Factors Influencing the Uptake of Biodiesel by US Industries

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I - *Abstract*

This is a descriptive marketing research study examining factors influencing in the uptake of biodiesel by US industries. Observable trends in fuel, energy and environmental standards have provided an apparent need for widespread divestment from fossil fuels. Yet for some reason many major US industries have failed to take advantage of modern advances in fueling technology, such as biodiesel. Particularly, biodiesel seems to have been largely forgotten in the American surge for "biofuels" (comprising only about 6% of the total North American biofuel market as of 2012) sharing the space with other examples such as ethanol, methanol and even wood chips.

Biodiesel is produced when ethanol or methanol is catalyzed with cellulosic oils, creating either ethyl biodiesel or methyl biodiesel respectively. When combusted it produces about 93% of the power produced by diesel fuel with 77% less particulate emissions, making it a much cleaner alternative with only slightly less potential energy output. When compared to the widely advocated substitution of ethanol for gasoline, where ethanol produces under68% of the power with 14-48% less particulate emissions, biodiesel is a far superior market substitute (AFDC, 2016).

The overall acceptance and promotion of ethanol as a feasible substitute raises obvious questions regarding the lack of acceptance for biodiesel. With this intention we structured the questions of the experiment survey around a few different factors which are thought to have an impact on the uptake of biodiesel. These are outlined as Cost Factors, Operational Factors, Environmental Factors, Logistical Factors, Political Factors and Marketing Factors. Going into

the experiment we have three hypotheses that we hope to test for: 1) Political Factors are a top influencing consideration, 2) Marketing Factors are a top influencing consideration, 3) Availability of other fuels is a top influencing consideration. Invalidation of the hypothesis will be achieved through realization that these topics are not top influencing considerations, determined by a "top three" ranking in prevalence indicated by congruent participant responses.

This study took place over the LinkedIn social platform which allows for the effective targeting of potential participants based on employer, industry or position within an organization. Since all participants will need to connect with the researcher in order to have the choice to participate, the survey itself does not request any information that may be identifiable at a later time. After all submissions were collected the data was analyzed to provide a thorough understanding of industries which have a greater potential for adoption. Questions were formatted from the perspective of a business which does not currently use biodiesel ("We do not use biodiesel in our business because…"), and participants were instructed to select the best answer as to why their businesses do not solely rely upon biodiesel as a fuel source (to accommodate businesses which do use biodiesel but not entirely).

The largest segments of participants were from businesses with revenues from $1-5billion (15%), <$1billion (14%) and $5-15billion (13%). These included over 40 named businesses such as Boeing, GE, GM and Caterpillar. As a majority of participants, the largest 3 department positions that were involved in the survey were Engineering (32%), Operations (23%) and Research & Development (12%).

Unsurprisingly, the results from the survey indicate that an average of about 57% of the business are currently dependent on “other fossil fuels” (such as diesel, gasoline, coal, etc.) and a distant secondary of approximately 17% using “Natural Gas” in one form or another. With various measures of each factor we were able to identify some of the most concerning influences for businesses which have biodiesel as a potential fuel source.

The most prevalent issue for each factor was found to be as follows: Cost Factors – Costs of Implementation, Operational Factors – Collaborators Have Not Switched, Political Factors – Industry Culture, Logistical Factors – Availability of Alternatives, Environmental Factors – Concerned about Land Use, Marketing Factors – Lack of Biodiesel Availability. Each one of these subjects was found to be leading the factor in how much it influences the decision whether or not to use biodiesel.

II - *Literature Review (Background)*

Secondary data collected leading up to this study revolved around previous research into current/future market growth, market penetration and global potential of biodiesel. The first of these studies tells us that the biodiesel market was expected to have explosive growth from 2006 and on, while covering potential alternative paths and causes for the lesser outcomes. Following that we take a look at a study which recognizes the current state of the US market (as of 2010) and how biodiesel has managed to enter the market so far. Lastly our review of existing literature is finalized with a look at the state of the international biodiesel market and how other nation-states have positioned themselves for a more environmentally prosperous future. The aggregation of these studies provides a well-rounded perspective of a variety of researcher's work in this field of study, while generating insights that raise genuine questions about the promising future of this industry.

The first bit of information that we reviewed comes from Steven G. Bantz and Dr. Michael L. Deaton from the 2006 System and Information Engineering Design Symposium. This study cites a 2006 Biodiesel Magazine model demonstrating very impressive projected growth for the biodiesel industry while also acknowledging industry analyst doubts and alternative projected outcomes for the industry. These alternative outcomes include smoothed production growth, boom and bust cycles, future explosive growth, and overshoot and collapse. Employing a holistic view – "an approach not found in the numerous individual, state, or regional feasibility studies" - it analyzes under what conditions each of these scenarios may occur. At this current time the market would seem to be functioning in a boom and bust cycle after exploding through the early 2000s and declining into 2010.

The second study that was used comes from Kenneth R. Szulczyk at the Department of Economics (Suleyman Demirel University) and Bruce A. McCarl at Texas A&M University. What this research provides is an insight into the understood benefits of biodiesels, how they relate to current market needs and a perspective on projected growth within the US. Both this and the previous study acknowledge the growth from 5mmgy in 2001 to 250mmgy in 2006, but this study in particular does not take a holistic approach, and does not focus so much on the future potential as it does acknowledging present doubts. Helping to effectively include an understanding of a negative outlook on the biodiesel industry's potential, the paper concludes with a few requirements to a "successful" future for the market. These would be necessary effective conditions under which the biodiesel industry might prevail, such as development of fuel additives to maintain high quality during colder weather and use of feedstock that has enhanced oil-content yield.

Third we examine the insights of Mustafa Balat from Sila Science in Trabzon, Turkey. In this paper the researcher recognizes the growth of the biodiesel market from 2000-2005 and the prospects for future growth relative to findings of the time. Bringing a global perspective into our national study will help to demonstrate some key differences in the US biodiesel industry from that of other places that have seen greater adoption rates. In 2005 Germany comprised half of the world's biodiesel production at 33,000bbls/day (bbls = barrels) and had eliminated all taxes on its trade (similar to food in the US), a telling policy move to make considering the US was only producing 5,900bbls/day and was certainly not pushing forward this initiative. Learning from these efforts and comparing them to the findings of our own research allows us

to develop a good understanding of what international and national factors may be preventing biodiesel's uptake in the US industry.

