BIODIESEL
Better. Cleaner. Now!

DOING BETTER BUSINESS

THE WHAT, WHY & HOW OF BIODIESEL FLEET SUCCESS

THE BIODIESEL FLEET ADVANTAGE

From the state's economic incentives to better engine performance and cleaner air, today's biodiesel offers bottom-line benefits that can give you the edge you need. If you are not yet using a biodiesel blend or are considering increasing the biodiesel blend you already use, this guide can help you start doing better business with biodiesel. >>>

BIODIESEL BASICS

BIODIESEL IS A CLEAN-BURNING ALTERNATIVE FUEL MADE FROM DOMESTIC, RENEWABLE RESOURCES.

The term biodiesel refers to pure, unblended fuel that meets ASTM D6751 standards and specifications and is referred to as B100. Biodiesel itself contains no petroleum, but it can be blended with petroleum-based diesel at any percentage. Biodiesel blends are indicated by a "B" followed by a number which represents the percentage of biodiesel in a gallon of fuel. For example, B20 means 20 percent biodiesel blended with 80 percent petroleum diesel.

COMMON BIODIESEL BLENDS

B5

The physical properties of biodiesel blends **up to and including 5 percent** are very similar to the physical properties of ultra-low sulfur diesel (ULSD). In fact, 5 percent and lower blends meet all the same specifications as ULSD and are covered under the specification ASTM D975. Blends up to and including 5 percent should be treated the same as No. 2 diesel.

B6 – B20

Blends of biodiesel from **6 to 20 percent** are also similar to ULSD, although as the level of biodiesel increases the finished blend will have higher lubricity, cetane and cloud point—as well as higher flash point and T-90 distillation temperature, making it a safer fuel. The B6-B20 specifications, ASTM D7467, have the same properties and limits as ULSD, with two additional parameters for storage stability that ULSD doesn't have (acid number and oxidation reserve), along with a slightly higher T-90.

Since they have the same properties as ULSD, biodiesel blends up to and including B20 meeting ASTM specifications have been used trouble-free in virtually every diesel engine without modifications, including in temperatures as low as -20ºF.

B20 +

Blends **over 20 percent** have been used in existing diesel engines, but additional precautions should be taken to manage compatibility with some hoses and gaskets, and cold flow for high blends. It is best to contact your fuel supplier and consult your owners' manuals before using blends over B20.

DIVERSE BIODIESEL FEEDSTOCKS

Biodiesel is one of the most diverse fuels because it can be made from many different feedstocks. This allows producers to take advantage of market factors such as supply and price, as well as feedstock characteristics that affect cold flow properties.

Any fat or oil can be used to make biodiesel. While soybean oil accounts for about half the biodiesel produced in the United States, corn distillers oil, a byproduct of ethanol production, is growing in use similar to canola oil and waste grease. Animal fat also contributes. Regardless of where the feedstock came from, all feedstock is either a by-product or a second-use product. Biodiesel cannot be created without producing something else first, like feed for livestock or protein for human consumption.

BIODIESEL'S IMPACT ON FUEL COSTS

As with all fuels, the cost of biodiesel will vary with market conditions. In recent history, offering biodiesel blends, especially higher blends like B20, has helped reduce the cost of diesel fuel, thanks in part to state and federal policies meant to encourage the use of alternative fuels.

ILLINOIS BIODIESEL TAX INCENTIVE FOR FUEL RETAILERS

Illinois first enacted a sales tax incentive for the sale and use of biodiesel blends in 2003.

- A full exemption for the state's sales tax is provided for blends higher than B10 through 2023. Beginning in 2024, the credit will shift to the following blends:
  - Blends over B13 in 2024
  - Blends over B16 in 2025
  - Blends over B19 in 2026
  - Blends over B10 will also qualify for the tax exemption between December and March of each year.

Due to the financial advantage of selling higher blends of biodiesel, many retail fuel outlets and marketers in Illinois sell B11 or higher year-round. In turn, these savings have led Illinois drivers and fleets to be among the country's leading consumers of biodiesel.

Regulated fleets that use B20 or higher qualify for biodiesel fuel use credits under the Energy Policy Act of 1992 (EPACT). For more information about EPACT refer to the Department of Energy document, *Earning Biodiesel Fuel Use Credits Under Standard Compliance*, found online: **https://epact.energy.gov/pdfs/biodiesel_guidance.pdf**.

