

A STUDY OF THE ATTITUDE OF CAR DRIVERS IN BANGKOK TO NGV AND ITS ECONOMIC IMPACT

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ABSTRACT

The cost of oil in Thailand was dramatically increased from US \$ 45 to US \$ 75 a barrel in 2006, and it might continue to increase. It has contributed to Thailand's trade deficit by about 9,720 million U.S. dollars, and this could ruin the energy and economic security for the future development of Thailand. The Royal Thai Government has nominated natural gas for vehicles (NGV) as an alternative fuel because it is cheap, non-pollutant, safe, and available in Thailand. About 42% of total volume of retail oil sales in Thailand occurred in and around Bangkok that contributed to 284 billion baht in 2005. If the car owners in Bangkok and adjacent areas of Bangkok were willing to use NGV, the transportation costs in Bangkok would be reduced 70% or estimated equivalent to 85.2 billion baht. Although 8.5 baht per liter of NGV is much cheaper than the 28-30 baht for petrol, NGV is still not very popular in Bangkok. This study focused on three major areas of findings, i.e., about 57.2% of car drivers in Bangkok complained that the Royal Thai Government and PTT Public Company Limited (PTT) did not provide enough information about NGV; 65.3% of car drivers would use NGV if there was enough evident to make them feel confident about NGV such as information about safety, no damage to engines, and high efficiency. A number of car drivers (56.1%) in Bangkok thought the installation of equipments to modify the car to be able to use NGV was expensive, and 71.7% of car drivers would use NGV if the costs of installation were lower. In addition, the last major concern was the number of NGV filling stations. Some of car drivers (75.8%) in Bangkok thought there were not enough NGV filling stations, while 79.3% of car drivers would use NGV if there were sufficient of NGV filling stations for them. It was recommended that there should be at least 880 NGV filling stations in Bangkok.

Keywords: Natural gas for vehicles, NGV, alternative fuel, liquefied petroleum gas, LPG.

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INTRODUCTION

Attempts have been made by the Royal Thai Government to reduce imported crude oil dependency, save foreign currency by using indigenous natural gas instead of imported fuel to reduce the country's trade deficit and alleviate the air pollution problem from vehicles. A program for wider use of natural gas for taxis was introduced in 2004. This is due to the fact that the recognition of NGV as its preferred alternative fuels according to the Kyoto Treaty of United Nations Framework Convention on Climate Change (UNFCCC) about environment concerns (BBC News, 2003). NGV is available in Thailand and can help to improve future energy security and economic development. Therefore, the Royal Thai Government has heavily promoted NGV through advertising and tax deductions for car drivers who use NGV (Anonymous, 2005). The PTT Public Company Limited, whose majority shares are owned by the Thai Government, has served as the key mechanism in the implement of program to increase the number of natural gas vehicles from around 2,600 in 2004 to 44,500 by 2008 with 120 NGV filling stations. Since May 2005, the plan has revised to 180 NGV filling stations and 180,000 natural gas vehicles in 2008 in Bangkok and provincial areas along the gas pipeline and highways. In the second phase (2009 - 2016), the utilization of natural gas in transport will expand throughout the country. The natural gas vehicles and NGV filling stations are projected to increase to 260,000 - 500,000 units and 500 NGV filling stations, respectively (Kwangsuksith, 2005). The PTT Public Company Limited has also supported the installation costs of 10,000 baht per car, freezing the price of NGV at 8.5 baht for two years, and providing 50 NGV filling stations in Bangkok out of 66 NGV filling stations across the country. There are about 15,000 natural gas vehicles across the country and about 80% of them are in Bangkok and its suburbs. The majority of natural gas vehicles (90 %) are taxis and BMTA buses and 10% of them are household cars. In Bangkok, there were about 4,899,969 cars of all types at the end of 2005 (Statistics Sub-Division, Technical and Planning Group, Land Transport Management

Bureau, 2006.). The Department of Energy Business by Ministry of Energy revealed that about 42.5 % or 11.36 billion liters of overall retail fuels were sold in Bangkok or roughly estimated as of 284 billion bath's worth in 2005. The cost of 284 billion baht was estimated from 11.36 billion liters with average price at 25 baht (Department of Energy Business, 2006b). Therefore, if cars in Bangkok and adjacent suburbs were converted to use NGV instead of gasoline and diesel fuels, the transportation costs in Bangkok would be reduced by about 70% or estimated approximately 85.2 billion baht. Consequently, the transportation providers will not need to increase fares. Car drivers in Bangkok will save more money and can use the budget to invest in other projects to improve the economy of Thailand. Moreover, it could improve the energy issue in Thailand because it has been estimated that there is enough natural gas to last for 50 years. This study was aimed at investigating the attitudes of car drivers in Bangkok towards NGV and its economic impact. The results will encourage more car drivers in Bangkok to use NGV (Onchan, 2006).

