A COMPARATIVE STUDY OF PROSPECTIVE NATURAL GAS FOR VEHICLE
(NGV) BUYERS' BEHAVIOR INTENTION

By

NONGNUCH LIKITSUWANNAKOOL

A Thesis submitted in partial fulfillment
of the requirement for the degree of

Master of Business Administration

Graduate School of Business
Assumption University
Bangkok, Thailand
May
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3.	Dr. Adarsh Batra	(Member)	…………………..
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ABSTRACT

Global warming and continuing oil price increases have become the appalling issues of the present day. These threatening crises are generally followed by arduous activity throughout the world, particularly in searching for alternative fuels with pollution-free properties. Thailand is at least fortunate enough to have such an alternative fuel as NGV (Natural Gas for Vehicles) officially launched by PTT Company Ltd. This study aims to look into the prospects of how NGV could gain more popularity, or more consumers, throughout the country.

The results of the study suggest that consumer's behavioral intentions toward NGV are affected by factors pertaining to social influences and NGV attributes. Each group contains several variables and is used in verifying its individual impact on consumer's behavioral intention; whereas the geographic locations, demographic factors and vehicle factors are taken into consideration for pin-pointing the main target. Analysis of Variance, Independent Sample T-Test, and Pearson Correlation Coefficient were statistical tools employed for interpreting and analyzing the significant relationships. Non-probability sampling was the main technique used on a quota and a convenience basis.

A survey of 500 potential consumers, comprising 100 respondents in each of the five separate regions, identified relevant geographic locations, demographic factors and their impact on behavior intention, while the differences in vehicle factors did not strongly affect the behavior intention. Moreover, the results of hypotheses testing show that the three highest ranks of significant factors inducing the consumers to use NGV are product attributes (product performance, product safety and appearance), and it is further noted that most of the product attribute factors, as compared to social influence factors, have high correlations with the behavior intention. Hence, PTT should expand the operations of additional refueling facilities throughout the country to assure the NGV users' convenience, and concentrate on the factors that influence the decision to use NGV by the target consumers. This implies that PTT should concentrate on the product itself in order to be successful in increasing the number of NGV users.

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CHAPTER 1
GENERALITIES OF THE STUDY

1.1 Introduction

During the past few decades, automobiles have offered many benefits to mankind. Besides, they have generated large economic advantages to entire societies. For most transportation, the direct cost of transferring passengers and carriages has fallen into a small fraction of the economic value created while the restrictive standard quality has placed importance on the vehicles, fuels, and roads which cause each trip to be cleaner and safer than ever. However, motor transport's ubiquity has also resulted in systemic and increasingly unacceptable problems. Moreover, currently dwindling resources, spiraling costs, and the green house effect, coupled with the vast potential of emerging markets, strongly suggest that sustainable alternatives to traditional mode of transportation (i.e. petroleum based automobiles) need to be explored (Byrne and Polonsky, 2001).

There are huge challenges facing would-be technology innovators and this is further complicated by the fact that achieving broad based sustainable solution requires multi-party action (Chilton, 2000; Lober, 1997). As it becomes increasingly obvious that dependence on finite fossil fuel resources will eventually result in dearth of supply, and the usage of such fuel has significantly contributed to environmental pollution, the drive to bring viable alternative fuel vehicles to market has intensified (Woodruff, Perterson, and Miller, 1991). The range of suggested alternative fuel vehicle types is widely varied and includes Natural Gas for Vehicle (Byrne and Polonsky, 2001).

Natural Gas for Vehicle (NGV) is a natural resource that is found in several parts of the world and available in large quantities. Presently, the utilization of natural gas has become an interesting issue because of its non-toxic, low carbon monoxide polluted and low cost per heating value. Resulting from the fuel crisis, various countries have paid more attention to NGV. It is becoming an alternative fuel of both

government and private sectors in many countries. NGV has been used in mass-transportation systems, such as public buses.

In Thailand, petroleum products, especially petrol, are used as a main source of fuel in transportation system. A total of 919.8 billion Baht worth of petroleum products was imported into the country in 2006 and that included the crude oil alone amounting to 786 billion Baht (BOT and EPPO, 2007). Its industrial development has caused substantial loss in trade balance. Moreover, Thailand is presently facing the problem of air pollution from the industrial fuel, transportation with lots of small particles such as Carbonmonnoxide (CO), Hydrocarbon (HC), Nitrogenoxide (NO_x) and Particulate Matters (PM) which are exceeding the standard level at 120 $\mu g/m^3$. The experimental result of the locally available NGV test indicates that the utilization of this alternative fuel is a viable option to ease the worsening situation (Tepsamrithporn and Chaiyawat, 2001).

It is very significant to study and determine the behavioral intention of Thai people in various region throughout the country who are car owners and non-buyers of NGV. Since buyers' intention scales are used to assess the possibility of a consumer purchasing a product or behaving in a certain ways (Schiffman and Kanuk, 2007) behavior intention has long been recognized in marketing field as a central concept as well as an important goal for referral purchasing of all business activities. Behavior intention is the attitude a consumer develops as a result of his/ her evaluation of the consumption expectation. In addition, behavior intention occurs when the perception of the reward from the purchase of goods or services by the consumer meets or exceeds his/her perceived sacrifice such as price and quality (Anderson, 1996; and Yi, 1988). NGV is a new product of energy of the Petroleum Authority of Thailand Public Company Limited (PTT) which serviced NGV buyers to the tune of 34,234 vehicles in the second quarter of 2007 (http://www.eppo.go.th., 2007) while the company is setting a goal at 171,000 for the year (www.pttplc.com, 06/09/2007). The purpose of this research is to concentrate on finding, developing, and planning factors affecting behavior intention of potential consumers. The following factors are taken into consideration:

The vehicle factors which consist of type of vehicle, life-time, type of engine, and engine power can be considered as real factors relating to the NGV product. These factors are supported by Byrne and Polonsky (2001); Dearing (2000); Berkowitz, Gallini, Miller, and Wolfe (1985); Kazimi (1997); Contadini (2000); Dregfus and Viscusi (1995). All these studies proved that the above factors are affecting the consumer's intention or adoption of fuel for vehicle consumption.

The NGV attributes in this study are modified from the product attributes mentioned in such researches as Individual Factors in Organizational Innovation Adoption by Talukder, Harris and Mapunda (2007); Individual Consequence in Environmentally Responsible Purchase Behavior by Follows and Jobber (2005); and Perceived Value in Irish Consumer Preference for Organic Meat by O'Donovan and McCarthy (2002). The NGV attributes comprise many sub-variables consisting of price perception cost of setting/maintenance, product performance, product safety, availability, time consumption, credibility of organization, information, and appearance. Many factors above are also employed by Byrne and Polonsky (2001); Dregfus and Viscusi (1995); Dearing (2000) as main factors when the consumers make a decision to adopt alternative fuel for transportation.

To better understand intention, a researcher also needs to measure the social influences that urge an individual towards the intention to act. A recent study also reveals that incorporating the consumer's emotional experience into the multi-attribute model has the potential of enhancing the predictability of motives and preferences (Schiffman and Kanuk, 2007). Another interesting research is the Consumer innovativeness and Perceived Risk Implications for High Technology Product Adoption by Hirunyawipada and Paswan (2006) who mentioned that the consumer's social network may affect negative responses that arouse more detailed study about the relationship between risk factors and behavior intention. The social influences are categorized into environmental concern, help country savings, government support, and risk from the number of users. The researcher is inspired by previous work related to Organizational Innovation Adoption: Determinants of the Adoption of Innovation by Individuals within an Organization (Talukder, Harris and Mapunda, 2007).

In addition, it is important to find the relationship among different demographic factors including gender, age, income level, and acceptance of NGV product. A market is divided by geographic location. The strategic philosophy suggests that people who live in the same area will share similar needs and apparently differ from those residing in other areas. Geographic segmentation is a useful tool for many marketers to understand local market needs and target consumers can be easily reached through the local media (Schiffman and Kanuk, 2007). This research focuses on the number of Thai people who are car owners and non-buyer of NGV since they are in the position to decide on modifying their own cars. To select the needed samples, the researcher employed the criterion of people who have own vehicle registered in each of the seventy-six provinces, segmented into five regions according to Thailand's geographical map, i.e. Central Area (include Bangkok), Northern Area, Northeastern Area, Eastern Area, and Southern Area as shown in Figure 1.1. The selected data is illustrated in Table 1.1:

Figure 1.1: Thailand geographical map segmented into five regions
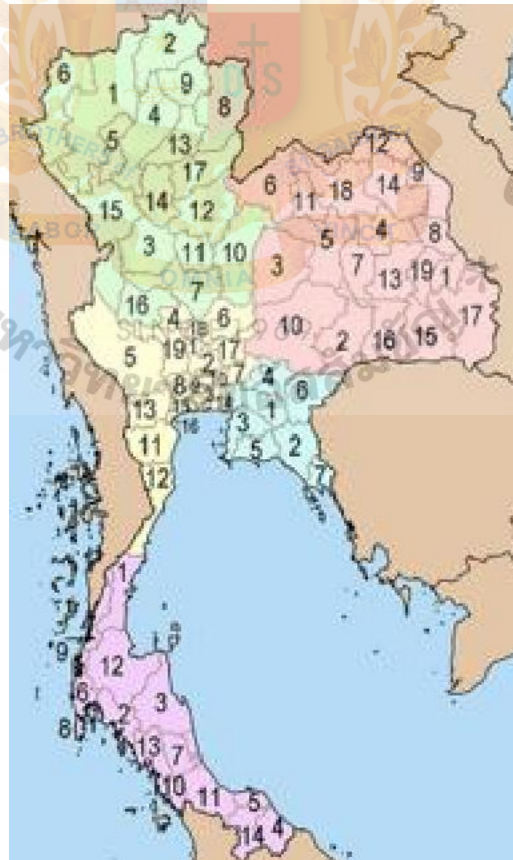
Source: www.thailand-maps.com/ (14/12/2007)

Table 1.1: The highest ranking provinces showing Thai people who have their own vehicles registered in each region of Thailand during 1997-2007

Thai people who have own vehicles registered in Thailand			
Region	**Highest Rank**	**Number (person)**	**Total of Region**
Central Area	Bangkok	2,283,536	3,188,482
Northern Area	Chiang Mai	118,603	377,617
Northeastern Area	Nakhon Ratchasima	187,222	1,085,087
Eastern Area	Chonburi	201,754	534,564
Southern Area	Songkhla	158,430	788,974
Total		**2,949,545**	**5,974,724**
Percentage		**50%**	**100%**

Source: Land Transport Management Bureau, Department of Land Transport (12/12/2007)

From Table 1.1, the cumulative number of Thai people who have their own vehicles registered in each highest ranking province of the five regions for the last ten years amounts to 50 percent of the country's total registration. It can be an indicator that half of the people having their own registered vehicles may turn to use NGV as an alternative fuel. However, this study focuses on the people who are car owners and NGV non-buyers, it does not distinguish the exact number of people who are now using NGV in their modified vehicles in each of the five regions or the so-called unknown population. In conclusion, Table 1.1 does not represent the real population.

1.2 Natural gas for vehicle

Natural gas has been used as a vehicular fuel for more than 80 years. NGV was first introduced in Italy where more than 300,000 cars are now driven by natural gas. Many other countries, spanning from the Americas to Asia and Australia, have adopted NGV as one of the fuels for cars. Today, more than one million cars around the globe are powered by NGV. Sometimes NGV is called compressed natural gas (CNG) because it is pressurized and stored in cylinder tanks at a pressure of 3,000 up to 3,600 pounds per square inch for an internal combustion engine. Natural gas for vehicle (NGV) comprises mostly of methane. In its natural form, NGV is colorless, odorless, and lighter than air. It offers complete and clean burning in engines with lower level of emission than other fossil fuels. It is regarded as an economical, safe,

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environmentally- friendly fuel for vehicles. For these reasons, NGV has become more popular throughout the world.

A summary of useful information about NGV (as available at www.pttplc.com, 06/09/2007; www.pttplc.com/tangv/, 06/09/2007; www.energy .go.th, 11/09/2007; www.ptit.org, 15/11/2007; www.eppo.go.th, 15/11/2007; www.iangv.org, 15/11/2007; and www.ngv.org, 14/12/2007) is hereby presented as follows:

1.2.1 Characteristics of Natural gas for vehicle

Natural gas for vehicle (NGV) has many unique characteristics that differ from other fuels. Table 1.2 shows the comparison of natural gas, gasoline, diesel, and Liquid Petroleum Gas (LPG) including the issues of physical status, safety, flammability limit, usage, combustion efficiency, environment, and fuel quality.

Table 1.2: Comparative Characteristics of Fuels

Comparisons	NGV	LPG	Gasoline/Diesel
Physical Status	Gas	Gas/Liquid at 7 bar	Liquid
Weight	Lighter than air (disperses if leaked)	Heavier than air (tends to unscatter)	Heavier than air and so flows on the ground when leaking
Flammability limit (% by volume)	5 – 15%	2.0 – 9.5%	Gasoline 1.4 – 7.6%, Diesel 0.6 – 7.5%
Auto Ignition Temperature	650 °C	481 °C	Gasoline 275 °C, Diesel 250 °C
Usage	As a gas, it can directly mix with air.	It is liquid that must be gasified before using.	It needs an atomizer to mix it with the air before combustion take place.
Combustion Efficiency	Complete combustion, produces a better flame and leaves no residue	Better combustion than fuel oil and mixes with air better	It burns poorly and creates soot.
Environmental impact	Cleaner and less polluting	Complete combustion and no soot	It burns poorly and creates soot.

Fuel quality	Colorless, odorless; direct fired combustion by natural gas, has no effect on products or processes	Colorless, odorless; odorant is filled for safety and usage	Its color and odor may affect the manufacturing process or product quality.

Source: www. ngv.org (14/12/2007)

From Table 1.2, the properties of NGV such as physical status, weight, flammability limit, auto ignition temperature show that NGV is safer than other fuels. The combustion efficiency and environmental impact of NGV also helps to save the environment, which is indicated in Figure1.2.

Figure 1.2: Comparison of Emission between NGV and Other fuels
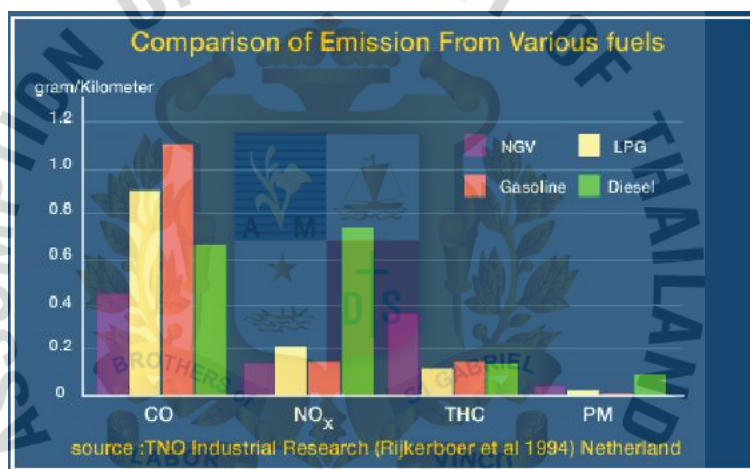
Source: www.pttplc.com (06/09/2007)

From Figure 1.2, the emission from various fuels such as Carbonmonnoxide (CO), Hydrocarbon (HC), Nitrogenoxide (NOx), and Particulate Matters (PM) shows that NGV has lower emissions than the average. It means NGV is more environmentally- friendly.

Apart from the numerous, advantages of its superior properties than other fossil fuels as mentioned above, we can look forward to bringing NGV into more popular use, as one of the possible solutions toward help reducing the green-house effect and global warming. Being lighter than air, natural gas floats when it is leaked into the ambience and thus is safer to use. It is relatively cheaper than other forms of

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petroleum such as oil. Yet, it offers more added value for Thailand to reduce its energy import bills if more people turn to use NGV with their cars. In addition, most of natural gas supplies presently used is produced locally.

On the other hand, there also are some minor cautions in using natural gas: Inhaling excessive volume of hydrogen sulphide that comes with certain natural gas. It may damage the eye tissues and cause respiratory diseases. Being flammable, it may cause fire and explosion when it contacts directly with heat or flames. It is prone to explode if significant volume of natural gas is accumulated in a confined area.

1.2.2 Natural gas for vehicle engine

Natural gas for vehicle engines are classified into two types as follows:

1. **Dedicated NGV or the dedicated natural gas vehicle which operates using only natural gas.**

A vehicle operates only on natural gas and is therefore optimized to take full advantage of the high octane inherent in natural gas. So it helps using fuel more efficiently. See Figure 1.3

Figure 1.3: Dedicated natural gas vehicle

Source: www.pttplc.com (06/09/2007)

2. Dedicated NGV or the dedicated natural gas vehicle which operates using two separate fuel systems.

2.1) Bi-fuel, a vehicle with two separated fuel systems designed to run on either an alternative fuel or a conventional fuel using only one fuel at a time. Typically, gasoline/natural gas bi-fuel vehicles are gasoline vehicles converted to bi-fuel operation by adding natural gas fuel storage, pressure regulation and control systems. The user has to select the setting systems, fumigation or multi-point ports injection (MPI). See Figure 1.4

Figure 1.4: Bi-fuel natural gas vehicle
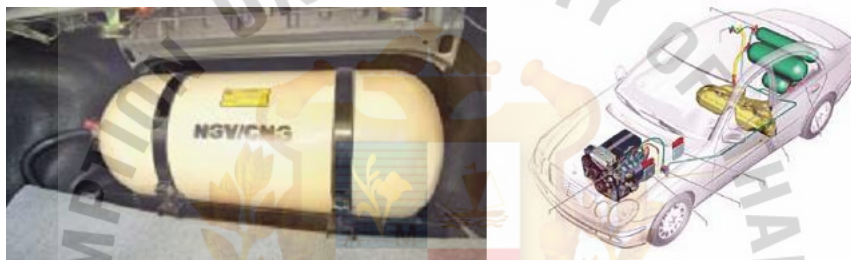
Source: www.pttplc.com (06/09/2007)

2.2) Diesel Dual Fuel, a vehicle designed to operate on some combination of both alternative fuel and conventional fuel simultaneously. Dual-fuel vehicles are equipped with two separate fuel systems, though a duel-duel vehicle can operate on one fuel or the other. See Figure 1.5

Figure 1.5: Diesel Dual Fuel natural gas vehicle

Source: www.pttplc.com (06/09/2007)

This study is focuses on Dedicated NGV or the dedicated natural gas vehicle which operates by using two separate fuel systems because only this system is currently used for private vehicles in Thailand.

Besides, the cylinders for NGV are classified into four material types, the characteristics of which are shown in Table 1.3:

Table 1.3: Comparative Cost and Weight of Fuels Cylinder material

Type of Material	Cost (%)	Weight (%)
Metal	40	100
Aluminum	80-95	65-55
Aluminum with Carbon fiber	90-100	45-25
Plastic with Carbon fiber	90	30

Source: NGV Product Development "Development of All-Composite NGV Fuel
Containers" (Newhouse and Tiller, 1998).

Table 1.3 shows that the percentage of installing cost conflicts with the percentage of weight. It shows that the higher the setting cost, the lower the weight. Generally, the average weight of a 70 liter cylinder is approximately 60-70 kilograms which is quite heavy. The installing cost of NGV system is around 30,000-65,000 baht depending on the type of material and the size of cylinder which is also quite expensive when compared with other fuels.   However, every cylinder needs to be tested and certified by many organizations such as NGV2, FMVSS 304, CSA B-51 Part 2, and ISO/DIS 11439.

1.2.3 Price of Natural gas for vehicle

Generally, NGV is cheaper than gasoline. To promote this clean fuel in Thailand, PTT has set NGV as half the price of diesel oil, or 40% lower than the gasoline price and 20% cheaper than the LPG, the price of which is currently subsidized. Ceiling prices have also been set to ensure that relativity does not go above 55% of the unleaded regular (ULR) gasoline price. This ceiling will be raised to 60% in 2008 and 65% in 2009, respectively (www.pttplc.com, 06/09/2007).

NGV pricing is set in Thailand to maintain the price advantages over other fuels. At present, NGV is priced at 8.50 baht/kg. On an energy-equivalent basis, NGV costs:

29%	of 95 Gasoline	price (33.29 baht/liter)
30%	of 91-Gasoline	price (31.99 baht/liter)
35%	of Diesel	price (29.74 baht/liter)
67%	of LPG	price (9.40 baht/liter).

Remarks: Retail prices are as of 03 Jan, 2008

The speed of recovering investment incurred in NGV conversion depends how extensively a vehicle is used. In other words, the more the car is run, the sooner the cost can be recouped.

1.2.4 Types of Natural gas for vehicle stations

At present, PTT has 153 NGV stations operating to serve the consumers (08/11/2007). The stations are classified into three types as follows:

1. Conventional stations: These conventional stations are located along gas pipelines and are capable of only filling gas into cars.
2. Mother stations: The stations are built along gas pipelines and fill gas into cars and gas tankers.
3. Daughter stations: The stations receive gas from tankers which transports gas from Conventional stations for filling into cars.

At present, there are only Mother and Daughter station systems in Thailand because the pipeline system has yet to be finished. However, PTT plans to add 101 NGV filling stations on stream in 2008 to support the growing number of NGV vehicles (15/08/2007).

1.2.5 Natural gas for vehicle in Thailand

NGV made its debut in Thailand in 1984 when a number of Bangkok buses and *tuk-tuk* taxis underwent the NGV experimental program. Technically, the experiment was a success with satisfactory engine performance being noted. However, the lower cost of prevailing motor fuels and the high costs of modifying engines to NGV fuelling at that time made the program far from economical.

In 1993, the Anand Panyarachun Administration's policy addressing the air pollution problems revived the interest in NGV. Funding supports were granted to the Bangkok Mass Transit Authority (BMTA) to acquire an initial fleet of 82 NGV buses and the country's first NGV filling station were built by PTT at BMTA's Rangsit depot in Bangkok's northern outskirts. PTT embarked on another trial, modifying 12 petrol engine cars and 16 diesel engine vehicles into a brand-new oil/gas bi-fuelling system in 1999. Again, the results were satisfactory.

In 2000, a larger NGV test program was launched when PTT sponsored the costs of turning 100 city taxis into oil/NGV burning vehicles. The success led PTT to start a pilot project by PTT bearing the cost of changing 1,000 taxies into NGV-powered cars. In parallel, PTT has started building additional NGV filling stations in Bangkok and adjoining areas.

In 2002, more than 60% of Thailand's electricity was generated by natural gas. About 77% of some 2,000 MMcfd of gas was directed to the Electricity Generating Authority of Thailand (EGAT), including independent power producers and small power producers. About 8% of the overall gas was delivered to the industrial cycle and 15% to the natural gas separation plants as raw materials. The natural gas has been used to substitute fuel oil, thus saving the country tens of billion of baht a year. Natural gas procured by PTT comes from offshore and inland sources as well as from Myanmar (Burma). Indigenous gas represents about 75% of total gas supplies with the remaining 25% from Yadana and Yetagun fields in Myanmar's Gulf of Martaban.

Currently there are 153 NGV stations in operation, with 90 more under construction. There are almost 34,234 NGVs on the roads, 10% of which are

replacing or supplementing the diesel fuel. In 2006, the country consumed 11 MMSCFD of natural gas for transport use, equivalent to 114 million liters per year of gasoline.

1.3 Historical background of Petroleum Authority of Thailand Public Company Limited (PTT)

Petroleum Authority of Thailand Public Company Limited (PTT) was incorporated as a public company on October 1, 2001 on corporatization from the Petroleum Authority of Thailand under the Corporatization Act of 1999. The history can be summarized as follows: (www.pttplc.com, 06/09/2007 and www.pttplc.com /tangv/, 06/09/2007)

1978 – 1982: PTT played an important role in handing the second world oil crisis. PTT began laying a 415-kilometer submarine pipeline from the Erawan gas field in the Gulf of Thailand to the shore at Rayong, and another 169-kilometer pipeline further to EGAT's South Bangkok power plant

1983 – 1987: PTT constructed through the country six LPG terminals, simultaneously complete with a transportation system under its LPG Market Development Project. Their Majesties the King and Queen, together with HRH Princess Maha Chakri Sirindhorn, HRH Princess Chulabhornwalailak graciously inaugurated PTT's first gas separation plant on April 18. PTT also in a joint venture with the public and private sectors established the National Petrochemical Co., Ltd. and PTT Exploration and Production Co., Ltd.

1988 – 1992: PTT took its first delivery of one trillion cubic feet of natural gas from Erawan, Baanpot, Satun, and Platong fields. PTT commissioned a Gas Separation Plant, Unit 2 in Rayong Province. PTT pioneered the sale of "PTT Hi Octane Unleaded", the first unleaded gasoline in Thailand.

1993 – 1997: PTT achieved the top position in the domestic oil market with a share of 26.8%. PTT commenced operation of its Gas Separation Plant Unit 3 which was located in the same area as Unit 1 & 2 in Rayong, and Plant Unit IV, in Khanom,

Nakorn Si Thammarat. An agreement had been affixed for the supply to PYY of the natural gas produced from Yadana and Yetagun gas fields in Myanmar.

1998 – 2002: The Yadana Natural Gas Pipeline Project was completed, the gas delivery began at the Myanmar-Thai border point of Ban I Tong in Thong Pha Phum, Kanchanaburi, and was further transmitted to the Electricity Generating Authority of Thailand's Ratchaburi combined-cycle power plant as from July 1, 1998 onwards. This was the Thailand's first import of natural gas. PTT invested 1,463-billion Baht to construct Thailand's first international petroleum and petrochemical research and development institute in Wang Noi district of Ayutthaya. In cooperation with Chitrlada Royal Project and ThaiOil to launched for the first time the source of gasohol at its Head Office's service station.

2003 – 2004: PTT was awarded Best Regional Jet Fuel Marketer 2003 from Asia-Pacific Airlines. PTT entered into an agreement to establish District Cooling and Power Plant System Co., Ltd to produce and supply the electricity and the chilled water for Suvarnabhumi Airport. PTT completed the construction of its Gas Separation Plant Unit V.

PTT's future projects will continue to focus on large-scale investments in the natural gas business, in anticipation of its growth. Presently, the major supply of natural gas is distributed to fuel the power generation, which is projected to increase at a rate of about 5.6% a year over the next five years (2007-2011). With that in mind, PTT has formulated plans for additional supply from domestic and external sources to meet its demand with parallel investment plans to expand its distribution network to meet the customers' needs. These have been mapped under the Third Gas Pipeline Master Plan covering a total of 11 onshore and offshore projects, and a new Gas Pipeline for the Sai Noi - South Bangkok Project (for both North and South Bangkok Power Plants).