BIODIESEL BLENDER CREDIT

First implemented in 2005, the United States Congress voted to provide a $1 credit per gallon of biodiesel blended to encourage clean air and energy independence. The credit applies to the blender of the fuel, who then may pass all or a portion of the credit along. Since 2005, the credit has lapsed and been reinstated several times. When available, this tax credit has led to dramatic growth in biodiesel production and market development. Beginning in 2025, the credit will transition to a producer tax credit based on carbon intensity of the feedstock used to produce the finished fuel.

RENEWABLE FUEL STANDARD

The RFS is a federal program that requires transportation fuel sold in the United States to contain a minimum volume of renewable fuels. The RFS provides additional incentives for blending renewable fuels by attaching Renewable Identification Numbers (RINs) to each gallon of renewable fuel. RINs are separated when B100 is blended with petroleum diesel. Once RINs have been separated, they can be sold or assigned to a broker to sell. This value can reduce the cost of biodiesel blends. The value fluctuates depending on supply and demand.

The Illinois Biodiesel Tax Incentive alone gives biodiesel blends a price benefit over ULSD; when one or both of the federal incentives are available as well, they add up to even bigger advantages and encourage use of higher blends like B20.

UNDERSTANDING BIODIESEL BLENDS

Once you've decided that using a biodiesel blend is the right decision for your organization or fleet, you must then choose which blend to use (B5, B11, B20, etc.) and whether to purchase blended fuel or blend your own. When selecting the blend, there are a few things to consider:

SELECTING YOUR BLEND

FUEL PRICE

The price of biodiesel will vary over time; however, the combination of state and federal incentives (see *Biodiesel's Impact on Fuel Costs*) often makes higher blends of biodiesel the best option, providing the best value. Talk with your supplier about current incentives available and how they affect pricing for higher biodiesel blends, like B20.

COLD WEATHER

With proper care, biodiesel blends up to B20 can be used year-round, even in cold climates. For proper cold-weather operation it's important to understand cloud point—the temperature at which solids start to form within the fuel and become visible to the naked eye. Typically, No. 2 diesel fuel has a cloud point in the range of −5°F to 15°F. No. 1 diesel fuel has a cloud point of −40°F or lower. That means without additives to improve cold flow properties, No. 2 diesel will begin to gel and plug filters at the cloud point. Blends of No. 1 and No. 2 diesel fuel, cold flow additives and/or fuel heating systems must be used to keep No. 2 diesel from gelling at temperatures below the cloud point.

Similarly, biodiesel blends may require additional additives or blending with No. 1 diesel during the colder months of the year. Work with your fuel distributor to achieve the desired cold weather protection, and test the biodiesel blend cloud point to verify cold weather operability. Continue to follow proper tank maintenance and housekeeping practices throughout the winter.

COMPATIBILITY

Blends up to and including B20 can be used in current fueling systems, underground storage tanks (USTs) and diesel vehicles in Illinois without additional notifications or approvals beyond those needed for ULSD. While all steel and fiberglass tanks are compatible with blends up to B100, blends over B20 may require B100 compatible hoses and gaskets, made from materials such as Viton® or Teflon,® and add additional UST notifications. Engine and vehicle recommendations for blends over B20 vary. A copy of Clean Fuels Alliance America's OEM support guide can be requested by emailing **CleanAir@Lung.org.**

PURCHASING BLENDED FUEL

Purchasing your fuel pre-blended from a reputable supplier is the easiest way to quickly begin using a biodiesel blend. But before choosing this route, there are a few questions you need to have answered.

DOES YOUR CURRENT FUEL SUPPLIER OFFER BIODIESEL BLENDS?

If so, will they provide the specific blend you intend to use?	If not, can you switch to another supplier that does?	Will your supplier help you adjust the blend higher or lower when requested?

BLENDING YOUR OWN

Blending on your own provides the opportunity to take the best advantage of the various biodiesel incentives; however, it may also require an initial investment, depending on your current infrastructure availability. You will also need to be registered as a blender with the IRS using Form 637.

