

# Turning Backup Generators into Green Engines with Biodiesel

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## ABSTRACT

Backup emergency generators represent a valuable resource in meeting fluctuating power needs throughout the country. Biodiesel has the potential to turn these units into “green generators” and increase usage of the generators and biodiesel fuel. Biodiesel is produced from various vegetable oils, especially from soybeans, as well as from animal fats and used cooking oil. Biodiesel offers many advantages in terms of handling and storage, engine performance and maintenance, as well as environmentally. Biodiesel also carries operational, environmental and economical concerns. However, these concerns are being addressed among facility managers, utilities and environmental agencies. The net effect is that biodiesel represents a largely untapped opportunity, up to now, to turn otherwise unproductive standby generator assets into more valuable renewable resources. There is growing experience around the United States. with biodiesel in standby generators to make this a real energy management option.

## GENERATORS STANDING BY

Over 100,000 backup generators in the U.S. are equivalent to 10% of national generating capacity. They are found at facilities such as military bases, airports, casinos, hospitals, data centers, communication centers, high rise buildings, hotels, public works facilities, security facilities, mines, refineries and many more.

Most generators see little use, except a monthly test run, and then not under load. When called upon to run, they fail to perform in too many cases; although those participating in peak demand management programs have a better record of reliability.

Utilities are finding it more attractive to set up standby generator programs for several reasons. One is to avoid emergency outages. A second is to reduce high spot market prices on the grid by paying customers to run their generators. A third is to postpone capacity additions of central generating stations and even transmission and distribution systems.

An inhibiting factor has been environmental concerns with running diesel generators. Although there are some natural gas fired standby generators, the large majority are diesel.

## BIODIESEL IS RENEWABLE ENERGY

Biodiesel has the potential to turn these units into "green generators." Biodiesel is produced from various vegetable oils, especially from soybean oil, as well as from animal fats and used cooking oil. There is a large and growing biodiesel industry in the U.S. with production expected to exceed 35 million gallons in 2004.

Biodiesel is becoming well accepted in transportation fleets such as for school systems, public transit authorities, waste management companies, military bases and national parks. It is also deployed in utility fleets and other publicly sensitive organizations, including ski areas. Over 400 fleets use biodiesel.

The most common mixture is called B20, which is 20% biodiesel and 80% petroleum diesel. Some vehicles use lower blends, such as B5, and others use higher blends, such as B50. A pure blend is B100, called neat biodiesel, for 100% biodiesel.

There has been limited experience with biodiesel in standby generators. Biodiesel is gaining attention with standby generators serving a few hospitals, national park facilities and utilities. One hospital in California has been burning B100, as a backup heating fuel, with approval from air quality management officials. Many national parks use B20 in standby generators rather than maintain separate supply and storage systems for transportation fleets. In 2004, biodiesel has seen significant interest from selected utilities. In some cases, it is for demand management. In at least one case, it is for a base load unit.

## BIODIESEL PROVIDES MANY ADVANTAGES

Biodiesel offers many advantages. It may be “dropped-in” to existing storage tanks and engines with few, if any, modifications. This allows biodiesel to effectively displace petroleum diesel.

Biodiesel adds lubricity to the engine. This allows the engine to run smoother.

However, biodiesel acts as a solvent. This results in loosening deposits in fuel tanks, supply lines and engines. As a result, there is a tendency to clog fuel filters. The remedy is simply to replace filters every few hours of operation. When the deposits are gone, filter changes may then return to a normal cycle.

Perhaps the most attractive feature is the ability of biodiesel to burn cleaner. Environmental emissions are substantially reduced for most pollutants, when compared to diesel. For B100, significant reductions occur for particulates, carbon monoxide and hydrocarbons, including toxic or hazardous emissions. There are no sulfur emissions.

While there are carbon dioxide emissions, these may be balanced against the sequestration of carbon that takes place in growing crops. For biodiesel produced from soybean oil, there is a net reduction of 78% in carbon dioxide.

Biodiesel looks good because of the low particulates. But it also smells good. Compared to diesel, biodiesel burns with a pleasant odor.

Biodiesel is biodegradable. Thus, in populated areas, spills will not pose significant concerns. It is claimed that biodiesel is as safe as table sugar and as toxic as table salt.

## DRAWBACKS OF BIODIESEL

Technically biodiesel requires extra attention in several respects. First, biodiesel does not flow as well as diesel when temperatures drop below freezing. However, additives can maintain proper flowing characteristics for biodiesel, just as are used in diesel in cold climates. For B100, storage in underground tanks largely assures proper flow in all temperature conditions.

A second concern relates to stability over time or shelf life. It is recommended that biodiesel be used within six months. Beyond that time, there can be complications with oxidation and condensation.

Sediments may form and water may accumulate. Again this can happen with diesel. The solution is to use anti-oxidants to extend shelf life. Some manufacturers of biodiesel claim good performance of their product well beyond six months, and maintain that diesel itself should not be stored beyond six months without treatment.

Another technical concern is growth of algae. However, this can be treated with a biocide, just as with diesel.

Fuel efficiency is the last technical concern. The heat rate in terms of Btus per gallon is lower for biodiesel than diesel. It is about 2% lower for B20 and 10% lower for B100. Yet, anecdotal evidence for transportation fleets indicates that efficiency is about the same. In fact, one school district claims higher miles per gallon with biodiesel, perhaps the result of the smoother and cleaner operation of the engines.

Environmentally, biodiesel causes an increase in nitrogen oxides typically. NOx increases about 2% with B20 and 10% with B100.

In certain regions where NOx is not a concern, this should not be an issue. It becomes even less of a concern when it is recognized that total emissions go down even as one emission goes up.

However, in areas where NOx is a concern, solutions exist. One is to install a catalyst for NOx removal. Another is to dilute biodiesel with an additive that reduces NOx emissions. A few gallons of specially formulated additive in thousands of gallons of biodiesel costs little and is most effective in reducing NOx.

One final area of interest is the economics of biodiesel. It does cost more. The costs are only pennies per gallon for B20 and about \$1.00 per gallon for B100 in 2004.

## NET BENEFITS OF BIODIESEL

Biodiesel should be a net benefit in many niche market applications. One is for customers with standby generators in populated areas. Biodiesel is safe and pleasant. Another is for utilities concerned about capacity shortages. Biodiesel may allow environmental regulators to accept more operation of selected standby generators, rather than wait until there is a blackout and all old diesel generators operate. A related net benefit is for utilities that want to postpone investments in central generation facilities and transmission and distribution networks by working with customers to operate standby generators as renewable resources with biodiesel. This

can be a benefit for utilities with wind and other intermittent resources, allowing the utility to firm up the intermittent source with biodiesel in standby generators. Finally, when combined with energy efficiency and demand response programs that reduce total energy use and emissions, biodiesel in standby generators is part of a comprehensive solution.

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#### ABOUT THE AUTHOR

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