Natural gas vehicle is defined as passenger car that consuming Compressed Natural Gas (CNG) as fuel. CNG is one kind of natural gas whose major component is methane gas which is lighter than air (Onchan, 2006). In 1984, NGV was used as fuel for the busses of Bangkok Mass Transport Authority (BMTA) and auto-rickshaws (3 wheelers) with satisfactory results. However, NGV was still not popular due to the reasonable cost of petrol during that time (about 6-8 baht per liter); it would be difficult to break even considering the installation costs of natural gas vehicle's equipments. In 1993, the Royal Thai Government paid much attention to the air pollution problem, promoted the use of NGV as alternative energy sources by allocating funds to BMTA to buy 82 natural gas vehicles for buses, and built the first NGV filling station at BMTA Rangsit bus terminus. The development and promotion of alternative fuels becoming a national agenda due to expected economic growth slowing caused by high oil prices. The Government plans to mandate the use of

natural gas fuel for buses, taxis and garbage trucks and to give investment privileges, cut vehicle registration fees or extend financial assistance to private operators who produce or use natural gas vehicles (Chai-Anan and Boonchanta, 2004).

The Royal Thai Government was more concern of the energy problem in the future and its extracted natural gas from the Gulf of Thailand in a Joint Development Agreement (JDA) project. The JDA was between Thailand and Malaysia to secure natural gas supply through the main pipeline from the Gulf of Thailand. The PTT Public Company Limited was the representative of Thailand and Petronas was the representative of Malaysia during that time (Thai Funds Foundation, 2002). The agreement was aimed to improve energy security and improve the trade balance between the two countries. The Royal Thai Government including cities and municipalities are showing great dedication in the support of rapid expansion of the use of alternative fuels and clean vehicles offering incentives: providing low cost to install equipment of natural gas vehicle for taxis. The costs of this campaign were shared between PTT Public Company Limited and the Fund for Energy Conservation. Five NGV filling stations were opened in 2001 (Onchan, 2006). Although NGV has been in Thailand for several years, very few people know about it. The average retail price of gasoline was 15.50 baht per liter, while the average retail price of diesel fuel was 13.50 baht per liter during the year 2001 through the middle of the year 2002, which was considered reasonable price. Thus, most of people in Bangkok were not interested in using alternative fuels, especially NGV. The price of gasoline began to increase to an average of 16.60 baht per liter in 2003, averaging 20.50 baht per liter at the end of the year 2004 and reaching around 27 baht in 2005. The average retail price of gasoline was about 30 baht per liter in 2007. In contrast, the price of diesel fuel was remained constant at around 14.59 baht per liter since the middle of 2002 until the middle of 2005 because the Royal Thai Government tried to put the price of diesel fuel under the control due to the necessity of diesel fuel for the industrial sector. Thus, during this

3-year period there was an increase in demand for diesel-vehicles instead of gasoline-vehicles. The Royal Thai Government started to let the price of diesel fuel flows like what they did to gasoline in 2005. The price of diesel fuel was subsequently increased rapidly and reached 27-28 baht per liter in 2006 (Shell in Thailand, 2006). The unstable crude oil price plays an important role on the economy of several sectors in Thailand, i.e., transportation, industry, agriculture, household use, etc. This is one reason why Thailand has an increased demand for crude oil and fuels. It has been shown that there is an increasing demand for crude oil and fuels as the energy to support the economic growth of Thailand by the Department of Energy Business, Ministry of Energy (Department of Energy Business, 2006a). The total figures reported by the Department of Energy Business were 41,386.156 million liters in 2002, 42,277.712 million liters in 2003, 45,024.792 million liters in 2004, 50,621.212 liters in 2004, and 48,032.65 million liters in 2005. These figures might reflect the unstable price of imported crude oil resulted in the increase of the price of fuel in Thailand. The government authorities have tried to encourage the car drivers to save energy by using alternative sources of energy, i.e., gasohol, bio-diesel fuel, and NGV. The average price of crude oil increased from U.S. \$ 45 per barrel to an average of U.S. \$ 75 per barrel in 2007 (World Oil.com., 2007) resulting in the trade balance deficit of Thailand of about 67 percent.