- In-line blending your own fuel will require a separate storage tank dedicated to biodiesel that is connected to the diesel tank and a blending system. Also consider equipment that allows the blending percentages to change, should incentives and other market conditions encourage use of a higher or lower blend.
- If in-line blending is not available, biodiesel can be splash-blended in a delivery truck or UST by following the directions below.
- When top-loading a delivery truck or UST, load diesel first and biodiesel second. Biodiesel is heavier and will mix with diesel as it enters the tank. Agitation during delivery or through other means will further aid in blending.
- When bottom-loading a transport at the bulk plant, load biodiesel first, then the diesel fuel. Since most terminals will not allow anything to be loaded into delivery trucks prior to entering the terminal, diesel will be loaded first at the terminal and biodiesel loaded at a second location. In the winter months, be sure to flush the manifold with diesel fuel after loading biodiesel. If bottom-loading both products separately at the terminal, load biodiesel first and diesel second. Users should never bottom-load biodiesel or diesel in a UST.
- B100 and diesel should be maintained at 15°F above the cloud point (preferably 60°F or more) while blending takes place. Once biodiesel is properly blended with ULSD, it does not separate.

It is important to note that in-line blending is the best way to ensure complete blending of biodiesel and diesel fuel. Whether blending yourself or purchasing pre-blended fuel, it is important to purchase biodiesel from a BQ-9000 accredited producer and a reputable fuel supplier. Find your local BQ-9000 accredited producer here: **www.bq-9000.org**

PURCHASING FROM RETAILERS

The Federal Trade Commission requires that all public pumps dispensing biodiesel blends above B5 indicate such with approved labels. Labels must be removed if the blend drops below 5 percent.

≤ B5

Biodiesel blends up to 5 percent require no additional label because these blends fall under the same fuel specification as ULSD (D975).

B6 – B20

Biodiesel Blend

contains biomass-based diesel or biodiesel in quantities between 5 percent and 20 percent

B-20 Biodiesel Blend

contains biomass-based diesel or biodiesel in quantities between 5 percent and 20 percent

B21 +

B-XX Blend

contains more than 20 percent biomass-based diesel or biodiesel

BIODIESEL MANAGEMENT BEST PRACTICES

STORAGE TANKS AND MATERIALS COMPATIBILITY

- Biodiesel best practices are the same as diesel best practices.
- Underground storage tanks (USTs) are preferred to avoid temperature extremes.
- Aboveground storage tanks should be sheltered or painted with reflective paint to resist excessive heat in the summer. High temperatures during storage accelerate fuel degradation regardless of fuel type.
- Most equipment and elastomers are compatible with biodiesel blends of 20 percent or less, and normal monitoring of seals and gaskets is sufficient. However, when replacing these parts purchase seals and gaskets made with Teflon® or Viton,® and ask your equipment distributor for B20 compatible parts and equipment.
- In UST System Compatibility with Biofuels, the U.S. Environmental Protection Agency outlines compatibility requirements for blends above B20, including:
  - Notify your implementing agency at least 30 days prior to storing regulated substances containing greater than 20 percent biodiesel.
  - Demonstrate compatibility of the UST system.
  - Keep records that document compliance with the compatibility requirement for as long as the UST system is used to store these regulated substances.

FOR FULL DETAILS OF REQUIREMENTS FOR OFFERING BIOFUEL BLENDS CALL THE FOLLOWING RESOURCES:

U.S. Environmental Protection Agency
P: 312.353.2000

Illinois State Fire Marshal
P: 217.785.0969

Illinois Bureau of Weights and Measures
P: 217.785.8301

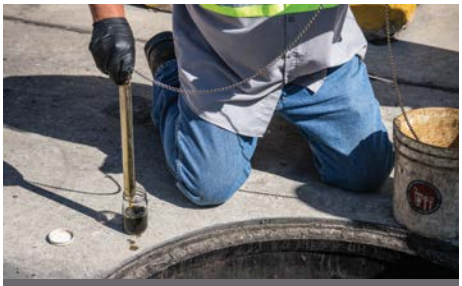
FUEL & TANK MAINTENANCE

The importance of keeping your tank and fuel system free of contaminants has become more important with the introduction of ULSD. Inspections and basic housekeeping practices will help promote a problem-free experience with either ULSD or biodiesel blends.