Although these studies are a little bit dated, we can gain an understanding of what has happened since the times by comparing with more contemporary data. By doing this we find that soon after the US stepped into the biodiesel arena as its number two contributor in 2006 the overall industry growth has slowed up until 2011 when it became the number one contributor. Adding this general understanding to the results from the survey about "Factors Influencing the Uptake of Biodiesel by US Industries" provides powerful insights about what has caused the industry not to boom as expected.

Our three main hypotheses that we derive from the literature are as follows: a) political factors are one of the most influential factors in the decision whether or not to use biodiesel, b) prevalence and promotion of other fuel sources have hindered biodiesel adoption, and c) lack of appropriate biodiesel marketing efforts has been a top influence the uptake of this biofuel by the US industries. In order to validate/invalidate these hypotheses we specifically address the participants with questions regarding political, marketing, environmental, logistical, operational and cost factors. Further drilling down into the survey we asked them about elements within each factor such as (but not limited to) regulatory and trade barriers, use and availability of other fuels, and promotion and placement of biodiesel. Including other potential influences is an important part of invalidation that allows us to extract the most possible value from participants without requiring a follow-up study for factors not captured in our hypotheses. From these other influences we have included considerations for things like "cleantech" (wind power, solar power, etc.), biodiesel power output and price of biodiesel.

This will be the first study to effectively survey the affected industry populations and determine causes of biodiesel's less-than-expected adoption. The majority of prior research about the biodiesel market has been dependent on the use of projection models, extensive literature reviews and speculation about future potential. Breaking away from the theories and calculations to get up close and personal with the individuals most directly involved in the question of "to use or not to use" biodiesel gives this research a unique perspective and very practical implications for both the near and distant future.

III – *Study*

For a complete review of the questions and format of the survey provided to participants please refer to appendix #1.

This survey was sent to 1,187 and received a total of 176 responses for a response rate of about 14.8% within 2 weeks of distribution over the business-oriented social network LinkedIn. In order to clean the data we removed anyone who failed to input answers for all of the factors and their elements, giving us 98 respondents. To complete our analysis of the cleaned data we used basic tools (mean, charts, etc.), correlation and regression analysis.

The results from the survey validate that the data collection method was effective at targeting a specific demographic. This is indicated by the fact that the six largest responding segments were 1) Energy – 21%, 2) Auto – 12%, 3) Manufacturing – 10%, 4) Transportation – 8%, 5) Utilities – 8%, 6) Aerospace – 7% making a total of 66% of the respondents, with 34% being "other" such as accounting, air transportation and many more.

Examining simple means (averages) of each element in each factor gives us a definitive measurement of how they rank against each other in terms of influence over the use/non-use decision for biodiesel. The highest three ranking elements in order from most influential to least are: other fuels are more readily available, costs to implement and lacking availability of biodiesel products. The lowest three ranking elements in order from most to least influential are: less concerned with climate change, currently receiving subsidies for fossil fuels and having a manager shut the thought of biodiesel down.

Our initial correlation analysis looked at the variables of managerial authority, current biodiesel use, estimations of business fuel dependence, and the relevant factors to biodiesel uptake (environmental, logistical, political, operational, cost, marketing). After doing the large-scale correlation analysis on over 5,289 data points many elements ended up exhibiting strong correlation that provide excellent insights. In order to validate these insights we picked two elements that are about (-).20 correlation and ran a regression analysis which confirmed significance with a factor of .044 which is less than P-Value=.05. For this reason we understand that anything with a correlation of at least (-).20 or more is statistically significant and should be considered in our results.

As a first-off comment we acknowledge the merit of having no industry selection (Accounting-Utilities) that correlates with any other aspect included in the analysis. This asserts that no one industry is expressing values that are indicated as either a strong negative or strong positive correlation with any of the factors or ranges of fuel dependency. Without these correlations our research provides an understanding of the industries indifferently without confining the results to any industry's domination of any characteristic or perspective.

With many elements that indicated a strong correlation in either a positive or negative regard we took note of each individually and decided based on prior knowledge and the initial secondary research which would be worthy of mentioning in the report. An example as to why this filtering of results would be necessary is the strong negative correlation between whether or not the business uses biodiesel and the estimated percentage of biofuels used by the business. As the percentage of biofuels increases, the value associated with the question of

use/non-use of biodiesel decreases (values of 1 Yes [use], 2 No [non-use], 3 I Don't Know). This means that there is an unsurprising correlation between people who use biodiesel and people who use biofuels. These unsurprising and obvious correlations are not of value to the research and so have been excluded from the report.

Key Insights:

Do you use biodiesel in your business? vs We do not use biodiesel…

- … because of lacking subsidies.

[Strong Positive Correlation of .22156]

- … because of adoption of negative industry schemas (about biodiesel).

[Strong Positive Correlation of .22549]

- … because of few or no existing liquid fuel systems (used in the business).

[Strong Positive Correlation of .20045]

- … because of lack of promotion (of biodiesel products).

[Strong Positive Correlation of .21544]

% of fuel dependence? (Nuclear) vs We do not use biodiesel…

- … because of lacking subsidies.

[Strong Positive Correlation of .20452]

- … because it is a combustible fuel.

[Strong Positive Correlation of .22124]

- % of fuel dependence (Other Fossil Fuels).

[Strong Negative Correlation of -.41719]

% of fuel dependence (Natural Gas) vs We do not use biodiesel…

- … because our employees are not adequately trained.

[Strong Negative Correlation of -.26899]

- … because of concerns about external supply chain malfunctions.

[Strong Negative Correlation of -.27533]

- … because of lack of IT support/integration (for biodiesel products).

[Strong Negative Correlation of -.25482]

- … because of a slow bureaucracy.

[Strong Negative Correlation of -.29659]

- … because of supply chain diversity.

[Strong Negative Correlation of -.25774]

- … because of trade barriers.

[Strong Negative Correlation of -.22332]

- … because of negative industry schemas (about biodiesel)

[Strong Negative Correlation of -.20173]

- … because of lack of subsidies (for biodiesel products).

[Strong Negative Correlation of -.22241]

- … because of regulatory barriers.

[Strong Negative Correlation of -.28005]

- … because of shelf-life.

[Strong Negative Correlation of -.24408]

- … because of concerns about internal supply chain malfunctions.

[Strong Negative Correlation of -.25473]

- … because of lack of common awareness.

[Strong Negative correlation of -.27614]

- … because existing diesel system cannot handle biodiesel.