An increase of trade deficit in Thailand has been roughly estimated and showed that around U.S. \$ 9,720 million or 369,360 million baht in 2005. The government authorities need to find the alternative fuels to support the economic growth of the country. NGV is one of best answers today because NGV has several good properties. Firstly, NGV creates less pollution as oppose to other energy sources. Thailand is bound by UNFCCC where everyone agreed in 1997 to reduce carbon dioxide by around 5.2%, which was later revised to 2% (BBC News, 2003).

There was a research result conducted by Research and Development Institute Saibu Gas Co., Ltd., which revealed that the natural gas or NGV produced toxic substances, such as carbon monoxide,

hydrocarbon, nitrogen oxide, and carbon dioxide less than that of the liquefied petroleum gas (LPG), gasoline, and diesel fuel. Moreover, results from a study done by researchers of West Virginia University comparing the average volume of pollutants from buses (model CUMMINS LTA – 10) that use NGV and diesel, NGV was found to create less carbon monoxide, nitrogen oxide and dust than diesel. The average dust from NGV is 0.027 g/km, diesel 0.965 g/km, carbon dioxide 0.8 g/km for NGV, and 13.11 g/km for diesel, nitrogen oxide 11.63 g/km for NGV, and 18.25 g/km for diesel. In addition, natural gas vehicles will create a higher average of hydrocarbon than diesel at 5.52 g/km and 1.51 g/km, respectively. Furthermore, the Australian Greenhouse Office compared natural gas vehicles and petrol cars and found that natural gas vehicles reduced carbon monoxide by about 50–80%, reduced nitrogen oxide by about 60 – 90%, reduced hydrocarbon by about 60–80%, and almost no dust was found.

Secondly, documents published by the Department of Mineral Resources on 31st December 2000 showed that there was ample volume of natural gas or NGV which can be used in the country up to 50 years. These resources are to be found in the territory of the Gulf of Thailand between Thailand and Malaysia. In addition, Thailand still has the alternative to buy natural gas from Myanmar and it may be possible to buy natural gas from Cambodia and Vietnam. Therefore, natural gas or NGV is a good alternative source of energy for Thailand, and will be beneficial for both industry and the general population by offering a cheaper alternative (Onchan, 2006).

NGV is safe and efficient for use in engines. It has been shown that NGV is safer than LPG because NGV is lighter than air and NGV will float upward to the sky with a higher boiling point than LPG. Conversely, LPG will fall to the ground with a lower boiling point. Logically, LPG should have a higher probability to explode than NGV. That is why LPG has odor while NGV does not have one. NGV has the better characteristics when compare with LPG. It is safe, has higher octane, and has no odor (PTT Public Company Limited, 2006a),

At present, there are two types of natural gas vehicles commercially available (Onchan, 2006). The dedicated natural gas vehicles that come with engines for NGV. It contains many advantages, such as good efficiency, good performance, and less exhaust gas. However, they are expensive, have no choice for other fuels, and are not currently available in Thailand. The second type of natural gas vehicle is bi-fuel car. This type of car comes with a benzene engine, but it has been modified to be able to use both gasoline and NGV. There are also diesel dual fuels cars, where the engine can use both diesel and NGV as fuel; therefore, the car owner can switch back and forth to use either diesel or NGV fuel whenever it is available. The modification costs are much cheaper than buying a new natural gas vehicle. The weak point of bi-fuel car is that the exhaust fumes are not as good as the dedicated natural gas vehicle. All natural gas vehicles in Thailand use bi-fuel engines and there are two systems of bi-fuel engine. The first system is a 2.1 fumigation system in which there is something called a “gas mixer” which absorbs the air with NGV before dispensing it to the engine. The estimated installation cost is around 35,000 to 50,000 baht per car. The second system is a 2.2 multi point injection system, or MPI, in which the fuel gas is directly injected into the oxygen valve of the engine, and it is controlled by an electronic control unit with other electronic measurements. The estimated installation cost is around 52,000 to 65,000 baht per car.

Most car drivers complain that the installation costs for the modification of bi-fuel engines are too expensive, but calculations based on the savings mode once the car has been converted, it has been calculated the payback period for installation budget at 35,000.00 baht. The cars that either travel at the average of 50 kilometers per day for 12 months or travel at the average of 100 kilometers per day for 6 months after installation, the long term gaining due to the use of NGV is much cheaper than gasoline, diesel fuel and LPG (Onchan, 2006).