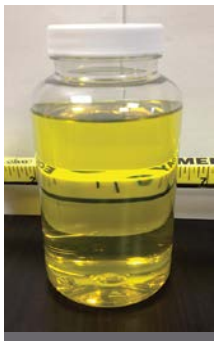
- Before introducing a biodiesel blend into a storage tank, it is best to sample the tank to make sure there is no water or sediment present.
- Always install a high-capacity, 30-micron paper-pleated dispenser filter on a storage tank to keep contaminants from reaching vehicle tanks. Water-absorbing and fiberglass filters are not recommended.
- Check tank bottoms twice a year (April and October) with a Bacon Bomb tank sampling device. If water or other contaminants are found, have them removed promptly.
- If hazy fuel is found, this indicates soluble water. Take steps to check for and remove water, and consider a de-icer product to keep the water suspended and moving through the system. It will be filtered through the dispenser.
- Check fill area for water regularly and remove if found.
- Keep tanks as full as possible to reduce the amount of air and water entering the tank.
- Before colder weather sets in:
  - Check tank bottoms for water.
  - Install a new 30-micron dispenser filter to handle the increased viscosity of the fuel.
  - Make sure fuel meets cold flow operability by discussing your needs with your supplier prior to purchase.
  - Winter fuel additives need to be administered when the fuel is a minimum of 10 to 15 degrees above the cloud point of the fuel.
- No. 1 diesel is lighter than No. 2 diesel. When using No. 1 to increase cold flow operability, put No. 1 in the tank first and No. 2 on top to achieve a better blend.

RETRIEVING A TANK BOTTOM SAMPLE

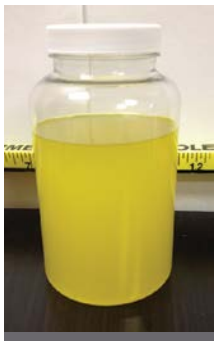
Check storage tanks for water and sediment twice each year, spring and fall, by obtaining a tank bottom sample. The Bacon Bomb sampler will retrieve the best bottom sample from a fuel storage tank. It is available in several sizes to fit almost all tank openings. Underground storage tanks can shift and settle over time. Free water and sediment will settle to the lowest point, so make sure to sample the lowest point of the tank. If possible, sample both ends of the tank to determine which is the lowest point.



BACON BOMB



CLEAR + BRIGHT



HAZY

FREE WATER

Use a clear plastic or glass jar so the sample can be visually inspected for water and sediment. The sample should appear clear and bright. If any free water and/or sediment is found it should be removed. If free water is present, the fuel should be tested for microbial contamination. Your fuel supplier should be able to provide this test for a fee or refer you to a lab. If significant or consistent sediment is found, have the tank cleaned.

HOW TO SAMPLE FUEL TANKS

BIODIESEL IN THE TANK: PART 1, ABOVE GROUND

BIODIESEL IN THE TANK: PART 2, UNDERGROUND

BIODIESEL IN THE TANK: VEHICLE

TROUBLESHOOTING COMMON DIESEL ISSUES

WATER CONTAMINATION/ICING:

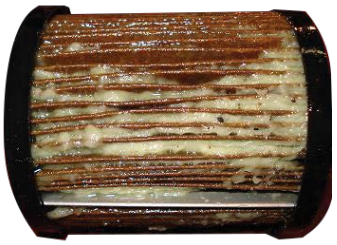
Water is the No. 1 cause of filter plugging issues in diesel engines. High water concentration in the fuel can lead to a buildup of water in the filters, causing filter plugging. Icing occurs when temperatures get below 32°F. At this temperature and below, excess water on the filter freezes and blocks the flow of fuel through the filter. Routinely checking and removing water in tanks and filters can help minimize problems with plugged filters. Keep storage tanks full to eliminate air space. Keep fuel caps on tight and regularly check hoses and gaskets for leaks. If using a water separating filter, check and drain if water is found. Avoid water absorbing filters.

MICROBIAL CONTAMINATION:

Since the introduction of ULSD in 2006, microbial contamination has become a more common problem associated with diesel fuel. Prior to ULSD, higher sulfur levels acted as a natural antimicrobial agent. Now, bacteria and fungi grow in the water/fuel interface. They can be present in supply tanks and lines, vehicle tanks and fuel system components. A distinct, pungent odor is normally present on a filter with microbial contamination. To prevent microbial contamination, follow the recommendations to prevent water contamination. If microbial contamination is suspected, it is recommended that you treat the contamination with a universally soluble (meaning soluble in fuel and water) biocide at the recommended kill rate.