[Strong Negative Correlation of -.3361]

- … because of prior misrepresentations (of biodiesel).

[Strong Negative Correlation of -.25681]

- … because of lack of promotion (of biodiesel products).

[Strong Negative Correlation of -.35503]

- … because of lack of peripheral incentives (to use biodiesel).

[Strong Negative Correlation of -.29336]

% of fuel dependence (Other Fossil Fuels): We do not use biodiesel…

- … because of concerns about malfunctions with external supply chain.

[Strong Positive Correlation of .26982]

- … because of perceived lack of profitability.

[Strong Positive Correlation of .21195]

- … because there are few or no systems that use liquid fuel.

[Strong Negative Correlation of -.25482]

- …because of lacking IT support and integration (for biodiesel products).

[Strong Positive Correlation of .27931]

- … because existing fuel systems are unable to convert (to biodiesel).

[Strong Positive Correlation of .26103]

- … because of a slow bureaucracy.

[Strong Positive Correlation of .30492]

- … because of adoption of industry culture.

[Strong Positive Correlation of .24047]

- … because of regulatory barriers.

[Strong Positive Correlation of .20131]

- … because of concerns about malfunctions with internal supply chain.

[Strong Positive Correlation of .21447]

- … because there is not enough biodiesel in supply to meet needs.

[Strong Positive Correlation of .25626]

These are just a small portion of the overall data points that have been generated, and they depict a great deal of information. For the sake of brevity and relevance we shall limit our view to these correlations and leave the remainder for later study. In the conclusion we will readdress our initial hypotheses and so for now we will discuss the potential applications of the above data.

This data set is pulled from correlations related to whether or not the businesses uses

biodiesel and the % of fuel dependence that they might have. Once again only obvious realizations have been left out, such as the positive correlation between electric vehicles not having liquid fuel systems and not using biodiesel.

What we find is that this method of analysis provides us a great view into the overall perspective of businesses not using biodiesel. With these four questions we can examine their elements and what this might mean for the biodiesel industry.

Starting off with “Do you use biodiesel in your business?” we are looking at the correlations between this and the reasons as to why the business may not use biodiesel. All correlations were Strong Positive meaning that as more people agree to the statements more people either do or do not use biodiesel. In essence, when it says “We do not use biodiesel because of lacking subsidies” has a Strong Positive Correlation with “Do you use biodiesel?” this is likely because it is a widely agreed upon factor as to why businesses do not use biodiesel. The same goes for the rest of the statements involving “lack of promotion”, “adoption of negative industry schemas” and “few or no liquid fuel systems”.

When looking at the second question that has strong correlations, “% of fuel dependence (Nuclear)”, we see two Strong Positive Correlations with “lacking subsidies” and “it’s a combustible fuel”. This indicates that these two considerations may be the most significant for businesses that are dependent on nuclear power as a fuel source. We also find one Strong Negative Correlation with “% of fuel dependence (Other Fossil Fuels)” which tells us that companies involved in nuclear are not likely to be dependent on other fossil fuels.

The third question that we have extracted for the purpose of this report is “% of fuel dependence (Natural Gas)” where every strong response came out to be negative. With a full section of Strong Negative Correlations we must take a look at what may make natural gas different from other fossil fuels (discussed in the next paragraph). The natural gas industry has recently seen a good bit of prevalence and it is largely responsible for the US push towards energy independence facilitated by President Barack Obama. Being adopted as a “clean burning alternative” to the old standard of coal it may be that many people in the natural gas industry are aware of other clean burning alternatives and so may disagree with a lot of the reasons not to use biodiesel. Also, in some scenarios natural gas can be produced renewably though this is a very small minority when compared to the larger hydraulic fracturing enterprise.

The fourth question is “% of fuel dependence (Other Fossil Fuels)” and demonstrates a stark contradiction to the previous natural gas section. There is only one Strong Negative Correlation in this section and it is not using biodiesel “… because of few or no liquid fuel systems” which makes sense. The rest are all Strong Positive Correlations involving everything from “regulatory barriers” to there being “not enough biodiesel in supply”. Overall most of these are not that surprising and help to clarify what areas need to be addressed for biodiesel to see greater adoption in this area. One part that is very interesting and rather critical to comment on is the fact that some businesses may not be using biodiesel because of “industry culture”. With this culture in place it is unlikely for the businesses involved to ever see the cleaner burning renewable resource as a serious consideration. However if this culture is either eroded or supplemented with a new culture this could be quite an opportunity for incoming biodiesel businesses.

For the full list of notable insights please see appendix #2.

All analyses were completed using Microsoft Excel.

IV – *Conclusion*

The aggregate of this study boils down to readdressing the initial three hypotheses which were: a) political factors are one of the most influential factors in the decision whether or not to use biodiesel, b) prevalence and promotion of other fuels have hindered biodiesel adoption, and c) lack of appropriate biodiesel marketing efforts has influenced the uptake of this biofuel by the US industries.

Quite surprisingly political factors did not turn out to be one of the top factors influencing the uptake of biodiesel, invalidating our first hypothesis. We were able to confirm this by comparing the average ranking of individual elements from each of the sets. What we found is that Political Factors only had two elements exceed a ranking of three (neutral): Industry Culture (3.12), Following Industry Trends in Technology (3.12). In contrast Cost Factors had three elements surpass a ranking of three (neutral): Price (3.08), Costs to Implement (3.38), Not Perceived to be Profitable (3.13); Logistical Factors had two elements above a ranking of three as well: Other Fuels Are More Readily Available (4.05), Insufficient Biodiesel Supply (3.09); and Marketing Factors also had three elements at this same level: Lack of Common Awareness (3.18), Lack of Availability (3.21) and Lack of Promotion (3.07). For this reason we must not reject the null hypotheses and have affirmed that another factor must be more influential in the decision whether or not to use biodiesel fuel, with a good bit of direction towards Logistical, Cost and Marketing Factors.

Our second hypothesis was confirmed by the study, being that the prevalence and promotion of other fuels has significantly impacted the adoption of biodiesel by US industries. **The**

overwhelming response to the element "We do not use biodiesel because… other fuels are more readily available" has provided a critical piece of insight that perfectly addresses this idea. With an average ranking of 4.05/5 it stands out as the most universally agreed upon reasoning for why biodiesel has not seen the expected adoption that it was set for following 2005. This is incredibly understandable because it is the same reason why the use of methanol and ethanol as a primary fuel source is not widely prevalent. Asking ourselves if there is something preventing these biofuels from entering the market we encounter the most obvious barrier to its growth, the fossil fuel market. Knowing that other biofuels have failed to successfully penetrate the existing channels for fuel placement, we conclude that in order to make biodiesel more available the industry will have to establish its own channels for placement and distribution.

