



The nuts & bolts of switching to Biogold™

Deciding to switch to Biogold*

The decision whether to switch will normally come down to a small number of points:

1. There are some significant benefits from switching to Biogold biodiesel including reduced greenhouse gas footprint, reduced risk to the local environment and reduced emissions. These are detailed in *Join the drive to gold with Biodiesel New Zealand*.
2. Biodiesel is different to mineral diesel and there is a very small risk that a fault may occur because of this. The chance may be very small, but it is a risk nonetheless.
3. The very small risk involved can be reduced even further by following certain practices.
4. In the unlikely event of a fault occurring, it may be the vehicle manufacturer, fuel manufacturer, fuel supplier or equipment owner that pays for the repair.

This brochure aims to provide you with information about the technical aspects of switching to Biogold biodiesel so that you can make a more informed decision. It covers the technical risks involved, how to minimise them, and warranty implications. These points, as well as the significant benefits that can be gained through switching, must be weighed up by the equipment owner and considered in light of the risk they wish to take on. For some, it will be a simple decision to switch. It may not be for others. We can provide further assistance in your decision to switch, including providing you with expert advice on your particular application.

Warranty implications

The warranty status is an often-debated topic when considering a switch to a different fuel. Engine manufacturers wish to provide a fit-for-purpose engine solution that remains that way long after the normal engine warranty has expired. In support of this, engine manufacturers tend to have aggressive testing and proving programmes. The use of blends with higher proportions of biodiesel may step outside these programmes, or risk of compromise may have been found when pushing some of these test regimes. Either way, engine manufacturers may state that they do not support the use of blends with higher proportions of biodiesel and in such instances their warranty would be void for any fuel-related faults. This is far from saying that a fault will occur with the use of such fuels. In fact, knowing the quality of the Biogold biodiesel product, the fuel supplier may cover the fuel-related



warranty on certain engines and applications, even when the engine manufacturer does not. This results in the following four warranty situations:

1. Where the engine manufacturer accepts the use of blends of biodiesel up to a certain proportion, the Biogold biodiesel meets that specification, and other engine manufacturer requirements are met, then the risk is covered by the engine manufacturer. This includes where the engine manufacturer or its agent extends the warranty beyond its normal recommendations, as may be the case for some applications and clients. General warranty information on many engine models is available on Biodiesel New Zealand's website. The engine manufacturer is the primary source for this information.
2. Where specific applications have been approved for use by the supplier of Biogold biodiesel then the fuel-related risk is covered by the fuel supplier under the conditions of that approval. These approved applications tend to involve engines fitted with simple exhaust systems (including simple catalyst systems) and where the operation of the equipment is suitable, and where same model engines have been approved overseas for use with higher biodiesel content fuels.
3. Where the engine manufacturer and the Biogold biodiesel fuel supplier do not provide engine warranty, then the equipment owner carries the fuel-related risk.
4. Where the warranty on the equipment has lapsed then the equipment owner carries the risk.

Note that the engine manufacturer must maintain the normal general warranty for design, workmanship, etc., regardless of whether biodiesel fuels are used or not.

*Biogold is a registered trade mark of Biodiesel New Zealand Ltd.

Fuels in the marketplace

NZ5

In New Zealand, diesel may contain up to 5% biodiesel without notice. Engine manufacturers accept this level of biodiesel so long as all relevant fuel standards are complied with. The fuel supplier has an obligation to meet the relevant standards, including a fit for common purpose requirement. These standards therefore protect the consumer. In the event of a fault occurring, the engine manufacturer has an obligation to make good if the engine is still under warranty (unless the fuel is found to be sub-standard, in which case the fuel supplier has an obligation to make good). Therefore, from the equipment owner's perspective, there are no warranty issues for biodiesel blends up to NZ5.

NZ20 and higher biodiesel blends

As has been mentioned, some engine manufacturers limit their warranty where higher biodiesel content fuels are used and in these cases the equipment owner should check to be clear about the warranty status of their equipment. Information from the engine manufacturer also provides a good first check on the expected compatibility of the engine to use biodiesel-containing fuels. However, as indicated, reliable, dependable performance may also be achieved with applications using fuels with higher biodiesel content than recommended by the engine manufacturer. The following sections aim to provide the technical background to this, so that those involved can better assess whether a particular application falls into this category. Regardless, it is recommended that this process is completed by checking with an expert with specialist knowledge in this area.

