freezes at temperatures 3°F to 5°F higher than petrodiesel, but it has been used in upper Wisconsin and Iowa during -25°F weather with no reported problems. B100 will begin to freeze at 25°F, however. Vehicle owners can solve cold start problems with biodiesel in the same manner as with conventionally fueled vehicles (e.g., using engine block or fuel filter heaters or storing the vehicles near or in a building).

## SAFETY

Biodiesel is biodegradable, which means it dissipates quickly after a spill. Biodiesel has a high flashpoint and low volatility so it does not ignite as easily as petrodiesel, which increases the margin of safety in fuel handling. In fact, it degrades four times faster than petrodiesel and is not particularly soluble in water. It is nontoxic, which makes it safe to handle, transport, and store. When blended with petrodiesel, the spill's petrodiesel portion is still a problem, but less so than with 100 percent petrodiesel. As with all vehicles, adequate training is recommended to operate and maintain biodiesel vehicles.

## MAINTENANCE

Maintenance requirements for B20 vehicles and petrodiesel vehicles are the same. B100 does pose a few concerns, however. Biodiesel acts as a sol-

vent to some fuel system components and concrete-lined tanks. This effect can release deposits accumulated on tank walls and pipes from previous diesel fuel storage, initially causing fuel filter clogs. As a result, vehicle owners should change the fuel filter after the first tank of fuel.

In addition, biodiesel will soften and degrade certain types of elastomers and natural rubber compounds over time, which can impact fuel system components such as fuel hoses and fuel pump seals. This is less of a concern with biodiesel blends than with B100. Manufacturers recommend replacing these parts with compatible elastomers. Some newer vehicles have biodiesel-compatible components, but users should contact their vehicle manufacturers for specific information.

## For More Information

**EPA Alternative Fuels Web Site**  
[www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm](http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm)

**National Biodiesel Board**  
1907 Williams Street, Suite B  
P.O. Box 104898  
Jefferson City, MO 65110-4898  
Phone: 573 635-3893 or  
800 841-5849  
Fax: 573 635-7913  
E-mail: [biodiesel@socket.net](mailto:biodiesel@socket.net)  
Web site: [www.biodiesel.org](http://www.biodiesel.org)

**Alternative Fuels Data Center**  
Web site: [www.afdc.nrel.gov](http://www.afdc.nrel.gov)

**National Alternative Fuels Hotline**  
Phone: 800 423-1DOE