Also, we wanted to investigate the potential for poor marketing efforts to be one of the reasons for biodiesel's less-than-spectacular expansion in recent years. What we found is that this is very much the case, where three of the elements in the Marketing Factors segment averaged ranks above three (neutral). These elements were Lack of Promotion (3.07), Lack of Availability (3.21), and Lack of Common Awareness (3.18). This places Marketing Factors in the top three factors influencing the uptake of biodiesel by US industries, validating this hypothesis. What this indicates is that the biodiesel businesses within the US needs to work on promoting their efforts and ensuring availability of products if they wish to encourage adoption.

Overall the experiment was a resounding success, with two hypotheses validated and one invalidated. We learned that we were correct in hypothesizing that Marketing Factors and the

availability of other fuels may be influencing the uptake of biodiesel, while we were surprised to learn that Political Factors are not as influential. Implications of these findings would be that they can be used to educate biodiesel businesses of opportunities and perceived shortfalls from relevant industries. Increasing marketing activities and focusing on enhancing availability of biodiesel will help to drive greater adoption rates. A great benefit of the experiment is found in the trove of additional data, where follow-up research can be done to further the understanding of the factors influencing the biodiesel industry.

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Appendix

#01 – Survey Questions

1. What industries are you involved in? (Hold the [Ctrl] button to select multiple) □ Accomodations □ Accounting □ Advertising □ Aerospace □ Agriculture & Agribusiness □ Air Transportation □ Apparel & Accessories □ Auto □ Banking □ Beauty & Cosmetics □ Biotechnology □ Chemical □ Communications □ Computer □ Construction □ Consulting □ Consumer Products □ Education □ Electronics □ Employment □ Energy □ Entertainment & Recreation □ Fashion □ Financial Services □ Food & Beverages □ Health □ Information □ Information Technology □ Insurance □ Journalism & News □ Legal Services □ Manufacturing □ Media & Broadcasting □ Medical Devices & Supplies □ Motion Pictures & Video □ Music □ Pharmaceutical □ Public Administration □ Public Relations □ Publishing □ Real Estate □ Retail □ Service □ Sports □ Technology □ Telecommunications □ Tourism □ Transportation □ Travel □ Utilities □ Video Game □ Web Services
2. In what department is your position? □ Purchasing □ Operations □ Research & Development □ Environmental □ Public Relations □ Marketing □ Accounting □ Engineering □ Other _____
3. Do you have a managerial position? □ Yes □ No
4. Do you use biodiesel in your business? □ Yes □ No □ I don't know

5. Estimate: What percentage of each fuel does your business currently depend on? (Total = 100%) _____ Nuclear _____ "Clean Tech" (Solar, Wind, Geo, etc.) _____ Natural Gas (LNG, CNG, etc.) _____ Other Fossil Fuels (Diesel, Gasoline, Coal, etc.) _____ Biofuels (Ethanol, Biodiesel, etc.) _____ "Electricity" (Electric Vehicles)
6. In this research we would like to know what Cost Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree Neither agree nor disagree

Somewhat agree

Strongly agree

... we are not adequately trained

□ □ □ □ □

... of the price of biodiesel

□ □ □ □ □

... we are concerned about malfunctions with supply chain

□ □ □ □ □

... of the costs to implement biodiesel

□ □ □ □ □

... it is not perceived to be profitable

□ □ □ □ □

7. In this research we would like to know what Operational Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree

Neither agree nor disagree

Somewhat agree

Strongly agree

... we have few (or no) systems that use liquid fuel

□ □ □ □ □

... of the lack of IT support/integration services available

□ □ □ □ □

... our existing liquid fuel system is unable to convert

□ □ □ □ □

... we have a slow bureaucracy that has not processed the idea yet

□ □ □ □ □

... our collaborators have not switched to biodiesel

□ □ □ □ □

... we had a manager shut the idea down

□ □ □ □ □

... supply chain diversification

□ □ □ □ □

8. In this research we would like to know what Political Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree Neither agree nor disagree

Somewhat agree

Strongly agree

... we are less concerned about climate change

□ □ □ □ □

... there are trade barriers preventing its adoption

□ □ □ □ □

... we receive subsidies for use of fossil fuels or receive fuels from a subsidized provider

□ □ □ □ □

... of the industry culture

□ □ □ □ □

... we adopt a negative industry schema about biodiesel

□ □ □ □ □

... there are a lack of subsidies available for biodiesel

□ □ □ □ □

... we follow the industry trends in technology

□ □ □ □ □

... there are regulatory barriers preventing its adoption

□ □ □ □ □

9. In this research we would like to know what Logistical Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree Neither agree nor disagree

Somewhat agree

Strongly agree

... we are concerned about shelflife of biodiesel products

□ □ □ □ □

... other fuels are more readily available

□ □ □ □ □

... we are concerned about malfunctions with internal supply chain

□ □ □ □ □

... there is not enough biodiesel in supply to satisfy our need

□ □ □ □ □

... we do not have the existing liquid fuel storage systems

□ □ □ □ □

... fuel efficiency is too low

□ □ □ □ □

10. In this research we would like to know what Environmental Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree

Neither agree nor disagree

Somewhat agree

Strongly agree

... we do not perceive biodiesel to be a cleaner alternative

□ □ □ □ □

... of environmental hazards during biodiesel production

□ □ □ □ □

... we are currently using LNG

□ □ □ □ □

... it is a combustible fuel

□ □ □ □ □

... we have a preference for "clean tech"

□ □ □ □ □

... we are concerned about land use/deforestation for biodiesel

□ □ □ □ □

... other fuels are cleaner burning

□ □ □ □ □

11. In this research we would like to know what Marketing Factors are influencing the uptake of biodiesel by your business. If your business does use biodiesel please let us know why it is not the sole source of fuel/energy for your organization.