The following sections also provide advice about how to minimise the risks associated with the differences between straight mineral diesel and biodiesel fuels, or even avoid them completely.

What are the possible issues and how do I avoid them?

We understand how important it is to have trouble-free operation. Although there is a small risk that a biodiesel-related issue may show itself for some applications, we know that these risks can be reduced and in some cases avoided altogether through good management. We therefore ask that users carefully consider the following information, as it provides the road to trouble-free operation.

Cleaning properties

Biodiesel cleans, so deposits and dirt in the fuel tank and fuel system may be dislodged and these could clog the fuel filters. This is not expected to occur with the use of NZ5 or NZ20 in new plant or in plant that has been well-maintained. However, it is recommended that the fuel filters for all other applications are replaced after the first tank of biodiesel.

Biodegradability

Biodiesel's ability to break down naturally is a good attribute for the environment, but it also means that

added care is required to ensure that it does not degrade in storage. We recommend that the fuel is turned over relatively quickly to maintain its freshness. Storing biodiesel for longer than six months should be avoided unless other controls are in place to ensure the quality of the fuel is maintained. We do not recommend using biodiesel in equipment that is seldom used, such as generators that are on months of stand-by.

Material compatibility

Biodiesel can interact with some materials, and may cause leaking seals or corrosion of some metal components within fuel systems. This is now a low risk for fuel systems as most at-risk components have already been identified and replaced because use on modern diesel fuels require it. However, Biodiesel New Zealand recommends that before switching to Biogold biodiesel, equipment owners should check the engine manufacturer's recommendations for compatibility of parts and also carry out a visual check for non-compatible components or components in poor condition. We also recommend a visual check for leaks or for hoses that appear to be wet with fuel or that appear soft after switching to Biogold biodiesel.

Lubricating oil dilution

With typical engine operation, there is usually some passing of fuel to the lubricating oil. Biodiesel fuels have different distillation curves to mineral diesels, causing less evaporation of biodiesel fuel from the lubricating oil once it is there, increasing the risk of oil dilution. To compensate for this some engine manufacturers recommend more frequent oil change periods. However, this may not be necessary if the condition of the oil is closely monitored. The risks involved can be far higher for some modern exhaust catalyst systems, particularly where the application is not well-suited to the use of biodiesel fuels. Applications that are mainly low load or where the engine seldom reaches normal operating temperatures should be avoided.

Cold temperature operation

Some biodiesels can gel at ambient temperatures and block fuel filters. For example, tallow-derived biodiesels currently manufactured in New Zealand may begin to show such filter-blocking tendencies at around 10-14°C (for B100). Such fuels would not meet the Biogold biodiesel requirements for engine use. Rapeseed oil-derived biodiesel fuels do not show filter blocking tendencies until around -5 to -15°C. This is an important Biogold biodiesel attribute, enabling the use of Biogold biodiesel fuels during New Zealand's winter months. It is for this reason that Biogold biodiesel is only made from high quality sources—quality used cooking oil and oilseed rape—and we rigorously test our fuel's cold flow properties. This, together with our history of testing over four Canterbury winters, ensures that we do not encounter cold flow issues.

We have not encountered any cold flow problems with our Biogold NZ100 used in marine applications and Biogold NZ60 or NZ80 blends used in transport applications despite their use right through the winter months.

Energy content

The amount of energy in a given volume of fuel, or volumetric energy density, of 100% biodiesel is around 7% lower than that of ordinary diesel. Ordinarily, this would mean that the fuel consumption when using B100 would be expected to increase by similar order, and that the peak power would also decrease in similar order. However, other characteristics of biodiesel tend to result

in smaller changes being found in practice. The exact response is engine and duty dependent. The difference in performance expected for the use of B20 is up to 1%, which is normally not noticeable—larger differences are usually found between the use of summer and winter grades of mineral diesel.

