



It's Worth It - Economically and Environmentally

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BIO DIESEL

We at American Clean Energy Systems Inc. (ACES), have taken much time, study, and finances to understand the situation that users of diesel powered equipment face and their varied choices in the fuels marketplace.

ACES has taken a special interest in Biodiesel and its stated stance by many as Americas foremost answer to renewable fuels and a giant step towards more independence from imported oil. While it is true that it is a renewable fuel, there are many concerns that still have to be addressed.

These shortcomings concern B20 through B100. Oxidation stability is one of Biodiesel's greatest challenges. Also the increase of oxides of nitrogen, pourpoint reversal, bacteria, fungus, and yeast are also not addressed with Biodiesel. Lubricity wear scar HFRR (ISO 12156-2:1998 passes the ambient temperature bocle tests, but has less success at combustion temperatures with long term varnish issues. However, we believe that with some correct formulation adjustments and sharing of technological breakthroughs, Biodiesel can be a good option. We believe that we can assist with our technology and expertise to reverse present limitations and augment functionality and success.

ACES has developed a formulation for diesel fuel that is multi-functional in application and helps address the pertinent specifications and New World limitations. We have performed multiple testing with Southwest Research Institute in San Antonio, Texas to confirm what capabilities our unique and proprietary formulations can produce. Oxidation of fuel can be greatly enhanced and stabilized. A primary benefit of our formulation will increase the BTU utilization of Biodiesel to produce greater combustion energy and a reduction in oxides of nitrogen. We can produce a much lower pourpoint with a special compound in our formulation, and we have an active biocide that is environmentally friendly. Another of our facets is a special high temperature detergent that will eliminate the gum, varnish and ring stickiness that has been a long term issue. Best of all, we have lubricity that can be introduced into

Biodiesel that has passed the Caterpillar 1K test – the military specification test for lubricity that requires 252 hours of high speed operation. As mentioned previously, these tests and many more have been performed and certified by Southwest Research Institute. As you are aware, they are the most prominent fuel testing lab in the United States, and probably the world.

Today, ACES provides a completely different system for solving the issue of EPA Phase III.

- **Fuel Reduction:** Our fuel catalysts contain an ignition improver, which reduces fuel consumption by better utilization of the BTU value of the fuel, which produces a far more consistent and complete combustion. Average fuel usage is reduced from 8% to 18%. Higher BTU utilization contributes to a much better fuel charge with more power and dramatic reductions in emissions.
- **Cetane Improvement:** Cetane rating is increased from 43.6 to 45.3 based on ASTM D- 613. This will assure better cold starting, reduced smoke and faster warm-ups with earlier underway operation.
- **Proprietary Biocide:** Bacteria, fungus and yeast are killed within 24 hours and dissolved by the detergency of the catalyst. The dissolved bacteria, fungus and yeast are sent through the filter and burned harmlessly.
- **Smoke Opacity:** Independent tests indicate a reduction of up to 25.5% on acceleration, and as much as 72 % in second gear. All power units will see an improvement regardless of life span.
- **Emission Reductions:** HC, CO, NOx and PM are all reduced because of the increase in complete combustion. Oxides of nitrogen are reduced an average of 20 %.
- **High Temperature Detergent:** Unlike petroleum distillate fuel additives, the detergent promotes full volumetric efficiency and allows for continually clean spray patterns while guarding against gum and varnish on the injector tip. It also delaminates fuel tank sediment, dissolves and burns it.
- **Metal Deactivator:** One of the compounds in the catalyst renders copper and vanadium inactive allowing no gum and varnish to form. Injectors and cylinders stay free of all carbon build-up that is

inherent in traditional diesel fuel usage with a noticeable reduction in smoke emissions.

- **Copious Upper Cylinder Lubricity:** Southwest Research Institute performed the Caterpillar 1K test, which is a military specification test on our diesel catalysts. The results showed that 252-hour engine testing was achieved with significant improvement in cylinder liner, piston and ring condition. The 1K test proved our catalysts perform better than 3000-ppm sulfur. Valve stems, guides, seats, faces and compression rings, as well as injector pumps and injectors, are lubricated with no fuel-related failures.
- **Increased Horsepower:** With the combination of greater BTU utilization, much improved lubrication and better hydrodynamic ring seal, average horsepower increased 15%. This contributes to better uphill, downhill and long grade performance.
- **Pourpoint Depressant:** Introduction of our catalyst into No. 2 fuel with a pourpoint of -7°F will produce -19°F continuous running. Filter plugging and gelling is not possible. Our very low viscosity formulations promote complete molecular equality so all fuel is evenly treated.
- **Water Emulsifier:** Water in the bottom of fuel tanks is effectively treated by a compound included in the formula that will emulsify the water and allow the engine to burn it. This emulsifier reduces water caught in the separator by up to 5% by volume.
- **Fuel Stabilization:** Our catalyst action promotes molecular balance resulting in a much greater and consistent flame travel in the combustion chamber. This compound keeps fuel from separating.
- **Metal Affinity Compound:** This feature allows fuel tanks in power units and storage tanks to be protected by a metal compound that prevents water from causing corrosion. It has a special affinity to copper and aluminum but also protects all metals.
- **Safe for Seals and Fuel System Components:** Most fuel additives contain common formulations that attack Buna-N, neoprene rubber and nylon. Our formulations will not dry out, swell or attack any fuel system component.