We do not use biodiesel in our business because... Strongly disagree Somewhat disagree

Neither agree nor disagree

Somewhat agree

Strongly agree

... lack of common awareness about biodiesel

□ □ □ □ □

... we believe that our existing diesel system cannot handle biodiesel products

□ □ □ □ □

... lack of availability of biodiesel products

□ □ □ □ □

... we have seen previous misrepresentations of biodiesel products

□ □ □ □ □

... lack of promotion of biodiesel products

□ □ □ □ □

... we are simply unaware of any benefits

□ □ □ □ □

... lack of peripheral incentives (additional perks when buying/using biodiesel)

□ □ □ □ □

12. Were there any factors that came to mind that we did not mention?

13. Do you have any additional comments for the researchers?

14. How many employees work at your business? □ 1-50 □ 51-500 □ 501-5,000 □ 5,001 - 10,000 □ 10,001 - 50,000 □ 50,001 - 100,000 □ 100,001 - 500,000 □ 501,000 - 1,000,000 □ 1,000,000+

15. What are total revenues for your business? □ < $1 million □ $1 million - $10 million □ $10 million - $50 million □ $50 million - $200 million □ $200 million - $500 million □ $500 million - $1 billion □ $1 billion - $5 billion □ $5 billion - $15 billion □ $15 billion - $50 billion □ $50 billion - $100 billion □ $100 billion+

16. What is the name of your business?

#02 – Please note that all insights reflect only the perceptions of the surveyed population.

Element #1	Element #2	Correlation (-1 – 1)	Insight
Do you use biodiesel in your business?	Lack of Subsidies	.221562	Strong Positive Correlation tells us that (not using biodiesel because of) lacking subsidies coincides with many of these individuals' businesses not using the fuel.
	Adopt Negative Industry Schema	.22549	Strong Positive Correlation tells us that (not using biodiesel because of) adoption of negative industry schemas about biodiesel coincides with many of these individuals' businesses not using the fuel.
	No or Few Existing Liquid Fuel Systems	.200453	Strong Positive Correlation tells us that (not using biodiesel because of) a lack of existing liquid fuel systems coincides with many of these individuals'

			businesses not using the fuel.
	Lack of Promotion	.215438	Strong Positive Correlation tells us that (not using biodiesel because of) a lack of promotion for biodiesel coincides with many of these individuals' businesses not using the fuel.
% of fuel dependence (Nuclear)	Lack of Subsidies	.204518	Strong Positive Correlation tells us that (not using biodiesel because of) a lack of subsidies for biodiesel coincides with many of these individuals' businesses being dependent on nuclear energy.
	It is a Combustible Fuel	.221243	Strong Positive Correlation tells us that (not using biodiesel because of) biodiesel being a combustible fuel coincides with many of these individuals' businesses being dependent on nuclear energy.
	% of fuel dependence (Other Fossil Fuels)	-.41719	Strong Negative Correlation tells us that (not using biodiesel because of) dependence on other fossil fuels is inversely related with many of these individuals' businesses not being dependent on nuclear

			energy (and vice versa)
% of fuel dependence (Natural Gas)	Not Adequately Trained	-.26899	Strong Negative Correlation tells us that (not using biodiesel because of) inadequate training is inversely related with a greater dependence on natural gas
	Concerned About Supply Chain Malfunctions	-.27533	Strong Negative Correlation tells us that (not using biodiesel because of) concerns about supply chain malfunctions is inversely related with dependence on natural gas
	Lack of IT Support/Integration	-.25482	Strong Negative Correlation tells us that (not using biodiesel because of) presence of IT support/integration is inversely related with a greater dependence on natural gas
	Slow Bureaucracy	-.29659	Strong Negative Correlation tells us that (not using biodiesel because of) slow bureaucracies is inversely related with dependence on natural gas
	Supply chain diversity	-.25774	Strong Negative Correlation tells us that (not using biodiesel because of) supply chain diversity is inversely related

			with dependence on natural gas
	Trade Barriers	-.22332	Strong Negative Correlation tells us that (not using biodiesel because of) the presence of trade barriers is inversely related with dependence on natural gas
% of fuel dependence (Natural Gas)	Negative Industry Schema	-.20173	Strong Negative Correlation tells us that negative industry schemas about biodiesel have an inverse relationship with dependence on natural gas.
	Lack of Subsidies	-.22241	Strong Negative Correlation tells us that (not using biodiesel because of) lacking subsidies are inversely related with dependence on natural gas.
	Regulatory Barriers	-.28005	Strong Negative Correlation tells us that (not using biodiesel because of) regulatory barriers are inversely related with dependence on natural gas.
	Shelf-Life	-.24408	Strong Negative Correlation tells us that (not using biodiesel because of) shelf-life is inversely related with dependence on natural gas.

	Malfunctions with Internal Supply Chain	-.25473	Strong Negative Correlation tells us that (not using biodiesel because of) concern about malfunctions with the internal supply chain is inversely related with dependence on natural gas.
% of fuel dependence (Natural Gas)	Lack of Common Awareness	-.27614	Strong Negative Correlation tells us that (not using biodiesel because of) lack of common awareness is inversely related with dependence on natural gas.
	Existing Diesel System Cannot Handle	-.3361	Strong Negative Correlation tells us that (not using biodiesel because of) incapability with existing diesel system is inversely related with dependence on natural gas.
	Prior Misrepresentations	-.25681	Strong Negative Correlation tells us that (not using biodiesel because of) prior misrepresentation is inversely related with dependence on natural gas.
	Lack of Promotion	-.35503	Strong Negative Correlation tells us that (not using biodiesel because of) lack of promotion is inversely related with dependence on