Housekeeping

Biodiesel attracts and absorbs water more than mineral diesel, which means that biodiesel tends to keep fuel systems drier. The included water in this “absorbed” state is not normally a concern. Concerns can arise when there are greater amounts of water involved, to the point that it puddles at the bottom of the tank. The presence of this “free” water also risks microbial growth (e.g., diesel bug, which is a threat to ordinary diesel as well). This risk is one of the reasons for the stringent water content specification of both biodiesel and mineral diesel, providing for some take-up of water without free water occurring in normal circumstances. To further lower this risk, it is recommended that tanks and systems are absent of water before their first use of biodiesel, and that good housekeeping is also used to avoid any unnecessary ingress of water. For example, we may recommend the use of water-removing filters on the vents of larger storage tanks.

Also with respect to housekeeping, the quality of the biodiesel fuel at source and right through the engine must be assured. Modern diesel engines are particularly fussy in this regard, with known issues occurring with ordinary diesel that has fallen out of specification. The ability of biodiesel to more easily decompose in the event of a spill, a plus for use in some environments, adds to this risk. It is one of the reasons why some engine manufacturers do not recommend the use of higher biodiesel content fuels in the most modern of diesel engines – those fitted with very high-pressure common rail fuel injection systems. For such applications fuel quality must be assured, the application must be suitable, and other controls will likely be necessary.

Viscosity

Biodiesel is slightly more viscous than ordinary diesel, and combined with its higher modulus of elasticity (it does not have the cushioning “spring” of mineral diesel under compression), this may show itself as higher pressure in some fuel pump systems, such as rotary pumps. If good engine operating practices are used, including warming the engine before operation at full power, this is unlikely to be an issue. Note that this best-practice method of operation tends to be programmed into the controllers used on modern engines.

Although this appears to be a long list of potential issues, it is very unlikely that a fault will occur when using Biogold, and even more unlikely if this is managed by following our recommendations. This will ensure that your switch to Biogold is smooth.

The switch to Biogold

Including some general good practices, in a nutshell these are our recommendations for the switch to Biogold biodiesel fuels:

1. **Before the switch** to NZ20, or to higher content Biogold biodiesel fuels, **check the application**, and avoid the following:
 - a. Where the engine operates at high speed under little load, for example lightly-loaded generators, or where

the engine is idled for long periods (as this heightens the risk of fuel dilution of the lubricating oil).

- b. Seldom-used plant (as there is heightened risk that the fuel degrades before use).
- c. Vehicles fitted with complex exhaust emissions control equipment, unless specifically checked for compatibility with experts or the engine manufacturer, and the application tends to operate under higher loads.
- d. Vehicles fitted with modern common rail injection systems, unless specifically checked for compatibility with experts or the engine manufacturer, and the highest of fuel quality can be assured at all times, right to the engine.

Also refer to the engine manufacturer’s recommendations. But be mindful that reliable, dependable engine performance may be achieved when using fuels with greater biodiesel content than those recommended by the engine manufacturer where the application is right, the fuel quality at the engine is assured, and the correct service and maintenance can be assured. The combined opinion of an expert plus that of the engine manufacturer may provide a more fitting assessment. Check also the list of recommendations for the use of Biogold biodiesel on Biodiesel New Zealand’s website.

2. **Before the switch**, check that the application is in suitable **condition**:
 - a. Check that the general health of the engine is good.
 - b. Check for the presence of water in the fuel tank and fuel system and remove any water found. If water is found, put in controls to avoid any future ingress.
 - c. Also, if water is found in the fuel, check for signs of diesel bug as this can cause serious engine damage regardless of what fuel is used. The presence of diesel bug will likely show itself as a pungent build up on the fuel filter element or sometimes as a more acidic smell when comparing the smell of the fuel with fresh fuel. If in doubt, dispense with the existing fuel and flush out the tank and fuel system. Hygiene check slides can also be used to better check for the presence of diesel bug.
 - d. Minimise the risk of water ingress.
 - e. Check fuel system components to ensure that there are no fuel leaks, no fuel components in poor condition or parts that may be incompatible (for example, “yellow-metal” components such as brass fuel couplings should be replaced where this is practical). These checks should include looking for swollen, overly soft or (fuel) wet fuel hoses. These are practical substitutes for positively identifying whether the hose is made from compatible material (often they are unmarked). Any fuel hoses found in poor condition should be replaced with known fuel-resistant hoses. Check Biodiesel New Zealand’s website for a list indicating the compatibility of different materials.

