

Assessment of Biodiesel Knowledge and Attitudes of the Heating Oil Industry

INTRODUCTION

Bioheat is a premium heating fuel consisting of a blend of Biodiesel and conventional No. 2 heating oil. Bioheat has undergone considerable emissions' testing that has proven it to be a clean, environmentally friendly and efficient alternative to conventional No. 2 heating oil. In an effort to bring Bioheat to market, and to compete as a viable alternative to natural gas, the National Biodiesel Board conducted a feasibility study in 2002. The goals of the study were to determine the potential market for Bioheat and provide recommendations for future efforts in promoting this fuel.

One recommendation was to perform a fuel dealer market survey that would answer some fundamental questions that were raised in the study; the key questions are as follows;

- **What is the optimal blend rate for Bioheat?**
- **What price premium would the market bear for Bioheat versus heating oil?**
- **Would heating oil retailers be willing to market Bioheat?**
- **Is the heating oil market familiar with the positive characteristics of Bioheat?**

The results of the fuel dealer survey would serve as a roadmap for future efforts to incorporate the efficacy of Bioheat in the current heating fuels market as a viable heating fuel blend stock.

SURVEY OVERVIEW

Funding sponsorship came from The United States Department of Agriculture, under the Biodiesel Education Grant. The purpose of the survey was to determine an oil heat distributor's general attitudes about Bioheat and to ascertain what they believed they're customers understood about Bioheat as well. Oilheat distributors will market Bioheat to their customers, the end users consisting of commercial users and individual homeowners. Additionally, the survey would provide an introductory outreach to the heating oil industry

The survey was performed in conjunction with the New England Fuel Institute (NEFI), a nationally recognized business association of 1,100 member companies in the heating oil and related heating service industry. The New England market is currently the largest consumer of heating oil in the US. Collaboration with NEFI would maximize responses as well as paint a picture of the acceptance of Bioheat as a viable blend stock for both high and low sulfur heating oil.

The survey was sent via e-mail to 350 heating oil dealers who accepted e-mail communications on a daily basis from they're governing body NEFI the response was tremendous with 109 committing to take part in this short but nevertheless comprehensive series of questions. A copy of the survey and the results are attached. The survey was fashioned to view attitudes towards both heating oil as a product and the heating oil industry itself. Identifying the weaknesses in the Oilheat industry as well attempting to determine the attitudes of both the Oilheat dealers and consumers are critical elements to establish the potential for the future of Bioheat sales to the industry.

The heating oil industry is in a period of self-evaluation due to the ongoing market losses suffered as a result of consumers switching to natural gas as a heating fuel. The number of American households using heating oil as a primary heating source has declined steadily from the 20% in the mid-1970's to hovering around 10% currently.

In an effort to boost Oilheat as a primary heating fuel, the Oilheat industry has developed a federal check-off program, titled the National Oilheat Research Alliance (NORA). NORA funding helps the industry promote Oilheat, consumer education, technical training and research and development of cleaner burning fuels and equipment ultimately to reduce conversions from oil to gas.

NORA funded a study, in October 2001, to determine consumer attitudes towards Oilheat which has provided the basis for a strategy to increase market share. The following issues were identified in that study as weaknesses.

NOTED HEATING OIL WEAKNESSES

The main competition to heating oil is natural gas, and fuel switching typically occurring when an existing oil heat system is replaced due to age or renovation. There are non fuel related issues associated with Oilheat that cause consumer dissatisfaction such as storage tanks in basements and delivery issues which can be compromised due to extreme cold or snowfall. The natural gas industry understands clearly the deficiencies in the heating oil industry and has capitalized on them.

The NORA study revealed a number of areas of dissatisfaction among Oilheat customers. The primary concerns with Oilheat as a fuel center around its cleanliness, odor and the environmental ramifications. Other Oilheat related dissatisfaction concerns include cost effectiveness and availability. Additional concerns identified were

a consumer perception of the Oilheat industry being linked to "Big Oil" or imported oil both clearly an issue posts the attacks on our nations security September 11, 2001. With all eyes on terrorism and political unrest "oil" was now and forever after in the spotlight and certainly not in a positive way.