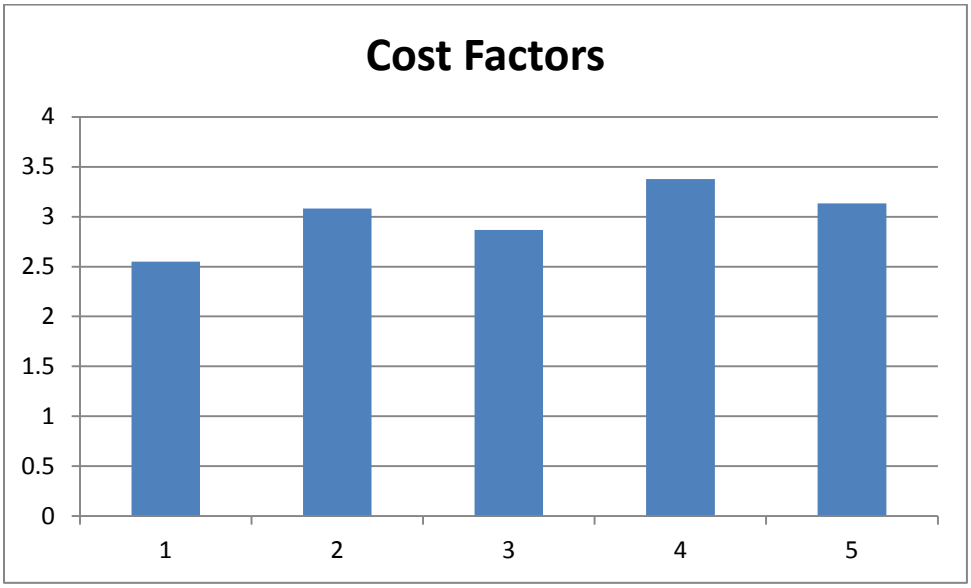
			natural gas.
	Lack of Peripheral Incentives	-.29336	Strong Negative Correlation tells us that (not using biodiesel because of) lack of peripheral incentive is inversely related with dependence on natural gas.
% of fuel dependence (Other Fossil Fuels)	Concerned about Malfunctions with Supply Chain	.269817	Strong Positive Correlation tells us that (not using biodiesel because of) concern about malfunctions with supply chain coincides with dependence on other fossil fuels
	Perceived Lack of Profitability	.211946	Strong Positive Correlation tells us that (not using biodiesel because of) perceived lack of profitability coincides with dependence on other fossil fuels
	Few or No Systems That Use Liquid Fuel	-.26482	Strong Negative Correlation tells us that (not using biodiesel because of) having no or few liquid systems is inversely related to dependence of other fossil fuels
	Lack of IT Support/Integration	.27931	Strong Positive Correlation tells us that (not using biodiesel because of) having a lack of IT support/integration coincides with the use

			of other fossil fuels
	Existing Fuel System Unable To Convert	.261025	Strong Positive Correlation tells us that (not using biodiesel because of) existing fuel systems that are unable to convert coincides with the use of other fossil fuels
% of fuel dependence (Other Fossil Fuels)	Slow Bureaucracy	.304918	Strong Positive Correlation tells us that (not using biodiesel because of) a slow bureaucracy coincides with the use of other fossil fuels
	Industry Culture	.240466	Strong Positive Correlation tells us that (not using biodiesel because of) having adopted industry culture coincides with the use other fossil fuels
	Regulatory Barriers	.201311	Strong Positive Correlation tells us that (not using biodiesel because of) regulatory barriers coincides with the use of other fossil fuels
	Concerns About Malfunctions with Internal Supply Chain	.214474	Strong Positive Correlation tells us that (not using biodiesel because of) concern about malfunctions with internal supply chain coincides with the use of other fossil fuels
	Not Enough Biodiesel Supply to Meet Our	.256256	Strong Positive Correlation tells us

	Needs		that (not using biodiesel because of) insufficient biodiesel supply coincides with the use of other fossil fuels
% of fuel dependence (Other Fossil Fuels)	Lack of Common Awareness	.241155	Strong Positive Correlation tells us that (not using biodiesel because of) lack of common awareness coincides with the use of other fossil fuels
	Previous Misrepresentations	.207851	Strong Positive Correlation tells us that (not using biodiesel because of) previous misrepresentation coincides with the use of other fossil fuels
	Lack of Promotion	.220685	Strong Positive Correlation tells us that (not using biodiesel because of) previous misrepresentation coincides with the use of other fossil fuels
% of fuel dependence (biofuels)	No or Few Liquid Fuel Systems	-.20327	Strong Negative Correlation tells us that (not using biodiesel because of) having no or few liquid systems is inversely related to dependence on biofuels
	Combustible Fuel	-.2378	Strong Negative Correlation tells us that (not using biodiesel because of)