The taxi drivers who used NGV and participated in this study had complained that the CNG cylinder of natural gas vehicles was too heavy and contained

less volume of gas compared to those cylinders of an LPG vehicle. The CNG cylinder of natural gas vehicles is weighed around 60 kilograms and contains about 15 kilograms of compressed natural gas. It has to be filled up with NGV twice a day, and costs about 300 baht which can travel around 250 - 300 kilometers a day, whereas the LPG cylinder needs to be filled up once a day. The LPG cylinder is weighed about 40 kilograms and contains about 30 kilograms of LPG. The LPG gas will cost about 450 baht to travel around 250 - 300 kilometers. (Seniwong Na Ayuthaya, 2006).

PTT agreed to allow a total of 30,000 taxis that use LPG fuel to have free installation of cylinder for NGV in the year 2006, and threatened to increase the price of LPG in the near future (Guangsuksatith, 2006). However, there were a few taxi drivers or taxi owners (a taxi owner is a person or corporation that owns taxi cars for rent) who were interested in this project. Although they know that NGV can save their money and protect their health, several taxi drivers and taxi owners are still reluctant to use NGV because they would then need to refill twice a day and they feel that there are insufficient NGV filling stations and difficult to access in Bangkok. There is a queuing up to refill at existing NGV filling stations in the average of 15 - 20 minutes (Rathakit, 2006). The result is that the taxi drivers who use NGV do not like to travel long distance for refilling that may reduce their working hours. There are only 66 NGV filling stations throughout the country and there are no NGV filling stations in the northern part, north eastern part and southern part of Thailand. However, there are about 210 LPG filling stations in Bangkok and surrounding suburbs without queuing up to refill (Seniwong Na Ayuthaya, 2006).

The reason why the cylinder of natural gas vehicles is much heavier than LPG cylinder because the materials used for constructing the cylinder are strong and rigid. This is because most components of NGV are methane which is lighter than air. Therefore, there is a need to use high compression, around 3,000 - 3,600 pounds per square inch, to transform it into a liquid. The cylinder of natural gas vehicles must be strong enough for this high compression. At present,

there are four types of cylinder for natural gas vehicles, i.e., steel, fiber glass; a mixture of aluminum, fiber glass, and fiber carbon; and a mixture of plastic, fiber glass and fiber carbon. The fourth type (a mixture of plastic, fiber glass and fiber carbon) is the most expensive one with very light in weight, and the first type (made of steel) is the cheapest one with very heavy in weight (PTT Public Company Limited, 2006b).

The cylinder of natural gas vehicles must undergo several testing processes such as the Hydrostatic Burst Test to prove its sustainability in the event of an explosion, the Ambient Cycling Test to prove there are no cracks or leaks at different temperatures, the Flaw Tolerance Test to prove durability, the Drop Test where cylinder of natural gas vehicles is dropped at least 3 meters onto concrete, and the Cylinder Gun Fire Test where cylinder of natural gas vehicles is shot at by a 30 mm gun at a speed of 850 meter per minute.

It seems clear that there is a considerable scope for enhancing the use of NGV among car drivers in Thailand. However, certain factors seem to deter those car drivers from using the fuel. This study was motivated by hoping to understand the extent and importance of those factors and to understand how to make the transition to NGV more attractive. A specific second goal was to identify the number of NGV filling stations that would be required in the Bangkok region to support the desired change to NGV.

RESEARCH METHODOLOGY

All information concerning natural gas for vehicles was searched from well written documents, web sites, and personal communication with fifteen car drivers in Bangkok (both use and not use NGV). Preliminary criteria that include both good points and bad points of NGV to industrial and transportation were made. All criteria were subsequently used to develop research instrument that required for the assessment of the attitude of car drivers in Bangkok

towards the use of NGV. The research questions in the research instrument consisting of three main areas. The first area was dealing with the interactions between demographic variables (gender, marital status, age, education, occupation, and monthly income), driving patterns (number of working days per week, types of engine, age of cars, fuel expenses, driving in Bangkok only, and car insurance) in Bangkok and negative attitude to the use of NGV. The second area was dealing with the impact of NGV on decision making of drivers to use NGV as alternative fuel, which consisting of different variables, i.e., perceived safety and performance; high installation costs; number of NGV filling stations in Bangkok. The third area was dealing with the impact of NGV on the future economic development of Thailand.