Cleanliness, odor and environmental concerns leading to negative consumer perceptions of heating oil were identified as;

1. Being bad for the environment, (air quality, ground water contamination)
2. Negative perception relating to people's health, (emissions, odor)
3. Extremely dirty, (color and consistency)
4. Downright prehistoric, (not suitable for new house construction)

Cost effectiveness and availability concerns leading to negative consumer perceptions of heating oil are;

1. Prices fluctuate from year to year and also within a year from month to month
2. General knowledge that Oilheat reserves are finite

The "Big Oil" and import concerns leading to negative consumer perceptions are identified as;

1. Perceptions that most of America's Oilheat is imported from unfriendly nations ultimately leading to,
2. Dependence on unfriendly foreign nations and
3. International unrest

HEATING OIL INDUSTRY STRATEGY TO INCREASE MARKET SHARE

NORA has taken the position that certain issues are misconceptions on the part of consumers, and can be corrected by consumer education. NORA has produced many consumer education advertisements many of which can be viewed at www.nora.org.

The main focus of this campaign is that oil is much cleaner than it used to be and since has adopted the catch phrase, "Clearburn Science", intended to give the perception of a new improved fuel readily available at a dealer near you. This idea is also intended to give consumers the impression of an efficient and new fuel unlike the higher sulfur fuel customarily found throughout the distillate marketplace today.

The Oilheat industry has taken measures to produce a better product. The main fuel cleanliness issue that has been addressed is through sulfur reduction. Lower sulfur fuels (500 ppm versus 2000 ppm) result in lower particulate emissions, less odor, cleaner burning, reduced maintenance and improved reliability. Although industry leaders are focused on implementing 500 ppm sulfur heating oil there is a grass roots interest in soy based Bioheat as well.

Through the encouragement and educational process that the National Biodiesel Board offered these regional industry leadership groups both NORA and the Massachusetts Oilheat Council agreed to fund a study titled "Combustion Testing of a Bio-Diesel fuel Blend in Residential oil Burning Equipment" prepared by John E. Batey, Energy Research in July of 2003. The purpose of this study is to evaluate the combustion performance of a blend of 20% soy-based biodiesel fuel combined with 80% low sulfur (0.05%) highway diesel compared to conventional home heating oil.

Tests were conducted at the New England Fuel Institute Training facility using a range of conventional oil powered boilers

and furnaces over a range of fuel firing rates and excess combustion air settings.

Key observations and findings of these combustion tests include:

- Nitrogen Oxide emissions are frequently reduced by about 20% by using the biodiesel/low sulfur blends.
- Combustion stability with the biodiesel blend is very good as indicated by low levels of carbon monoxide that are similar to the conventional fuel oil.
- Sulfur Oxide emissions are reduced by 83 percent by using the biodiesel blend.
- Smoke numbers are lower with the biodiesel blend than the home heating oil when the same burner air setting is used.
- Fuel oil and combustion odors are improved by using the biodiesel /low sulfur oil blend compared to home heating oil based on these preliminary tests.

This combustion test project demonstrated that very good combustion performance is produced by the biodiesel fuel blend in the conventional residential oil heating equipment that was tested. No significant changes in carbon monoxide levels (incomplete combustion) were observed. The reduction of air emissions with the biodiesel blend is substantial, producing much lower environmental impacts. This includes reductions in sulfur oxides (83%), nitrogen oxide (20%), carbon dioxide (20%), and particulate matter. Most of the sulfur oxide reduction is produced by using the low sulfur highway fuel. Preliminary analyses indicate that the 20% soy-based biodiesel/low sulfur diesel blend has an environmental cost that is better than natural gas when gas leakage during transmission, storage, and distribution are included. This transforms home heating oil into a premium fuel with very favorable environmental impacts.

NOTED BIOHEAT ATTRIBUTES

Introduction of Bioheat as a heating fuel has many positive characteristics, both physical and perceptive, that counter heating oil negatives and dovetails with the NORA strategy to increase market share.