			it being a combustible fuel is inversely related to dependence on biofuels

#03 – Factors and Their Elements



We do not use biodiesel because…

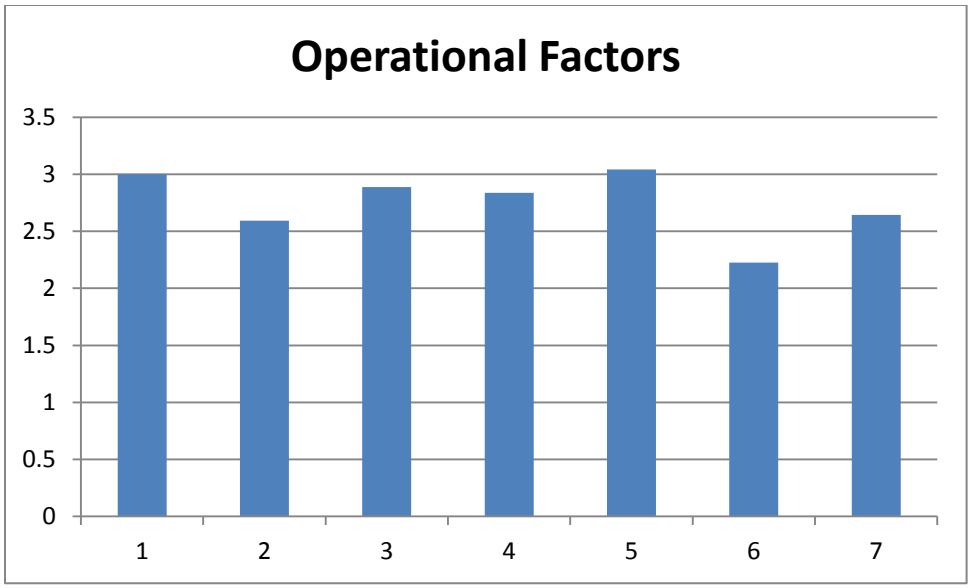
1: … we are not adequately trained

2: … of the price of biodiesel

3: … we are concerned about malfunctions with supply chain

4: … of the costs to implement biodiesel

5: … it is not perceived to be profitable



We do not use biodiesel in our business because…

1: … we have few (or no) systems that use liquid fuel

2: … of the lack of IT support/integration services available

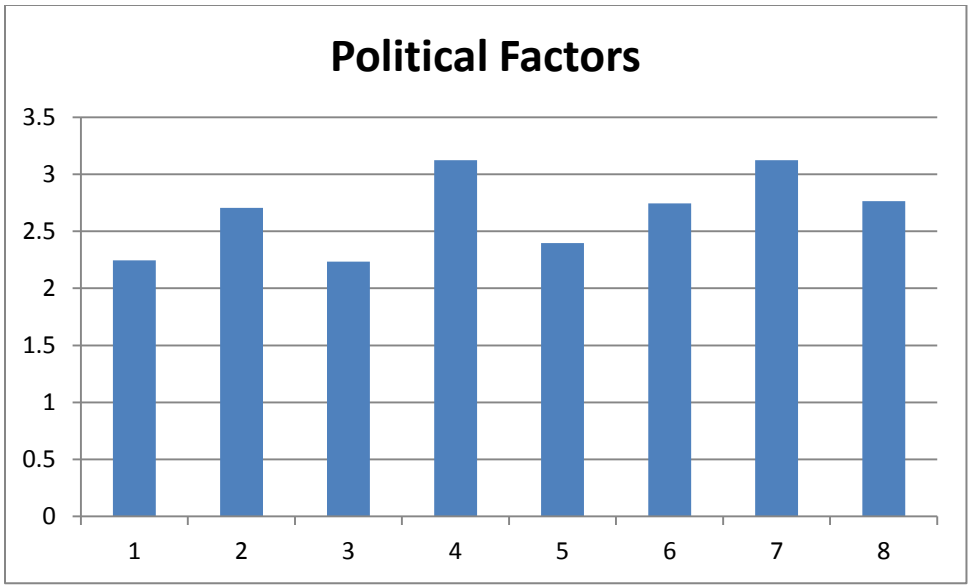
3: … our existing liquid fuel system is unable to convert

4: … our existing liquid fuel system is unable to convert

5: … our collaborators have not switched to biodiesel

6: … we had a manager shut the idea down

7: … supply chain diversification



We do not use biodiesel in our business because …

1: … we are less concerned about climate change

2: … there are trade barriers preventing its adoption

3: … we receive subsidies for use of fossil fuels or receive fuels from a subsidized provider

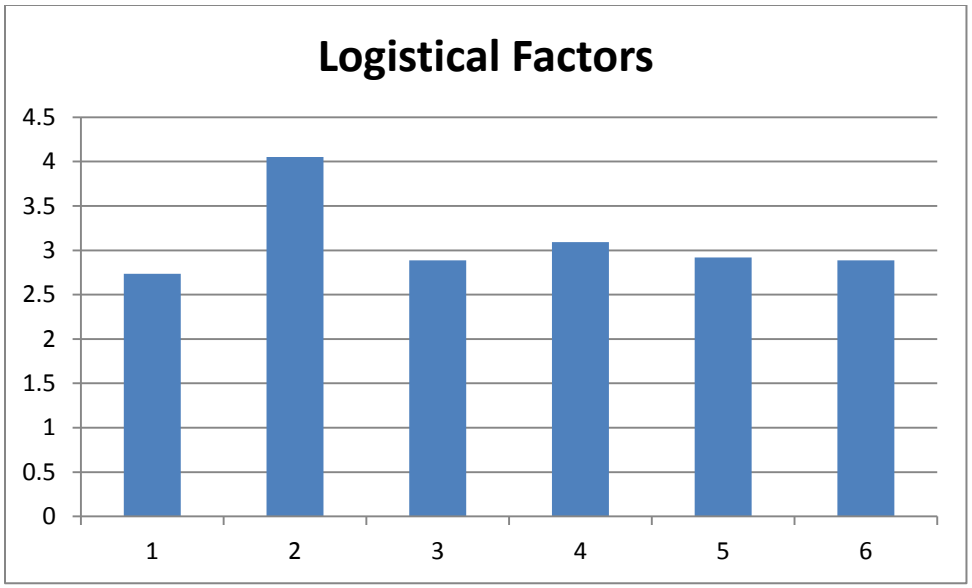
4: … of the industry culture

5: … we adopt a negative industry schema about biodiesel

6: … there are a lack of subsidies available for biodiesel

7: … we follow the industry trends in technology

8: …there are regulatory barriers preventing its adoption



We do not use biodiesel in our business because…

1: … we are concerned about shelf-life of biodiesel products

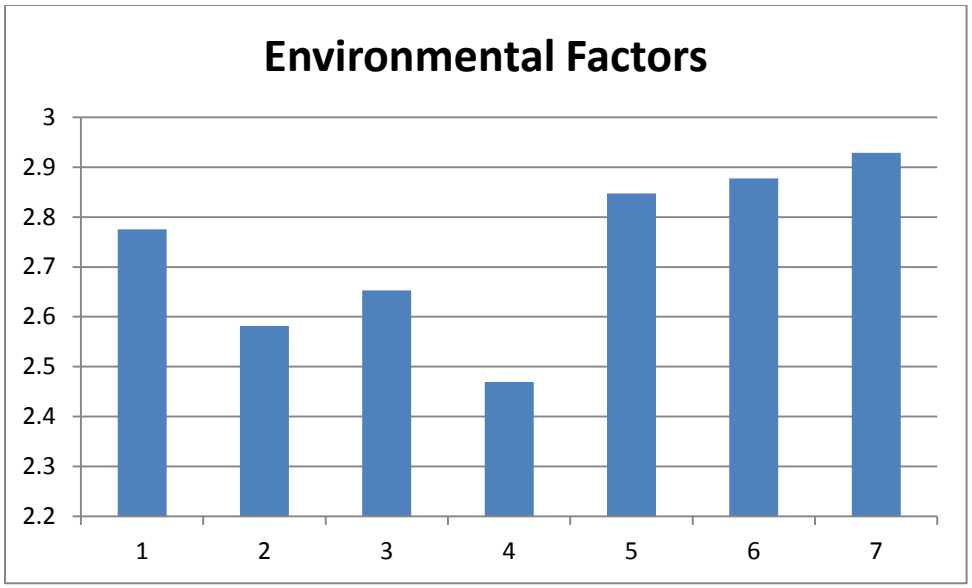
2: … other fuels are more readily available