Some operators with older vehicles (i.e., where there is greater risk of loosening of dirt) sometimes also insert a pre-filter before the main fuel filters.

3. **For the switch**, it is good practice to switch to Biogold biodiesel a few days to a week before an oil and oil filter change (at least a tank of fuel consumption before).

This way, any extra loosened dirt loading on the lubricating oil due to biodiesel's cleaning properties can be removed with the first oil change. In no circumstances, however, should this practice result in operating the engine on oil in poor condition.

4. After the switch:

- a. Check for any fuel hoses that appear (fuel) wet and for leaks from fuel hoses and around fuel system components. The first check should be within a few days of switching to Biogold biodiesel fuels, then at least once more a week later. Operators should also be on the lookout for (fuel) wet patches under vehicles that have been parked for a time and also for the smell of fuel.
- b. If switched to blends greater than NZ20, or where there is risk of loosening of dirt (e.g., older vehicles), replace the fuel filter after the first tank of Biogold biodiesel use, or within the first few days, whichever is sooner. If the engine power begins to decrease after switching, it may be caused by a blocked fuel filter. In this instance, replacing the fuel filter should restore the engine power.
- c. It is good practice to test the condition of the lubricating oil at or before halfway through the oil service period if using Biogold NZ20 or higher blend proportion fuels. In particular, have the fuel dilution of the lubricating oil checked. Biodiesel New Zealand is developing a test for this purpose. This may allow you to maintain the normal service period rather than shorten it, as is often recommended by engine manufacturers.

5. Recommended operating practices.

Practices that are best for the use of mineral diesel also suit the use of biodiesel fuels, particularly those with higher proportions of biodiesel. These recommended practices include:

- a. Warming the engine to normal operating temperature before operating at full power (noting that this takes additional time when starting from cold and in cold ambient temperatures).
- b. Avoiding excessive periods of high speed, low power operation.
- c. Avoiding excessive periods of idling.
- d. Keeping the fuel level high in the fuel tank where there are large changes in temperature. This will reduce the breathing of the tank and reduce the ingress of water vapour.
- e. Keeping a watch on engine oil levels, noting any unusual changes in level. An increase in level may be due to fuel ingress and should be checked.



To further help with your switch we have developed this into the following summary checklist for mechanics to complete. This checklist can also be downloaded from Biodiesel New Zealand's website www.biodiesel-nz.co.nz. We also have experts to help you with your specific applications.

Checklist for the use of higher biodiesel proportion blends



Whether to switch:

Consider risk profile of the application.

Take additional precautions if:

- The engine or vehicle appears to be in poor condition
- The engine manufacturer does not recommend the use of higher proportion biodiesel fuels
- The proportion of biodiesel in the blend increases above 30%.

Avoid applications where:

- The engine is seldom used
- The engine idles for long periods
- The engine operates at high speed under little to no load
- The engine is fitted with complex exhaust emissions equipment (unless specifically checked for compatibility)
- The engine is fitted with very high-pressure modern diesel injection systems (unless specifically checked for compatibility).

Before the switch:

Consider the condition of the application:

- Check for the presence of water
- Check for leaks and for fuel system components in poor condition
- Check the general health of the engine
- Consider fitting a pre-filter in the fuel line.

For the switch:

The best timing for a switch is just prior to an engine oil and oil filter change.

After the switch:

- Check for fuel leaks
- Replace the fuel filter after a few days or after about one tankful of fuel consumed, whichever is sooner
- If practical, also change the oil and oil filter after a few days or after about one tankful of fuel consumed
- Check the oil for contamination with fuel before the first service is due after the switch.

Use good operator practices, including warming the engine up before full power use, checking oil levels and avoiding excessive idling.