In order to add more value to the natural gas business chain, PTT plans to invest in an ethane separation project and the sixth gas separation plant with a capacity of 800 MMcf/d to produce ethane as feedstock for the 1,000,000 metric ton/year. PTT has promoted the use of Natural Gas for Vehicles on account of its clean-burning properties and environmental friendliness.

In 2007, PTT has been accredited with 6 National Recognition awards and 4 International Recognition awards reflecting its entrusted and reliable.

1.4 Statement of problem

NGV is one of the alternative fuels that was launched by PTT in order to relieve the country's trading loss from import of expensive fuel and environmental problems. Although, NGV buyers tend to increase to 34,234 vehicles, the figure is still far below the target of 171,000 vehicles set by PTT in the second quarter of 2007, which means the company achieves only 20% of total target for the year. The problem leads the researcher interests in study buyer's behavior intention to find the prospects of how NGV could gain more popularity, or more consumers, throughout the country in order to serve the 80% of missing goal.

Buyer behavior intention scales are used to assess the possibility of consumer purchasing a product (Schiffman and Kanuk, 2007). It is important to study behavior intention in order to understand the attitude of consumers and their evaluation of the consumption expectation toward NGV. Basically, behavior intention occurs when the perception of the reward from the purchase of goods or services by the consumer meets or exceeds his/her perceived sacrifice such as price and quality (Anderson, 1996; and Yi, 1988).

The study aims to analyze the relationship between geographic locations, demographic factors, vehicle factors, social influence, and NGV attributes, all of which influence the behavior intention of car owners, in each of the five regions of Thailand. The findings of this study can help in setting future marketing plans with better consumer appeals for NGV. The benefits lie in helping Thailand to save on the imported costs of gasoline and also reducing air pollution in the future.

Research Questions:

1. Are there any differences between five geographical locations and behavior intention of the car owners who are non-buyers of NGV?

2. Are there any differences between behavior intention and demographic variables of car owners who are NGV non-buyers?

3. Are there any differences between vehicle factors and behavior intention toward NGV behavior intention of the car owners who are NGV non-buyers in five regions which are classified by types of vehicle, life-times of vehicle, types of engine, and engine powers?

4. Are there any relationships between social influence attitudes (environmental concern, helping country in savings, government support, and risk from the number of users) and behavior intention of car owners who have not yet used NGV?

5. Are there any relationships between NGV attributes (price perception, cost of setting/maintenance, product performance, product safety, availability, time consuming, credibility of organization, information, and appearance) and behavior intention of the car owners who are NGV non-buyers?

1.5 Research objectives

The purpose of the study is to examine the factors that influence Thai peoples' behavior intention toward NGV product. In addition, the study will investigate the difference between geographical locations, and analyze the relationship among demographic profiles. These various factors are needed for a better understanding that could lead to wider acceptance of NGV product. The research objectives are as follows:

1. To measure the differences between five geographical locations and behavior intention of the car owners who are non-buyers of NGV.

2. To measure the differences in buyer behavior intention and different demographic factor of the car owners who are NGV non-buyers between five regions.

3. To measure the differences between vehicle factors and behavior intention of the car owners who are NGV non-buyers in five regions which are classified as types of vehicle, life-times of vehicle, types of engine, and engine powers.

4. To analyze the relationships between social influence (environmental concern, helping country in savings, government support, and risk from the number of users) and behavior intention of the car owners who are NGV non-buyers.

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5. To analyze the relationships between NGV attributes (price perception, cost of setting/maintenance, product performance, product safety, availability, time consuming, credibility of organization, information, and appearance) and behavior intention of the car owners who are NGV non-buyers.

1.6 Scope of research

This study is envisaged as a descriptive research using a questionnaire as a survey method in collecting data from vehicle owners who are NGV non-buyers and local residents (who are living in that area, work at that area, or have a vehicle in that area) among the five regions of Thailand. Data is collected at PTT's leading oil stations in each region. The model consists of five independent variables and one dependent variable.

Five independent variables are location, demographic factors, vehicle factors, attitude of social influences, and NGV attributes toward behavior intention. This research focuses on measuring by location, the highest number of car owners who are NGV non-buyer in each region: Central Area (Bangkok), Northern Area (Chiang Mai), Northeastern Area (Nakhon Ratchasima), Eastern Area (Chonburi), and Southern Area (Songkhla). In addition, the demographic factors considered as independent variables are gender, age level, and personal income. The vehicle factors consist of various subcategories including types of vehicle, life-times of vehicle, types of engine, and engine powers. The attitude of social influences have many subcategories, including environmental concern, help country in savings, government support, and risk from number of users. The NGV attributes which are important factors are divided into many subcategories including price perception, cost of setting/maintenance, product performance, product safety, availability, time consuming, organization credibility, information, and appearance.

The researcher adapted the questionnaire from many previous studies. For example, the behavior intention questions, social influence questions and product attribute questions from Environmentally Responsible Purchase Behavior: a test of consumer model by Follows and Jobber (2005); Irish consumer preference for organic meat by O'Donovan and McCarthy (2002); Subjective norms, attitudes and intentions

of Finnish consumers in buying organic food by Tarkiainen and Sundquist (2005); and Consumer innovativeness and perceived risk implications for high technology product adoption by Hirunyawipada and Paswan (2006).

Furthermore, some parts of the questionnaire are applied from previous studies that are related to the automobile and transportation industry. For instance, the vehicle factor questions, social influence questions and NGV attribute questions are from Impediment of consumer adoption of sustainable transportation, alternative fuel vehicles from Byrne and Polonsky (2001); Sustainable transportation by Dearing (2000); Disaggregate modeling of Canadian vehicle ownership, trip making and fuel usage by Berkowitz, Gallini, Miller, and Wolfe (1985); Consumer perceptions of green power by Rowlands, Parker, Scott (2002); Social cost comparison among fuel cell vehicle alternatives by Contadini (2000); and Rates of time preference and consumer valuations of automobile safety and fuel efficiency by Dregfus and Viscusi (1995).

1.7 Limitations of the research

In studying behavior intention, the car owners who are NGV non-buyers in five regions, comes from a purposive sample that represents the opinions of Thai people who have their own vehicle registered in each region of Thailand and who are non-buyers of NGV. Although the researcher knows the numbers of Thai people who have their own vehicles registered in each region of Thailand and the numbers of people who already using the NGV, these are only approximate amounts; hence the researcher estimated the targeted samples from the highest ranking of Thai people who have their own vehicles registered in each region segmented by Land Transport Management Bureau from 1997 until now (as shown in Table 1.1).

Therefore, the sample size was also estimated from several previous studies to be 500 respondents in order to answer the questionnaires by using quota sampling, and convenient sampling as sampling procedures. This research focuses on five variables (geographical locations, demographic characteristics, vehicle factors, social influences and NGV attributes) which the researcher will apply to all dependent variables based on previous studies on Organizational Innovation Adoption:

Determinants of the Adoption of Innovation by Individuals within an Organization by Talukder, Harris and Mapunda (2007), Environmentally responsible purchase behavior: a test of a consumer model by Follows and Jobber (2005), Irish Consumer preference for organic meat by O'Donovan and McCarthy (2002), and Subjective norms, attitudes and intentions of Finnish consumers in buying organic food by Tarkiainen and Sundqvist (2005). The last constraint of this study is time and survey budget limitations. Moreover, the research was carried out in the period of 15th February 2008 until 30th March 2008, hence the findings may not be generalizable to other time periods or circumstances.

1.8 Significance of the study

The study demonstrates many important factors influencing the behavior intention towards NGV fuel. The separate analysis of demographic profiles will apparently disclose people in each region of Thailand who are potential consumers of NGV. Its overall details could lead to further elaboration for forecasting the possible number of vehicle owners in each region who are inclined, to some extent, towards the intention to use NGV.

The findings of this study can be a guideline paper beneficial to PTT Public Company Limited. It could offer supportive data for the organization to evaluate prospective consumption expectation, to prepare suitably effective marketing plans with directives for business expansion. If PTT succeeds in increasing the number of its NGV customers, Thailand will gain substantial currency savings from the reduction of oil imports. We then will look forward to a society of environmental consciousness, since NGV is one of the green products that save the earth.

1.9 Definition of Terms

Air Quality Standards: It refers to the level set by law that may not be exceeded for restricted pollutants in the ambient air. Such standards are used to determine the volume of pollutants that may be emitted by the industries and the motor vehicles (www.pttplc.com, 12/11/2007).

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Alternative Fuel: It means a fuel that can be used as a substitute for traditional fuels, such as gasoline or diesel. Alternative fuels include natural gas (compressed and liquefied), propane (LPG), hydrogen, biomass-derived fuels, alcohol (including ethanol and methanol), alcohol mixtures with gasoline or other fuels, electricity, or any other fuel determined to be non-petroleum. Sometimes, referred as "alternative transportation fuel" (www.pttplc.com, 12/11/2007).

Alternative Fuel Vehicles (AFVs): Vehicles with engines that operate on fuels other than gasoline or diesel. AFVs are designed and manufactured by an original equipment manufacturer (OEM), or those converted to operate on fuels other than gasoline or diesel (www.pttplc.com, 12/11/2007).

Behavior intention: An attitude being formed progressively towards a decision to act on something, for example, buying a specific brand of car (O'Keefe, 2002).

Buyer: Thai consumer who are car owners and NGV's non buyers since they are in the position to decide modifying their own cars.

Carbon Dioxide (CO_2): It is colorless, odorless, nonpoisonous gas that is normal constituent of the air. CO_2 is a product of fossil fuel combustion. Although it does not have a direct adverse human health effects, it creates greenhouse gas that traps the earth's heat, contributing the potential for global climate change (www.pttplc.com, 12/11/2007).

Carbon Monoxide (CO): It is colorless, tasteless, odorless gas slightly lighter than air. It is poisonous if inhaled since it combines with hemoglobin in the blood to prevent oxygen transfer. CO is emitted in incomplete combustion of fossil fuels (too little air, or oxygen) and is a major cause of urban air pollution (www.pttplc.com, 12/11/2007).

Compressed Natural Gas (CNG): It refers to a natural gas which is compressed so that it can be used as a portable fuel supply. CNG is stored in high-pressured containers (www.pttplc.com, 12/11/2007).

Consumer: In this study, consumer is defined as Thai people who are car owners and NGV's non buyers.

Greenhouse Effect: A term used to describe the roles of water vapor, carbon dioxide, and other gases which make the Earth's surface warmer. These radioactively active gases are relatively transparent to incoming short-wave radiation, but are relatively opaque (blocking) to outgoing long wave radiation. The greenhouse gases within the

lower levels of the atmosphere trap the long wave radiation, which would otherwise escape to space, causing re-radiation of some of the energy back to the Earth. This maintains the surface at higher temperatures if the gases were absent (www.pttplc.com, 12/11/2007).

Hydrocarbon (HC): Organic chemical compounds that consist only of carbon and hydrogen. Hydrocarbons are usually major components of petroleum products, natural gas, and coals. Hydrocarbons that are not burned completely during combustion contribute to air pollution, i.e., smog (www.pttplc.com, 12/11/2007).

Hydrogen (H_2): A colorless, odorless, highly flammable gas used in hydrogenation of petroleum and to produce ammonia. Hydrogen is also an important constituent of manufactured gas (www.pttplc.com, 12/11/2007).

Locations: Thailand's market is divided by living location into five regions i.e. Central Area (Bangkok), Northern Area, Northeastern Area, Eastern Area, and Southern Area. It is believed that people who live in the same area share similar needs and wants and may differ from those in other areas these needs and wants (Schiffman and Kanuk, 2007).

Methane (CH_4): The simplest of the various hydrocarbons and is the major hydrocarbon component of natural gas, and in fact is commonly known as natural gas. It is colorless, odorless, and burn efficiently without many by-products. Methane is a greenhouse gas (www.pttplc.com, 12/11/2007).

Natural Gas Vehicle (NGV): A vehicle that operates on either CNG or LNG (www.pttplc.com, 12/11/2007).

NGV Attributes (Product Attributes): In this case, it is a set of tangible and intangible attributes (Schiffman and Kanuk, 2007) of NGV products.

  -Price perception: The awareness of pricing a product whether it is cheap or expensive or money-worth (Monroe and Olson, 1973; Monroe and Krishnan, 1985).

  -Cost of setting/maintenance: Cost of fuel cylinders, systems setting and maintenance (www.pttplc.com, 12/11/2007).

  -Product performance: The ability of a product to operate its function (Kotler, 2000).

  -Product safety: It refers to the quality of being safe from possible danger and accident, such as danger of fire or explosion (www.pttplc.com, 12/11/2007).

-Availability: Availability of fuels, availability of fuel delivery outlets or stations, and availability of maintenance services.

-Time consuming: The personal time spent on vehicle refueling and finding the station (Contadini, 2000).

-Credibility of organization: The credibility, reliability, and trustworthiness of the PTT Public Co., Ltd.

-Information: The limits of the promotional messages (Schiffman and Kanuk, 2007).

-Appearance: In this place, NGV appearance differentiates from many traditional industrial fuels as a symbol of a green product to save the earth (Dreyfus and Viscusi, 1995).

Oxides of Nitrogen (NO$_x$): The collective designation, or a general term for compounds of nitrogen oxide, nitrogen dioxide, and other nitrogen oxides. Oxides of nitrogen are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO$_x$ is one of the major air pollutants, and causes numerous adverse health effects (www.pttplc.com, 12/11/2007).

Particulate Matters (PM): It is a microscopic component of air pollution that penetrates deeply into the lungs (Pollution Control Department, 2002).

Pipeline: A continuous pipe conduit, equipped with valves, compressor stations, communications systems, and meters, etc. for transporting natural and/or supplemental gas from one point to another, usually from a point in or beyond the producing field or processing plant to another pipeline or to points of use (www.pttplc.com, 12/11/2007).

Pollution: Substances in water, soil, or air that degrade the natural quality of the environment, adversely affect sight, taste, or smell, and/or cause a health hazard (www.pttplc.com, 12/11/2007).

Refueling: Filling up the vehicle with fuel. In refueling NGV, gas is taken from the distribution mains and pumped in to the vehicle's storage cylinder (www.pttplc.com, 12/11/2007).

Social Influences (Attitude): Social pressure that influence individuals to follow a person or others (Schiffman and Kanuk, 2007).

-Environmental concern: A sense of concern jointly shared by so many people over various dangerous substances in the water, soil, or the air that

degrade the natural quality of the environment and adversely affect their sight, taste, or smell, and/or cause a health hazard (www.pttplc.com, 12/11/2007).

-Help country in savings: An action aimed for the economic benefits of the society as a whole (Dearing, 2000).

-Government support: Governmental actions could stimulate alternative fuel vehicles (AFV) production (Lober, 1997).

-Risk from number of users: There is an uncertainty that consumers face when they can not foresee the consequences of their purchase decisions because a minority of people use the product.

The large refuel stations of PTT: The refuel stations which were have equal or more than 5 pumps. They also have infrastructures which provide various services, such as vehicles maintenance service, convenience shops, and clean toilets (www. pttplc.com, 12/11/2007).

Vehicles Factors: Byrne and Polonsky (2001) mentioned that vehicle characteristic is one of impediments against consumer adoption of alternative fuel vehicles (AFV).

-Type of vehicle: Types of private vehicles in Thailand consist of private car not exceeding 7 seats, private car exceeding 7 seats, and private truck (Department of Land Transport, 2007).

-Life-time: There is a vehicle's age.

-Type of engine: Vehicle application which is either benzene or diesel. (Isarasaena-Na-Ayutthaya, Rongviriyapanith, Vichearnsan, and Sanyaluklur-chai, 2006).

-Engine power: The capacity of an engine (size) which is derived from a measurement of the total volume of all the cylinders in the engine (www.in.answers.yahoo.com, 14/1/2008).

CHAPTER 2

LITERATURE REVIEW

This chapter deals with the theories and related literature review. It consists of four parts: Firstly, the theories related to the behavior intention; secondly, the theories/concepts describing those related to the study's topic; thirdly, other related literature reviews explaining the relationship between variables; and lastly, some previous studies which help to build the conceptual framework employed in this study.

2.1 Theories

In this section, the researcher relates the theories and model necessary to develop the conceptual framework for the research. All related theories are explained as follows:

2.1.1 The Stage of the Buying Decision Process

Kotler (2000) proposed that consumers pass sequentially through all five stages in buying a product which is a high-involvement purchase. Those five stages are:

1). Problem Recognition: The initial step wherein people identify their need.

2). Information search: Then, they need to find the information to justify their need, amount of information is more or less depending on the problem they are facing.

3). Evaluation of alternatives: They will evaluate the information obtained.

4). Purchase decision: They will decide to purchase the product that is most preferable.

5). Post-purchase behavior: The last step, people gather after-use experience and information.

This study focuses on the stages between the evaluation of alternatives and purchase decision, as behavior intention plays the most important role during these stages. Figure 2.1 shows the sequences of five stage model:

Figure2.1: Integration of Five Stages Model of the Consumer Buying Process
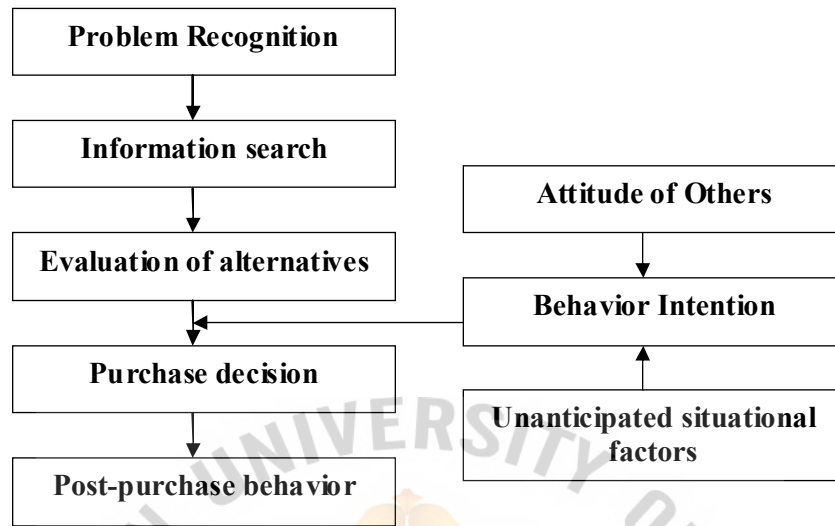
Source: Kotler (2000), Marketing Management: Millennium Edition, p. 167

Once the behavior intention is formed toward a preferred alternative, it might be intervened by attitude of others which somehow affect to the would-be buyer's tendency. It depends on the intensity of such attitude, particularly negative and the consumer's consideration to comply with their wishes. The more intense the other person's negativism and the closer relation they are to the consumer, the more likely the consumer will adjust his or her purchase intention. The second factor is the unanticipated situational factors that may arise to change the behavior intention. Preferences and even purchase intentions are not completely reliable predictors of the purchase behavior.

According to Wells and Prenskys' (1996) evaluation of alternatives refers to the use of decision rules that attempt to determine which product would be most likely to satisfy goals by determining various criteria. Each consumer assigns different levels of importance to each criterion (Kotler, 2000). Before making a purchase decision he or she may already form an intention to purchase the most preferred brand. The product a consumer intends to buy may be different from what he or she eventually purchases.

Purchasing is the center of consumer behavior; it involves the exchange of something of value to an individual for a product in order to satisfy his or her need

(Wells and Prensky, 1996). However, the consumer may terminate the buying process before making the purchase if one or more of the terms are unacceptable. This stage of the buying process is the transition from purchase intention to purchase decision. After the consumer has formed a choice among the alternatives, they ultimately decide to purchase a selected brand from the selected dealer. Thus, that consumer applies a variety of criteria in evaluating purchasing decision, which will vary in shaping alternative selection. Other issues of concern to the consumer such as price, maintenance, and installation are discussed and agreed during this stage (Skinner, 1994).

2.1.2 Tricomponent Attitude Model

Attitudes are defined as a mental predisposition to act that is expressed by evaluating a particular entity with some degree of favor or disfavor (Hanna and Wozniak, 2001; Pratkanis, Breckler, and Greenwald, 1989). Engel, Blackwell and Miniard (1993) also stated that consumers' attitude enable the marketers to evaluate and prepare marketing activities before implementing them into the market place. They can be formed either as a direct result of experiences with a product or through information acquired from others, including the mass-media. Similarly, Kotler (2000) stated that an attitude describes a person's enduring favorable or unfavorable cognitive evaluations, emotional feelings, and action tendencies toward an object or idea. People have attitudes toward almost everything: religion, politics, clothes, music, food, and so on. Attitudes create inside them a picture of liking or disliking an object. Attitudes lead people to behave in a fairly consistent way toward similar objects. Generally, people do not interpret and react to any object immediately. For this reason, attitudes are rather difficult to change. Over time, a person's attitudes settle in a consistent pattern, and to change a single attitude in him/her may require major adjustments in his/ her other attitudes.

Attitude consists of three major components namely, cognitive, affective, and conative (behavior) as follows:

1). Cognitive attitude: A person acquires his/ her knowledge and perceptions through a combination of direct experience and related information attitude of an object. By this, he/ she is forming a belief that such attitude-object possesses attractive attributes as it is generally accepted that specific behavior will lead to specific outcomes (Schiffman and Kanuk, 2007).

2). Affective attitude: A person's emotions or feeling towards particular product or brand constitute the affective component attitude (Schiffman and Kanuk, 2007). In other words, being affective is the feelings a person has toward an object or the emotions that object evokes for the person (Jagdish, 1999).

3). Conative attitude: A person's tendency to respond in a certain manner toward an object or activity. In marketing and consumer research, the conative component is frequently treated as an expression of the consumer's intention to buy (Schiffman and Kanuk, 2007).

2.1.3 Theory of Reasoned Action Model

The theory of reasoned action model represents a comprehensive integration of attitude components into a structure that is designed to lead to both better explanation and better prediction of behavior. It is similar to the basic tricomponent attitude model but is arranged in a different pattern as shown in Figure 2.2.

Figure 2.2: A Simplified Version of the Theory of Reasoned Action Model
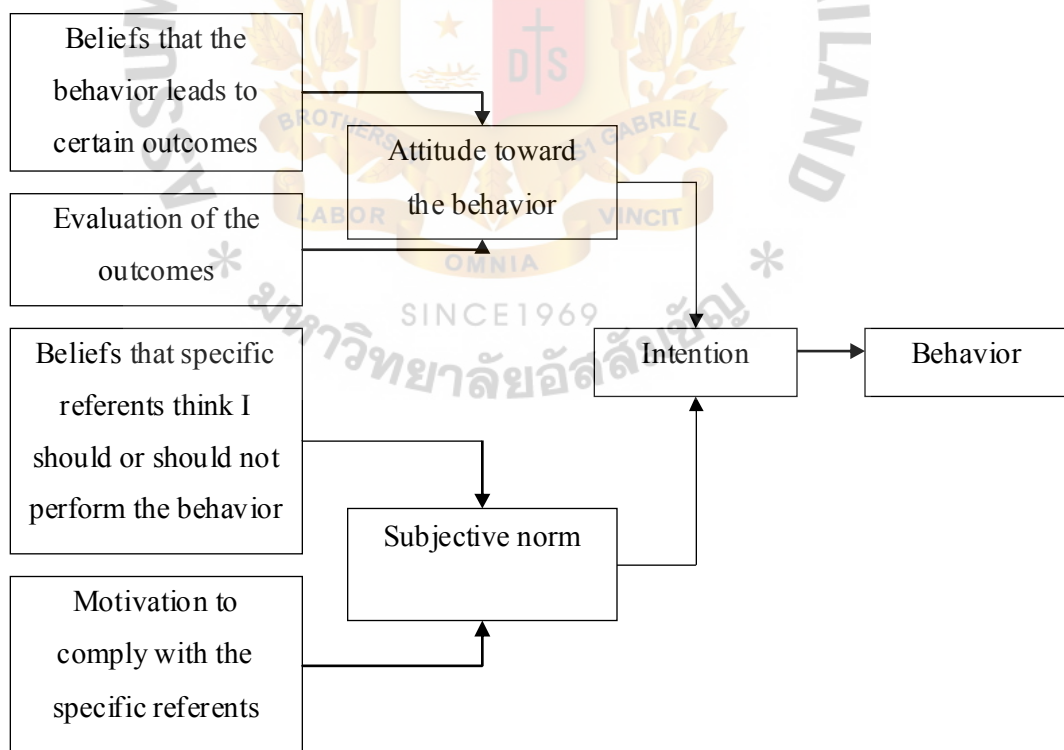
Source: Schiffman and Kanuk (2007), Consumer Behavior: Ninth Edition, p. 241

According to the above figure, intentions are influenced by personal attitude judgment and social-normative considerations. These two factors may not contribute equally to the formation of intention, but carry varying weights in influencing the intentions. The determinants of the attitudinal component transform to an individual's attitude toward the behavior and then develop into his/ her salient beliefs to act simultaneously. For the determinants of the normative component, an individual's subjective norm is taken to be based on his/ her judgment of the normative expectations coupled with specific salient reference group. The subjective norm is also based on the individual's motivation to comply with each of those referents. The theory of reasoned action (TRA) is necessitated by the original model's limitations in dealing with behaviors over which people have incomplete volitional control (Ajzen, 1991). TRA has also been applied in organic food buying behavior research, and in studying the intentions to buy friendly-to- environmental products (Kalafatis, Pollard, East, and Tsogas, 1999). There are previous studies on organic food buying behavior wherein the role of subjective norms refers to the perceived social pressure whether or not to perform the behavior (Ajzen, 1991).

2.2 Behavior Intention

The central interests of persuaders are the behaviors of voluntary actions, the ones under the actor's volitional control. The most immediate determinant of such an action is presumably the actor's behavior intention--what the person intends to do. Influencing behavior, then, is to be accomplished through influencing a person's intentions (O'Keefe, 2002). Also, Kotler (2003) mentioned that the studies of consumer behavior deal with how individuals, groups, and organizations select, buy, use and dispose of goods, services, ideas, or experiences in order to satisfy their needs and desires. Buyer behavior studies are of help to understand the consumer well. Consumers may state their needs and wants but act otherwise in the light of their expectations, perception, and other situational factors. They may respond to some influences that change their mind at the last minute leading to an impulse purchase. Thus, marketers have to study their target consumer's wants, expectations, perceptions, preferences, intentions. To influence his/ her behavior intention means knowing about consumer psychology and reaching other factors that affect the consumer in making decision to purchase or consume. In addition, Schiffman and

Kanuk (2007) mentioned that the behavior intention scale measures the likelihood that people will act in a certain way in the future, such as buying the product or recommending it to a friend.