1. Bioheat has virtually no sulfur, and burns clean with less soot and residue. These burning qualities are exactly the improved fuel message that NORA is promoting, especially the lower sulfur. The Batey report which can be found on the National Biodiesel website, details the reductions in NOX, SOX, smoke, odor and lower particulates of Bioheat compared to standard heating oil.
2. Bioheat is a renewable, domestically produced fuel that is associated with the US agricultural industry. This image is in stark contrast to that of heating oil which was clearly in the NORA study as tied to big oil and imported.

In conclusion, Bioheat is environmentally friendly (fewer emissions), biodegradable, renewable, domestically produced and is part of the domestic agricultural industry. These positives are the exact opposite and counter the heating oil negatives.

THE SURVEY QUESTIONS

The survey consisted of ten questions. The survey and results are listed below:

Fuel Dealer Survey of Biodiesel Knowledge

1. ***Are you aware of both the laboratory and field testing that have been conducted on Biodiesel and Biodiesel blends over the past three years?***

85 responded Yes
24 responded No

78% Yes; 22% No

2. ***Have you reviewed the Massachusetts Oilheat report "Bioheat"?***

24 responded Yes
85 Responded No

22% Yes; 78% No

3. ***Can you list the environmental factors that would be affected by adding Biodiesel to heating oil?***

23 responded with listed correct environmental factors
9 responded with incorrect environmental factors
77 did not respond to this question
21% answered correctly

4. ***What do you believe the consumer tolerance to price increases would be if the Oilheat industry delivered a reconfigured home heating oil product that had the following benefits,***

- ***Sulfur reductions***
- ***Lower maintenance costs from sulfur reductions***

(.02 - .04) (.05 - .07) (.07 - .09) (No tolerance to higher prices)

The range of responses was across the board; average cost acceptance was 3.4 cents with 26% at zero tolerance to higher prices

5. ***What do you believe the consumer tolerance to price increases would be if the Oilheat industry delivered a reconfigured home heating oil product that had the following benefits,***

- ***Lower SOX and NOX emissions.***
- ***Increased Domestic production potential.***

(.02 - .04) (.05 - .07) (.07 - .09) (No tolerance to higher prices)

The range of responses was across the board; average cost acceptance was 3.4 cents with 25% at zero tolerance to higher prices

6. Place a numerical value in order of importance what your customers value most with respect to buying criteria with oil heat (1 being the most important, 4 the least)?

- **Price**
- **Service**
- **Fuel Quality**
- **Secure supply**

The results were tallied and the rank was as follows:

1. Service
2. Price
3. Supply
4. Fuel Quality

7. Did you know that Biodiesel and lower sulfur fuel blends reduce the odor produced by home heating oil both in terms of the unburned fuel and exhaust gases?

(Yes / no)

85 responded Yes
20 responded No
4 did not respond

Response was 81% positive

8. **Would you be willing to participate in a pilot program to market Bioheat, a blend of Biodiesel and #2 heating oil?**

(Yes / no)

80 responded Yes
23 responded No
6 did not respond

Response was 78% positive

9. **Do you feel your customers are aware of the environmental properties of Biodiesel?**

(Yes / no)

5 responded Yes
103 responded No
1 did not respond
Response was 95% negative

10. Is your customer base primarily:

Metropolitan	Suburban	Rural
25-40	40-55	55+
Low income	moderate income	high income

The answers to this question showed across the board willingness to market Bioheat with 86% of rural, 78% of suburban and 78% of metropolitan will to market it.

OILHEAT INDUSTRY AWARENESS OF NOTED BIOHEAT QUALITIES

The survey consisted of a series of questions that were designed to determine the level of knowledge heating oil dealers had about BIOHEAT. The 109 responses yielded the following results:

78% of the responding Oilheat dealers were aware of lab and field testing of Bioheat, but 78% of the respondents did not read the results of tests or literature about the product.

When asked a specific true or false question concerning the reduction of the bad odor of burned heating oil, again 81% of the respondents answered the question correctly, but when asked to name one environmental property of Bioheat only 21% of the respondents could name one or more, correctly. 9% of the respondents answered the question with a negative Bioheat property such as “cold weather issues” or “higher prices”.