An experimental trial of the developed instrument was carried out with 20 car drivers in Bangkok. The sample of car drivers was selected by using simple random technique from car drivers that passing by the site of the experimental trial. The PTT gas station near Mo-Chit bus terminal was the site of selection. Details of hypotheses are summarized in Tables 1 and 2. All questionnaires obtained from the preliminary trial were used to check for the completeness and to make a correction if any mistake had occurred. A new completed set of questionnaire was developed and

ready for the use with the true sample of car drivers in Bangkok.

The Taro Yamane formula was used to determine the proper sample size.

The formula used is:

$$n = N / (1 + N * E^2)$$

$$400 \text{ cars} = 4,899,969 \text{ cars} / (1 + 4,899,969 * 0.05^2)$$

Where "n = proper quantity of samples", "N = number of population", E = significant level".

Thus, the sample size of 400 car drivers was selected and 400 sets of questionnaires were prepared for the field trial. Simple random technique was used in the study. All data from questionnaires were analyzed by SPSS program based on MANOVA (Multivariate Analyze of Variance) technique to test hypotheses. All hypotheses and results are shown in Tables 1 and 2. All analyzed details are shown in data analysis section and used for discussion.

Hypotheses

These hypotheses were included in the equations required by the MANOVA analysis:

Equation of hypotheses for Table 1 $Y_{ji} = X_{ji}$

$Y_{ji} = X_{1.1} + X_{1.2} + X_{1.3} + X_{1.4} + X_{1.5} + X_{1.6}$

Y_{ji} = dependent variable

X_{ji} = independent variable

Table 1. Hypotheses and their significant values.

Symbol	Hypotheses	Sig. Value	Accept/Reject
$Y_{ji}=X_{1,1} - X_{1,6}$	There were no interactions between the variables of the demographic set to the attitude of car drivers in Bangkok.	$1 > 0.05$	Accept
$Y_{ji}=X_{1,1}$	There were no differences in attitude between genders.	$0.356 > 0.05$	Accept
$Y_{ji}=X_{1,2}$	There were no differences in attitude between people of different marital statuses.	$0.233 > 0.05$	Accept
$Y_{ji}=X_{1,3}$	There were no differences in attitude between people of different ages.	$0.955 > 0.05$	Accept
$Y_{ji}=X_{1,4}$	There were no differences in attitude between people with different education levels.	$0.210 > 0.05$	Accept
$Y_{ji}=X_{1,5}$	There were no differences in attitude between people with different occupations.	$0.197 > 0.05$	Accept
$Y_{ji}=X_{1,6}$	There were no differences in attitude between people with different monthly incomes.	$0.779 > 0.05$	Accept

Equation of hypotheses for Table 2 $Y_{ji} = X_{2,1} + X_{2,2} + X_{2,3} + X_{2,4} + X_{2,5} + X_{2,6}$

Table 2. Hypotheses and their significant values.

Symbol	Hypotheses	Sig. Value	Accept/Reject
$Y_{ji}=X_{2,1} - X_{2,6}$	There were no interactions between the variables of driving patterns to the attitude of car drivers in Bangkok.	$1 > 0.05$	Accept
$Y_{ji}=X_{2,1}$	There were no differences in attitude between people with different number days of driving per week.	$0.214 > 0.05$	Accept
$Y_{ji}=X_{2,2}$	There were no differences in attitude between people with cars with different types of engine.	$0.07 > 0.05$	Accept
$Y_{ji}=X_{2,3}$	There were no differences in attitude between people with cars of different ages.	$0.263 > 0.05$	Accept
$Y_{ji}=X_{2,4}$	There were no differences in attitude regardless of the cost of fuel.	$0.961 > 0.05$	Accept
$Y_{ji}=X_{2,5}$	There were no differences in attitude between those who drive in Bangkok only and those who do not.	$0.784 > 0.05$	Accept
$Y_{ji}=X_{2,6}$	There were no differences in attitude between people with different types of insurance.	$0.969 > 0.05$	Accept

Data Analysis

All of the independent variables in the demographic set and driving pattern had no interactions against all sets of dependent variables of driver's attitudes because the significant values were higher than 0.05. There were no co-effects among individual variables of demographic variable sets towards the attitude of car driver in using of NGV. Also, there were no co-effects among driving pattern variable set and the attitude of car drivers towards the use of NGV. Subsequently, the individual groups of sample were tested according to gender, marital status, age, educational level, occupation, monthly income, number of days driving in a week, the engine types, age of car, fuel expenses, driving in Bangkok only, and insurance. All of these independent variables had a significant value of more than 0.05. It revealed that there were no differences between attitudes within each of independent variables, for example, male and females showed no difference in attitude towards NGV. This suggests that it will not be necessary to segment the overall market into distinctive segments for advertising and marketing purposes.

