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Analyzing the factors that influence Chinese consumers' adoption of the biodiesel: The private vehicles owner's investigating in Beijing

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ABSTRACT

The purpose of the research is to study consumers' attitudes towards biodiesel implementation in China. In the paper, authors analyzed the future trends of diesel demand and revealed the prospects of biodiesel in China. And a comprehensive survey has been conducted for 226 private diesel vehicle owners (drivers) in Beijing. The questionnaire survey method is used to collect information, including respondents' viewpoints on fuels selection, biodiesel quality, biodiesel price and related policies. Furthermore, authors applied Structured Equation Modeling (SEM) to analyze the collected data. The results indicate that the most important factor affecting consumers' selection of biodiesel is price. Other significant factors are policy, government incentives and biodiesel quality. Besides, the results also showed that policy and government incentives could affect the price and quality of biodiesel. These results give rise to serious consideration about consumers' preference for and awareness of biodiesel. The research findings will help government and corporations to understand the consumer's energy consumption behaviors and improve the further implementation for biodiesel in Beijing.

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1. Introduction

With the rapid increase of energy demand in the world, the price of fossil fuel has risen sharply. Besides, the global climate change has become a serious problem. Under the circumstances, biodiesel developed rapidly as a new type of green energy which is clean and sustainable. And many scholars and research institutions have conducted a lot of research on biodiesel. As a kind of significant fuel, biodiesel is available, renewable, environment friendly and has higher combustion efficiency [1,2]. "Global Biodiesel Market Analysis and Forecasts to 2020" issued on April 6, 2010 reported that in the first decade of 21st century, the compound annual growth rate of production in global biodiesel market is 41.9%, and the production is expected to increase continually in the second decade, representing a CAGR of 10%. In order to improve energy security and to meet the rising energy consumption, the biodiesel market is expected to produce 45,219 million liters of biodiesel in 2020. At present, the European Union is the world's largest biodiesel producer, accounting for 53% of all biodiesel productions in 2010, followed by the United States. In recent years, emerging markets for biodiesel are expected to develop in China, India, and Brazil [3–5].

China's economy has developed quite fast in recent years; thus the demand of diesel in China has increased a lot. According to the latest data, the annual diesel consumption of China reached 124,329 million tons in 2007, and the number increased to 169,721 million tons in 2012. Scholars estimated that the diesel consumption in China will go up to 210 million tons in 2020 [6]. However, with the dwindling of fossil fuel reserves and increased difficulties in drilling, domestic diesel annual output is difficult to meet the rising consumption of diesel in China. Moreover, the toxic emissions and particulate matter generated from fossil diesel combustion have caused serious air pollution and directly affected citizens' living condition, just like the PM 2.5 pollution in Beijing. As the result, it is impending to promote alternative energy to relieve all of these problems. The development of biodiesel industry conforms to the trend of the times, which can help to reduce dependency on oil and combat air pollution.

As an emerging biodiesel market, China has lagged far behind U.S. and European countries, which might be explained from the following aspects. First of all, the development of biodiesel industry is still in its infancy in China. The promotion for biodiesel is not enough; thus people have limited knowledge about the quality, price and relevant attributes of biodiesel [7]. Second, profit earned from biodiesel is quite low. Due to the rising expense of materials and low sales price, a lot of biodiesel manufactures operate in deficit. Last but not least, biodiesel industry could not enjoy enough support of the government. Since Chinese government has not provided powerful subsidy policy, companies are difficult to develop. Fortunately, government of China have set ambitious targets for the promotion of biodiesel in recent years, namely, achieving 1.93 million tons biodiesel production in 2020, which is 5.75 times as large as the present production (0.34 million tons biodiesel) [8]. If Chinese government wants to achieve the goal, an important issue should be discussed, which refers to the major factors affecting biodiesel's promotion. Therefore, the authors will concentrate on these issues in the study and hope that the research result can present effective strategies for biodiesel corporations and further promote the development of biodiesel in China.

In present studies, most researches focused on the progress, technical analysis and material selection analysis of biodiesel while marketing is omitted. Therefore, this paper adopted the method of questionnaire survey to research the target consumers who has known about biodiesel. Then authors use the Structured Equation Modeling (SEM) to find out the major factors influencing people to adopt biodiesel. Finally, authors will present development strategies of biodiesel industry and give certain suggestions based on the research findings.

SEM is a statistical technique for testing and estimating causal relations through the use of combination of statistical data and qualitative assumptions. SEM has been widely used in healthcare, logistics, information management, banking, psychology, marketing and tourism management. A structural equation model has become a preferred data analysis method for empirical research. Following the trend in empirical research, authors adopt SEM to analyze the first-hand data from survey.

2. Literature review

Biodiesel is considered as one of the alternative fuels which can help to protect the environment and improve energy safety. A fair number of scholars have done relative studies on biodiesel. Most of them believe that regulation and technology are major factors to motivate consumers to use biodiesel. However, private car owners have considerable freedom to choose different types of diesel in China. Therefore, it is not only important to know about biodiesel supply, but also significant to understand consumer purchasing intention. Thus, authors review the literature related to biodiesel from the perception of consumers.

2.1. Policy and government incentives

Government's policy for production is decisive to the popularization of biodiesel [9]. Due to the profitableness of bio-fuel production [10], policy such as government procurement, subsidies on the cultivation of non-food crops and exemption from tax [11,12] will directly promote the development of biodiesel industry. Many countries in the world have adopted various policy initiatives, specific legislation to regulate and improve the use of biodiesel.

In the European Union (EU, the world's largest biodiesel manufacturer), the increasing interest and importance of biodiesel have been recognized by the governments of many countries; thus they have issued biodiesel-related policies [13]. (1) Government procurement—the empirical results done in Spain showed that the procurement of buses that use biodiesel can help to increase the biodiesel consumption [14]. (2) Direct financial subsidy from the governments—the subsidy focuses on start-up of processing enterprises, technology research and raw material production. According to the EU reform in 2003, farmers who grow crops for energy are able to enjoy the "carbon credits" subsidy, namely the policy of 45 euro cents per hectare [15]. (3) Exemption from value added tax—EU allows member countries to apply differentiated tax rates in order to promote bio-fuels. And Europe usually executes high energy tax on conventional fuel.

In the United States, government takes similar measures to support their biodiesel industry. First, various kinds of subsidies were provided to biodiesel research institution and manufactories. Second, Koplow [16] estimated that the tax revenue due to biodiesel exemption would reach almost $1.4 billion US dollar to encourage the application of biodiesel. In addition, American government enlarges sales channels to boost biodiesel consumption. For example, the official vehicles of nearly 350 departments, including the US Army, Park Service and municipal authorities have used biodiesel.

Asia is an emerging market of bio-fuel and the increase in the use of biodiesel also benefits from government supports. In India, Ministry of Rural Development calls on local governments to publicize biodiesel fuel and Oil Ministry is responsible for proposing economic and political strategies to the comprehensive