OXIDATION:

In today's high pressure common rail engines, ULSD can be prone to thermal breakdown. Thermal oxidation is characterized by fine, black sediment on the filter and looks as if the pleats have been covered by permanent marker. The black filter is caused by hot fuel return which causes coking of the fuel (burning of the fuel causing it to break down and create sediment) and leads to filter plugging. Thermal oxidation on the filter may look similar to microbial contamination; however, it will not have the distinct, pungent odor of microbial contamination. Premium diesel with a stability or anti-coking additive is recommended. If anti-coking additive is already being used, check for a mechanical reason that the engine is running hot.



PARAFFIN WAX:

Paraffin is a naturally occurring material in diesel fuel. It does not come from biodiesel. Since the introduction of ULSD, diesel is less soluble, meaning it cannot hold the paraffin in solution. When the temperature of the fuel is at or below its cloud point, paraffin material can precipitate out and collect on the bottom of the tank. Wax anti-settling agent additives (WASA) are used to keep paraffins suspended in solution rather than collecting at the bottom of the tank where they can cause filter plugging.

BIODIESEL MINOR COMPONENTS AND FILTER CLOGGING:

The biodiesel specification contains strict controls for minor components, such as mono-, di- or triglycerides, which can remain in biodiesel from the production process. If biodiesel is not properly processed these minor components, which tend to freeze at a higher temperature than the bulk biodiesel if concentrations are too high, can be captured by the fuel filter and cause filter clogging. This can be exacerbated in the presence of water. The biodiesel specification addresses this through two grades, a No. 2 grade which many people use throughout the year, or a No. 1 grade which has tighter controls on minor components for use in extremely cold weather. If a petroleum jelly or butterscotch pudding substance is found on a fuel filter, this can be caused by a water absorbing filter or by too high a level of biodiesel minor components. The fuel should be checked for water and ensure that the biodiesel met its specification. In some cases, a No. 1 biodiesel may be needed depending on the particular diesel fuel and climate.

SEDIMENT:

Sediment caused by rust, tank scale and other contaminants will plug fuel filters. Filters plugged by sediment are characterized by sediment in the folds of the filter and solid particles in the filter casing. Sediment on the filter also attracts glycerin which further plugs the filter. Regularly monitor tanks and clean when necessary in order to reduce tank contaminants.

ANSWERING YOUR QUESTIONS

DO BIODIESEL BLENDS UP TO B20 HAVE SIMILAR PERFORMANCE TO PETROLEUM DIESEL?

YES. Diesel vehicle operators should see similar power and performance when using blends up to 20 percent. Biodiesel enhances the lubricating properties of diesel fuel, reducing wear and prolonging engine life. Biodiesel has a detergency effect to keep injectors and fuel systems clean. Using B11 to B20 with diesel particulate filers (DPF) results in longer intervals between regeneration resulting in less fuel consumption.

CAN I USE BIODIESEL BLENDS IN MY DIESEL VEHICLE?

YES. Biodiesel blends up to B20 can be used in any diesel vehicle. Most major engine companies have formally stated that use of blends up to B20 will not void their parts and workmanship warranties. Some manufacturers outside of the U.S. do not endorse blends above B5; however, in states like Illinois where higher biodiesel blends are common, those manufacturers have sent letters to registered car owners stating that higher biodiesel blends can be used in their vehicles. Original Equipment Manufacturer (OEM) information can be requested via email to CleanAir@Lung.org.

WILL I VOID MY WARRANTY IF I USE A BIODIESEL BLEND?

NO. According to federal law, vehicle warranties cover parts and workmanship, not fuel. Unless use of a higher-than recommended blend of biodiesel is the cause of engine or parts failure, the warranty must be honored. Keep in mind that if the engine parts fail because of out-of-specification diesel or biodiesel, the failure may not be covered by the warranty.

DOES BIODIESEL HAVE A SIMILAR SHELF LIFE TO ULTRA-LOW SULFUR DIESEL?