Byrne and Polonsky (2001) mentioned that consumer behaviors, especially in environmentally-linked business activities and expectations, are generally difficult to predict. There are indications that a combination of reward, reinforcement, and regulatory coercion approaches is proven to be effective (Fisk, 1998). With regard to the potential purchase of an alternative fuel vehicle, the matter of convenience also needs to be taken into account. In other words, the likelihood of adoption is in direct relation to the extent of behavior modification required. These behavior modifications may include everything from significant change in driving and fuelling patterns to alterations in the perception of transportation as a whole. Therefore, there are many issues that influence the consumers within the purchase decision process for environmentally-responsible goods.

2.3 Location

The market, according to the strategic theory, is divided by living location. People who live in the same area will share similar needs and wants, which differ from those living in other areas (Schiffman and Kanuk, 2007). It is also mentioned in the Stimulus-Response Model of Buyer Behavior, location or geographic area is one of the subcultures which represent geographical segmentation and physical diversity. It is a human nature that people have a sense of regional identification and use this it as a way of describing others. Many consumer research studies have confirmed that they are regional differences in consumption patterns, product purchase, ownership, or usage levels (Kotler, 2003).

Figure 2.3 explains that marketers segment a society into a number of smaller subgroups that consist of people similar in terms of ethnic origin, customs, and the ways they behave. These subcultures constitute important marketing opportunities for astute marketing strategists. This figure presents a model depicting the role that subjective culture plays in determining one's beliefs, practices, and values, which in turn impact his/ her social norms, attitudes, behavioral intentions, and ultimately the behavior.

Figure2.3: A Theoretical Model of Culture's influence on Behavior
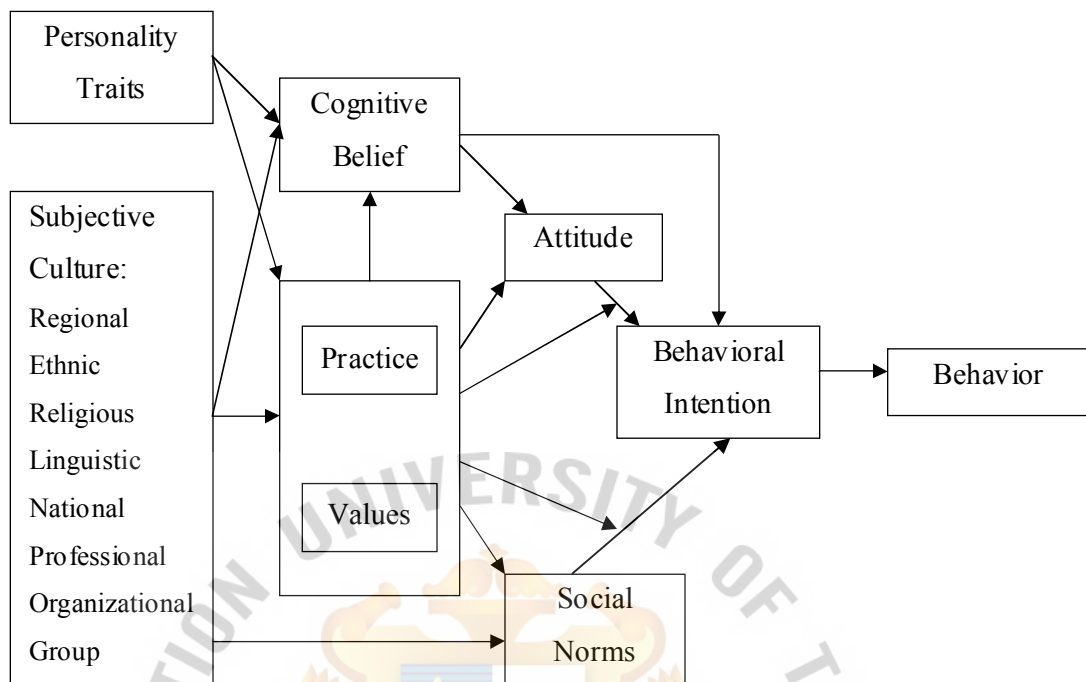
Source: Schiffman and Kanuk (2007), Consumer Behavior: Ninth Edition, p. 382

In the case of Thailand, its seventy six provinces are segmented into five regions following Thailand's geography map, namely Central Area (Bangkok), Northern Area, Northeastern Area, Eastern Area, and Southern Area as shown earlier in Figure 1.1.

2.4 Demographic Profile

Consumer demographics play a significant role in the way the consumer expects and perceives a product and follows particular buyer behavior. Demographic segmentation divides the market into groups based on variables such as age, gender, education, income, occupation, generation, etc. which are the most popular bases of consumer segmentation. The consumer needs, wants, and usages are often related closely with demographic factors, which results in differences in consumer behavior (Kotler and Armstrong, 2003). In this study, the researcher focuses on the consumer's gender, age, and personal income, whereas the marital status, education, and occupation are also described.

2.4.1 Gender

Gender is a trait that divides the customers into males and females. This trait remains constant throughout one's life, and influences consumer values and preferences (Sheth, Mittal, and Newman, 1999). Moreover gender is quite frequently a distinguishing segmentation variable which has pervasive effect on roles. For the user, gender implies the purchase of some gender-specific products and services, based either on some biological or physiological needs, or on culture-generated gender-specific customs and tastes. Many performance-related values differ between men and women, such as ergonomics in the design of the driver's seat in a car, or the extra-security needs in the hotel accommodations for women business travelers (O'Keefe, 2002). Therefore, successful marketers use their knowledge about male-female preferences to meet the needs of both groups.

2.4.2 Age

Schiffman and Kanuk (2007) mentioned that product needs and interests often vary with the consumers' age. People buy different goods and services over their lifetime. Different ages of the consumer entail different preferences. Consumption is shaped by the family life cycle which involves the stages of each person's life in the family; each stage affects each family member to have different preferences (Berkowitz, Kerin, Hartley, and Rudelius, 1994). Thus, marketers have found age to be a particularly useful demographic variable for market segmentation (Schiffman and Kanuk, 2007).

2.4.3 Personal income

It is a strong indicator of the ability to pay for a product or a specific model of a product. Income is another socio-economic variable frequently used to approximate one's social-class standing. How he/ she spends his/ her incomes reflects different values. It is often combined with other demographic variables to more accurately define a target market (Schiffman and Kanuk, 2007).

2.4.4 Marital status

Marketers have discovered the benefits of targeting specific marital status grouping which is determining the demographic and media profiles of the household decision-makers in order to develop appropriate marketing strategies. It has been recognized that the family has been the focus of most marketing efforts for many products and services. Therefore, the household continues to be the relevant consuming unit (Schiffman and Kanuk, 2007).

2.4.5 Education

Schiffman and Kanuk (2007) also mentioned that the level of a person's formal education is another commonly accepted approximation of social-class standing. Generally speaking, the higher the education a person has, the more likely it is that the person is well paid or has a better income. People, through education, attain discernment and form a pattern of preferences based on their social surroundings and their own self. The higher the education level of an individual, the more likely it is that the individual will make a more informed decision on a product and a brand choice.

2.4.6 Occupation

Occupation is widely accepted and probably the best-documented measurement of social class, because it reflects occupational status. The importance of occupation is dramatized by the frequency to serve as a guide sizing up or evaluating and opinions of others (Schiffman and Kanuk, 2007). As a person's occupation also influences his or her consumption pattern, the differences in occupation consequently lead to different needs for products and services.

2.5 Vehicle Factors

Vehicles are designed with a variety of characteristics. According to applicable requirements, the different characteristics of a vehicle reflect the different individualities of a consumer. These include, but are not limited to the range of vehicles as follows:

2.5.1 Types of vehicles

The types of private vehicles registered in Thailand are classified by Department of Land Transport (2007) as follows:

1). Private car not exceeding 7 seats. Any vehicles having a maximum of 2.50 meters wide 12 meters long which are shown in Figure 2.5.

2). Private car exceeding 7 seats. Any vehicles having a maximum of 2.50 meters wide and 12 meters long which are also shown in Figure 2.5. In addition, the length of body between the centers of the rear wheel and the rear body of the vehicle is not exceeding two thirds of the length between the centers of the front wheel and the rear wheel.

3). Private truck. Any vehicles having a maximum of 2.50 meters wide and 12 meters long which are also shown in Figure 2.5. In addition, the length of body between the centers of the rear wheel and the rear body of the vehicle is not exceeding three fifths of the length between the centers of the font wheel and the rear wheel.

Figure2.5: Types of private vehicles in Thailand
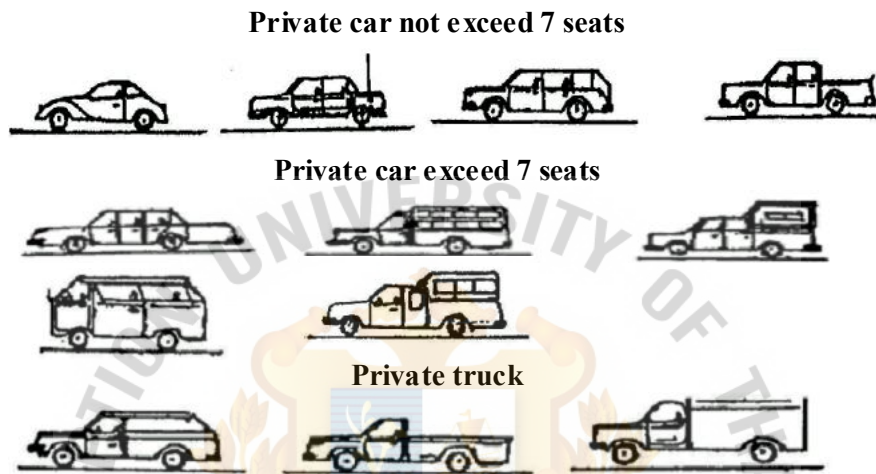
2.5.2 Life-time

It is a vehicle's age. Generally speaking, a physical life time or duration is the length of time a product continues or lasts (Macmillan, 1996).

2.5.3 Types of engine

There are two basic types for vehicle application: gasoline (benzene) and diesel.

2.5.4 Engine power

The capacity of an engine (size) is a measurement of the total volume of all the cylinders in the engine (www.in.answers.yahoo.com, 14/1/2008). The engine size or displacement is measured in cubic centimeters (cc) or cubic inches (ci). In terms of engines, the displacement is the volume of space a piston travels through during a single stroke. A larger number, whether expressed in cubic centimeters or cubic inches, denotes a larger engine. The displacement is only one of the factors that determine the performance of the vehicle. The best way in determining the engine power and performance is to view the detailed specifications for that engine which should list the displacement (cc or ci) RPM (revolutions per minute) and the horse

power (HP) inclusively (www.rcvehicles.about.com/od/nitroengines/f/displacement. htm, 14/1/2008).

2.6 Social Influences (Attitude)

Social pressure can influence individuals to follow as well as to break the rules. The extent to which the consumer attitudes are influenced by the social pressure is dependent on their susceptibility to such pressure. Consumer susceptibility is the need to enhance one's image and to be appreciated by others through the acquisition and use of products and brands, the willingness to conform to the expectations of others regarding the purchase decisions, and the tendency to learn about the products by observing others or seeking the information from others. Schiffman and Kanuk (2007) mentioned that social well-being means having satisfactory relationships and interacting well with others. It includes exhibiting fairness, justice, and concern and appreciating the differences among the people. As part of the socio cultural inputs, there is a wide range of noncommercial influences. In this study, the researcher employs various dimensions as follows:

2.6.1 Environmental concern

It is one of the social marketing concepts which requires all marketers to adhere to the principles of social responsibility in the marketing of their goods and services; that is they should endeavor to satisfy the needs and wants of their target market in ways that preserve and enhance the well-being of the consumers and the society as a whole (Schiffman and Kanuk, 2007). In this study, it refers to the level of people's concerns about the substances in the water, soil, or the air that degrade the natural quality of the environment and adversely affect sight, taste, or smell, and/or any health hazards (www.pttplc.com, 12/11/2007). There are three primary reasons that natural gas is an environmentally friendly fuel. Firstly, NGV on the whole scarcely contributes to the greenhouse gas formation because it releases the least carbon when compared with other fuels. Secondly, the fuel cycle emissions of NGV are less than other transportation fuels. Thirdly, as a motor fuel, NGV provides superior emission performance relative to gasoline and diesel.

2.6.2 Help country in savings

Vehicles and fuels have empowered the people around the world in ways that were never before possible, and in the process generated large economic benefits to society as a whole (Dearing, 2000). In the case of Thailand, the government and other leading organizations also released many media campaigns of fuels consumption that can help country in saving resources spent via importing gasoline for its people.

2.6.3 Government support

The state government as part of its obligations needs to support products in the market. For example, it needs to propose the limit of greenhouse gas emissions by automobiles. Governmental actions could stimulate the production for NGV, tax credits for NGV as well as infrastructure development (Byrne and Polonshy, 2001).

2.6.4 Risk from the number of users

The perceived risk is defined as the uncertainty that the consumers feel when they can not foresee the consequences of their purchase decisions due to the limited number of users. It is a social risk which is one of the major types of risks (Schiffman and Kanuk, 2007).

2.7 NGV Attributes (Product Attributes)

Product attributes, as perceived by consumers, are one of the critical factors in the product choice process. Kotler and Armstrong (2003) mentioned that a product is anything that can be offered to the market for attention, acquisition, use, or consumption with the objective to satisfy a want or need; it includes physical objects, services, persons, places, organizations and ideas. Assael (1998) also defined a product as a bundle of attributes and benefits designed to satisfy consumer needs. Basically, a product is often a firm's most important link with consumers. The products or services help to create the image of the firm in the consumer's mind. In the marketing context, people tend to perceive a product and its attributes according to their own expectations (Schiffman and Kanuk, 2007). In this study, any product (goods or service) means a set of tangible and intangible attributes of an object or a service that can be categorized into three types: features, functions, and benefits (Crawford and Benedetto, 2000). The case of NGV and its attributes are linked to the following points:

2.7.1 Price perception

Price is one of the most important product characteristics evaluated by the consumers. In some instances, the consumers are very price sensitive, and they tend to discard the product of which price is relatively higher than the competitor's. However, the price can be used as a surrogate indicator of product quality; as a result a higher price may be viewed positively by certain segments of the market. Other researchers mentioned that price itself is a strong indicator of quality in people's minds, particularly in the absence of other data (Monroe and Olson, 1973). Natural gas fuel price is lower than gasoline. In Thailand, PTT has priced NGV at half the price of diesel oil. The speed of recovering the investment incurred in NGV conversion depends on how extensively a vehicle is used (www.pttplc.com, 2007).

2.7.2 Cost of setting/maintenance

The maintenance cost of NGV vehicles seems to be most economical since it can travel as far as 25,000 miles between recommended oil changes, the distance of which is four times more than a diesel powered vehicle can take (www.pttplc.com, 2007).

2.7.3 Product performance

Performance is defined as the quality of physical outcomes of using a product or service (Sheth, Mittal and Newman, 1999). In addition, consumers are expected to associate the value with the tangible performance specifications as well as with the softer and more subjective attributes of the product. Thus, consumer researchers are interested in judging the ideal product performance whereby consumers are most likely to form their product attributions. Specially, they want to find out why a product meets or fails to meet consumer expectations. In this regard, they could attribute the product's successful performance to the product itself or to the combination of these factors (Schiffman and Kanuk, 2007). Product performances relate to the customization or fitness for use whether the product can meet various consumer needs or has the desired consumer specifications. Such performance in this case is related to the vehicle's emission, burning, speed, acceleration, and driving range.

2.7.4 Product safety

Any vehicle fuel can be dangerous if handled improperly because fuels contain energy which must be released by burning. It refers to the quality of being safe from such hazardous danger as fire or explosion (www.pttplc.com, 12/11/2007).

NGV has an excellent safety record, because of the properties and integrity of the fuel itself and its fuel delivery system. Natural gas has a very limited range of flammability which will not burn below 5% or above 15% approximate concentrations when mixed with air. The selection of NGV cylinders is also critically important. The summary of cylinder technology and design from the Gas Research Institute (GRI) provides background and guidance on NGV cylinder inspections and identifies proper practices in the care and handling of NGV compressed gas cylinders. Although the use of high storage pressures might appear dangerous, the process of NGV compression, storage and fueling are required to meet stringent industry and government safety standards. The strength of the NGV fuel storage system allows it to withstand crashes and heat much better than the standard gasoline tanks.

2.7.5 Availability

The marketability of alternative fuels vehicle (AFVs) is basically subject to the availability of resources sufficient to bring such alternative technologies to the market. The idea of consumer viability of AFVs may be noble when considering the current dependency on the proven pollution-producing fossil fuel (Speth, 1998), but it is relatively infeasible owing to the lack of supporting infrastructures, which include the availability of AFV fuel, delivery outlets or stations, and maintenance services.

2.7.6 Time consuming

The time spent on vehicle refueling and finding a station may vary from a few seconds to many minutes (Contadini, 2000).

2.7.7 Credibility of organization

It refers to the reliability of the organization that leads consumers to trust and believe in its value. Credibility is built on a number of factors, of which the most important are the perceived intentions of the source (Schiffman and Kanuk, 2007).When people have had no experience with a product, they tend to trust a favored or well-known brand name. Consumers often think that the well-known brands are better and are worth buying for the implied assurance of quality, dependability, performance, and service. The marketer's promotional efforts supplement the perceived quality of their products by helping to build and sustain a favorable brand image. It also is the reliability relating to whether the product can be free from deficiencies for a long period of time. In this study, the credibility of organization means the PTT Public Co., Ltd's credibility.

2.7.8 Information

Schiffman and Kanuk (2007) mentioned that consumers have access to more information than ever before. Before making purchase decisions, they can easily find reviews of products that have been posted by previous buyers, by clicking a button to compare the features of different product models at the sites of online retailers, or subscribe to virtual communities of persons who share the same interests they do. In turn, marketers must be aware of the limits of their promotional messages and not assume that consumers know all of their buying options.

2.7.9 Appearance

The product attribute being identified is the appearance of the NGV. This feature is expected by all the respondents. NGV appearance differentiates from many traditional industrial fuels and can be associated with the particular fuel's sensory properties, specific technology of production and such product authenticity as loss in cargo space due to cylinder setting (www.pttplc.com, 2007).

2.8 Related literature reviews

2.8.1 Vehicle factors towards behavior intentions

According to Byrne and Polonsky (2001); Dearing (2000); Berkowitz, Gallini, Miller, and Wolfe (1985); Kazimi (1997); Contadini (2000); Dregfus and Viscusi (1995), vehicle characteristic is one of impediments against consumer adoption of alternative fuel vehicles (AFV). Berkowitz, Gallini, Miller, and Wolfe (1985) gauged the estimation of gasoline demand by using aggregate data. To confirm their statements, an aggregate model has been outlined estimating the gasoline demand for the vehicle's fuel industry (vehicle type), by summing the number of vehicle holdings in the households. Hence, this study which aims at predicting the demand for NGV also requires the type of private vehicle holdings. Besides, Dreyfus and Viscusi (1995) suggested that the remaining life of product affects the operating costs which many consumers are concerned about. An economic analysis of NGV as a vehicle fuel should be focused on various factors including vehicle application (gasoline or diesel), vehicle types. The extent of the economic benefits will depend on the potential number of vehicles tending to use NGV.

2.8.2 Social influence towards behavior intentions

The sustainable transportation is generally treated in terms of addressing environmental issues alongside with social and economic objectives' and emphasizing the requirement for social and much as technological innovation (Dearing, 2000). Talukder, Harris and Mapunda (2007) explained that the social influence affects the attitude towards innovation. Byrne and Polonsky (2001) also mentioned that stakeholder groups, such as Governments, Corporations and Activists have an influence on the consumer's purchase decision.

Regarding the environmental concern factor as mentioned by Follows and Jobber (2000), if the environmental consequences are important enough to the consumers, the resulting outcome may be the purchase of an environmentally responsible product. In the case of helping the country in savings, Dearing (2000) stated that most people tend to be influenced by the mass media to have some concern over the macroeconomics of a whole country. Chilton (2000) also mentioned that state governments have a significant role in the potential to bring in alternative fuel vehicles (AFVs) to the market as well as on the environmental conservation being within their jurisdiction. For example, several nations have proposed to limit or even prohibit greenhouse gas emissions by automobiles. Other governmental actions could stimulate the AFV production including tax credit, special transportation alternatives for AFVs, and infrastructure development. Government can thus be seen as an inescapable stakeholder in the AFV process, and may in fact be a potential partner in facilitating the development, rather than posing a barrier for developing sustainable alternatives (Lober, 1997; Dreyfus and Viscusi, 1995).

NGV may also offer the most cost-effective approach to environmental improvement within developing economies. An economic limitation may be an obstacle to meeting the performance standards the societies are seeking in the long-term (Dearing, 2000). Researchers have tried to compare the risks with those of more familiar fuels and how the public perception might be aroused and the acceptance achieved on the basis of their comparative performances and the balance between the risks and the opportunities offered to the consumers with anticipation that the popularity and production of NGV's on the increase, the setting costs are expected to decrease (Ricci, Newsholme, Bellaby, and Flynn, 2007).

2.8.3 Product Attributes and their influence on behavior intentions

Byrne and Polonsky (2001) stated that there are many issues that influence the consumers on the purchase decision process for fuel. These include, but are not limited to the fuel price, cost of modification, maintenance cost, avalaibility, refueling time, safety, and emission. Similarly, Ricci Newsholme, Bellaby, and Flynn (2007) agreed that the individual's behavior and attitudes toward future fuel applications and the existing production and distribution facilities would be counter-balanced by the interaction of trade-offs between cost, safety, usability and perceived personal and global benefits. Kazimi (1997) suggested that, some of the most important attributes, which include the purchasing price, operating cost, acceleration, speed, distance on a full tank, refueling time are the bases to determine the intentions toward vehicles and fuels. Similarly, Contadini (2000) mentioned that the necessary input values influencing the consumer intention are the vehicle performance, fuel infrastructure, and the overall health cost to the society. Dearing, (2000) also mentioned that price is clearly important for NGV purchasing decision and it can be either a positive or negative influence on the consumers (Mowen and Miner, 1998). Moreover, Dreyfus and Viscusi (1995) mentioned that the fuel consumption is related to the vehicle weight and other factors. Consumer demands also depend on infrastructure availability (Buchholz, 1998; Clift and Wright, 2000; Ewing and Sarigollu, 2000), and the time spent on vehicle refueling and finding a station (Contadini, 2000) that may vary from a few seconds to many minutes also affects the decision to purchase.

2.9 Previous Studies

Paitoon (2003) studied the factors affecting the use of NGV in Thailand. The purpose of this study was to identify the degree of positive perception for NGV. The study was conducted by mailing the questionnaires to 200 respondents who worked in four different career positions based in Bangkok and offshore. Partial Correlation Coefficients and Cross-tabulation were used in the statistical collection and analysis, focusing on four factors which were NGV safety, environment, cost and economy, and refueling. The results showed that people were aware of NGV benefits on other factors but doubtful about the safety of NGV.

Byrne and Polonsky (2001) studied the various impediments to consumer adoption of alternative fuel vehicles (AFVs), including regulatory barriers, resources, infrastructure and the vehicle characteristics themselves. Secondary data was used in this study, by means of exploratory research method. These impediments also impact on other stakeholders, such as state governments, producers (corporations), competitions (alternative products), and activist groups. The inter-relationships amongst the stakeholders are complex, as one group may initiate any action that serve as impediments for others. Developing the system-based sustainable alternatives to the traditional, environmentally harmful automobiles requires a network of relationships between stakeholders and impediments that require to be considered. This study looks at the various impediments as well as how they can affect various stakeholders. It then posed a broad based integrative approach to provide the most favorable environment for the consumers to consider AFVs.

Ricci, Newsholme, Bellaby, and Flynn (2007) studied the public attitudes towards a future hydrogen economy; the findings of their study provide certain empirical insights about the socio-cultural contexts of knowing the continuous development of unfamiliar technological systems alongside with new technologies and raising the subsequent issues of public interests. The research attempted to contribute to a wider debate about public engagement in technological changes. This paper draws upon the preliminary findings from three qualitative field studies. Focus groups were conducted with members of the public in three different areas of the UK where hydrogen projects are being planned and/or developed. Findings were connected to the evidences gathered in other previous studies addressing the similar relationship between the general public and the new technologies. In the case of hydrogen energy and its role in a future economy, questions about safety were presented but did not dominate the debate. Participants in the focus groups were not only concerned about the technical and economic aspects of hydrogen technologies, but also wanted to understand what hydrogen as an energy carrier and fuel would mean for them and in their daily lives; whether it would deliver the promise of realizing a better future for the global environment and mankind; and whether it would disrupt the people's lifestyles and require a significant change in their collective and individual behaviors. Moreover, a frequent issue raised by many people was their ambivalence about the reliability of information on hydrogen.

Berkowitz, Gallini, Miller, Wolfe (1985) adopted a disaggregate approach to modeling the components of gasoline demand. Gasoline demand in this model was viewed as the outcome of the following household decisions: vehicle holdings (number and type) and vehicle usages (non-discretionary and discretionary). This is causal research using secondary data already in hand. Modeling gasoline demand in this way correctly specifies the gasoline as an input into the production of transportation services and allows for the interdependence of household decisions on the vehicle holdings and the usage. Moreover, estimation of the components of gasoline demand allows the policy makers to identify the means by which individuals will respond to any policy changes. This leads to more effective policies designed to reduce gasoline consumption. The researchers used this model to estimate the price, the fuel efficiency elasticity of vehicle usage and the gasoline demand.

Rowlands, Parker, and Scott (2002) examined the relationship between the consumer's perceptions of the environmental impact of different energy resources and the consumer's stated willingness to pay a premium for green power. Those developing green power products can be chosen for inclusion as one of the energy resources in their offerings. Given this, the information about potential purchaser's preferences is extremely valuable. To investigate this further, a total of 480 residents of Waterloo Region, a community in Southern Ontario (Canada), were surveyed. The aforementioned relationship was investigated using Chi-Square tests and Analysis of Variances producers. The significant findings indicated those who were willing to pay only a small (or no) premium for green power expressed their acceptance to three of eleven energy resources investigated-namely, nuclear power, large-scale hydropower and natural gas. This survey suggested that, these energy resources are not as popular among the most environmentally-mobilized section of consumers.

