Advantages of Biofuels

B100 biodiesel has many benefits over traditional, petroleum-based diesel fuel. It reduces air pollution, costs less than petroleum diesel, and results in cleaner engines. Experts estimate that about 1/3 of our transportation fuel needs can be met by domestically-produced biofuels.

Environmental & Social Benefits

- Decreases emissions of fossil fuels that contribute to climate change and air pollution
- Lessens risk of environmental harm in the event of a fuel spill
- Reduces dependence on imported oil
- Supports agriculture and the U.S. economy

Operational Benefits

- Improves engine performance
- Extends engine life
- Reduces need for engine maintenance due to cleaning properties of biodiesel
- Reduces operating and maintenance costs by 20-40% vs. petroleum-based fuels

Human Health Benefits

- Reduces exposure to harmful and cancer-causing chemicals
- Reduces seasickness due to less offensive odor

Leading the Way

Now that GLERL has met its goal of converting its vessel fleet to 100% biofuel, the lab is sharing its expertise to help others convert their vessels to petroleum-free operation. In 2002, GLERL formed the Green Ship Working Group, which has helped more than 150 small vessels from both the government and private sectors convert to biofuel.

In 2010, GLERL began to focus its technology transfer efforts on the federal government through the Federal Green Fleet Working Group. Through this group, GLERL shares its expertise and resources and collaborates on projects with other federal agencies interested in marine applications of biofuels. As a leader in the field, GLERL developed a 5-Step Conversion Process to help other agencies move towards the use of biofuels in their large vessels. In 2011, both the U.S. Army Corps of Engineers (USACE) and the Maritime Administration (MARAD) conducted marine biofuel tests. The USACE test successfully implemented GLERL’s Green Ship principles on four vessels stationed around the country. MARAD conducted one of the first large-scale tests of a biofuel consisting of 50% petroleum-based diesel and 50% biodiesel made from algae, which many experts believe is a

DID YOU KNOW?

- Ethanol and biodiesel, the primary biofuels in use today, can be blended with or substituted for gasoline and diesel for use in unmodified automobiles, trucks, and ships.
- Biodiesel in GLERL’s vessels is made from soybean oil, but can be made from many agricultural products. Even used cooking oil can be reprocessed as a biofuel.
- Rapeseed and canola oils are part of the mustard or cabbage family and can be used for motor oils and hydraulic fluid.
What’s Ahead?
Although GLERL has reached its Green Ship goal of petroleum-free operation and is helping others do the same, work remains to evaluate the conversion and to explore future opportunities to expand use of renewable fuels in other aspects of GLERL’s research. With more than a decade of experience, GLERL has compiled one of the largest data sets on the effects of biofuels and bio-products on marine engines. Initial results of these activities suggest that the technologies developed at GLERL are viable. Key ongoing activities include:

- Monitoring and documenting long-term effects of B100 use on engine components.
- Completing field tests and evaluating of use of bio-crankcase oils.
- Identifying and implementing measures to reduce nitrogen oxide (NOx) emissions associated with biodiesel.

Green Tips for Recreational Boaters
Any diesel-powered boat can be converted to run on biofuels, just like GLERL’s vessel fleet. Converting your boat is not only good for the environment, it’s better for the health and safety of you and your family. Even gasoline-powered vessels can “go green” by using bio-based oils and lubricants. There are many technologies emerging to make recreational boating more environmentally-friendly, including the use of alternative fuels such as ethanol and butanol that can improve engine performance and reduce air pollution. GLERL has assisted industry groups in evaluating alternative fuels for gasoline engines and has helped develop best industry practices.

In addition to biofuels, there are many other ways to reduce your recreational vessel’s impact on the environment. These include eliminating overboard discharges of waste, following best practices for fueling your boat, and using environmentally-friendly alternatives to anti-fouling bottom coatings. These tips and more are available from the U.S. Environmental Protection Agency at www.epa.gov/otaq/boat-fs.htm and eartheasy.com/play_eco-friendly_boating.htm.

You can also help the environment by docking your boat at a certified Clean Marina that is committed to environmental stewardship. More information on Clean Marinas is available from NOAA at coastalmanagement.noaa.gov/marinas.html.

Proven Results
Data collected by GLERL since the conversion of its vessel fleet to biofuels show significant environmental benefits and cost savings. The table shows GLERL’s average B100 (100%) soy biodiesel emissions reductions as compared to #2 petroleum diesel. In some cases, these observed reductions are better than those predicted for B100 by the U.S. Environmental Protection Agency. In addition to these environmental benefits, GLERL has seen a 20-40% cost savings since converting its vessels to biofuels.

Emission Reductions: B100 vs. Petroleum

<table>
<thead>
<tr>
<th>Emission Type</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Unburned Hydrocarbons</td>
<td>-77%</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>-48%</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>-59%</td>
</tr>
<tr>
<td>NOx (nitrogen oxide)</td>
<td>-7%</td>
</tr>
<tr>
<td>Sulfates</td>
<td>-74%</td>
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</tbody>
</table>

For more information: Dennis Donahue, Marine Superintendent