These are but a few of the advantages that are truly breakthroughs in fuel technology that ACES has pioneered. We produce technology that is both simple to introduce and cost effective in application.

BIODIESEL COMPARISON CHART

BIO DIESEL	E-DIESEL/OXY DIESEL	ACES
Lower Energy Content- Less BTU. Using B20 produces around 122,300 in straight #2 and produces 114,800 with winter blend 50/50 #1 & #2 blend. B20 is 20% biodiesel and 80% petroleum diesel fuel.	Lower Energy Content -Less BTU in #2 fuel around 8 to 20% power loss. Ethanol has approximately 65,000 BTU per gallon 7.5% Ethanol, 1% combined additive and 91.5% petroleum diesel fuel	Higher BTU utilization/Ignition improver promotes more complete burn - around 94% Much improved flame travel. Introduced via gallon form @ 1 oz Aces II per 15 gallons.
5-7% Less Energy per gallon compared to regular Diesel. Burn More Fuel.	If used in 10-15% by volume: produces 109,00 BTU per gallon- Burn More Fuel.	More energy from existing #2 base fuel, or #1 & #2 winter blends. More miles obtained with less fuel used.
Cetane of 40	Lower Cetane	Raises Cetane 2.5 points from neat diesel fuel. High
Methyl Ester produces injector coking creating higher injector pressures and increased heat. This causes seals to harden and crack. Attacks rotary fuel pumps resulting in reduced economy.	Injector materials are affected by softening and swelling of seals over time.	High temperature detergent with a proprietary metal deactivator for copper and vanadium chemically inhibits gum, varnish, and coking. Safe for all fuel system components.
Lubricity calculated by bocle test for wear scar to match 460 max wear pattern. Practical experience shows a honey colored gum and hard varnish on rings. Lubricity with B20 adequate at best.	No lubricity - Alcohol tends to dry cylinders and produce gum and varnish. At 15 ppm this blend will not be sufficient.	Copious lubricity. Better than 3000 PPM Sulfur. Withstands engine temperatures and aids in lubricating piston rings and valves, stems and guides. 600% less bore wear, 360% less stem, guide and valve wear.
Biodiesel causes NOx to be increased a minimum of 2%	Reduction of NOx not specified.	Reduces NOx, PM, CO, and HC. 10 to 50%
Increased cost per gallon around 15 to .25 per gallon	Increased cost per gallon around 10 to .20 per gallon	Increased cost per gallon of .03 to .10 per gallon

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<p>Methyl Ester/Alkyl Ester softens and degrades elastomers and natural rubber compounds. Impacts fuel system components including hoses and fuel pump seals. Elastomer seals and hoses need retrofitting.</p>	<p>Softens and degrades some neoprene, nylon, buna materials including injectors, pumps and nylon systems, absorbs water.</p>	<p>No effect on seals or any fuel system materials. Lubricates injector pumps, injectors, emulsifies water and suspends it and allows it to be burned. Protects fuel system materials like copper and aluminum.</p>
<p>Cold weather fuel Gelation / filter plugging and increased injector deposits. B100 gels faster than neat diesel fuel. B20 also needs pourpoint treatment for winter use.</p>	<p>No Cold weather problems associated with E-Diesel. However, a pour point additive will still be needed to keep it from gelling/clouding.</p>	<p>Pour point reduced from -7 below regular diesel to -19 below with Aces. The catalyst straight has a pour point of below -64 degrees below Zero.</p>
<p>Bacteria, Fungus and Yeast are a constant problem and will need to be addressed with a biocide/fungicide. Also residual alcohol from esterification process can remove deposits from fuel tanks and lines causing filter plugging. Flushing will be necessary.</p>	<p>Bacteria, Fungus and Yeast are a constant problem and will need to be addressed with a biocide/fungicide</p>	<p>Contains a bactericide / fungicide / yeasticide to kill all in 24 hours and dissolve it. De-lamination of deposits allows for continual cleaning without plugging problems.</p>
<p>Oil contamination and dilution may necessitate shortening intervals of oil changes. Produces oil sludging.</p>	<p>Oil contamination and dilution may necessitate shortening intervals of oil changes. Produces oil breakdown.</p>	<p>Produces extra lubricant producing a hydrodynamic seal on piston rings to reduce blowby and extend oil change intervals.</p>
<p>Has poor oxidation stability qualities which accelerate fuel oxidation in the fuel system. Especially vulnerable are the electronic systems because they operate at higher temperatures.</p>	<p>Absorbs water and causes some separation problems. Flash mixing of diesel with Ethanol has produced a somewhat more stable mixture.</p>	<p>Promotes molecular balance in the fuel and makes it permanently shelf and tank stable. Promotes tank and storage facility cleanliness and reduction in water present in the bottom of the tank (with continued use)</p>