Contadini (2000) made a comparison of the social costs among the emerging vehicle technologies if applied practically by using different approaches and variables. The objective of this paper was to compare the social costs of different fuels being considered for use in fuel cell vehicles. To address the necessary input values, a detailed analysis of different technological aspects was carried out. These aspects were related to: the complexity of each technology (vehicle cost, maintenance requirement and life expectancy); vehicle performance (fuel economy and relative

market share); fuel infrastructure (fuel cost); full-cycle emissions (fuel upstream emissions and vehicle operation emissions); and overall health costs to the society. This study compared the use of methanol and hydrogen fuels in fuel cell vehicles with the use of reformulated gasoline in the advanced internal combustion engines, hybrid and fuel cell vehicles. The input assumptions being used are based on the current literatures. The results show that both alternative fuel technologies are very close in their benefits, and both are superior to gasoline. Methanol is found to have the greatest benefit in reducing the costs associated with the damages to human health from air pollution.

Poonsawat (1998) sought, by means of a questionnaire, to examine the factors influencing the consumer's decision-making process of buying a small passenger car in Bangkok metropolitan area. The survey method was based on a non-probability sampling of 500 samples. The results were examined through the hypotheses testing by using the standard deviation and the Chi-square statistics technique. The findings showed that the most influential factors were the car's durability and reasonable price, the service center, and the salesperson's individuality.

Dreyfus and Viscusi (1995) estimated the hedonic price model for automobiles using a data set on households from the United States Department of Energy Residential Transportation Energy Consumption Survey. The standard hedonic models were generalized to recognize the role of discounting of the fuel efficiency and safety, yielding an estimated rate of time preference ranges which included the prevailing rate of interest for car loans in 1988 and was consequently consistent with the market rates. The purchasers exhibited an implicit value of life ranging which was within the range found in the labor market as well as the other market contexts. The model also estimated a significant price effect for the auto injury risks and the fuel efficiency.

Follows and Jobber (2005) studied a consumer model of environmentally responsible purchase behavior which was tested by using covariance structural analysis. The researchers distributed the questionnaires through the mail which were returned by 334 respondents. By using the Chi-square statistics technique, the model successfully predicted the purchase of environmentally responsible and non-

responsible product alternatives. A hierarchical relationship from the values of product; the specific attitudes to purchase; and the intention to purchase behavior was confirmed. Individual consequences, which take the personal implications of consumption into account, were found to be just as important in predicting the intention as the environmental consequences of a diaper product. The study empirically tested a values typology as a basis to explain the attitude formation.

Talukder, Harris, and Mapunda (2007) examined the extent to which individuals within a single organization, the University of South Australia, adopted a specific technology. The study examined the application of selected advanced features of Microsoft Outlook. There was a large variation in the usage of these advanced features, and the university was anxious to expand these applications. The procedure for obtaining the data was through an online survey questionnaire which was made available to 1,280 full-time academic and administrative staff of the university, across the four academic divisions. The aforementioned relationship was investigated using Multiple Regressions. The independent variables in the study consisted of three factor groups; namely the organization factors, the individual factors, and the social influence, which affected the attitude towards innovation. In addition, all three factors were divided into many subcategories. For example, in the case of individual factors there were cumulatively perceived usefulness, personal innovativeness, prior experience, image, and enjoyment of entire innovative sub-variables. Moreover, this framework also found the influence of demographics forming the attitudes of the adopters. The attitude towards innovation then brought about the behavioral intention to the individual adopters towards the innovation. The result of this study confirms that the perceived usefulness has a strong effect on the usage.

O' Donovan and McCarthy (2002) used the evaluation models to identify such variables as health consciousness, environmental concern, and income as the important determinants of organic food choice. The objective of this research was to examine the Irish consumer's perception of organic meat. The questionnaires were completed by 250 respondents, representing the Irish population. Three groups of consumers were identified by using Correlation Coefficients and Chi-Square test. Respondents who purchased or had the intention to purchase the organic meat placed much higher levels of importance on the food safety, compared to those with no

intention to purchase. Furthermore, the purchasers of organic meat were more concerned about their health than non-purchasers. They also believed that the organic meat was superior to the conventional meat in terms of quality, safety, and value. The availability and the price were the key different the purchase the organic meat. Higher socio-economic groups were more willing to purchase the organic meat. The increasing awareness of food safety and pollution issues are the important determinants in the purchase of organic meat; but securing a consistent supply of organic meat is paramount to ensuring growth in this sector.

Tarkiainen and Sundqvist (2005) proposed a modification to the Theory of Planned Behavior (TPB) model with an aim for a better results, implying that in the organic food-buying context the role of subjective norms differs from the original theory of planned behavior. In other words, the subjective norms aroused the buying intention indirectly through the attitude formation. In this study, the researchers distributed the questionnaires to 200 respondents. The results were examined through the hypotheses testing by using the Correlation Coefficients and the Chi-square statistics technique. They showed that the modified TPB model predicted the intention to buy the organic food much better than the original model. Based on the results, it could be summarized that consumers' intentions to buy organic food could be predicted by their attitudes, which could further be predicted by the subjective norms, and that the behavioral intentions reliably predicted its self-reported behavior.

Tse (1999) sought to examine how perceived product safety might be affected by such product-related factors as price, brand name, store name, promotion channels, source credibility, country of origin, nature of product testing authority and warranty. A total of 500 undergraduates were invited to complete the interviews. The findings showed that the perceived product safety was significantly affected by all of the variables mentioned above. It implied that, by carefully manipulating these variables in formulating the marketing strategies, managers could attract the large and growing market of safety-conscious consumers and gain a competitive edge that could not possibly be ignored

Kalafatis, Pollard, East, and Tsogas (1999) examined the determinants that influenced the consumers' intention to buy environmentally friendly products between

two distinct market conditions, UK and Greece, which respectively resulted in 175 and 170 usable responses to the questionnaires. The results were examined through the hypotheses testing by using the Correlation Coefficients and the Chi-square statistics technique. For the UK sample, social norm was found to be the only determinant associated with a significant direct effect on intention. Whereas, in the Greek sample, the result appeared to be more complicated. Although, perceived control was the only determinant that was associated with a significant direct effect on intention, the modification indices indicate significant indirect effect of both referent and control beliefs.

Isarasaena-Na-Ayutthaya, Rongviriyapanith, Vichearnsan, and Sanyaluklur-chai (2006) analyzed the NGV Needs of Thai people in suburban areas through questionnaire survey, multi-stage samplings, and Logit statistic methods. Their resulting prediction was that 24,000 people around the suburbs intend to use NGV: 30 percent of these are benzene car-owners and 70 percent diesel users. The survey found that they are more likely interested in the lower price of NGV despite the higher cost of setting.

CHAPTER 3
RESEACH FRAMEWORK

This chapter consists of four sections which are the theoretical framework, conceptual framework, research hypotheses, and operationalization of variables. Firstly, the theoretical framework is a logically developed, described and elaborated framework of variables. The theoretical framework helps the researcher to apply a logical sense of the relationships among the several factors that have been identified as important to the problem. Secondly, the conceptual framework is hereby being applied by the researcher in explaining the independent and the dependent variables in this study. Thirdly, the research hypotheses present the statements indicating the relationship between the variables. Lastly, the operationalization of variables translates all the variables into action.

3.1 Theoretical Framework

There are a numerous researches, with accompanying illustrations, explaining the relationship between various factors as shown in the following figures. The factors affecting the behavior intention as outlined in the framework consists of the individual factors, as part of the important determinants of adoption, which affect an individual's awareness of the functioning and application of innovation, usefulness suited with his/her activities; the social influences which members of a social group have upon one another's behavior in adoption (Talukder, Harris, and Mapunda, 2007), the role of the subjective norm by Tarkiainen and Sundquist (2005); and the product attributes, as the major stimuli, that influence the consumer's affective, cognition and behavioral tendencies, as corresponding with the individual consequences of Follows and Jobber's (2005) model and also O'Donovan and McCarthy (2002) who used the perceived value in place of product attributes. All the factors mentioned above are shown in figures 3.1-3.4.

Figure3.1: The Framework of Organizational Innovation Adoption: Determinants of the Adoption of Innovation by Individuals within an Organization
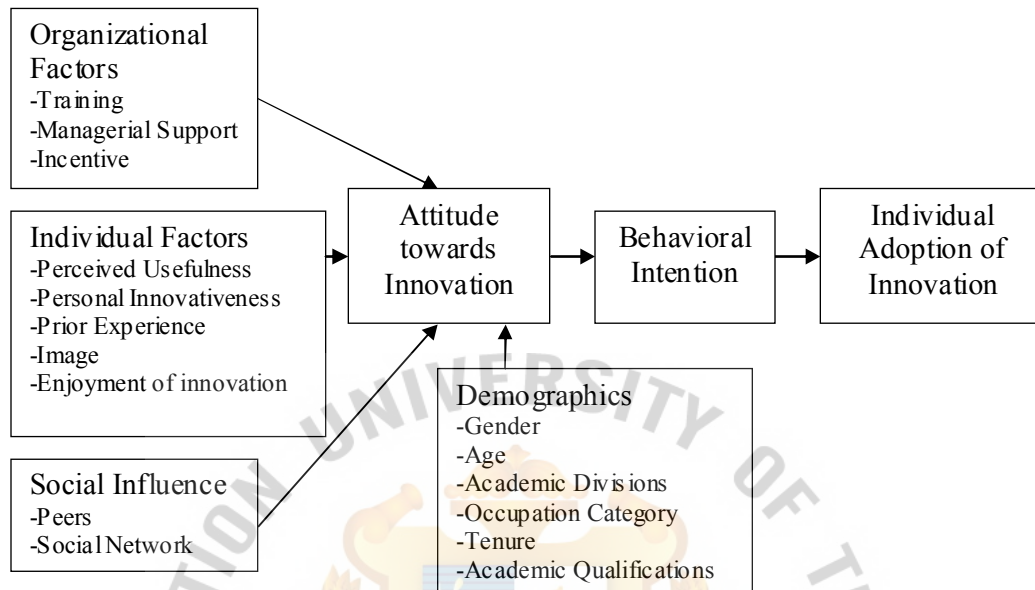
Figure 3.1 represents a study of potential adopters and the factors influencing their adoption decision by individuals of advanced and voluntary elements of technological innovation within the organization. The independent variables in the framework consist of three factor groups, i.e. the organization and the individual factors, and the social influence, which affect the attitude towards innovation. In addition, all three factors have many sub-categories. For example, in the case of individual factors there are cumulatively perceived usefulness, personal innovativeness, prior experience, image, and enjoyment of innovation as sub-variables.

Some of these sub-variables, such as the perceived usefulness may imply the same meaning as the perceived value of O'Donovan and McCarthy's (2002) research, and the product attributes mentioned in other researches. This framework

also finds the impact of demographics on the attitudes' of adopters. The attitude towards innovation leads to the behavioral intention of the individuals to adopt the innovation. The researcher also applied these individual factors (product attributes), social influence, and demographic factors in the conceptual framework.

Figure3.2: The Framework of environmentally responsible purchase behavior: a test of a consumer model
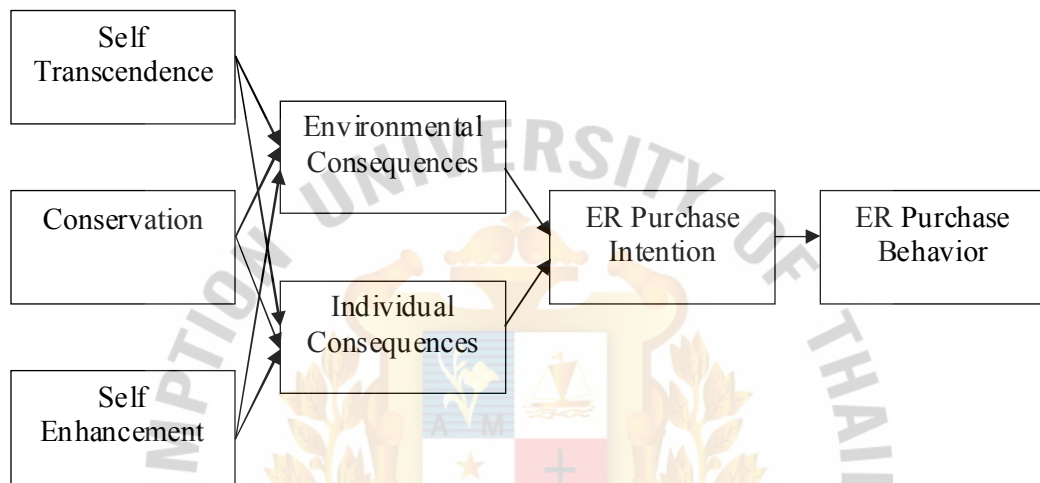
Source: Follows, B. and Jobber (2005), Environmentally responsible purchase behavior: a test of a consumer model, European Journal of Marketing, Vol. 34, No.5/6, p. 735

Figure 3.2 presents a study of the socially conscious consumers who take into account the public consequences of their private consumption; the consumers incorporate the social issues into their purchase decisions by evaluating the consequences of their consumption behavior on society. Firstly, the three consumer value types: self transcendence, conservation, and self enhancement are illustrated and then intervened by the awareness of both the environmental and the individual consequences, thereby affecting the consumer attitude that can be indicated by the attitude measurement scales. This process relates one factor with another before coming to terms with the two attitudes that form a specific purchase intention to be followed by the purchase behavior afterwards. Follows and Jobber (2005) also emphasized in the case of individual consequences that the convenience and ease of

use is one of the product attributes. In this study, the researcher focused only on the environmental and individual consequences to examine the difference between the consumer behavior intentions toward NGV.

Figure3.3: The Framework of Irish Consumer preference for organic meat and environmental concern
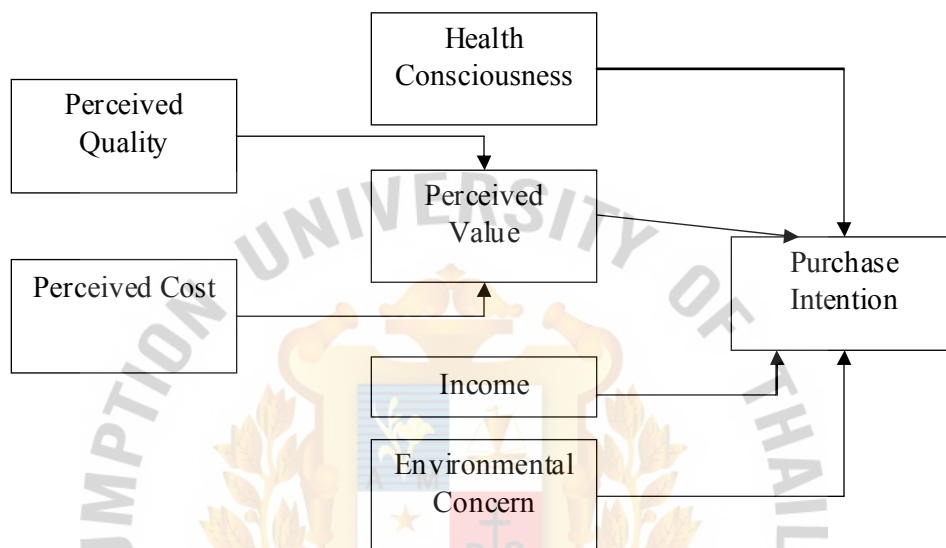
Source: O'Donovan, P. and McCarthy, M. (2002), Irish Consumer preference for organic meat, *British Food Journal*, Vol.104, No.3/4/5, p. 354

Figure 3.3 presents the study of consumer demand for organic meat with special reference to the consumer's perception of food safety, thereby illustrating various factors which affect directly to the purchase intention, i.e. health consciousness, perceived value, income, and the environmental concern. According to O'Donovan and McCarthy (2002), the perceived value factor is linked to the product attribute and the perceived quality element is explained as the quality attribute. Also, the perceived cost, sometimes replaced by the price, is one of the product attributes that the consumers are concerned about.

Watson, Viney, and Schomaker (2002) mentioned that, such utility products as fuel and food fall closely in the category of convenience goods owing to the consumers' regular need and frequent purchase. Therefore, Figure 3.3 and Figure 3.4

are illustrated herein to support the researcher's study on NGV. In this study, the researcher also applied the perceived value and environmental concerns to identify the differences in the consumer behavior intentions toward NGV.

Figure3.4: The Framework of Subjective norms, attitudes and intentions of Finnish consumers in buying organic food
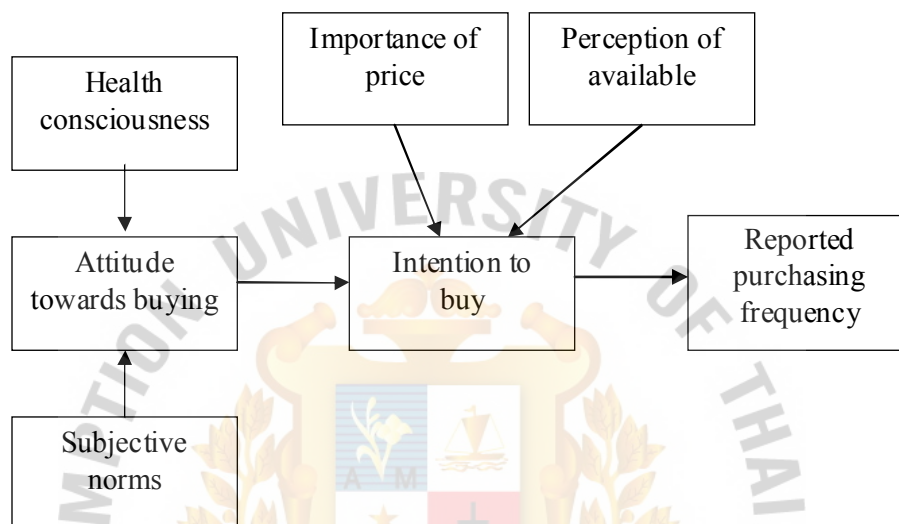
Source: Tarkiainen and Sundqvist (2005), Subjective norms, attitudes and intentions of Finnish consumers in buying organic food, British Food Journal, Vol.107, No.11, p. 812

As shown in Figure 3.4, there are six independents consisting of health consciousness, subjective norm, attitude towards buying, importance of price, perception of availability, and the intention to buy. In contradiction, there are three dependents which are the attitude towards buying, intention to buy, and the reported purchasing frequency.

It can be further explained that the attitude towards buying and the intentions to buy are the intervening variables, whilst, the subjective norm plays a similar role to the social influence factor referring to the perceived social pressure whether or not to perform the behavior. According to, Schiffman and Kanuk (2007), the importance of price and the perception of availability linking the intention to buy also imply some

factors in the product attribute. The researcher adapts subjective norms, importance of price, and perception of available factors for the conceptual framework.

3.2 Conceptual Framework

Based on the preceding theoretical frameworks, the researcher has modified and created a new model of the behavior intention study toward NGV non-buyer behavior as shown below:

Figure 3.5: The Conceptual Framework of a Comparative Study of Prospective Natural Gas for Vehicle (NGV) Buyers' Behavior Intention
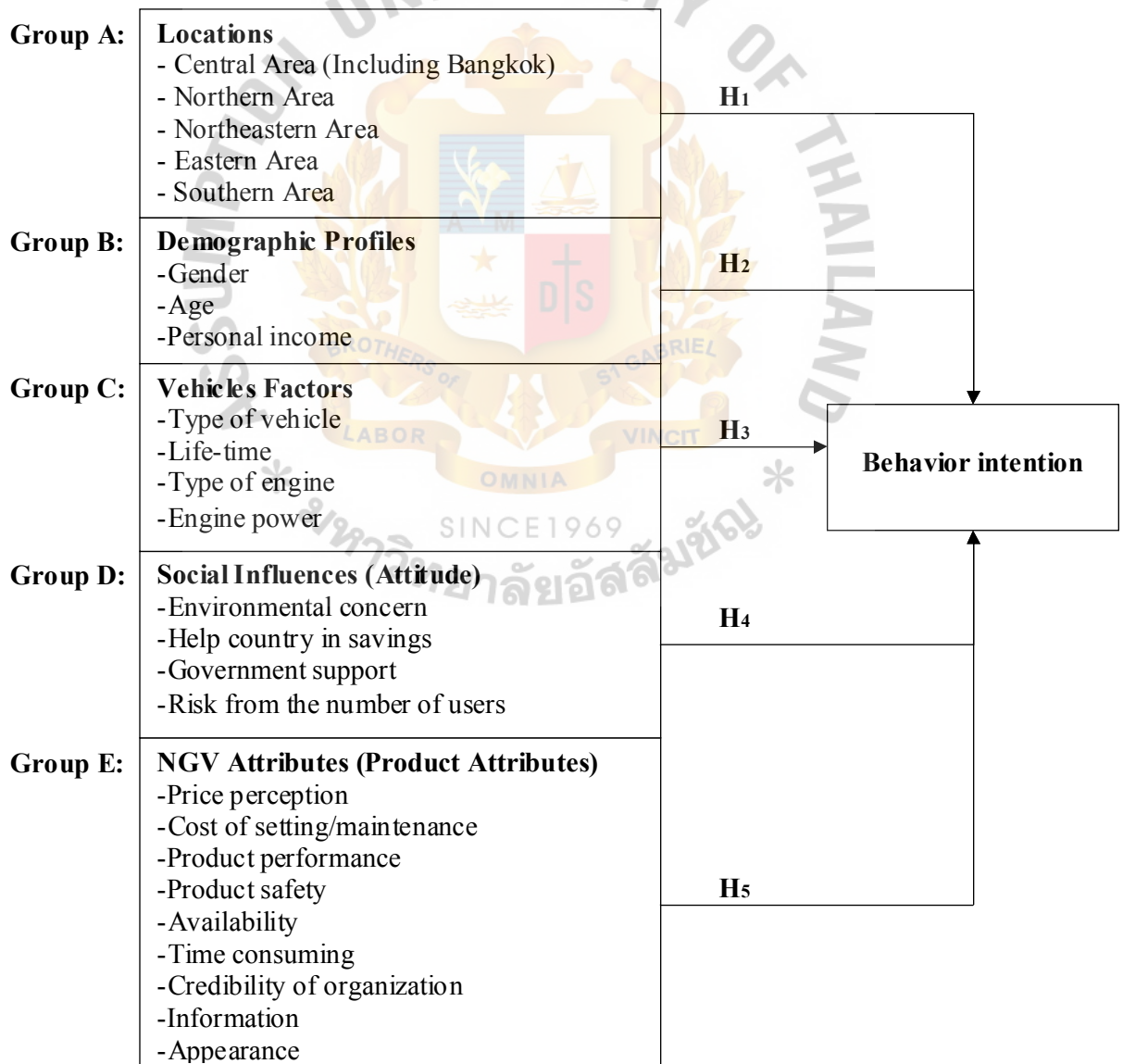
This Modified Conceptual framework based on Talukder, Harris and Mapunda (2007); Follows and Jobber (2005); O'Donovan and McCarthy (2002); and Tarkiainen & Sundqvist (2005)

In the model, the framework shows three key factors affecting the behavior intention: vehicle factor, social influence (attitude) and NGV attribute (product attribute), each of which consists of various sub-variables as follows:

Firstly, the vehicle factors include types' of vehicle, life-time, types of engine and engine power, all of which are considered as the real factors that are related to the NGV product. Although the vehicle factors cannot exhibit any action, each individual owner of different vehicles will actuate the behavior action. The sub-variables in this factor are supported by Byrne and Polonsky (2001); Dearing (2000); Berkowitz, Gallini, Miller, and Wolfe (1985); Kazimi (1997); Contadini (2000); Dregfus and Viscusi (1995) which concluded that the vehicle characteristics and performance (i.e. type of vehicle, life-time, type of engine, and engine power affected the customer intention or adoption of fuel for vehicle consumption.

Secondly, the social influences (attitude) as adapted from the framework of Organizational Innovation Adoption by Talukder, Harris and Mapunda (2007), consist of four sub-variables:

-Environmental concern, which is similar to the framework of Environmentally responsible purchase behavior by Follows and Jobber (2005); the framework of Irish Consumer preference for organic meat by O' Donovan and McCarthy, (2002). It is further supported by Byrne and Polonsky (2001); Ricci, Newsholme, Bellaby, and Flynn (2007); Dearing (2000); Rowlands, Parker, Scott (2002) pertaining to their studies on sustainable energy.

-Help country in savings were supported by Ricci, Newsholme, Bellaby, Flynn (2007); Berkowitz, Gallini, Miller, and Wolfe (1985); and several Thai Journals.

-Government support is one of the consumer concerns which affect their decisions to purchase (Byrne and Polonsky, 2001; Dregfus and Viscusi, 1995, and various Thai Journals).

-Risk from number of users which is similar to the social risk in the consumer innovativeness and perceived risk implication by Hirunyawipada and Paswan (2006), that it is the effect of negative responses from the consumer's social network.

Thirdly, the NGV attributes (product attributes) are a modification from the following frameworks: The Individual Factors in Organizational Innovation Adoption by Talukder, Harris and Mapunda (2007); The Individual Consequence in Environmentally Responsible Purchase Behavior by Follows and Jobber (2005); and The Perceived Value in Irish Consumer preference for Organic Meat by O'Donovan and McCarthy (2002). The sub-variables consist of price perception, cost of setting/maintenance, product performance, product safety, availability, time consumed, credibility of organization, information, and appearance. According to Byrne and Polonsky (2001); Dregfus and Viscusi (1995); and Dearing (2000), these are the main factors by which the consumers make their decisions to adopt sustainable transportation alternative fuel vehicle (AFV).

This modified conceptual framework studies the behavior intention of the consumers who are non-buyers of NGV, who reside in different locations in the five regions of Thailand, i.e. Central Area (Bangkok), Northern Area, Northeastern Area, Eastern Area, Southern Area. At the same time, the study identifies the consumers' demographic factors such as gender, age, marital status, education level, occupation, and personal income.