It was found that many people were still confused about the properties of NGV during the time of survey, for example, 7.3% of the sample thought that NGV would cause air pollution, 25% of them had no idea, and the remaining 67.7% of the

sample knew that NGV was clean technology. One third of the sample, or about 32.3%, still misunderstood concerning NGV. Misunderstandings like this will be a big obstacle to encourage car drivers in Bangkok to use NGV. It was found that 70% of car drivers in Bangkok were interested in using NGV, the media which informed car drivers about NGV were sequentially ranked as follows: television was considered as the highest rank (39.6%) followed by newspapers and magazines (25.7%), radio (17.4%), friends, signboards and stickers (7.4%), internet (6.5%), and finally seminar and booth (3.4%). Although the Royal Thai Government and PTT have heavily advertised and promoted the use of NGV as an alternative fuel; however, approximately 57.2% of car drivers in Bangkok complained that the Royal Thai Government and PTT did not provide enough information about NGV, while 16.4% said that they had no knowledge about it at all. Several drivers commented that PTT only provided the good side of NGV and that they felt insecure about using it. It was shown that 77.2% of the sample would use NGV if any well known institute could prove and confirmed that the conversion to use NGV would not damage their vehicles, with high efficiency and safe (non-toxic and non-explosive), while about 15.5% of the sample said that nothing would change their minds. Most of car drivers in Bangkok, about 71.5%, believed that NGV was environmentally friendly, whereas 21.4% of them had no ideas, as shown in Table 3.

Table 3. A summary of attitude of car drivers towards the performance of engines and vehicles using NGV.

(%)	No damage to engines	Perform well	Safety
Agree	33.4	33.8	46.6
No idea	48.9	51.4	40.3
Disagree	17.8	14.8	13.1
Total	100.0	100.0	100.0

From Table 3, it seems that about half or more than half of all car drivers in Bangkok felt that they were not fully informed about NGV. That is the crucial reason why car drivers in Bangkok are still not interested in using NGV.

Table 4. A summary of attitude of car drivers in Bangkok who were willing to use NGV.

(%)	Willing to use NGV if there was an institution confirmation about the use of NGV	Willing to buy natural gas vehicles
Agree	77.3	65.3
No idea	15.5	25.8
Disagree	7.3	8.8
Total	100.0	100.0

Table 4 indicates that if there were reliable institutions to convince car drivers to feel secure about using NGV, including engine compatibility, performance and safety, almost 100% of car drivers would buy one. Moreover, if there were more NGV

available on the market, more than two thirds of respondents claimed that they would buy one. Many car drivers in Bangkok complained about two other things, i.e., installation costs and the availability of NGV filling stations.

Table 5. A summary of attitudes towards installation equipment costs of natural gas vehicles

(%)	Affordable NGV institution cost	Reduced installation cost of natural gas vehicles would encourage them to use NGV
Agree	26.8	71.7
No idea	30.1	18.8
Disagree	56.1	11.3
Total	100.0	100.0

Table 6. A summary of attitude of car drivers towards the availability of NGV filling stations.

(%)	Providing enough NGV filling stations now	Willing to use NGV if there were more NGV filling stations
Agree	8.5	79.3
No idea	15.8	15.0
Disagree	75.8	5.8
Total	100.0	100.0

must be serious in increasing the number of NGV filling stations across Bangkok. Ideally, Bangkok and its nearby suburbs should have about 880 NGV filling stations available, based on the proportion of LGV-supplied filling stations in the region and the number of vehicles they support.

Finally, one factor that should be considered seriously is the fact concerning the use of NGV which would support the Thai economy. Of those interviewed car drivers, 76% of them agreed. However, it is estimated that sufficient NGV is available in Thailand for around 50 years. Bangkok consumed about 73 million barrels (11.36 billion liters/ 155) in 2005. Currently, the price of 1 barrel is equal to U.S. \$ 75, thus vehicles in Bangkok require U.S. \$ 5.5 billion worth of fuel (73 million barrels x \$75). There are 70% of car drivers who are interested in using NGV. Suppose 70% of car drivers in Bangkok used NGV - it would reduce oil imports by about U.S. \$ 3.8 billion (73 million barrels x 0.7 or 70% x U.S. \$ 75 per barrel). This is enough to build a new sky train or underground route to solve the traffic jam problem, which would clearly benefit the citizens of Bangkok as a whole.

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