YES. The biodiesel specifications were designed for a minimum shelf life of at least six months, and recent data from the National Renewable Energy Laboratory (NREL) indicates today's B20 has a minimum shelf life of at least a year, with almost half of the samples having shelf life of over three years. NREL data also showed fuel stabilizers were effective in not only extending the original shelf life of B20, but good housekeeping and simple re-additization of stored fuel was successful in extending shelf life four years or longer.

IS MICROBIAL CONTAMINATION RISK WITH BIODIESEL SIMILAR TO ULSD?

YES. Prior to ULSD, higher sulfur levels acted as a natural anti-microbial in diesel fuel, preventing the growth of bacteria and fungus. The removal of sulfur removed these anti-microbial properties. Bacteria and fungus are now able to grow in the water-fuel interface, whether a biodiesel blend is included or not.

CAN BIODIESEL BLENDS BE USED IN WINTER?

YES. Biodiesel blends are used year-round anywhere ULSD is used. Blends up to 5 percent should be treated the same as ULSD. Blends higher than 5 percent may require winter additives and/or the addition of No. 1 diesel, depending on the local temperature and characteristics of the base diesel fuel. Check with your supplier about preparing the biodiesel blend for your climate conditions.

ARE THERE FUEL QUALITY STANDARDS FOR BIODIESEL?

YES. Like petroleum diesel, biodiesel must meet strict quality standards before it is accepted into the fuel distribution system. B100 must meet the American Society for Testing and Materials (ASTM) standard D6751. This B100 is then used to blend with petroleum diesel to create the intended blend and meet the corresponding ASTM specification: B5 – ASTM D975, or B6 to B20 – D7467. As diesel fuel and engines change over the years, the biodiesel ASTM specification is continuously reviewed and adjusted to ensure successful operation, just as the ASTM specifications for diesel and gasoline are reviewed and changed.

Fuel marketers may be hesitant to offer biodiesel blends because they have heard reports about quality problems in the early years of biodiesel development. Because of these early quality concerns, the biodiesel industry implemented a quality assurance program. This BQ-9000 program provides added assurance that biodiesel is produced, maintained and sold in conformance with the current ASTM D6751 specification. Nearly all biodiesel now in the market is produced and handled by BQ-9000 approved companies.

BIODIESEL BENEFITS

POWER & PERFORMANCE

Today's biodiesel is a reliable, high-performance fuel that works in any diesel engine without modifications up to B20. Due to its superior lubricity, biodiesel reduces engine wear and contains higher cetane for quicker starts and reduced black and white smoke.

COMPATIBILITY

Biodiesel blends up to 20 percent are compatible with fueling equipment and diesel engines in use today. Think of it as a "drop-in" fuel.

ENERGY SECURITY

The American Lung Association recognizes biodiesel as a Clean Air Choice alternative to petroleum diesel fuel. Biodiesel blends can reduce emissions from diesel vehicles and equipment, including particulate matter and harmful pollutants, reducing risk of exacerbating asthma and other respiratory diseases.

LOCAL ECONOMY

Illinois is one of the largest biodiesel-producing states. Biodiesel production supports more than 7,500 jobs in all sectors of the Illinois economy. The Illinois biodiesel industry generates $1.6 billion of household income and is responsible for more than $3 billion of Illinois Gross Domestic Product.

AIR QUALITY & HEALTH

The American Lung Association recognizes biodiesel as a Clean Air Choice alternative to petroleum diesel fuel. Biodiesel blends can reduce emissions from diesel vehicles and equipment, including particulate matter and harmful pollutants, reducing risk of exacerbating asthma and other respiratory diseases.

ENVIRONMENT

The U.S. Environmental Protection Agency has designated biodiesel an advanced biofuel. Compared with regular diesel fuel, biodiesel generates up to 86 percent fewer CO_2 emissions from production and use. Biodiesel is also a non-toxic and biodegradable fuel, which promotes a healthy environment.

BIODIESEL

Better. Cleaner. Now!

FOR MORE DIESEL AND BIODIESEL INFORMATION

HELPLINE: 1.800.929.3437

This helpline exists to assist diesel users with diesel- and biodiesel-related questions, troubleshoot and diagnose problems and provide guidance on proper fuel handling and tank maintenance practices.

For information on biodiesel benefits, visit BiodieselAdvantage.com

FLEET

Funded by the Illinois Soybean Association Checkoff Program.

ILLINOIS SOYBEAN ASSOCIATION