3: … we are concerned about malfunctions with internal supply chain

4: … there is not enough biodiesel in supply to satisfy our need

5: … we do not have the existing liquid fuel storage systems

6: … fuel efficiency is too low



We do not use biodiesel in our business because…

1: … we do not perceive biodiesel to be a cleaner alternative

2: … of environmental hazards during biodiesel production

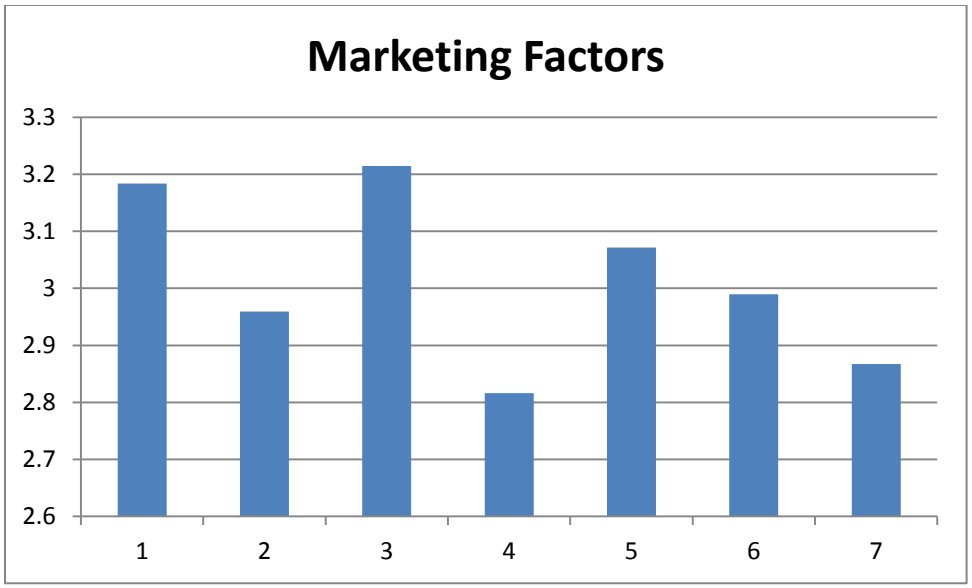
3: … we are currently using LNG

4: … it is a combustible fuel

5: … we have a preference for "clean tech"

6: … we are concerned about land use/deforestation for biodiesel

7: … other fuels are cleaner burning



We do not use biodiesel in our business because…

1: … lack of common awareness about biodiesel

2: … we believe that our existing diesel system cannot handle

3: … lack of availability of biodiesel products

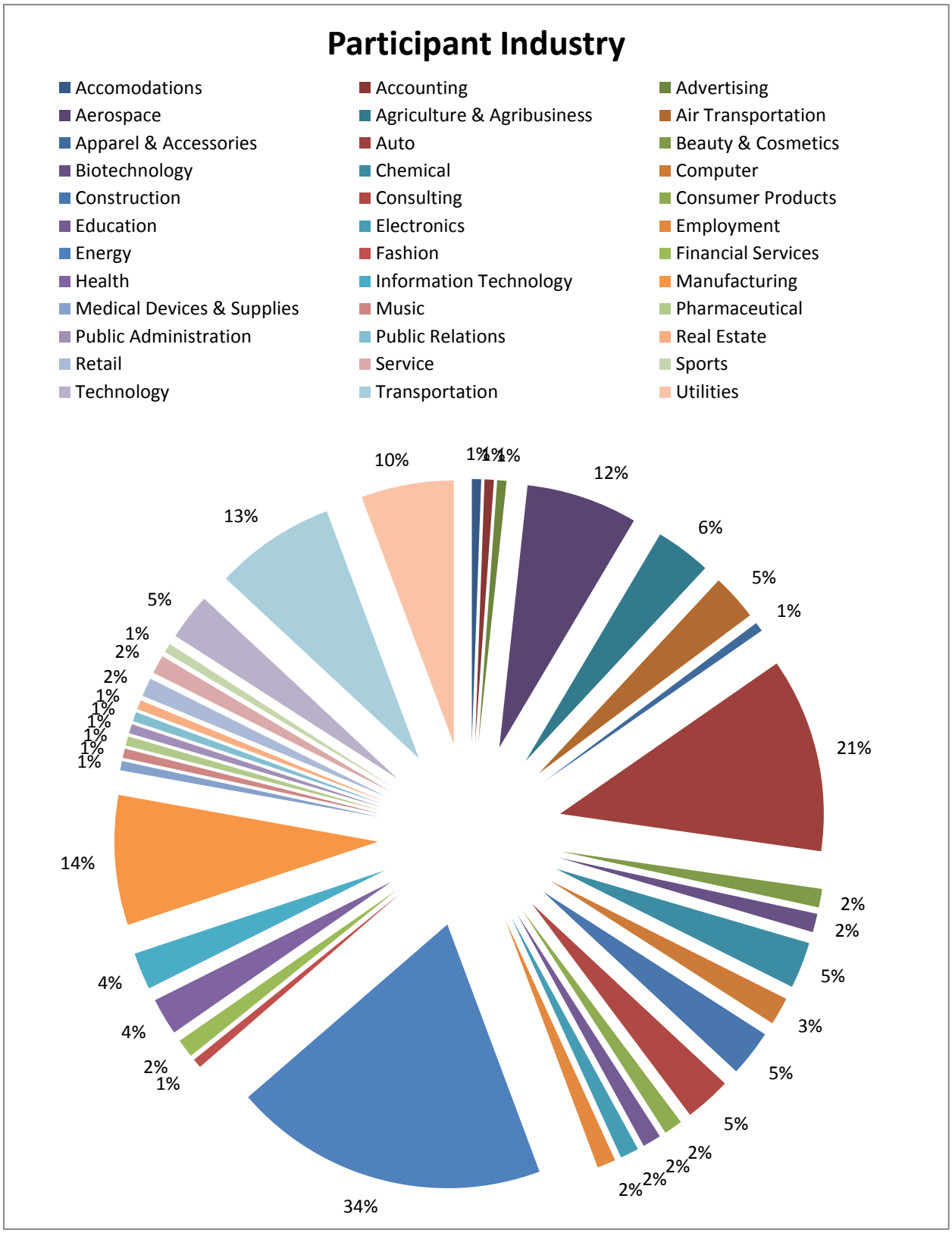
4: … we have seen previous misrepresentations of biodiesel

5: … lack of promotion of biodiesel products

6: … we are simply unaware of any benefits

7: … lack of peripheral incentives (additional perks when buying/using biodiesel)

#04


Participant Industry
Accomodations
Accounting
Advertising
Aerospace
Agriculture & Agribusiness
Air Transportation
Apparel & Accessories
Auto
Beauty & Cosmetics
Biotechnology
Chemical
Computer
Construction
Consulting
Consumer Products
Education
Electronics
Employment
Energy
Fashion
Financial Services
Health
Information Technology
Manufacturing
Medical Devices & Supplies
Music
Pharmaceutical
Public Administration
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Real Estate
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