In general, Oilheat dealers are aware of Bioheat but have very little specific knowledge about the fuel or its’ properties. Relative to dealers who are well informed, there is a large percentage that is aware of negative attributes of Bioheat.

PRICE DIFFERENTIAL TOLERANCES AND DESIRED BLEND RATE

A topic that has been discussed by both the Biodiesel proponents and the Oilheat industry has centered on the appropriate blend rate of BIOHEAT and heating oil in a finished Bioheat product. Aspects to consider include:

- Production capacity compared to heating oil sales in various markets or in total,
- The price premium potential customers would be willing to pay for the blended fuel.
- Technical restrictions that encompass stability, microbial contamination, sediment in heat systems which include copper and safe cold flow.

The survey identified the price premium Oilheat dealers would be willing to pay under two different scenarios. In the first, with a question asking what premium would consumers be willing to pay for a lower sulfur fuel the average was 3.4 cents with 26% answering zero. Excluding the zero respondents the premium is 4.7 cents per gallon.

The question was asked: What premium would consumers be willing to pay for a fuel with lower emissions and domestically produced. The answer was 3.6 cents with 25% answering zero. Excluding the zero respondents the premium became 4.9 cents per gallon.

In a separate survey given at the Oilheat Visions Conference in September 2004, the question was changed to describe the qualities of Bioheat fully: domestically produced renewable fuel with lower sulfur, is biodegradable, and reduces emissions such as particulates, CO₂ and NO_x. The answer was 6 cents per gallon.

Using current costs for BIOHEAT and local Northeastern market prices, for each one per cent of BIOHEAT blended into heating oil, it would raise the price of the finished product by \$.009 per gallon. Based on the range of answers this price tolerance would give a range of blend rates from 4% BIOHEAT to 6.7%. The results show that if dealers have the correct information about Bioheat characteristics they will be willing to pay more for the finished product.

The response to this question is surprising given the emphasis the Oilheat industry has placed on providing a lower sulfur fuel.

BIOHEAT MARKET

Oilheat dealers were asked if they would be willing to participate in a pilot program to market Bioheat to their customers. 78% of the respondents answered yes they were willing. A second question was asked: Do you feel your customers are aware of the environmental qualities of Bioheat? The answer came back that 95% of dealers felt their customers were unaware of the environmental properties of Bioheat.

These answers were surprising when you look at them in conjunction with answers to other questions in the survey. Since only a small number of dealers can list even one environmental characteristic of Bioheat, yet 78% are willing to market the product.

TEAM RECOMMENDATIONS

The majority of heating oil dealers are willing to market Bioheat and pay a premium for it in spite of the fact that they are that they are not knowledgeable about its' positive characteristics. The more facts dealers have regarding the burning qualities of Bioheat the more they are willing to pay for it. They also believe that their customers are not aware of the characteristics of Bioheat. These results point to the fact that the Oilheat

industry has not accepted solely sulfur reduction as a means of competing with natural gas. The industry is still looking for alternatives.

Based on the survey results it is clear that there needs to be a focus on the following areas in the immediate future.

- **Provide an Oilheat dealer education program on Bioheat positive attributes:** Clean, Renewable, Domestic, Biodegradable, and Reduced Emissions. There has to be very specific identification by dealers in order for them to justify the price premium with benefits realized.
- **Consumer education/advertising on the same Bioheat positive attributes,** in the way NORA has educated consumers about Oilheat. In numerous interviews, Oilheat dealers said they were committed to provide products their customers asked for. The dealers are not committed to traditional heating oil, and if consumers ask for Bioheat dealers will provide it.
- Through continued technical programs currently addressed in the Biodiesel Education Grant **address industry concerns over cold flow, solvency, stability, flame safety, sediment formation from yellow metals like copper fuel oil lines and price issues.** These negative effects are negligible in low blend rates and this message is not clear however technical resolution must be given to these hot topics of concerns for many industry leaders.
- **Increase the awareness of fuel quality issues** that effect burner reliability and efficiency. Although Oilheat consumers are concerned with fuel quality, dealers are not. Dealers must understand that poor fuel quality causes customer losses.