

**WHAT ARE INTENTIONS TO BUY ELECTRIC VEHICLES FOR  
THAI PEOPLE?**



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## **WHAT ARE INTENTIONS TO BUY ELECTRIC VEHICLES FOR THAI PEOPLE?**

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### **ABSTRACT**

Due to the present emerging eco-friendly trend together with a highly fluctuated gasoline price in previous decades, the electric vehicles are now becoming realistic concepts and practically used in many countries. By studying 102 Bangkok dwellers who have experiences in or currently consider to purchase a car, the research will explore the intention to buy the electric cars in Thai market and the factors influencing those intentions. An online questionnaire was distributed randomly to the author's peers and co-workers. After computing Exploratory Factor Analysis and Multiple Linear Regression (Stepwise), it appeared that the main factors influencing the intention to buy are the environmental impact, security, price, and indirect benefits. Even though the ranking of its sensitivity is not complied with Maslow's hierarchy of needs, all of these factors were also existed in the results of the previous researches in European countries (Thiel et al, 2012)(Lieven et al, 2010), United States (Hidrué et al, 2011), and Malaysia (Razak et al, 2014). Moreover, the respondents are likely to purchase an EV if it is available in Thailand (probability is 4.81 out of 6). It is safe to assume that the market has interests in the product. However, they hesitate to acquire them immediately after considering the readiness of supporting facilities.

**KEY WORDS:** Electric Vehicles / Green technology / Innovative concept / Alternative energy / Intention to buy

58 pages



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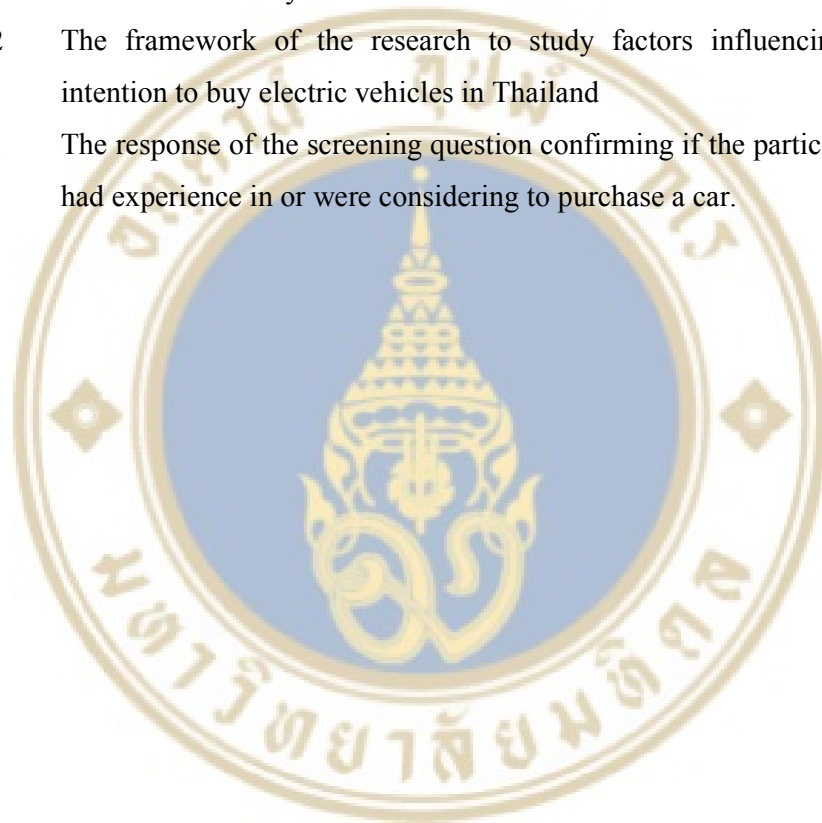
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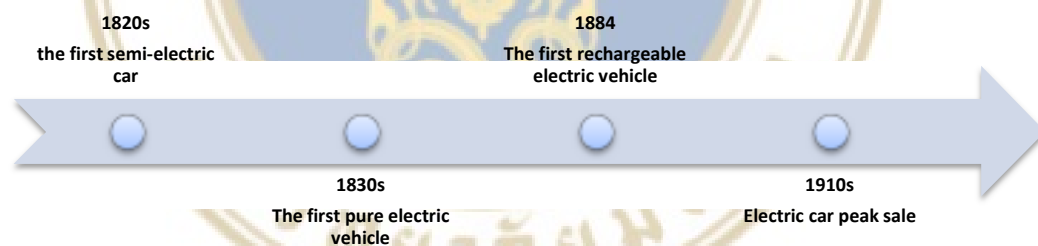


## CHAPTER I

### INTRODUCTION

#### 1.1 History of electric cars

The electric cars actually are not a new concept. According to the U.S. Department of Energy, in the early 1800s, inventors in Hungary, the Netherlands, and the United States together with a blacksmith from Vermont initiated the idea to create a battery-powered vehicle and did create the first semi-electric cars in the 1820s (History of Electric Car, 2014). Not long after that (around 1832-1839), a Scottish inventor named Robert Anderson developed the first pure electric vehicle which is non-rechargeable. However, it wasn't until 1884 that Thomas Parker, English inventors, built some of the first practical electric cars powered by a rechargeable lead-acid battery, which was invented by French scientists.