3.3 Research Hypotheses

Hypotheses are conjectural statements of the relationship between two or more variables that carry clear implications for testing the stated relations. The hypotheses posed in this study are as follows:

<u>Group A</u>: To measure the difference between the consumer locations and the behavior intention

H1 $_o$: There is no difference in the behavior intention when segmented into separate

consumer locations

H1 $_a$: There is a difference in the behavior intention when segmented into separate

consumer locations

Group B: To measure the difference between demographic factors and behavior

intention as follows:

H2 $_o$: There is no difference in the behavior intention when based on gender

H2 $_a$: There is a difference in the behavior intention when based on gender

H3 $_o$: There is no difference in the behavior intention when segmented by age ranges

H3 $_a$: There is a difference in the behavior intention when segmented by age ranges

H4 $_o$: There is no difference in the behavior intention when determined on personal income

scale

H4 $_a$: There is a difference in the behavior intention when determined on personal income

scale

Group C: To measure the behavior intention and various vehicle factors as follows:

H5 $_o$: There is no difference in the behavior intention when determined by types of vehicle

H5 $_a$: There is a difference in the behavior intention when determined by types of vehicle

H6 $_o$: There is no difference in the behavior intention when segmented by life-times of

vehicle

H6 $_a$: There is a difference in the behavior intention when segmented by life-times of

vehicle

H7 $_o$: There is no difference in the behavior intention when based on types of engines

H7 $_a$: There is a difference in the behavior intention when based on types of engines

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H8 $_o$: There is no difference in the behavior intention when determined by engine powers

H8 $_a$: There is a difference in the behavior intention when determined by engine powers

Group D: To measure the correlation between social influences and behavior intention as follows:

H9 $_o$: Environmental concern has no relationship with behavior intention

H9 $_a$: Environmental concern has a relationship with behavior intention

H10 $_o$: Help country in savings has no relationship with behavior intention

H10 $_a$: Help country in savings has a relationship with behavior intention

H11 $_o$: Government support has no relationship with behavior intention

H11 $_a$: Government support has a relationship with behavior intention

H12 $_o$: Risk from the number of users has no relationship with behavior intention

H12 $_a$: Risk from the number of users a relationship with behavior intention

Group E: To measure the correlation between NGV attribute and behavior intention as follows:

H13 $_o$: Price perception has no relationship with behavior intention

H13 $_a$: Price perception has a relationship with behavior intention

H14 $_o$: Cost of setting/maintenance of vehicle has no relationship with behavior intention

H14 $_a$: Cost of setting/maintenance of vehicle has a relationship with behavior intention

H15 $_o$: Product performance has no relationship with behavior intention

H15 $_a$: Product performance has a relationship with behavior intention

H16 $_o$: Product safety has no relationship with behavior intention

H16 $_a$: Product safety has a relationship with behavior intention

H17 $_o$: Availability of NGV has no relationship with behavior intention

H17 $_a$: Availability of NGV has a relationship with behavior intention

H18 $_o$: Time consuming of NGV has no relationship with behavior intention

H18 $_a$: Time consuming of NGV has a relationship with behavior intention

H19 $_o$: Credibility of organization has no relationship with behavior intention

H19 $_a$: Credibility of organization has a relationship with behavior intention

H20 $_o$: Information has no relationship with behavior intention

H20 $_a$: Information has a relationship with behavior intention

H21 $_o$: Appearance has no relationship with behavior intention

H21 $_a$: Appearance has a relationship with behavior intention

3.4 Operationalization of variables

The construction of actual definition and concrete measurement techniques will result in the desired measurements. Therefore the researcher has developed the choice of specific research procedures or the operations that will result in representing the concepts of interest as well as to measure the variables in the theoretical framework.

Table 3.1: Operational Definition of Dependent and Independent Variables

Variable	Concept of Variable	Operationalizing Components	Measurement Scale
1.Behavior intention	To measure the degree of decisions the individuals make to spend their available resources (money, time, effort) on consumption.	It includes: -Consumer intention to use NGV -Consumer will recommend others to buy NGV -Consumer hopes that buying NGV in the near future is reasonable	Interval scale
2. Locations	To identify the respondent's geographical area group	It refers to the respondent's geographical area/ group covering five locations of Thailand (Central, Northern, Northeastern, Eastern, and Southern area)	Nominal scale
3.Demographic Profiles	-Gender: To identify the respondent's sexual status	-It refers to the respondent's status of male or female	Nominal scale
	-Age: To classify the age of respondents	- It refers to the respondent's age ranges of 18-25 years, 26-33 years, 34-41 years, 42-49 years, or 50 years upwards	Ordinal scale
	-Income level: To categorize the monthly income of the respondents	- It refers to the respondent's monthly income scale of less than or equal to 10,000 Baht, 10,001-20,000 Baht, 20,001-30,000 Baht, 30,001-40,000 Baht, and over 40,000 Baht	Ordinal scale
4. Characteristic of vehicles	-Types of vehicle: To identify the vehicle type of the respondents	- It refers to the vehicle's type whether it is a private car not exceeding 7 seats, private car exceeding 7 seats, private truck, and others	Nominal scale

	-Life-time of vehicle: To indicate the age of the respondent's vehicle	- It refers to the life-time of vehicle, whether it is less than 1year, 1-5 years, above 5-10 years, and above 10 years	Ordinal scale
	-Types of engine: To identify the engine type of the respondent's vehicle	- It refers to the type of engine of the vehicle, whether it is benzene or diesel	Nominal scale
	-Engine power of vehicle: To categorize the engine power of the respondent's vehicle	- It refers to the engine power of vehicle, whether it is less than or equal to 1,500, 1,501-1,800, 1,801-2,000, 2,001-3,000, and over 3,000 cc	Ordinal scale
5. Social influences	-Environmental concern: To measure the respondent's attitude towards environment- al concern by examining the degree of agreement	It includes: -Friendly to the environment -Reducing the air pollution -Cleaner burning fuel	Interval scale
	-Help country in savings: To measure the respondent's attitude towards helping the country in savings by examining the degree of agreement	It includes: -Reduce crude oil import -Help country to save money -Has positive impact on the economy	Interval scale
	-Government support: To measure the respondent's attitude towards government support by examining the degree of agreement	It includes: -Encourages product utilization -Reduces the annual vehicle tax to users -Fixes the price -Gives the minimum interest rate loans for necessary modification	Interval scale

	-Risk from the number of users: To measure the respondent's attitude towards risk from the number of users by examining the degree of agreement	It includes: -Few people use the product that causes consumer's concern about buying it. -Fewer people use the product, hence, the consumer may think of the product as having little utility -Switching to use the product when many people are using the same	Interval scale
6. NGV attributes	-Price perception: To measure the respondent's price perception towards the product by examining the degree of agreement	It includes: -It is cost-saving fuel -The price meets the consumer's expectations -Compared to other kinds of fuel, it is rather worth the money -The time of recovering the investment depends on how extensively a vehicle is used.	Interval scale
	-Cost of setting/maintenance: To measure the respondent's expectation towards the setting/ maintenance cost by examining the degree of agreement	It includes: -The set-up cost of component parts (gaseous fuel system and storage cylinder installation) is not too expensive -The maintenance cost is expected to be lower when compared to other fuels	Interval scale
	-Product performance: To measure the respondent's opinion towards product performance by examining the degree of agreement	It includes: -Suitable for all types of engines. (Benzene, Diesel) -Good for the elaboration of all types of vehicle -Gives long distance of journey	Interval scale

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		-Gives the same speed/acceleration as gasoline -Complete burning rate for any engine -Complete substitute fuel for any vehicle	
-Product safety: To measure the respondent's opinion towards product safety by examining the degree of agreement	It includes: -Safe alternative fuel -Standard set up -The strong capacity of product (cylinder) for containing highly pressurized gas -Safe for the consumer's health by preventing any diseases caused by air pollution	Interval scale
-Availability: To measure the respondent's opinion towards product availability by examining the degree of agreement	It includes: -Sufficient resources -Refueling stations of product are currently available -Set-up stations are easy to find -Maintenance stations easy to find	Interval scale
-Time consuming: To measure the respondent's expectation towards product's time consuming by examining the degree of agreement	It includes: -Refueling time is expected to be time-saving -Each refueling lasts for a long time of driving as compared to other fuels	Interval scale
-Credibility of organization: To measure the respondent's opinion towards organization credibility, reliability, and trust by examining the degree of agreement	It includes: -Company has a good reputation -Consumer can trust its product -Consumer can rely on the product once it is used	Interval scale

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	-Information: To measure the respondent's opinion towards product information whether or not it is sufficient for the consumer making by examining the degree of agreement	It includes: -Product properties information is available and plentiful -The information comparing the differences among fuel products is available and plentiful	Interval scale
	-Appearance: To measure the respondent's anticipation about product appearance whether or not it is appealing towards intention by examining the degree of agreement	It includes: -Expect that many sizes of product to suit any vehicle -Design of product that consumer expects appropriate for his vehicle -Weight of product that consumer expects is suitable -There are still enough spaces left for package loading when setting -If setting up in the car, the balance of the vehicle is still good	Interval scale

CHAPTER 4
RESEARCH METHODOLOGY

This chapter presents an overview of the research methodology. In order to realize the research objectives, appropriate research design is important as the guide in collecting the data. This chapter consists of seven parts. The first part is the research method that describes the way of selecting the respondents and collecting the data. The second part describes the characteristic of research population and the sample size of respondents. The third part is devoted to explain the research instrument; in this case, the researcher used a questionnaire which combines a series of different questions which examined the behavior intention toward NGV product. The fourth part is used to explain the pretest results. The final section involves the explanation of data collection and statistical analysis.

4.1 Method of research used

This descriptive research, which has been conducted by a questionnaire-survey method, explains the demographic profile of a population or phenomenon, and seeks to determine the answer to the 'who,-what,-where,-and-how' questions, and to identify the differences in the need, attitudes, and characteristics of subgroups (Zikmund, 2003). This data is known as quantitative data. The actual population or respondents is unknown. The researcher focuses on the vehicle-owners who have not experienced buying NGV. Due to the limitation of this study, only 500 respondents are selected as a sample size. The quota and the convenient samplings are applied in collecting the data at the top province of each of the five regions. The survey took place during February and March 2008 at a number of large refueling stations owned by PTT Public Company Limited. The questionnaire covers factors related to vehicle type, social influences, and product attributes which are related to respondents' NGV behavior intention.

4.2 Respondents and sampling procedures

4.2.1 Population

The population in this study is people who have their own vehicles registered in five regions in Thailand totaling 5,974,724 people as shown in Table 1.1. The highest ranking number of registrations is in the Central Area of Thailand, or Bangkok (2,283,536), while the Northern Area is Chiang Mai (118,603), the Northeastern Area is Nakhon Ratchasima (187,222), the Eastern Area is Chonburi (201,754), and the Southern Area is Songkhla (158,430). However, the population of the study is purely NGV non-buyers and the researcher does not know the exact number of people who are now using NGV in their modified vehicles in each of the five regions. Therefore, the real population is unknown.

4.2.2 Sample size

The samples, as mentioned, are the people who do not use NGV with their vehicles and are an unknown population. Hence, the number of samples needed for conducting this research is based on previous studies: Rowland, Parker, Monroe and Scott (2002) examined the consumer perceptions of the environmental impacts of different energy influencing the behavior intentions toward green products, 480 respondents answered the questionnaires. Another is Follows and Jobber's (2005) study whereby the authors researched the determinants of environmentally responsible purchase behavior in baby diaper product, with 334 sampled respondents. In addition, Au and Enderwick (2000) studied the attitude towards technology adoption: results of an empirical study, 298 persons completed the questionnaires. In the same way, Tarkiainen and Sundquist (2005) studied subjective norms, attitude and intentions of 200 Finnish consumers, who were sample respondents, in buying organic food. Similarly, Fin and Suh (2005) applied 200 respondents as the sample sizes for integrating effect of consumer perception factors in predicting private brand purchase in a Korean discount store context.

Furthermore, Blank (1984) mentioned that the sample size must be large enough to represent the entire population in order to generate a valid result. Therefore, this study targeted 500 sample respondents to ensure a good outcome.

4.2.3 Sampling procedure

The sampling procedures comprise of purposive sampling, quota sampling, and convenience sampling, respectively as per the following details:

Step1: Purposive Sampling

The purposive sampling method of non-probability is employed when an experienced individual selects the sample based on his/her judgment (Sekaran, 1992). According to Table 1.1, the researcher used the highest ranking province in each region. Thai people who have their own cars registered in each region represent each region's population as follows: Central Area represented by Bangkok, Northern Area represented by Chiang Mai, Northeastern Area represented by Nakhon Ratchasima, Eastern Area represented by Chonburi, and Southern Area represented by Songkhla.

Step2: Quota Sampling

The quota sampling method of non-probability is used in representing the subgroups of the population (Blank, 1984; Sekaran, 1992). The number of people who have registered the vehicles in each region is known, however, those who are non-buyers of NGV are unknown. The study focuses on the behavior intention in each region, and the research collected data from approximately 500/5 = 100 respondents in each region. The proportion is illustrated in Table 4.1:

Table 4.1: The proportion of respondents among five regions

Regions	Amount (person)
Central Area (Bangkok)	100
Northern Area (Chiang Mai)	100
Northeastern Area (Nakhon Ratchasima)	100
Eastern Area (Chonburi)	100
Southern Area (Songkhla)	100
Total	500

Step 3: Convenience Sampling

The convenience sampling is used in order to collect the needed data from 500 respondents who are conveniently available to answer the questions (Sekaran, 1992) at the refueling stations of PTT Public Company Limited, during February to March of year 2008. Thus, the people who refuel in PTT stations have better access to knowledge about the NGV product and can be prospective or future NGV consumers of the PTT Public Co., Ltd. Five questionnaires were distributed every hour to the respondents for completion in order to avoid any errors.

4.3 Research Instrument

The research questionnaire, consisting of sixty-one questions, divided into six parts was prepared in Thai language, which is suitable for the understanding of respondents. The details are as follows:

Part 1: Screening question;

1.1 The first 'yes–no' question is to screen the respondents on whether or not he/she owns a vehicle registered in Thailand.

1.2 The following open-ended question is to ask the amount of private vehicles registered in Thailand of the respondents.

Part 2: Demographic profiles:

2.1 Gender; there are two choices provided, male or female.

2.2 Age; there are five choices provided, for the age ranging from 18-25 years old, 26-33 years old, 34-41 years old, 42-49 years old, and above 50 years old.

2.3 Marital status; there are two choices provided, single or married.

2.4 Education level; there are three choices provided, i.e. less than bachelor degree, bachelor degree or equivalent, and higher than bachelor degree.

2.5 Occupation; there are five choices provided, i.e. are student, government or state enterprise officer, official employee, business owner, and others.

2.6 Income; there are five choices provided, i.e. are less than or equal to 10,000 Baht, 10,001-20,000 Baht, 20,001-30,000 Baht, 30,001-40,000 Baht, and Above 40,000 Baht.

2.7 Living area; there are five choices provided, i.e. Central Area (Bangkok), Northern Area, Northeastern Area, Eastern Area, and Southern Area.

Part 3: Characteristic of vehicles and fuel consumption; there are five questions asking using closed-ended question as adapted from Isarasaena-Na-Ayutthaya, Rongviriyapanith, Vichearnsan, and Sanyaluklur- chai (2006).

3.1 Types of vehicle; this question has a remark requesting the respondent to select the vehicle most frequently used at present. In addition, there are four choices provided, i.e. private car not exceeding 7 seats, private car exceeding 7 seats, private truck and others according to the type of private vehicle officially registered in Thailand with the Department of Land Transport (12/12/2007).

3.2 Life-time of vehicle; this question specifies the number of years in use until now; four choices are provided i.e. less than 1year, 1-5 years, 5-10 years, and above 10 years.

3.3 Types of engine; two choices are provided i.e. benzene and diesel.

3.4 Engine power of vehicle; five choices are provided i.e. less than or equal to 1,500 cc, 1,501-1,800 cc, 1,801-2,000 cc, 2,001-3,000 cc, above 3,000 cc.

3.5 Average fuel expense per month; there are five choices provided i.e. less than or equal to 1,000 Baht, 1,001-2,000 Baht, 2,001-3,000 Baht, 3,001-4,000 Baht, and above 4,000 Baht.

Part 4: Social Influences; there are four variables which consist of Environmental concern, Help country in savings, Government support, and Risk from the number of users. The thirteen questions are based on Likert five point scales method examining the degree of agreement. The questions are concerned with social influences on behavior intention toward NGV, using Schiffman and Kanuk's (2007) model.

The scales in this part are ranked in respective order:

    1. refers to "Strongly disagree"

    2. refers to "Disagree"

    3. refers to "Neutral"

    4. refers to "Agree"

    5. refers to "Strongly agree"

Part 5: NGV attributes; there are nine variables consisting of Price perception, Cost of setting/maintenance, Product performance, Product safety, Availability, Time consuming, Credibility of organization, Information and Appearance. The thirty-two questions are also based on Likert five point scales method asking degree of agreement. The questions are related to product attribute influencing behavior intention toward NGV by using Schiffman and Kanuk's (2007) model.

The scales in this part are ranked in respective order:

1. refers to "Strongly disagree"
2. refers to "Disagree"
3. refers to "Neutral"
4. refers to "Agree"
5. refers to "Strongly agree"

Part 6: Behavior intention; there are two questions using Likert five point scale to sound out the degree of NGV behavior intention by using the Schiffman and Kanuk (2007) model.

The scales in this part are ranked in respective order:

1. refers to "Definitely not"
2. refers to "Probably not"
3. refers to "Uncertain"
4. refers to "Probably"
5. refers to "Definitely"

At this point, the customers are encouraged to express their opinions or suggestions on NGV.

4.4 Pre-tests

Before the active field study, a pilot study employing 50 questionnaires was launched for testing by convenience sampling at PTT refueling stations in Bangkok in November, 2007, in order to determine its suitability for the ultimate survey. The pilot study follows what Vanichbancha (2007) mentioned in that the number of trial survey should be at least 25 respondents. In addition, the researcher is using the Cronbach's coefficients alpha which is suitable for multi-point scaled items in testing

its consistent reliability where an α less than 0.6 means that the questionnaires are considered as poor and unreliable , whereas an α greater than 0.6 means the questionnaires considered as acceptable, according to Sekaran (1992). Based on the statistical package for social science (SPSS program) which was used to pre test the questionnaires, the results are shown in Table 4.2:

Table 4.2: The reliability of the questionnaire showing each dimension

Variables	Interval variables	Cronbach's Alpha
Social influences	Environmental concern	.614
	Help country in savings	.752
	Government support	.727
	Risk from number of users	.532
NGV Attributes	Price perception	.626
	Maintenance cost	.635
	Product performance	.814
	Product safety	.841
	Availability	.870
	Time consuming	.486
	Organization credibility	.623
	Information	.825
	Appearances	.861
Behavior intention	Behavior intention	.807

From Table 4.2, the results show that the pre-tested questionnaire of all variables dimensions was reliable because of Cronbach's coefficients alpha is greater than 0.6, with the exception of 2 variables i.e. Risk from number of users and Time consuming. However, the bigger sample size will offer better values of alpha test. As Vanichbancha (2007) mentioned that the number of pretest samples should be 20-100. Therefore, the researcher is confident of higher alpha values based on the distribution of 500 questionnaires.

4.5 Collection of Data

The data of this research comes mainly from two sources. The first is from the primary data or the data that has been collected from the respondents who answered the questionnaires during early February-March, 2008 at a number of large refueling stations of PTT Public Company Limited in the five provinces mentioned in Table1.1.

Five questionnaires were distributed every hour to the respondents for filling. The reason of focusing on PTT refueling stations because PTT is one of the most significant organizations in Thailand and apart from being the market leader of fuels, it is also is the only one NGV buyer (www.eppo.go.th, 15/11/2007). The second source of data is secondary data that has been collected through Internet from the previous researchers, whose works were published in various journals and articles. Some of the information is also obtained from such hard copies such as theses and text books, and the newspapers as well. The information on the number of the people who have their own vehicles registered in each province/region in Thailand during 1997-2007 was obtained from the Land Transport Management Bureau, Department of Land Transport on December 12, 2007.

4.6 Statistical treatment of data

The researcher used both descriptive and inferential analysis in the statistical treatment of data. For the descriptive statistics, the researcher used percentage, arithmetic mean, and standard deviation in explaining the demographic information of respondents and in estimating the proportion among respondents. For the inferential statistics, the researcher used the SPSS program to test the hypotheses set up for this study. The explanations on the statistical techniques used are as follows:

The descriptive statistics

In case of descriptive statistics, the researcher used percentage, arithmetic mean, and standard deviation to explain the demographic information of respondents and estimate proportion among respondents. By doing this, the collected raw data was summarized into a form that is easy to understand and interpret (Zikmund, 2003). The statistical tools and formulae used in this research are (Ingram and Monks, 1992):

Percentage: $\text{Percentage }(\%) = \dfrac{X \times 100}{n}$

Mean: $\overline{X} = \dfrac{\sum X}{n}$

Standard deviation: $SD = \sqrt{\dfrac{\sum(\overline{X} - X)^2}{n-1}}$

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Where X = Individual data values or frequency

$\overline{X}$ = Mean

n = Sample size

SD = Standard deviation

The inferential statistics

The inferential statistics is an estimate or prediction or some other generalization about a population based on the information contained in a sample (Zikmund, 2003). The researcher used SPSS Program to analyze the relationship among the selected factors with the help of the following statistical tools:

Independent T-Test

The independent T-Test is a statistical tool used to analyze the difference between two population means of independent samples. In this research the two different groups are the two genders of consumers. The formula is shown below (Zikmund, 2003):

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\dfrac{S_1^2}{n_1} + \dfrac{S_2^2}{n_2}}}$$

Where: $\overline{X_1}$ = Sample mean of group 1

$\overline{X_2}$ = Sample mean of group 2

S_1 = Sample standard deviation of group 1

S_2 = Sample standard deviation of group 2

n_1 = Sample size of group 1

n_2 = Sample size of group 1

Analysis of Variance (ANOVA)

The analysis of variance is a statistical tool designed to test the equality means over the two groups with the dependent variable. In this research, the different groups were the location and the demographic profiles of consumer, exclusive of gender. The formula is shown below (Zikmund, 2003):

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$$SS_{total} = \sum_{i=1}^{n} \sum_{j=1}^{c} \left(X_{ij} - \overline{\overline{X}} \right)^2 \qquad SS_{total} = SS_{within} + SS_{between}$$

Where: X_{ij} = Individual score or test unit in the jth group

$\overline{\overline{X}}$ = Group mean

n = Number of all observations or test units in a group

c = Number of the jth group

$SS_{whithin}$ = Sum of square within groups

$SS_{between}$ = Sum of square between groups

$$SS_{within} = \sum_{i=1}^{n} \sum_{j=1}^{c} \left(X_{ij} - \overline{X}_j \right)^2 \qquad SS_{between} = \sum_{j=1}^{c} n_j * \left(\overline{X}_j - \overline{\overline{X}} \right)^2$$

Where: X_{ij} = Individual score or test unit in the jth group

$\overline{X}_j$ = Group mean for the jth group

$\overline{\overline{X}}$ = Group mean

n_j = Number of items in the jth group

n = Number of all observations or test units in a group

c = Number of the jth group

$$MS_{between} = \frac{SS_{between}}{c-1} \qquad MS_{within} = \frac{SS_{within}}{c*n-c}$$

Where: $MS_{between}$ = Mean square between groups

MS_{within} = Mean square within groups

$c-1$ = Degree of freedom between groups

$c*n-1$ = Degree of freedom within groups

n = Number of all observations in a group

c = Number of groups

$$F = \frac{MS_{between}}{MS_{within}}$$

Coefficient of Correlation

The coefficient of correlation is a measurement of the strength and direction of the linear relationship between the two variables, and the resulting numerical measurement describes the linear association between the two variables (Zikmund, 2003). Below is the interpretation of each Correlations Coefficients, resulting from the Correlation Test (Mason, Lind, and Marchal, 1999).

Correlations Coefficients	Correlation Level
-1.00	Perfect negative correlation
-0.95	Strong negative correlation
-0.50	Moderate negative correlation
-0.10	Weak negative correlation
0.00	No correlation
+0.10	Weak positive correlation
+0.50	Moderate positive correlation
+0.95	Strong positive correlation
+1.00	Perfect positive correlation

In this research, the researcher found the relationships among various sub-variables which are demographic profile, sub-variables in the vehicle factors, sub-variables in social influences, sub-variables in NGV attributes and behavior intention., according to the following (Zikmund, 2003):

$$r = \frac{S_{xy}}{\sqrt{S_x S_y}} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where: r = Sample Coefficient of Correlation

4.7 Summary of statistical tools used in testing hypotheses

The null hypotheses are summarized in Table 4.3 with the statistical techniques used as follows:

Table 4.3: The statistical technique used for each of hypothesis

Null Hypothesis	Null Hypothesis description	Statistical technique used
H1 $_o$	There is no difference in the behavior intention when segmented into separate consumer locations	Analysis of Variance (ANOVA)
H2 $_o$	There is no difference in the behavior intention when based on gender	Independent T-Test
H3 $_o$	There is no difference in the behavior intention when segmented by age ranges	Analysis of Variance (ANOVA)
H4 $_o$	There is no difference in the behavior intention when determined on personal income scale	Analysis of Variance (ANOVA)
H5 $_o$	There is no difference in the behavior intention when determined on types of vehicle	Analysis of Variance (ANOVA)
H6 $_o$	There is no difference in the behavior intention when segmented by life-times of vehicle	Analysis of Variance (ANOVA)
H7 $_o$	There is no difference in the behavior intention when based on types of engines	Independent T-Test
H8 $_o$	There is no difference in the behavior intention when determined by engine powers	Analysis of Variance (ANOVA)
H9 $_o$	Environmental concern has no positive relationship with behavior intention	Coefficient of Correlation
H10 $_o$	Help country in savings has no positive relationship with behavior intention	Coefficient of Correlation
H11 $_o$	Government support has no positive relationship with behavior intention	Coefficient of Correlation
H12 $_o$	Risk from the number of users has no negative relationship with behavior intention	Coefficient of Correlation
H13 $_o$	Price perception has no negative relationship with behavior intention	Coefficient of Correlation
H14 $_o$	Cost of setting/maintenance of vehicle has no negative relationship with behavior intention	Coefficient of Correlation
H15 $_o$	Product performance has no positive relationship with behavior intention	Coefficient of Correlation

H16 $_o$	Product safety has no positive relationship with behavior intention	Coefficient of Correlation
H17 $_o$	Availability of NGV has no positive relationship with behavior intention	Coefficient of Correlation
H18 $_o$	Time consuming of NGV has no negative relationship with behavior intention	Coefficient of Correlation
H19 $_o$	Credibility of organization has no positive relationship with behavior intention	Coefficient of Correlation
H20 $_o$	Information has no positive relationship with behavior intention	Coefficient of Correlation
H21 $_o$	Appearance has no negative relationship with behavior intention	Coefficient of Correlation

CHAPTER 5

PRESENTATION OF DATA AND CRITICAL

DISCUSSION OF RESULTS

This chapter presents the results obtained from the survey that was conducted in PTT's large refueling stations in Thailand based on the conceptual framework and the procedures discussed earlier in Chapter 3 and 4. The primary data analysis can be classified into two sections. The first section contains the descriptive statistics identifying the data in forms of frequency, percentage, and mean. The second section presents the hypothesis testing results.

