

Bioheat Fact Sheet

Harvard Green Campus Initiative

What is Bioheat?

Bioheat is a blend of heating oil and biodiesel. Biodiesel is oil that is most often made from soy, palm, canola, or refined used vegetable oil. Biodiesel can be blended with any type of heating oil, including #2 for residential boilers, #6 for industrial boilers, and ultra low sulfur heating oil. The ratio of heating oil to biodiesel can vary, but it is most often combined as B5 (5% biodiesel), B10 (10% biodiesel), or B20 (20% biodiesel).

Bioheat is not a new product; it has been used in Europe for over 20 years but is just beginning to gain in popularity in the United States (one Pennsylvania company has used it in over 10,000 homes since 2005). The U.S. oil heat industry has accepted bioheat and hopes to use B5 interchangeably with standard heating oil, as there is virtually no difference in performance.

Bioheat Performance

In tests conducted by Brookhaven National Laboratory, bioheat at low blend levels showed little or no negative impact on a burner's performance while simultaneously improving the emissions, lubricity, efficiency, and cleanliness of combustion.

Boilers do not need to be converted to use blends of B20 or less. Mixes of greater than 20% can be used in existing boilers, but retrofits are needed because the pumps and seals may break down due to bioheat's high solvency. When first used, bioheat may dissolve sludge in the boiler, leading to clogging, so filters may need to be changed more often soon after the switch. The use of bioheat in boilers does not have any of the cold weather limitations associated with vehicular biodiesel.

Bioheat Standards

Bioheat is regulated by two national standards. The industry standard for biodiesel is ASTM D6751, which ensures that biodiesel is good quality, will perform consistently, and meets certain criteria (such as flash point and viscosity). BQ-9000 is a voluntary quality control program for vendors and manufacturers. It requires that all batches are tested for compliance with ASTM D6751 and includes storage, sampling, testing, blending, shipping, distribution, and fuel management best practices.

Environmental Benefits

Biodiesel is non-toxic, biodegradable, and renewable. NO_x, sulfur, carbon monoxide, smoke, hydrocarbons, and particulate matter are all reduced when using bioheat (although different studies find differing reductions). B20's net life cycle CO₂ emissions are reduced by 15.66% due to carbon recycling by the plants (although, at the stack, CO₂ emissions have been found to increase by 4.7% with B20 compared to diesel). The higher CO₂ levels are from more complete combustion and the concurrent reductions in other carbon-containing stack emissions. Environmental benefits increase as greater percentages of biodiesel are used.

Emissions Reductions: B20 compared to #2 fuel oil

	NO _x	SO _x	CO
B20 in a commercial boiler	6% reduction	-	6% reduction
B20 in a residential boiler	6% reduction	-	9% reduction
B20 and low sulfur highway diesel: mix of boilers	20% reduction	83% reduction	No change
B20 in Rhode Island school boilers	19% reduction	18% reduction in sulfur	No change

Sources: [C.R.Krishna, J. Batey, Energy Research Center](#), & [Rhode Island Public Schools](#)

Bioheat Costs

In Massachusetts, heating oil prices have increased by 64% over the past three years. B20 prices, on the other hand, should drop as more distributors and processing plants come online in New England, increasing the supply and competition (this was the case in Vermont after demand increased). As of November 2007, there were 165 accredited processing plants in the US and 80 under construction, up from 25 plants in 2004. Biodiesel prices should be more stable than oil, as biodiesel is not affected by global supply or political issues.



In August 2007, Mass Energy's (a discount oil provider) price of B20 bioheat was 5 cents per gallon less than #2 heating oil. The price differential is larger (about 30 cents more per gallon for bioheat) for Harvard buildings that buy wholesale #2 oil through UOS.

When MIT's biodiesel processing plant is functioning, Harvard could be able to obtain free or inexpensive biodiesel generated from the University's own waste oil.

Biodiesel Feedstock

Biodiesel is most often made from tallow, soybean, palm, canola, or used vegetable oil. Many of these sources have environmentally harmful practices associated with their production. As of August, 2007, biodiesel in Massachusetts comes mostly from soybean oil processed in Florida and also some animal tallow and soy from other parts of the U.S. The ideal feedstock for biodiesel is used vegetable oil. For more information on feedstocks, please see the Harvard Green Campus Initiative biodiesel feedstock fact sheet.

Bioheat Case Studies

Over a four-year period, B20 was field tested by Brookhaven National Laboratories in several hundred homes in the Northeast and no significant problems were found. Below are synopses of other pilot studies of sites that are similar to Harvard.

Vermont Biodiesel Project

The Vermont Biodiesel Project ran five successful pilot projects in 2004-2006, including tests of B20 bioheat in a lab and residential homes. The two heating oil dealers reported no system service calls related to bioheat. They also stated that:

In summary, we would like to say that B20 performed as well as No.2 fuel oil in a heating application. We will recommend it to any customer currently burning No.2 fuel oil. We were pleasantly surprised. We experienced no more problems with the boilers and furnaces at Middlebury College [using B20 bioheat] than we would expect from units running on No.2 fuel oil.

Another pilot tested bioheat composed of #6 heating oil and various percentages of biodiesel (5%, 10%, and 20%) in industrial steam boilers with great success.

The boilers did not have any operational issues and the boilers actually needed less maintenance than usual. The biodiesel was added directly to the tank, since the heat and circulation of fuel provides enough heat and agitation to blend the fuels. They found that:

The benefits of using biodiesel mixed with #6 fuel oil include easier measurement of fuel in tanks, easier routine cleaning of the burners and strainers, lower emissions, lower demand for imported oil, and reduction of fossil CO₂ emitted.

Schools Using Bioheat

Middlebury College
Colby College
Bates College
University of Southern Maine
Eastern Connecticut State University
Rhode Island Public Schools

States of Massachusetts and Maine

Due to the rising costs of oil, the State of Massachusetts tested 3% biodiesel mixed with #2 heating oil (B3). After a successful test, all state buildings that use #2 heating oil are now required to use a minimum of B3 bioheat. The minimum percentage of biodiesel will be progressively increased to reach the goal of using B10. The State of Maine has also been heating at least 19 buildings with B10 since 2004.

Recommendations

HGCI recommends the use of bioheat for the following reasons, it:

- Has been successfully field tested,
- Does not require any equipment conversions,
- Reduces equipment maintenance,
- Will lower Harvard's greenhouse gas emissions,
- Is a renewable resource,
- Reduces our dependence on foreign oil, and
- Will help stimulate the supply side of the market.

Sources for Purchasing Bioheat

World Energy: www.worldenergy.net
Mass Energy: <http://massenergy.com>
UOS: Mary Smith, 495-0398