5.1 Descriptive Statistics

The following table 5.1 summarizes the descriptive analysis of respondents' demographic factors and general background.

Table 5.1: The Analysis of Respondents' Demographic Factors by Using Frequency and Percentage.

Variables	Frequency (f)	Percent (%)
Gender		
- Male	335	67.0
- Female	165	33.0
Total	500	100.0
Age		
- 18-25 years old	147	29.4
- 26-33 years old	161	32.2
- 34-41 years old	72	14.4
- 42-49 years old	84	16.8
- above 50 years old	36	7.2
Total	500	100.0
Marital status		
- Single	299	59.8
- Married	201	40.2
Total	500	100.0

Education level		
- Less than Bachelor degree		
- Bachelor degree or Equivalent	135	27.0
- Higher than Bachelor degree	246	49.2
Total	119	23.8
	500	100.0
Occupation		
- Student		
- Government or State enterprise officer	118	23.6
	158	31.6
- Official employee		
- Business owner	128	25.6
- Others	76	15.2
Total	20	4.0
	500	100.0
Income level		
- Less than or equal to 10,000 baht		
- 10,001-20,000 Baht	142	28.4
- 20,001-30,000 Baht	148	29.6
- 30,001-40,000 Baht	94	18.8
- Above 40,000 Baht	65	13.0
Total	51	10.2
	500	100.0
Living area		
- Central area (include Bangkok)		
- Northern area	100	20.0
- Northeastern area	100	20.0
- Eastern area	100	20.0
- Southern area	100	20.0
Total	100	20.0
	500	100.0

According to Table 5.1, the highest percentage of the respondents' gender is male for 67% (335), followed by 33% (165) who were female.

The highest percentage of the respondents' age range falls into the 26 to 33 years for 32.2% (161), followed by the 18 to 29 years at 29.4% (147), the 42 to 49 years at 16.8% (84), the 34 to 41 years at 14.4% (72), and above 50 years at 7.2% (36), respectively.

The percentage of the single respondents is 59.8% (299) greater than 40.2% (201) respondents who are married.

The highest percentage of the respondents' education level is bachelor degree or equivalent for 49.2% (246), followed by those below bachelor degree at 27% (135), and the higher degrees at 23.8% (119), respectively.

The highest percentage of the respondents' occupation is government or state enterprise officer for 31.6% (158), followed by official employee 25.6% (128), student 23.6% (118), business owner 15.2% (76), and others 4% (20), respectively.

The highest percentages of the respondents' income level is those earning 10,001-20,000 baht for 29.6% (148), followed by those less than or equal 10,000 baht 28.4% (142), 20,001-30,000 baht 18.8% (94), 30,001-40,000 baht 13.0% (65), and above 40,000 baht 10.2% (51), respectively.

This survey has been conducted on an equal number of respondents living in each of the five regions in Thailand, i.e. Central area (include Bangkok), Northern area, Northeastern area, Eastern area, and Southern area by using quota sampling method.

Table 5.2: The Analysis of the Social Influence factor by using Mean and Standard Deviation

	N	Mean	Std. Deviation
Social Influence			
Environmental			
- NGV is friendly to the environment	500	3.87	0.879
- Using NGV reduces the air pollution	500	3.85	0.853
- NGV is potentially a cleaner burning fuel than gasoline	500	3.57	0.935
Total	500	3.76	0.763
Help Country in Savings			
- Using NGV can reduce crude oil import	500	4.06	0.888
- Using NGV can help country to save money	500	4.07	0.859
- NGV has a positive impact toward economy	500	3.97	0.867
Total	500	4.03	0.781
Government Support			
- You believe that the Government encourages the use of NGV	500	3.70	0.900
- You believe that the Government reduces the annual vehicle tax to NGV users	500	3.66	0.942

	N	Mean	Std. Deviation
- You believe that the Government fixes the price of NGV	500	3.62	0.926
- You believe that the Government gives the lending interest incentives for NGV instrument setting	500	3.74	0.975
Total	500	3.68	0.767
Risk from the number of user			
- Few people are using NGV that makes you become concerned about buying it	500	3.43	0.971
- The fewer people use NGV, the less utility you will have from these product	500	3.14	1.004
- You will switch to NGV only when a lot of people are using	500	3.13	1.087
Total	500	3.24	0.841

Table 5.2 shows that the highest mean of social influence is 4.03 in the help country savings variable, followed by the environmental 3.76, the government support 3.68, whereas the lowest is 3.24 in the risk from the number of user variable.

Table 5.3: The Analysis of the NGV Attribute factors by using Mean and Standard Deviation

	N	Mean	Std. Deviation
NGV Attributes			.
Price			
- NGV is cost-saving fuel	500	3.92	0.864
- The price of NGV meets your expectations	500	3.66	0.857
- Comparing to other kinds of fuel, NGV is more value for your money	500	3.86	0.867
- The speed of recovering investment incurred in NGV conversion depends how extensive a vehicle is used. The more the car runs, the sooner the cost can be recovered	500	3.79	0.861
Total	500	3.81	0.714
Maintenance Cost			
- The cost for NGV set up component parts (gaseous fuel system and storage cylinder installation) is not expensive	500	2.90	1.063
- The maintenance cost of NGV that you expect is less when comparing to other kinds of fuel	500	3.04	0.936
Total	500	2.97	0.901
Performance			
- NGV is suitable for all types of engine. (Benzene, Diesel)	500	3.29	0.904
- NGV is good for the elaboration of all types of vehicle.(Compact, Sedan, SUV, ...)	500	3.37	0.869
- NGV gives long distance of journey	500	3.28	0.918

- NGV gives the same speed/acceleration of your vehicle as gasoline	500	3.19	0.933
- NGV has a complete burning rate for engine	500	3.37	0.836
- NGV is a complete substitute fuel for vehicle	500	3.41	0.887
Total	500	3.32	0.682
Safety			
- NGV is a safety alternative fuel	500	3.52	0.862
- NGV set up is standardized	500	3.39	0.831
- The strength of NGV cylinders and other equipment can contain high pressure of gas	500	3.47	0.843
- NGV is safe for consumer's health by preventing disease from air pollution	500	3.62	0.868
Total	500	3.50	0.720
Availability			
- NGV has a sufficient resource	500	3.21	0.916
- NGV gas stations are currently available	500	2.63	1.077
- NGV set up stations is easy to find	500	2.80	1.051
- NGV maintenance stations is easy to find	500	2.69	1.030
Total	500	2.83	0.878
Time Consumed			
- NGV refuel time that you expect is saving	500	3.19	0.999
- Refueling NGV one time gives a long time driving compares to other fuels	500	3.21	1.010
Total	500	3.20	0.906
Credibility of organization			
- PTT company has a good reputation	500	3.94	0.795
- You can trust NGV fuel from PTT	500	3.80	0.770
- You can rely on NGV fuel if you use it	500	3.55	0.861
Total	500	3.77	0.677
Information			
- The NGV properties information is abundantly available	500	3.23	0.884
- The information about the difference among fuel products is readily available	500	3.17	0.848
Total	500	3.20	0.814
Appearance			
- You expect that many sizes of NGV cylinder are appropriate for vehicle	500	3.41	0.829
- Shape of NGV cylinder that you expect is appropriate for vehicle	500	3.33	0.880
- Weight of NGV cylinder that you expect is suitable	500	3.22	0.922
- If you set up NGV in your car, there are still spaces left for package loading	500	3.13	0.915
- If you set up NGV in your car, the balance of your vehicle is still good	500	3.23	0.872
Total	500	3.26	0.730

Table 5.3 shows that the highest mean of total NGV attributes' is 3.81 in the price perception variable, followed by the credibility of organization 3.77, the safety 3.50, the product performance 3.32, the appearance 3.23, the time consumed and the information 3.20, and the maintenance cost 2.97, while the lowest is 2.83 in the availability variable.

Table 5.4: The Analysis of the consumers' Behavior Intention by using Mean and Standard Deviation

	N	Mean	Std. Deviation
Behavior Intention			
- You intend to use NGV	500	3.59	1.043
- You will recommend others to buy NGV	500	3.63	1.037
- You think that buying NGV in the near future is reasonably	500	3.53	1.027
Total	500	3.58	0.983

Table 5.4 shows that the average mean of behavior intention is equal to 3.58. The highest mean of behavior intention is 3.63 in recommend others to buy NGV sub-variable, whereas the lowest is 3.53 in think that buying NGV in the near future is reasonably sub-variable.

5.2 Reliability analysis

The researcher used a questionnaire which was distributed to 500 respondents in PTT's large refueling stations of Thailand during the period of 15th February 2008 until 30th March 2008. The reliability of the questionnaire was analyzed by using Cronbach's coefficient alpha similar to the pretest conducted and presented in Chapter 4. The results are shown in Table 5.14.

Table 5.5: The reliability of the questionnaires of each interval variables dimensions

Variables	Interval variables	Cronbach's Alpha
Social influences	Environmental concern	.819
	Help country in savings	.878
	Government support	.837
	Risk from number of user	.762
NGV Attributes	Price perception	.848
	Setting/Maintenance cost	.765

	Product performance	.858
	Product safety	.868
	Availability	.883
	Time consuming	.769
	Organization credibility	.784
	Information	.867
	Appearances	.884
Behavior intention	Behavior intention	.944

From Table 5.5, the Cronbach coefficient alpha values of all variables dimensions were greater than 0.6 which meant that the questionnaire was reliable and acceptable.

5.3. Hypotheses Analysis

There are five groups of hypotheses which were classified into twenty one research hypotheses. All hypothesis tests can be divided into two groups. The first group (hypothesis one - hypothesis three), ANOVA and Independent Sample t-test is performed to test the difference between demographic factors and vehicle factors toward behavior intention. The second group (hypothesis four - hypothesis five), Pearson Product-Moment Correlation Coefficient is performed to test the relationship between both social influences and NGV attributes toward behavior intention.

<u>Group A:</u> To measure the difference between the consumer locations and the behavior
          intention

H1 $_o$: There is no difference in the behavior intention when segmented into separate living
       locations

H1 $_a$: There is a difference in the behavior intention when segmented into separate living
       locations

Table 5.6: The analysis of the difference of the consumers' behavior intention when segmented into separate living locations by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	50.222	4	12.556	14.401	.000
Within Groups	431.578	495	.872		
Total	481.800	499			

In the first hypothesis testing, the null hypothesis stated that there is no difference in the consumers' behavior intention despite their different living locations. The analysis of variance in Table 5.6 indicates that the sig. of consumer locations and behavior intention of NGV is equivalent to 0.000, which is less than 0.05 (0.000<0.05). It means that the null hypothesis is rejected. Therefore, it indicates that there is a difference in the consumers' behavior intention when determined by different living locations at the 0.05 significant level.

Group B: To measure the difference between the consumers' demographic factors and their behavior intention

$H2_o$: There is no difference in the behavior intention when based on gender

$H2_a$: There is a difference in the behavior intention when based on gender

Table 5.7: The analysis of the consumers' behavior intention when based on gender by using Independent sample t-test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
							Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)			Lower	Upper
MBI	Equal variances assumed	.092	.761	1.068	498	.286	.09980	.09344	-.08379	.28339
	Equal variances not assumed			1.082	338.123	.280	.09980	.09221	-.08157	.28117

The null hypothesis stated that there is no difference in the behavior intention when based on gender. The analysis of Independent sample t-test in Table 5.7 shows that the sig. (2-tailed test) is equal to 0.286, which is greater than 0.05 (0.286>0.05). It means that the null hypothesis has failed to reject. Then, it can be concluded that

there is no difference in the consumers' behavior intention when based on gender at the 0.05 significant level.

H3$_o$: There is no difference in the behavior intention when segmented by age ranges

H3$_a$: There is a difference in the behavior intention when segmented by age ranges

Table 5.8: The analysis of the consumers' behavior intention when segmented into age ranges by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12.027	4	3.007	3.168	.014
Within Groups	469.773	495	.949		
Total	481.800	499			

The null hypothesis showed that there is no difference in the behavior intention when segmented by age ranges. The analysis of variance in Table 5.8 indicates that the sig. of the consumers' age ranges and their behavior intention of NGV is equivalent to 0.014, which is less than 0.05 (0.014<0.05). It means that the null hypothesis is rejected. Therefore, it indicates that there is a difference in the consumers' behavior intention when segmented by age ranges at the 0.05 significant level.

H4$_o$: There is no difference in behavior intention when determined on personal income scales

H4$_a$: There is a difference in behavior intention when determined on personal income scales

Table 5.9: The analysis of the consumers' behavior intention when determined on their personal income scale by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.915	4	3.479	3.680	.006
Within Groups	467.885	495	.945		
Total	481.800	499			

The null hypothesis showed that there is no difference in the behavior intention when determined by personal income scale. The analysis of variance in Table 5.9 indicates that the sig. of the consumers' personal income scale and their behavior intention of NGV is equal to 0.006, which is less than 0.05 (0.006<0.05). It means that the null hypothesis is rejected. Therefore, it indicates that there is a difference in the consumers' behavior intention when determined by personal income scale at the 0.05 significant level.

Group C: To measure the consumers' behavior intention and various vehicle factors

H5$_o$: There is no difference in the behavior intention when determined on types of vehicle

H5$_a$: There is a difference in the behavior intention when determined on types of vehicle

Table 5.10: The analysis of the consumers' behavior intention when determined by types of vehicle by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.936	3	.979	1.014	.386
Within Groups	478.864	496	.965		
Total	481.800	499			

The null hypothesis showed that there is no difference in the behavior intention when determined by types of vehicle. The analysis of variance in Table 5.10 indicates that the sig. of types of vehicle and behavior intention of NGV is equal to 0.386, which

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is greater than 0.05 (0.386>0.05). It means that the null hypothesis has failed to reject. Therefore, it indicates that there is no difference in the consumers' behavior intention when determined by types of vehicle at the 0.05 significant level.

H6$_o$: There is no difference in the behavior intention when segmented by life-times of vehicle

H6$_a$: There is a difference in the behavior intention when segmented by life-times of vehicle

Table 5.11: The analysis of the consumers' behavior intention when segmented by life-times of vehicle by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.743	4	1.436	1.493	.203
Within Groups	476.057	495	.962		
Total	481.800	499			

The null hypothesis showed that there is no difference in the behavior intention when segmented by life-times of vehicle. The analysis of variance in Table 5.11 indicates that the sig. of life-times of vehicle and behavior intention of NGV is equivalent to 0.203, which is greater than 0.05 (0.203>0.05). It means that the null hypothesis has failed to reject. Therefore, it indicates that there is no difference in the consumers' behavior intention when segmented by life-times of vehicle at the 0.05 significant level.

H7$_o$: There is no difference in the behavior intention when based on types of engines

H7$_a$: There is a difference in the behavior intention when based on types of engines

Table 5.12: The analysis of the consumers' behavior intention when based on types of engines by using Independent sample t-test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
MBI	Equal variances assumed	10.016	.002	-2.843	495	.005	-.25132	.08840	-.42500	-.07763
	Equal variances not assumed			-2.916	494.313	.004	-.25132	.08618	-.42064	-.08199

The null hypothesis stated that there is no difference in the behavior intention when based on types of engines. The analysis of Independent sample t-test in Table 5.12 shows that the sig. (2-tailed test) is equal to 0.004, which is less than 0.05 (0.004<0.05). It means that the null hypothesis is rejected. Then, it can be concluded that there is a difference in the consumers' behavior intention when based on types of engine at the 0.05 significant level.

H8$_o$: There is no difference in the behavior intention when determined by engine powers

H8$_a$: There is a difference in the behavior intention when determined by engine powers

Table 5.13: The analysis of the consumers' behavior intention when determined by engine powers by using ANOVA

ANOVA

MBI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.391	4	.848	.877	.477
Within Groups	478.409	495	.966		
Total	481.800	499			

The null hypothesis showed that there is no difference in the behavior intention when determined by engine powers. The analysis of variance in Table 5.13 indicates that the sig. of engine powers and behavior intention of NGV is equivalent to 0.477, which is greater than 0.05 (0.477>0.05). It means that the null hypothesis has failed to reject. Therefore, it indicates that there is no difference in the consumers' behavior intention when determined by engine powers at the 0.05 significant level.

Group D: To measure the correlation between social influences and behavior intention

H9 $_o$: Environmental concern has no relationship with behavior intention

H9 $_a$: Environmental concern has a relationship with behavior intention

Table 5.14: The analysis of the relationship between environmental concern and behavior intention

Correlations

		MSIen	MBI
MSIen	Pearson Correlation	1	.343**
	Sig. (2-tailed)		.000
	N	500	500
MBI	Pearson Correlation	.343**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.14 indicates that the sig. of environmental concern and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between environmental concern and behavior intention at the 0.01 significant levels. Correlation coefficient value is equal to 0.343, which means that there is a weak positive correlation between environmental concern and the consumers' behavior intention.

H10 $_o$: Help country in savings has no relationship with behavior intention

H10 $_a$: Help country in savings has a relationship with behavior intention

Table 5.15: The analysis of the relationship between help country in savings and behavior
intention

Correlations

		MBI	MSIcs
MBI	Pearson Correlation	1	.333**
	Sig. (2-tailed)		.000
	N	500	500
MSIcs	Pearson Correlation	.333**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.15 indicates that the sig. of help country in savings and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between help country in savings and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.333, which means that there is a weak positive correlation between help country in savings and consumers' behavior intention.

H11$_o$: Government support has no relationship with behavior intention

H11$_a$: Government support has a relationship with behavior intention

Table 5.16: The analysis of the relationship between government support and behavior
intention

Correlations

		MBI	MSIgs
MBI	Pearson Correlation	1	.310**
	Sig. (2-tailed)		.000
	N	500	500
MSIgs	Pearson Correlation	.310**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.16 indicates that the sig. of government support and behavior intention is equal to 0.000, which is less than 0.01

(0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between government support and behavior intention at the 0.01 significant levels. Correlation coefficient value is equal to 0.310, which means that there is a weak positive correlation between government support and consumers' behavior intention.

H12 $_o$: Risk from the number of users has no relationship with behavior intention

H12 $_a$: Risk from the number of users a relationship with behavior intention

Table 5.17: The analysis of the relationship between risk from the number of users and behavior intention

Correlations

		MBI	MSIra
MBI	Pearson Correlation	1	.067
	Sig. (2-tailed)		.136
	N	500	500
MSIra	Pearson Correlation	.067	1
	Sig. (2-tailed)	.136	
	N	500	500

The analysis of Pearson Correlation in Table 5.17 indicates that the sig. of risk from the number of users and behavior intention is equal to 0.136, which is greater than 0.01 (0.136>0.01). It means that the null hypothesis has failed to reject. Thus, there is no relationship between risk from the number of users and consumers' behavior intention at the 0.01 significant level.

Group E: To measure the correlation between NGV attribute and behavior intention

H13 $_o$: Price perception has no relationship with behavior intention

H13 $_a$: Price perception has a relationship with behavior intention

Table 5.18: The analysis of the relationship between price perception and behavior
intention

Correlations

		MBI	MATTpr
MBI	Pearson Correlation	1	.460**
	Sig. (2-tailed)		.000
	N	500	500
MATTpr	Pearson Correlation	.460**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.18 indicates that the sig. of
price perception and behavior intention is equal to 0.000, which is less than 0.01
(0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a
relationship between price perception and behavior intention at the 0.01 significant
level. Correlation coefficient value is equal to 0.460, which means that there is a weak
positive correlation between price perception and consumers' behavior intention.

H14 $_o$: Cost of setting/maintenance of vehicle has no relationship with behavior intention

H14 $_a$: Cost of setting/maintenance of vehicle has a relationship with behavior intention

Table 5.19: The analysis of the relationship between cost of setting/maintenance of vehicle
and behavior intention

Correlations

		MBI	MATTmc
MBI	Pearson Correlation	1	.309**
	Sig. (2-tailed)		.000
	N	500	500
MATTmc	Pearson Correlation	.309**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.19 indicates that the sig. of cost
of setting/maintenance of vehicle and behavior intention is equal to 0.000, which is
less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there

is a relationship between cost of setting/maintenance of vehicle and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.309, it means that there is a weak positive correlation between cost of setting/maintenance of vehicle and consumers' behavior intention.

H15 $_o$: Product performance has no relationship with behavior intention

H15 $_a$: Product performance has a relationship with behavior intention

Table 5.20: The analysis of the relationship between product performance and behavior intention

Correlations

		MBI	MATTpf
MBI	Pearson Correlation	1	.607**
	Sig. (2-tailed)		.000
	N	500	500
MATTpf	Pearson Correlation	.607**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.20 indicates that the sig. of product performance and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between product performance and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.607, which means that there is a moderate positive correlation between product performance and consumers' behavior intention.

H16 $_o$: Product safety has no relationship with behavior intention

H16 $_a$: Product safety has a relationship with behavior intention

Table 5.21: The analysis of the relationship between product safety and behavior intention

Correlations

		MBI	MATTsf
MBI	Pearson Correlation	1	.563**
	Sig. (2-tailed)		.000
	N	500	500
MATTsf	Pearson Correlation	.563**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.21 indicates that the sig. of product safety and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between product safety and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.563, which means that there is a moderate positive correlation between product safety and consumers' behavior intention.

H17$_o$: Availability of NGV has no relationship with behavior intention

H17$_a$: Availability of NGV has a relationship with behavior intention

Table 5.22: The analysis of the relationship between availability of NGV and behavior intention

Correlations

		MBI	MATTav
MBI	Pearson Correlation	1	.320**
	Sig. (2-tailed)		.000
	N	500	500
MATTav	Pearson Correlation	.320**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.22 indicates that the sig. of availability of NGV and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a

relationship between availability of NGV and behavior intention at the 0.01 significant levels. Correlation coefficient value is equal to 0.320, which means that there is a weak positive correlation between availability of NGV and consumers' behavior intention.

H18 $_o$: Time consuming of NGV has no relationship with behavior intention

H18 $_a$: Time consuming of NGV has a relationship with behavior intention

Table 5.23: The analysis of the relationship between time consuming of NGV and behavior intention

Correlations

		MBI	MATTtc
MBI	Pearson Correlation	1	.476**
	Sig. (2-tailed)		.000
	N	500	500
MATTtc	Pearson Correlation	.476**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.23 indicates that the sig. of time consuming of NGV and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between time consuming of NGV and behavior intention at the 0.01 significant levels. Correlation coefficient value is equal to 0.476, which means that there is a weak positive correlation between time consuming of NGV and consumers' behavior intention.

H19 $_o$: Credibility of organization has no relationship with behavior intention

H19 $_a$: Credibility of organization has a relationship with behavior intention

Table 5.24: The analysis of the relationship between credibility of organization and behavior intention

Correlations

		MBI	MATTcd
MBI	Pearson Correlation	1	.477**
	Sig. (2-tailed)		.000
	N	500	500
MATTcd	Pearson Correlation	.477**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.24 indicates that the sig. of credibility of organization and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between credibility of organization and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.477, which means that there is a weak positive correlation between credibility of organization and consumers' behavior intention.

H20$_o$: Information has no relationship with behavior intention

H20$_a$: Information has a relationship with behavior intention

Table 5.25: The analysis of the relationship between information and behavior intention

Correlations

		MBI	MATTin
MBI	Pearson Correlation	1	.349**
	Sig. (2-tailed)		.000
	N	500	500
MATTin	Pearson Correlation	.349**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.25 indicates that the sig. of information and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a

relationship between information and behavior intention at the 0.01 significant levels Correlation coefficient value is equal to 0.349, which means that there is a weak positive correlation between information and consumers' behavior intention.

H21 $_o$ **:** Appearance has no relationship with behavior intention

H21 $_a$ **:** Appearance has a relationship with behavior intention

Table 5.26: The analysis of the relationship between appearance and behavior intention

Correlations

		MBI	MATTap
MBI	Pearson Correlation	1	.509**
	Sig. (2-tailed)		.000
	N	500	500
MATTap	Pearson Correlation	.509**	1
	Sig. (2-tailed)	.000	
	N	500	500

**. Correlation is significant at the 0.01 level

The analysis of Pearson Correlation in Table 5.26 indicates that the sig. of appearance and behavior intention is equal to 0.000, which is less than 0.01 (0.000<0.01). It means that the null hypothesis is rejected. Thus, there is a relationship between appearance and behavior intention at the 0.01 significant level. Correlation coefficient value is equal to 0.509, which means that there is a moderate positive correlation between appearance and consumers' behavior intention.

Table 5.27: Summary of hypothesis testing results

Null Hypotheses Statements	Results of null Hypothesis testing
H1: There is no difference in the behavior intention when segmented into separate consumer locations	Reject
H2: There is no difference behavior intention when based on gender	Failed to reject
H3: There is no difference behavior intention when segmented by age ranges	Reject

H4: There is no difference behavior intention when determined by personal income scale	Reject
H5: There is no difference in the behavior intention when determined by types of vehicle	Failed to reject
H6: There is no difference in the behavior intention when segmented by life-times of vehicle	Failed to reject
H7: There is no difference in the behavior intention when based on types of engines	Reject
H8: There is no difference in the behavior intention when determined by engine powers	Failed to reject
H9: Environmental concern has no relationship with behavior intention	Reject
H10: Help country in savings has no relationship with behavior intention	Reject
H11: Government support has no relationship with behavior intention	Reject
H12: Risk from the number of users has no relationship with behavior intention	Failed to reject
H13: Price perception has no relationship with behavior intention	Reject
H14: Cost of setting/maintenance of vehicle has no relationship with behavior intention	Reject
H15: Product performance has no relationship with behavior intention	Reject
H16: Product safety has no relationship with behavior intention	Reject
H17: Availability of NGV has no relationship with behavior intention	Reject
H18: Time consuming of NGV has no relationship with behavior intention	Reject
H19: Credibility of organization has no relationship with behavior intention	Reject
H20: Information has no relationship with behavior intention	Reject
H21: Appearance has no relationship with behavior intention	Reject

CHAPTER6
SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

In this chapter, the researcher summarizes and concludes the results which were presented in Chapter 5. It consists of five sections. The first section contains the summary of findings which are comprised of the demographic factors, descriptive analysis and hypotheses testing. The second section is the discussion and implication of this research. The third section presents the conclusion of the study. The fourth section is the recommendation for the beneficiaries. And the last section offers suggestions for future study.

6.1 Summary of findings

This part presents interpretations of the results from the data gathered, which includes a summary of respondents' characteristics, social influences, NGV attributes, behavior intention, and a summary of hypotheses testing.

Summary of Demographic factors

Based on the questionnaire data collected from 500 respondents, it has been found that the majority of respondents in this study is male (67%). The age group between 26 to 33 years old is considered as the largest group comprising 32.2% of the total respondents. Most of them or 59.8% are single. A total of 49.2% of respondents' education level is bachelor degree or equivalent. In terms of occupation, the largest number of respondents accounting for 31.6% is government or state enterprise officers. In addition, 29.6% have an average monthly income between 10,001-20,000 baht. Each group, or 20% of respondents come from five living areas, namely, Central area (include Bangkok), Northern area, Northeastern area, Eastern area, and Southern area.

Summary of descriptive analysis

The analyses of each of the dependent and the independent factors of behavior intention, social influences, and NGV attribute, the outcome of descriptive analysis are summarized below:

Behavior intention shows an average mean equivalent to 3.58, which means that the respondents feel uncertain about their intention to use NGV and to recommend others to buy NGV.

Social influences, the findings show that the highest mean is 4.03 in the help country savings variable. It can be interpreted that in their agreement, respondents tend to equate the use of NGV to helping the country in saving money. On the other hand, the lowest mean is 3.24 as in the risk from the number of user variable. It means that the risk from a small number of current NGV users hardly affects the decision of the respondents to use NGV.

NGV attribute, the findings show the highest mean of 3.81 in the price perception variable, which means that respondents perceive NGV as a cost-saving fuel. On the other hand, the lowest mean of 2.83 in the availability variable, means that the respondents are uncertain about the number of stations available where they can fill up their vehicles with NGV.

Summary of hypotheses testing

Hypothesis 1: There is a difference in the behavior intention when segmented into separate consumer locations.

Hypothesis 2: There is no difference in the behavior intention when based on gender.

Hypothesis 3: There is a difference in the behavior intention when segmented by age ranges.

Hypothesis 4: There is a difference in the behavior intention when determined by personal income scale.

*Hypothesis 5:* There is no difference in the behavior intention when determined by types of vehicle.

Hypothesis 6: There is no difference in the behavior intention when segmented by life-times of vehicle.

Hypothesis 7: There is a difference in the behavior intention when based on types of engines.

Hypothesis 8: There is no difference in the behavior intention when determined by engine powers.

Hypothesis 9: Environmental concern has a relationship with behavior intention.

Hypothesis 10: Help country in savings has a relationship with behavior intention.

Hypothesis 11 Government support has a relationship with behavior intention.

Hypothesis 12: Risk from the number of users has no relationship with behavior intention.

Hypothesis 13: Price perception has a relationship with behavior intention.

Hypothesis 14: Cost of setting/maintenance of vehicle has a relationship with behavior intention.

Hypothesis 15: Product performance has a relationship with behavior intention.

Hypothesis 16: Product safety has a relationship with behavior intention.

Hypothesis 17: Availability of NGV has a relationship with behavior intention.

Hypothesis 18: Time consuming of filling NGV has a relationship with behavior intention.

Hypothesis 19: Credibility of organization has a relationship with behavior intention.

Hypothesis 20: Information has a relationship with behavior intention.

Hypothesis 21: Appearance has a relationship with behavior intention.

6.2 Discussion and implication

According to the summary of findings in the previous section, the results of SPSS analysis show that sixteen out of twenty one null hypotheses in five groups as discussed in chapter 3 are rejected, except for hypotheses two, five, six, eight, and twelve. The details of all five-group hypotheses are shown as follows:

Group A, the result from hypothesis one is rejected which means that there are differences in the behavior intention when determined by different consumer locations as illustrated in Figure 6.1.

Figure 6.1: The comparison of the behavior intention mean scores when segmented by different consumer locations
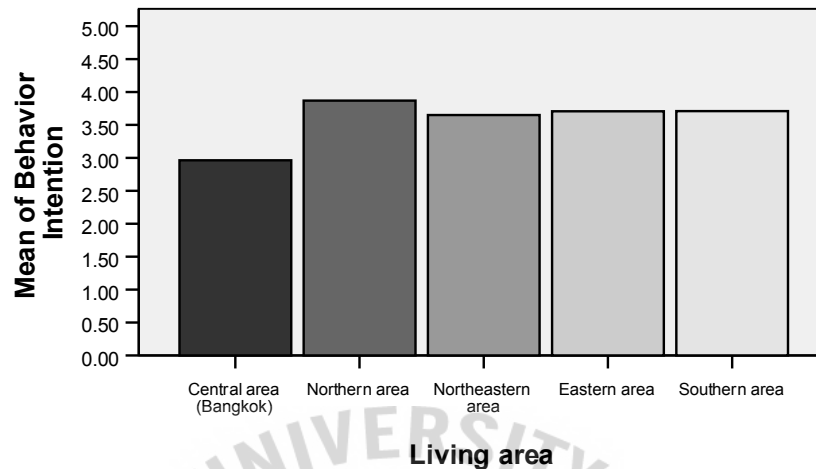
In figure 6.1, the arithmetic mean shows that the people who intend to use NGV are those who live outside of the Central area, namely, Northern area (3.87), Southern area (3.71), Eastern area (3.70), and Northeastern area (3.65), respectively. On the other hand, the arithmetic mean in Central area (including Bangkok) equals to 2.96 which means that people who live in this area feel uncertain about the use of NGV product. The reason is supported by Schiffman and Kanuk (2007) who mentioned in the theory of geographical location that people who live in the same area will share similar needs and wants, and differ from those living in other areas. Another reason, Central area is the center of technology and information which enables the consumers to perceive any changes or movement very quickly on NGV. While NGV has had news of problems being released to the general public from time to time, it might increase people's reluctance in Central areas on using NGV.

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Group B, the result from hypothesis two failed to reject which means that there is no difference in the behavior intention when based on gender. Probably, NGV is not associated with gender because it is not a gender-specific product. In addition, NGV is one of the transportation fuels which are very common in everyone's daily life. On the other hand, the results from hypotheses three and four are rejected. This shows that there is a difference in the consumer behavior intention either when segmented by age ranges or when determined by personal income scale as illustrated in Figure 6.2 and Figure 6.3.

Figure 6.2: The comparison of the behavior intention's mean scores when segmented by age ranges
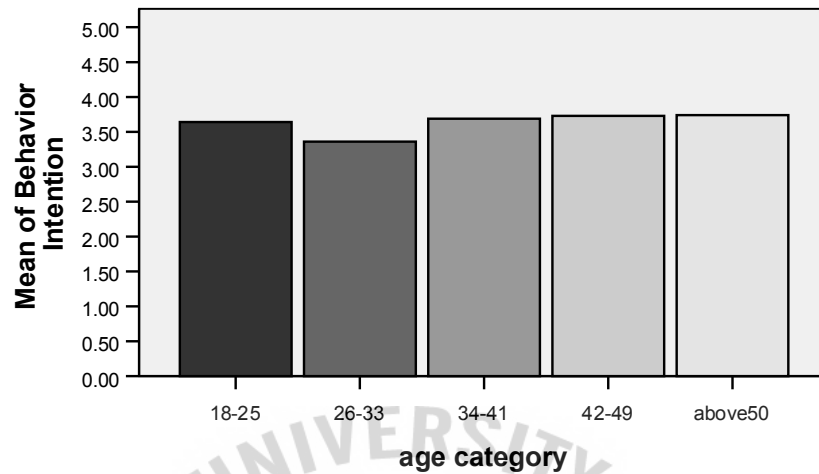

Figure 6.2, the arithmetic mean shows that the people having the most intention to use NGV are those who are mature, in the age above 50 years old (3.74) and those between 42-49 years old age range (3.73), while the people who have the least intention to use NGV are the working people aged between 26-33 years old (3.36). There is a possibility that the working people have many responsibilities and investment obligations for the future, and might not want to invest in NGV for their cars because the NGV setting cost is more expensive when compared to other fuels. Thus, it might create an uncertain feeling among the people in this group which can result in their opting for traditional fuels in their cars at this point in time.

Figure 6.3: The comparison of the behavior intention's mean scores when determined by personal income scale
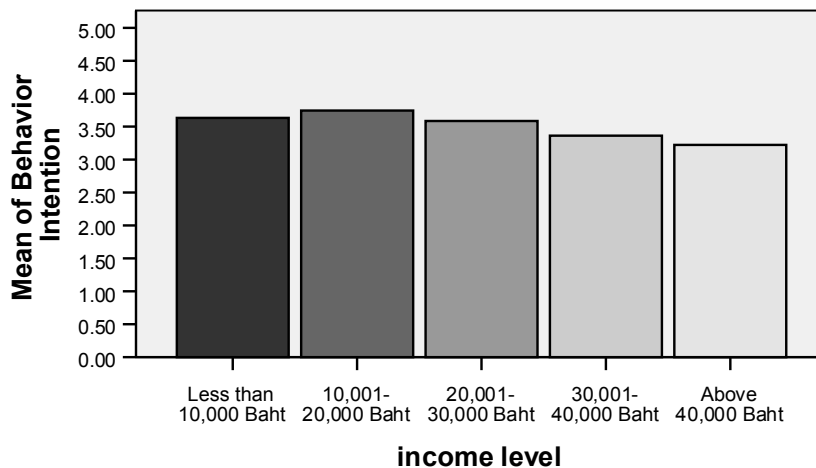
In Figure 6.3, the arithmetic mean shows that the people who have the most intention to use NGV are those who have less income, between 10,001-20,000 Baht (3.74) and less than 10,000 Baht (3.63). Whereas for people who have higher income, their behavior intentions tend to decrease. For example people who have income between 20,001-30,000 Baht have the mean value at 3.58, whereas people who have higher income have the mean value at 3.36, and 3.22, respectively. The recent spiraling increases in oil price have very strong effect on people who have lower income. Thus, natural gas has been viewed as a potential fuel substitute with the lowest price and might draw attention from the people with low income rather than those having higher income who can currently afford the high price of oil.

Group C, the results from hypotheses five, six, and eight failed to reject indicating that there is no difference in the behavior intention when determined or segmented by types of vehicle, by life-times of vehicle, and engine powers. Probably, people may observe more vehicles on the street using NGV as a substitute fuel such as buses, vans and taxis. This makes the respondents perceive that NGV substitute fuel is acceptable for a variety of vehicles. On the other hand, the result from hypothesis no.7 is rejected which means there is a difference in the behavior intention when based on types of engines as illustrated in Figure 6.4.

**Figure 6.4:** The comparison of the behavior intention's mean scores when based on types of engines
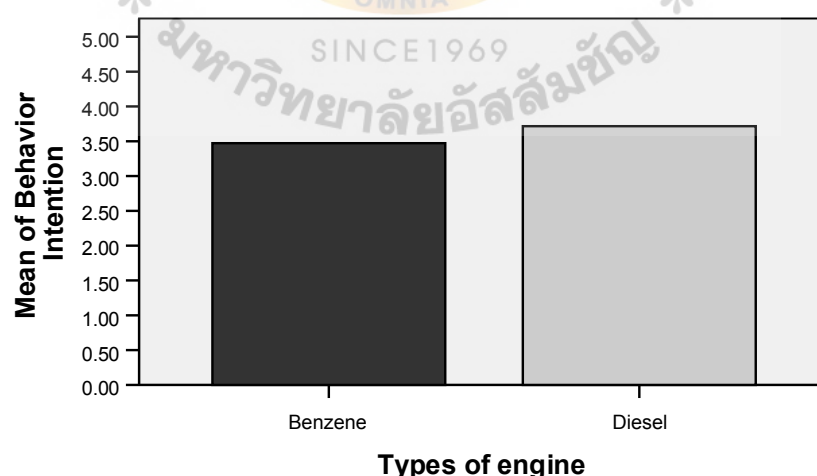
Figure 6.4, the arithmetic mean shows that the people who have the most intention to use NGV are diesel car-owners (3.71), followed by benzene car-owners

(3.47). This corresponds to another study conducted on NGV Needs of Thai people in Suburban Areas by Isarasaena-Na-Ayutthaya, Rongviriyapanith, Vichearnsan, and Sanyaluklur- chai (2006), which resulted in a prediction that people who intend to use NGV are 30 percent of benzene car-owners and 70 percent of diesel car-owners. Probably the recent increases in diesel price (www.ngv.org, 14/12/2007), may push the natural gas as a potential substitute for diesel in an effort to offset the increasing fuel cost.

Group D, the results of the null hypotheses nine, ten, and eleven are rejected. All correlation coefficient values are between 0.310 and 0.343, which means that there are weak positive correlations between environmental concern, help country in savings and government support toward behavior intention. In other words, the three variables have little power to convince the consumers to use NGV. The finding proves that social pressure can influence individuals to conform (Schiffman and Kanuk, 2007). On the other hand, the result of hypothesis testing twelve fails to reject, implying that there is no relationship between risk from the number of users and behavior intention. The results show some conflicts with the previous study. It may arise from the cultural difference of the respondents. In addition, Schiffman and Kanuk (2007) also mentioned that the extent to which a consumer' attitudes can be influenced by the social pressure depends on his/her susceptibility to such pressure. There is a possibility that Thai people are not sensitive to the risk from the number of NGV users.

Group E, the results of hypothesis testing shows that all the null hypotheses in this group are rejected. The Pearson Correlation Analysis indicates that there are positive relationships between each independent variable in the NGV attributes and behavior intention because they have the correlation coefficient values between 0.309 and 0.607. The testing results of hypotheses fifteen, sixteen, and twenty one, show that there are moderate positive correlations between product performance, product safety, and appearance toward NGV behavior intention. Moreover, the results of hypotheses thirteen, fourteen, seventeen, eighteen, nineteen, and twenty show that there are weak positive correlations between price perception, setting/maintenance cost, availability, time consumed, credibility of organization, and information toward NGV behavior intention. The overall results show that NGV attributes have

relationships with behavior intention. The finding proves the statement that product attributes as perceived by consumers are one of the critical factors in the product choice process (Kotler and Armstrong, 2003).

6.3 Conclusion

The majority of respondents were male and of single status, were government or state enterprise officers, aged above 50 years old, with bachelor degrees or equivalent, having income levels between 10,001-20,000 Baht.

According to hypothesis testing, there are differences in the consumer behavior intention when determined by different living locations, age levels, and income levels whereas gender is insignificant. Also, there is a difference in the consumer behavior intention when segmented by types of engines whereas types of vehicle, life-times of vehicle and engine powers are not different. It can be concluded that the differences in most of the demographic characteristics lead to the discrepancy in the consumer's behavior intention towards NGV while differences in vehicle factors hardly affects their behavior intention.

In addition, there are relationships between three variables in terms of social influence i.e. environmental concern, help country in savings, and government support toward behavior intention, whereas risk from the number of users variable has no relationship. It must be noted that all variables in the product attributes i.e. price perception, cost of setting/maintenance of vehicle, product performance, product safety, availability of NGV, time consuming, credibility of organization, information, and appearance have a relationship with behavior intention. It is quite evident that the consumers give a higher level of importance to each of the product attributes than to each of the social influences. It can be concluded that consumers pay more attention to overall product attributes than social influences.

Finally, the hypotheses testing show that the three highest ranks of significant factors apparently influencing the consumers to use NGV are product attributes, namely, product performance, product safety, and appearance.

6.4 Recommendations

Based on the findings of this research, most of the factors entail certain relationship toward the consumer behavior intention. It is very important to know more precisely the factors that affect the consumers' decision to use NGV in order to succeed in the fuel business. Therefore, the researcher would like to recommend the PPT management team to plan and implement the strategy for development and improvement of their NGV operation to serve the need of future consumers as well as to satisfy them. The recommendations are detailed as follows:

1. Recommendation for differentiated studies (geographic locations, demographic factors, and vehicle factors).

The hypothesis testing results of group A to C show that the difference in geographic, demographic factors (age levels and personal income levels), and vehicle factors (types of engine) reflects the difference in behavior intention. They also identify the possible main target groups in terms of four segments which are as follows:

Firstly, geographic location segmentation, people who have the intention to use NGV are those who live outside the Central area because they have higher scores in terms of behavior intention. Presently PTT has expanded the NGV and refueling infrastructure focusing on Greater Bangkok and the provincial areas along the natural gas pipeline route and along the super highways (www.ngv.org, 14/12/2007). PTT should not ignore the people in other areas because they are one of the main target groups. Hence, the researcher recommends PTT to expand the operations throughout the center along with the Central area because NGV service station network should cover the area where NGV users are assured of convenience in refueling facility.

Secondly, demographic segmentation, the consumers who tend to use NGV are mature people whose ages are 42 years old and up. According to a previous local journal (Marketeer, 2006), it has been reported that the number of this age group are on the increase to an approximate 14 million or 20% of the total Thai population. Moreover, the purchasing power of this group is 3 times higher than people in their

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30s. It must also be noted that 75-79% of the people aged 50 years old and above have an average income of about 40,000 Baht per month. Thus, NGV product has an opportunity to grow in the future. Furthermore, people in this group do not have to take care of their children anymore and more than one fourth of them are divorced or single, and also have full power to make a decision. Therefore, PTT should concentrate on such factors as safety and appearance that can convince people of this group to make a decision to use NGV. The supporting reason from the same journal, mentioned that the people of this group tend to be concerned about their health, and their image. In addition, the consumers who have lower income tend to use NGV rather than those of higher income. Presently PTT has a suitable strategy for people of this group by promoting the low price of NGV and giving loans with minimum interest rate for NGV instruments and setting that attract low-income consumers. PTT might influence more consumers by other factors, such as giving discounts or special promotion for installing NGV cylinders in their vehicles.

Thirdly, in terms of segmentation of vehicle's engine types, diesel engine users are the main target of PTT because this group is the one with the highest intention. Therefore, PTT should promote more in-use diesel-powered vehicle conversion. The researcher suggests that PTT should promote NGV via television's transportation & technology programs in order to give the information that can stimulate increased use.

2. Recommendation for relationship studies (Social influences, NGV attributes).

Although the results show that almost all the hypotheses have some minor relationships between each variable of the social influences and NGV attributes towards the behavior intention, there are three variables that need to be mentioned: product performance, product safety, and appearance. It means that these factors seem to be the most attractive and can influence consumers' behavior intention, moreover, they are part of the product attributes. To summarize, most of the product attribute factors have higher correlations with behavior intention than the social influence factors. Therefore, the researcher suggests that PTT should concentrate on the product itself especially product performance, product safety, and appearance to increase the

number of NGV users until they can achieve their targets. The suggestions for the factors are discussed below:

For high impact factors, safety and quality control are of the crucial concern for the consumers. All precautionary measures should be taken to avoid any occurrence of accidents, such as CNG tank explosions, which are very effective in scaring people away from using NGV. PTT should arrange training programs on a regular basis for their installation and maintenance personnel to assure their high quality and performance standard to the general public. At the same time, PTT should establish a certain period of product warranty to ensure consumer satisfaction. In terms of appearance, research and innovation should continue in a creative manner with an initial objective to reduce the size and weight of cylinders to create excellent balance of the vehicle, increase in loading space, and design the appropriate shape for vehicles of different types.

For other attribute factors, the benefits of using NGV i.e. low price and sufficient infrastructure etc. are to be guaranteed. These will help boost the NGVin terms of sustainable development. The company should keep its share of the bargain of fuel price incentives of more than 50% which is attractive to vehicle owners for NGV conversions or replacement of their existing vehicles with NGV. PTT also needs to expand the existing facilities in order to minimize the time consumed at filling stations. In term of setting/maintenance cost, local production will lower the costs of these products. PTT should control and set standards for the local facilitators. In addition, PTT should arrange the seminar workshop on a periodical basis for imparting correct knowledge about NGV to the people who are involved, and organize the NGV product in order to distribute the accurate information on NGV to the consumers in the same direction. Then, the company should use the media or communication strategy to continuously feed factual information on NGV products to avoid misunderstandings about NGV. Both measures will enhance the good image of the product and the PTT organization.

There are some social influence attitudes that have relationships with behavior intention, the correlation values are low. Nevertheless, PTT should not ignore those factors because they still have some impact on NGV usage. The company might

participate in a co-sponsorship for such programs as Drive- Safely projects with NGV in order to increase the consumer's awareness for NGV product.

6.5 Further study

Even though this study has offered some useful findings to PTT and other marketing practitioners, there is still scope for further research on this topic. Thus, the researcher would like to offers suggestions to any interested parties as follows:

1. To study the factors that influence behavior intention for each customer segmentation:

This study only found that there are differences in behavior intention when determined by various demographic factors but the study did not measure the factors that are related to the customers in each segment. Therefore, the researcher suggests that future researchers should find the probable factor that influences the behavior intention for each group to discover the needs and wants of specific groups of consumers, so that the products can be developed and promoted to satisfy each group's needs, following Schiffman and Kanuk (2007) who mentioned that market segmentation can be defined as the process of dividing a market into distinct subsets of consumers with common needs.

2. To study the customer satisfaction of NGV users among five regions

The sample for the next study should be the actual NGV users because their direct experiences will give both negative and positive experiences of NGV. This will help PTT to improve their action plans to better satisfy current and new users.

3. Comparing expectation as well as perception of new settings of NGV or new NGV consumers

In order to increase the customers' satisfaction, PTT should narrow or fill the gap between the two variables to know where the customers' satisfaction level lies, as well as provide open-ended question in the questionnaire to induce the customers'

suggestions in order to know how to improve NGV product and service.

4. To study the Thai attitude toward NGV by comparing with Liquid petroleum Gas (LPG) and other alternative fuels

The finding of the suggested research will give the real picture of the whole fuel market and its competitors to find out what are its strengths and weaknesses that will help PTT to create a suitable plan to compete against other fuel providers and create more sustainable solutions for NGV

5. Applying the research for forth-coming alternative vehicles.

Any researches who are interested in new fuel products, such as nuclear, can apply or adapt the findings as a base for their studies.
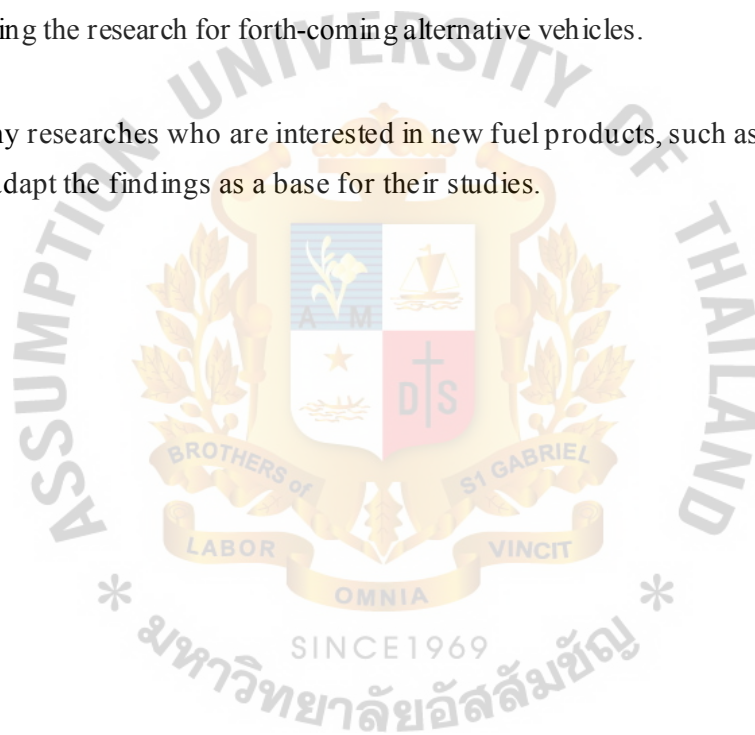
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APPENDIX A

Questionnaire English version

Questionnaire

Direction:

The question has 6 parts, totaling 61 items. Part 1 is a screening question. Part 2 covers questions on demographic variables. Part 3 contains questions on characteristics of vehicles and fuel consumption. Part 4 covers social influences. Part 5 reflects perception of NGV attributes and Part 6 covers questions on behavioral intention.

Part 1: Screening question

1. Do you have your own vehicle registered in Thailand?

[ ] Yes   [ ] No

2. Number of private vehicles registered in Thailand.........................

Part 2: Demographic variables

Please select the most appropriate items:

1. Gender

[ ] Male   [ ] Female

2. Age

[ ] 18-25 years old   [ ] 26-33 years old

[ ] 34-41 years old   [ ] 42-49 years old

[ ] Above 50 years old

3. Marital status

[ ] Single   [ ] Married

4. Education level

      [ ] Less than Bachelor degree   [ ] Bachelor degree or equivalent

      [ ] Higher than Bachelor degree

5. Occupation

      [ ] Student   [ ] Government or State enterprise officer

      [ ] Official employee   [ ] Business owner

      [ ] Others....................

6. Income level

      [ ] Less than or equal to 10,000 Baht [ ] 10,001-20,000 Baht

      [ ] 20,001-30,000 Baht   [ ] 30,001-40,000 Baht

      [ ] Above 40,000 Baht

7. Living area

      [ ] Central area (Bangkok)   [ ] Northern area

      [ ] Northeastern area   [ ] Eastern area

      [ ] Southern area

Part 3: Characteristic of vehicles and fuel consumption

1. Types of vehicle that you use (Please select the one most used at present)

      [ ] Private car not exceeding 7 seats [ ] Private car exceeding 7 seats

      [ ] Private truck   [ ] Others....................

2. Life-time of vehicle that you most use currently

      [ ] Less than 1year   [ ] 1-5 years

      [ ] 5-10 years   [ ] Above 10 years

3. Types of engine that you use (same vehicle in question1-2)

      [ ] Benzene   [ ] Diesel

4. Engine power of vehicle that you use (same vehicle as in question1-2)

      [ ] Less than or equal to 1,500 cc   [ ] 1,501-1,800 cc

      [ ] 1,801-2,000 cc   [ ] 2,001-3,000 cc

      [ ] Above 3,000 cc

5. Your average fuel expenses per month

      [ ] Less than or equal to 1,000 Baht [ ] 1,001-2,000 Baht

      [ ] 2,001-3,000 Baht   [ ] 3,001-4,000 Baht

      [ ] Above 4,000 Baht

Part 4: Social Influences: This sector contains social influence questions. Indicate your level of agreement or disagreement with each of the following statements 1 (totally agree) to 5 (totally disagree). Please select the number which most reflects your opinion

Variables	1 Totally Disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
Environmental concern					
1. NGV is friendly to the environment					
2. Using NGV reduces the air pollution					
3. NGV is potentially a cleaner burning fuel than gasoline					
Help country in savings					
4. using NGV can reduce crude oil import					
5. using NGV can help the country to save money					
6. NGV has a positive impact toward economy					
Government support					
7. You believe that the Government encourages the use of NGV					
8. You believe that the Government reduces the annual vehicle tax to NGV users					
9. You believe that the Government fixes the price of NGV					
10. You believe that the Government gives the minimum interest rate for NGV instrument setting					
Risk from the number of users					
11. Few people are using NGV that makes you concerned about buying it					
12. The fewer people use NGV, the less utility you will have from this product					
13. You will switch to NGV only when a lot of people are using it					

Part 5: NGV attributes: This sector contains NGV attributes questions. Indicate your level of agreement or disagreement with each of the following statements 1 (totally agree) to 5 (totally disagree). Please select the number which most match your opinion.

Variables	1 Totally Disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
Price perception					
1. NGV is cost-saving fuel					
2. The price of NGV is acceptable					
3. Compared to other kinds of fuel, NGV is of more value for your money					
4. The speed of recovering investment incurred in NGV conversion depends how extensively a vehicle is used. The more the car runs, the sooner the cost can be recouped					
Cost of setting/maintenance					
5. The cost for set-up NGV system components (gaseous fuel system and storage cylinder installation) is not expensive					
6. The maintenance cost of NGV that you expect is cheaper when compared to other kinds of fuel					
Product performance					
7. NGV is suitable for all types of engine. (Benzene, Diesel)					
8. NGV is good for setting up in all types of vehicles (Compact, Sedan, SUV,...)					
9. NGV allows for long distance journeys					
10. NGV gives a same speed/acceleration of your vehicle as gasoline does					
11. NGV has a complete burning rate for the engine					
12. NGV is a complete substitute fuel for use in the vehicle					

Variables	1 Totally Disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
Product safety					
13. NGV is a safe alternative fuel					
14. NGV set up is standardized					
15. The strength of NGV cylinders and other equipment is designed to withstand high pressure of gas					
16. NGV is safe for consumer's health because of its pollution-free nature					
Availability					
17. NGV is a sufficient resource					
18. NGV gas stations are currently available					
19. NGV supply stations are easy to find					
20. NGV maintenance stations are easy to find					
Time consuming					
21. NGV refuel time that you expect is saving					
22. Refueling NGV one time give a long time use compared to other fuels					
Credibility of organization					
23. PTT company has a good reputation					
24. You can trust NGV fuel from PTT					
25. You can rely on NGV fuel if you use it					
Information					
26. The NGV properties information is available					
27. The information about the difference among fuel products is available					
Appearance					
28. You think that many sizes of NGV cylinders are appropriate for each type of vehicle					
29. Shape design of NGV cylinder that you think is appropriate for vehicle					

Variables	1 Totally Disagree	2 Disagree	3 Neutral	4 Agree	5 Totally Agree
30. Weight of NGV cylinder that you think is suitable					
31. If you install NGV in your car, there are still spaces left for package loading					
32. If you install NGV in your car, the balance of your vehicle is still good					

Part 6: Behavior intention: This sector contains behavior intention questions with each of the following statements 1 (definitely not) to 5 (definitely). Please select the number which most fits your opinion

Sub-variables	1 Definitely not	2 Probably not	3 Uncertain	4 Probably	5 Definitely
1. You intend to use NGV					
2. You will recommend others to buy NGV					
3. You hope that buying NGV in the near future is reasonable					

Other suggestions: ………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

APPENDIX B

Questionnaire Thai version

แบบสอบถาม

<u>ข้อมูลชี้แจงเกี่ยวกับแบบสอบถาม</u>

      แบบสอบถามนี้เป็นส่วนหนึ่งของการทำวิทยานิพนธ์ของ นางสาว น้องนุช ลิขิตสุวรรณกูลนักศึกษา ปริญญาโท ภาควิชาบริหารธุรกิจ จัดทำขึ้นโดยมีวัตถุประสงค์เพื่อ ศึกษาและเปรียบเทียบการตัดสินใจ เลือกใช้ก๊าซธรรมชาติ (เอ็นจีวี) ของผู้เป็นเจ้าของรถยนต์นั่งส่วนบุคคลที่ยังไม่ทำการติดตั้งระบบก๊าซ ธรรมชาติ (เอ็นจีวี) ในระหว่าง 5 ภูมิภาคของประเทศไทย

      ข้อมูลที่ได้จะถูกเก็บเป็นความลับ และใช้ประโยชน์ทางวิชาการเท่านั้น จึงใคร่ขอความร่วมมือจาก ท่าน ในการตอบแบบสอบถามตามความคิดเห็นของท่าน ซึ่งจะเป็นประโยชน์ต่อการวิเคราะห์ข้อมูล ทั้งนี้ ทางผู้วิจัยขอขอบคุณทุกท่านที่ได้สละเวลา ในการตอบแบบสอบถามอย่างครบถ้วน มา ณ โอกาสนี้

<u>ส่วนประกอบในแบบสอบถาม</u>

      แบบสอบถามชุดนี้ มีคำถามรวมทั้งสิ้น 61 คำถาม แบ่งออกเป็น 6 ส่วน ดังนี้

ส่วนที่ 1 การตรวจสอบกลุ่มเป้าหมาย

ส่วนที่ 2 ข้อมูลส่วนบุคคล

ส่วนที่ 3 ข้อมูลเกี่ยวกับรถยนต์และการใช้เชื้อเพลิง

ส่วนที่ 4 ความคิดเห็นเกี่ยวกับปัจจัยสังคมที่มีผลต่อการเลือกใช้ก๊าซธรรมชาติ (เอ็นจีวี)

ส่วนที่ 5 ความคิดเห็นเกี่ยวกับคุณลักษณะของก๊าซธรรมชาติ (เอ็นจีวี) ที่มีผลต่อการตัดสินใจเลือกใช้

ส่วนที่ 6 พฤติกรรมการเลือกใช้ก๊าซธรรมชาติ (เอ็นจีวี) ในอนาคต

โปรดทำเครื่องหมาย / หรือ X ลงใน [ ] หรือ ช่องว่างตามข้อความที่เป็นจริงเกี่ยวกับตัวท่าน หรือที่ตรง กับความคิดเห็นของท่าน

ส่วนที่ 1 การตรวจสอบกลุ่มเป้าหมาย

    1. คุณมีชื่อเป็นเจ้าของรถยนต์ ที่ได้รับการจดทะเบียนในประเทศไทยใช่ หรือ ไม่

        [ ] ใช่   [ ] ไม่

    2. คุณมีชื่อเป็นเจ้าของรถยนต์ ที่ได้รับการจดทะเบียนในประเทศไทยทั้งหมด จำนวน........คัน

ส่วนที่ 2 ข้อมูลส่วนบุคคล

    1. เพศ

        [ ] ชาย   [ ] หญิง

2. อายุ

    [ ] 18-25 ปี   [ ] 26-33 ปี

    [ ] 34-41 ปี   [ ] 42-49 ปี

    [ ] มากกว่า 50 ปี

3. สถานภาพ

    [ ] โสด   [ ] แต่งงาน

4. ระดับการศึกษาสูงสุด

    [ ] ต่ำกว่าปริญญาตรี   [ ] ปริญญาตรีหรือเทียบเท่า

    [ ] สูงกว่าปริญญาตรี

5. อาชีพ

    [ ] นักศึกษา   [ ] รับราชการ/ รัฐวิสาหกิจ

    [ ] พนักงานเอกชน   [ ] ธุรกิจส่วนตัว/ ค้าขาย

    [ ] อื่นๆ โปรดระบุ.....................

6. รายได้ส่วนบุคคลเฉลี่ยต่อเดือน

    [ ] ต่ำกว่าหรือเท่ากับ 10,000 บาท   [ ] 10,001-20,000 บาท

    [ ] 20,001-30,000 บาท   [ ] 30,001-40,000 บาท

    [ ] สูงกว่า 40,000 บาท

7. ที่อยู่อาศัย

    [ ] ภาคกลาง (รวมกรุงเทพมหานคร) [ ] ภาคเหนือ

    [ ] ภาคตะวันออกเฉียงเหนือ   [ ] ภาคตะวันออก

    [ ] ภาคใต้

ส่วนที่ 3 ข้อมูลเกี่ยวกับรถยนต์และการใช้เชื้อเพลิง

1. ประเภทของรถยนต์ที่คุณใช้ (โปรดเลือกคันที่คุณใช้บ่อยที่สุดในปัจจุบัน)

    [ ] รถยนต์นั่งส่วนบุคคลไม่เกินเจ็ดที่นั่ง (รย.1) [ ] รถยนต์นั่งส่วนบุคคลไม่เกินเจ็ดที่นั่ง (รย.2)

    [ ] รถบรรทุกส่วนบุคคล (รย.3)   [ ] อื่นๆ โปรดระบุ.....................

2. อายุในการใช้งานของรถยนต์ที่คุณใช้บ่อยที่สุดในปัจจุบัน

    [ ] น้อยกว่า 1 ปี   [ ] ตั้งแต่ 1-5 ปี

    [ ] มากกว่า5-10 ปี   [ ] มากกว่า10 ปีขึ้นไป

3. ชนิดของเครื่องยนต์ (รถยนต์คันเดียวกับคำตอบข้อ1-2)

    [ ] เบนซิน   [ ] ดีเซล

4. ขนาดของเครื่องยนต์ในรถยนต์ที่คุณใช้ (รถยนต์คันเดียวกับคำตอบข้อ1-2)

      [ ] น้อยกว่าหรือเท่ากับ 1,500 ซีซี   [ ] 1,501-1,800 ซีซี

      [ ] 1,801-2,000 ซีซี   [ ] 2,001-3,000 ซีซี

      [ ] มากกว่า 3,000 ซีซี

5. ค่าใช้จ่ายโดยเฉลี่ยในการเติมเชื้อเพลิงโดยรวมทั้งหมดต่อเดือน

      [ ] น้อยกว่า หรือเท่ากับ 1,000 บาท   [ ] 1,001-2,000 บาท

      [ ] 2,001-3,000 บาท   [ ] 3,001-4,000 บาท

      [ ] มากกว่า 4,000 บาท

ส่วนที่ 4 ความคิดเห็นเกี่ยวกับสังคมที่มีผลต่อการเลือกใช้ก๊าซธรรมชาติ (เอ็นจีวี): แสดงถึงความคิดเห็นและความเข้าใจของท่านที่มีต่อปัจจัยต่างๆ ในสังคมซึ่งมีผลต่อการเลือกใช้ กรุณาให้คะแนนโดยลำดับความสำคัญตั้งแต่ 1 (ไม่เห็นด้วยอย่างยิ่ง) จนถึง 5 (เห็นด้วยอย่างยิ่ง) ที่ตรงกับความคิดเห็นของท่านมากที่สุด

ตัวแปร	1 ไม่เห็นด้วยอย่างยิ่ง	2 ไม่เห็นด้วย	3 ปานกลาง	4 เห็นด้วย	5 เห็นด้วยอย่างยิ่ง
ปัจจัยด้านสิ่งแวดล้อม					
1. ก๊าซเอ็นจีวี เป็นเชื้อเพลิงที่เป็นมิตรกับสิ่งแวดล้อม					
2. การใช้ก๊าซเอ็นจีวีช่วยลดปัญหามลพิษทางอากาศได้					
3. การเผาผลาญก๊าซเอ็นจีวี ดีกว่าการเผาผลาญน้ำมัน					
ช่วยประเทศชาติประหยัด					
4. การใช้ก๊าซเอ็นจีวีช่วยลดปริมาณการนำเข้าน้ำมันดิบ					
5. การใช้ก๊าซเอ็นจีวีช่วยชาติประหยัดเงินตราต่างประเทศ					
6. การใช้ก๊าซเอ็นจีวีส่งผลดีต่อเศรษฐกิจของประเทศ					
การสนับสนุนจากรัฐบาล					
7. ท่านเชื่อว่ารัฐบาลให้การสนับสนุนการใช้ก๊าซเอ็นจีวี					
8. ท่านเชื่อว่ารัฐบาลลดภาษีรายปีสำหรับรถยนต์ที่ใช้ก๊าซเอ็นจีวี					
9. ท่านเชื่อว่ารัฐบาลตรึงราคา ก๊าซเอ็นจีวี					
10. ท่านเชื่อว่า รัฐบาลให้สินเชื่อดอกเบี้ยต่ำในการติดตั้งอุปกรณ์สำหรับก๊าซเอ็นจีวี					

	1 ไม่เห็นด้วย อย่างยิ่ง	2 ไม่เห็น ด้วย	3 ปานกลาง	4 เห็น ด้วย	5 เห็นด้วย อย่างยิ่ง
ความเสี่ยงจากปริมาณผู้ใช้ก๊าซเอ็นจีวี					
11. ปริมาณผู้ใช้ก๊าซเอ็นจีวีที่น้อยมีผลกระทบต่อการ เลือกใช้ก๊าซเอ็นจีวีของคุณ					
12. ปริมาณผู้ใช้ก๊าซเอ็นจีวีที่น้อยทำให้คุณคิดว่าประโยชน์ โดยรวมที่ได้รับจากก๊าซเอ็นจีวีมีน้อย					
13. คุณจะใช้ก๊าซเอ็นจีวีก็ต่อเมื่อปริมาณผู้ใช้ก๊าซเอ็นจีวีมี จำนวนมาก					

ส่วนที่ 5 ความคิดเห็นเกี่ยวกับคุณลักษณะของก๊าซธรรมชาติ (เอ็นจีวี) ที่มีผลต่อการตัดสินใจเลือกใช้:
แสดงถึงความคิดเห็น และความเข้าใจของท่าน ที่มีต่อคุณลักษณะของก๊าซธรรมชาติ (เอ็นจีวี) ซึ่งมีผลต่อการ
เลือกใช้ กรุณาให้คะแนนโดยลำดับความสำคัญตั้งแต่ 1 (ไม่เห็นด้วยอย่างยิ่ง) จนถึง 5 (เห็นด้วยอย่างยิ่ง) ที่
ตรงกับความคิดเห็นของท่านมากที่สุด

ตัวแปร	1 ไม่เห็นด้วย อย่างยิ่ง	2 ไม่เห็น ด้วย	3 ปานกลาง	4 เห็น ด้วย	5 เห็นด้วย อย่างยิ่ง
ราคาของก๊าซธรรมชาติ					
1. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่ราคาประหยัด					
2. ราคาก๊าซเอ็นจีวีตรงกับความคาดหวังของท่าน					
3. เมื่อเปรียบเทียบกับเชื้อเพลิงอื่นในปัจจุบัน ราคาของก๊าซ เอ็นจีวี มีความคุ้มค่ามากกว่า					
4. ความคุ้มค่าของการลงทุนระบบก๊าซเอ็นจีวี กับรถยนต์ ขึ้นอยู่กับระยะทางของการใช้รถ ถ้าใช้มาก ก็จะคุ้มทุนเร็ว					
ต้นทุนการติดตั้งอุปกรณ์และค่าดูแลรักษา					
5. ต้นทุนของการติดตั้งอุปกรณ์และส่วนประกอบสำหรับ ก๊าซเอ็นจีวี (ระบบ และถังเก็บก๊าซเอ็นจีวีสำหรับรถยนต์) ไม่แพง					

ตัวแปร	1 ไม่เห็นด้วยอย่างยิ่ง	2 ไม่เห็นด้วย	3 ปานกลาง	4 เห็นด้วย	5 เห็นด้วยอย่างยิ่ง
6. ท่านคาดว่า ค่าใช้จ่ายในการซ่อมบำรุง และดูแลรักษาของอุปกรณ์เครื่องยนต์ของรถที่ติดตั้งก๊าซเอ็นจีวีประหยัดกว่าการใช้เชื้อเพลิงแบบอื่น					
ประสิทธิภาพของก๊าซเอ็นจีวี					
7. ก๊าซเอ็นจีวี เป็นเชื้อเพลิงที่ใช้ได้ดี กับเครื่องยนต์ ทุกประเภท ทั้งเบนซิน และดีเซล					
8. ก๊าซเอ็นจีวี เป็นเชื้อเพลิงที่ใช้ได้ดี กับรถยนต์ ทุกชนิด ทั้งรถยนต์ขนาดเล็ก รถยนต์ขนาดกลาง หรือรถยนต์บรรทุก					
9. ก๊าซเอ็นจีวี เป็นเชื้อเพลิงที่ทำให้ระยะทาง ในการเดินทางสูง					
10. ก๊าซเอ็นจีวี เป็นเชื้อเพลิงที่ให้ความเร็ว/อัตราเร่งเทียบเท่ากับน้ำมัน					
11. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่ดีต่อประสิทธิภาพเครื่องยนต์ด้วยการเผาไหม้อย่างหมดจด					
12. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่สามารถใช้ทดแทนพลังงานน้ำมันได้อย่างสมบูรณ์					
ความปลอดภัย					
13. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงทางเลือก ที่มีความปลอดภัย					
14. การติดตั้งอุปกรณ์ของก๊าซเอ็นจีวีมีมาตรฐานที่ดี					
15. ถังก๊าซเอ็นจีวีและอุปกรณ์ต่างๆ มีความแข็งแรง และทนทานต่อแรงอัดของก๊าซได้					
16. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่ปลอดภัยต่อสุขภาพ โดยการไม่ก่อมลพิษจากทางอากาศ					
การหาได้					
17. ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่มีปริมาณทรัพยากรเพียงพอต่อการใช้งาน					
18. สถานีบริการก๊าซเอ็นจีวีหาได้ง่ายในปัจจุบัน					
19. สถานที่ติดตั้งก๊าซเอ็นจีวีหาได้ง่าย					

ตัวแปร	1 ไม่เห็นด้วยอย่างยิ่ง	2 ไม่เห็นด้วย	3 ปานกลาง	4 เห็นด้วย	5 เห็นด้วยอย่างยิ่ง
20. สถานที่ซ่อมบำรุงของก๊าซเอ็นจีวีหาได้ง่าย					
ระยะเวลาในการใช้งาน					
21. ท่านคาดว่า ก๊าซเอ็นจีวีเป็นเชื้อเพลิงที่ประหยัดเวลาในการเติมน้ำมัน					
22. เติมก๊าซเอ็นจีวีหนึ่งครั้งสามารถใช้ได้เป็นระยะทางนาน เมื่อเปรียบเทียบกับเชื้อเพลิงอื่น					
ความน่าเชื่อถือของบริษัท					
23. ปตท.เป็นบริษัทที่มีชื่อเสียงที่ดี					
24. ท่านสามารถเชื่อถือก๊าซเอ็นจีวีที่เป็นเชื้อเพลิง จากบริษัท ปตท.					
25. ท่านรู้สึกไว้วางใจได้ ถ้าตัดสินใจใช้ก๊าซเอ็นจีวี					
ข้อมูล					
26. มีการเผยแพร่ข้อมูลทางด้านคุณสมบัติก๊าซเอ็นจีวีที่เพียงพอ ต่อการตัดสินใจเลือกใช้					
27. มีการเผยแพร่ข้อมูลก๊าซเอ็นจีวีทางด้านความแตกต่างจากเชื้อเพลิงชนิดอื่นที่เพียงพอ ต่อการตัดสินใจเลือกใช้					
ลักษณะของก๊าซเอ็นจีวี					
28. ท่านคาดว่า ขนาดของถังบรรจุก๊าซเอ็นจีวีที่หลากหลาย มีความเหมาะสมต่อรถยนต์					
29. ท่านคาดว่า รูปร่างของถังบรรจุก๊าซเอ็นจีวีมีความเหมาะสมต่อรถยนต์					
30. ท่านคาดว่า น้ำหนักของถังบรรจุก๊าซมีความเหมาะสมต่อรถยนต์					
31. ถ้าติดตั้งถังก๊าซเอ็นจีวี ปริมาณที่ว่างสำหรับบรรทุกสัมภาระยังคงเพียงพอต่อการใช้งาน					
32. ถ้าติดตั้งถังก๊าซเอ็นจีวี รถยนต์ยังคงมีความสมดุลที่ดี					

ส่วนที่ 6 พฤติกรรมการเลือกใช้ก๊าซธรรมชาติ (เอ็นจีวี) ในอนาคต: แสดงถึงพฤติกรรมการเลือกใช้ก๊าซเอ็นจีวีในอนาคต กรุณาให้คะแนนโดยลำดับความสำคัญตั้งแต่ 1 (ไม่อย่างแน่นอน) จนถึง 5 (ใช่อย่างแน่นอน) ที่ตรงกับความคิดเห็นของท่านมากที่สุด

	1 ไม่อย่างแน่นอน	2 อาจจะไม่	3 ไม่แน่ใจ	4 อาจจะใช่	5 ใช่อย่างแน่นอน
1. ถ้าท่านเลือกได้ ท่านตั้งใจจะเลือกใช้ก๊าซเอ็นจีวี เป็นเชื้อเพลิงสำหรับรถยนต์ของท่าน					
2. ท่านจะแนะนำเพื่อน หรือบุคคลที่รู้จัก ให้ใช้ก๊าซเอ็นจีวี เป็นเชื้อเพลิงสำหรับรถยนต์					
3. ท่านคาดว่า สมควรที่จะเลือกใช้ก๊าซเอ็นจีวี ในอนาคตอันใกล้นี้					

ข้อเสนอแนะอื่น ๆ : ……………………………………………………………………………..………….……...

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APPENDIX C

Data analysis

Descriptive Statistics

gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	335	67.0	67.0	67.0
	female	165	33.0	33.0	100.0
	Total	500	100.0	100.0	

age category

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	147	29.4	29.4	29.4
	26-33	161	32.2	32.2	61.6
	34-41	72	14.4	14.4	76.0
	42-49	84	16.8	16.8	92.8
	above50	36	7.2	7.2	100.0
	Total	500	100.0	100.0	

marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	single	299	59.8	59.8	59.8
	married	201	40.2	40.2	100.0
	Total	500	100.0	100.0	

education level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than Bachelor degree	135	27.0	27.0	27.0
	Bachelor degree or equivalent	246	49.2	49.2	76.2
	Higher than Bachelor degree	119	23.8	23.8	100.0
	Total	500	100.0	100.0	

occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Student	118	23.6	23.6	23.6
	Government or State enterprise officer	158	31.6	31.6	55.2
	Official employee	128	25.6	25.6	80.8
	Business owner	76	15.2	15.2	96.0
	Others...	20	4.0	4.0	100.0
	Total	500	100.0	100.0	

income level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 10,000 Baht	142	28.4	28.4	28.4
	10,001-20,000 Baht	148	29.6	29.6	58.0
	20,001-30,000 Baht	94	18.8	18.8	76.8
	30,001-40,000 Baht	65	13.0	13.0	89.8
	Above 40,000 Baht	51	10.2	10.2	100.0
	Total	500	100.0	100.0	

Living area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Central area (Bangkok)	100	20.0	20.0	20.0
	Northern area	100	20.0	20.0	40.0
	Northeastern area	100	20.0	20.0	60.0
	Eastern area	100	20.0	20.0	80.0
	Southern area	100	20.0	20.0	100.0
	Total	500	100.0	100.0	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MSIen	500	1.00	5.00	3.7613	.76258
MSIcs	500	1.00	5.00	4.0347	.78118
MSIgs	500	1.00	5.00	3.6795	.76719
MSIra	500	1.00	5.00	3.2360	.84113
MATTpr	500	1.00	5.00	3.8080	.71425
MATTmc	500	1.00	5.00	2.9740	.90108
MATTpf	500	1.00	5.00	3.3187	.68186
MATTsf	500	1.00	5.00	3.4995	.72036
MATTav	500	1.00	5.00	2.8320	.87810
MATTtc	500	1.00	5.00	3.2030	.90550
MATTcd	500	1.00	5.00	3.7653	.67664
MATTin	500	1.00	5.00	3.1990	.81377
MATTap	500	1.00	5.00	3.2628	.73021
MBI	500	1.00	5.00	3.5800	.98261
Valid N (listwise)	500				

Report

MBI

Living area	Mean	N	Std. Deviation	Sum	% of Total Sum
Central area (Bangkok)	2.9633	100	1.03138	296.33	16.6%
Northern area	3.8700	100	.92465	387.00	21.6%
Northeastern area	3.6500	100	.88430	365.00	20.4%
Eastern area	3.7067	100	1.00981	370.67	20.7%
Southern area	3.7100	100	.79935	371.00	20.7%
Total	3.5800	500	.98261	1790.00	100.0%

Report

MBI

age category	Mean	N	Std. Deviation	Sum	% of Total Sum
18-25	3.6417	147	.88199	535.33	29.9%
26-33	3.3602	161	1.09098	541.00	30.2%
34-41	3.6898	72	.91129	265.67	14.8%
42-49	3.7302	84	.97283	313.33	17.5%
above50	3.7407	36	.89836	134.67	7.5%
Total	3.5800	500	.98261	1790.00	100.0%

Report

MBI

income level	Mean	N	Std. Deviation	Sum	% of Total Sum
Less than 10,000 Baht	3.6338	142	.84057	516.00	28.8%
10,001-20,000 Baht	3.7432	148	.98752	554.00	30.9%
20,001-30,000 Baht	3.5851	94	.97359	337.00	18.8%
30,001-40,000 Baht	3.3641	65	1.01160	218.67	12.2%
Above 40,000 Baht	3.2222	51	1.19381	164.33	9.2%
Total	3.5800	500	.98261	1790.00	100.0%

Report

MBI

Types of engine that you use (same vehicle	Mean	N	Std. Deviation	Sum	% of Total Sum
Benzene	3.4719	279	1.06085	968.67	54.1%
Diesel	3.7164	221	.85696	821.33	45.9%
Total	3.5800	500	.98261	1790.00	100.0%

Inferential Statistics

MBI

Duncan[a]

| Living area | N | Subset for alpha = .05 | |
		1	2
Central area (Bangkok)	100	2.9633	
Northeastern area	100		3.6500
Eastern area	100		3.7067
Southern area	100		3.7100
Northern area	100		3.8700
Sig.		1.000	.131

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 100.000.

MBI

Duncan[a,b]

| age category | N | Subset for alpha = .05 | |
		1	2
26-33	161	3.3602	
18-25	147	3.6417	3.6417
34-41	72		3.6898
42-49	84		3.7302
above50	36		3.7407
Sig.		.077	.578

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 75.092.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

MBI

Duncan[a,b]

| income level | N | Subset for alpha = .05 | | |
		1	2	3
Above 40,000 Baht	51	3.2222		
30,001-40,000 Baht	65	3.3641	3.3641	
20,001-30,000 Baht	94		3.5851	3.5851
Less than 10,000 Baht	142		3.6338	3.6338
10,001-20,000 Baht	148			3.7432
Sig.		.344	.089	.324

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 84.133.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.