**Figure 1.1 Electric car development**

In the 1900s when people in the western countries became wealthier and more technological savvy, they seek for a development in transportation which, at that time, a horse was still the main mean to commute. There were 3 sources of widely used powers - steam, gasoline, and electric - which have different proficiencies and constraints.

Steam had always been a reliable source of power for trains and factories. Some of the first self-propelled vehicles were made to be powered by steam in the 1700s. However, as for cars, it was until the 1870s that this technology was applied to.

One of the reasons was because steam wasn't very practical for a personal car. Steam vehicles needed a long startup time which sometimes could be up to 1 hour in a cold weather. Also, it needed to be refilled with water, in order to generate the steam, making it cannot go far.

Almost in the same period that the electric car was marketed, gasoline vehicles also made itself introduced in 1800s and were popular until now. It was known for the improvement of the internal combustion engine that gives higher speed and energy efficiency comparing to steam and electric. This technology, later on, was also widely spread onto aircraft and boats. However, it wasn't without a flaw. People who can drive gasoline cars had to know about its mechanism because it often needed a manual maintenance. In the past, starting the engine is not as easy as today. The engine needed to be started manually with a hand crank, not in the passenger room but at the engine. Moreover, they made a lot of noise, and their exhaust was unpleasant.

Electric cars didn't have any of the problems like the steam-powered or gasoline-powered. They didn't make a lot of unpleasant noise or emit a smelly pollutant. Definitely, it needed a maintenance, but not as frequently as a gasoline car. As a result, electric cars quickly became popular with urban people in America, especially women, to commute within the city. In 1912 when more houses were wired for the electricity, electric vehicles were even more popular as it became easier to be recharged and handled. Since the targets are an upper-class customer, they often featured luxurious interiors making their sales peak in the 1910s.

In early 1900s, a lot of the inventors and companies saw the potential in the electric cars and tried to eliminate its limitations and improve its performance. For example, Hartford Electric Light who partnered with General Vehicle (electric car manufacturer) initiated the exchangeable battery service that allowed people to replace their depleted battery with a new recharged one and calculate the charge by mileage. This was effective in solving a lacking of the recharging infrastructure problem. In term of the performance, Ferdinand Porsche, the founder of a famous sport car company, designed an all-wheel drive electric sport car that broke several speed records. He, as well, created the first electric-gasoline hybrid car in 1900 and sold it in the very next year to England for racing. Even Thomas Edison, the world's notable scientist and inventor believed that electric technology was superior than the other

two. He partnered up with Henry Ford, his close friend, to develop a low cost battery to make electric cars more affordable.

The event later took an awkward turn. It was Henry Ford's Model T that drove electric cars out of the market. Model T, a pure gasoline-powered car, was launched and mass produced in 1908 with almost a one third price of the electric cars'. While in a similar period, Charles Kettering came up with an electric starter for gasoline engine. It got rid of the trouble to use a hand crank starter, which definitely improve its user friendliness and widened the market. Another main factor was the discovery of a large petroleum reserve, Texas crude oil, making the gasoline price much more competitive comparing to other sources of power. A lot of the gas stations continuously turned up in the urban and rural areas. In some countries, it was even easier to find the gas station than a house that had electricity in the rural area. After that, an electric car slowly faded from the market until completely disappeared in 1935 (Ibid).

#### THE NEW BEGINNING

Electric vehicles didn't make any progress in about another 30 years after that. The gasoline car, on the other hand, continued to grow due to the overwhelming demand. In the age while the oil was still abundant and very cheap, the inventors put their focus into improving the car performance only. Not a lot of people seem to care about the energy efficiency. It was the time when the internal combustion system improved so much.

Another turn of event was during around 1973 when there was an energy crisis and the oil price skyrocketed. The major crude-oil-importing countries such as EU countries and USA started to look for a substitute power that was independent to the fluctuated oil market. This was when the government in each country saw the importance of a sustainable power and started to fund the electric and hybrid vehicle research again. Not only the governments, but the car manufacturing firms were also alerted on this emerging trend. General Motors, for example, began to develop an electronic city vehicle again in comply with the sustainable energy and environmental friendly concept.

Still, the electric vehicle in this era could not keep up with an advanced gasoline technology that had continuously improved for more than 30 years. It could not generate the speed as fast as the gasoline-powered. Moreover, the farthest distance it could go was only 65 kilometre before needing to be recharged again. This project was being developed behind the scene until two events officially showed the world a true practical electric vehicle.

The first event was in 1997 when Toyota launched Prius, a hybrid electric compact sedan, in Japan. It suddenly became a big hit in the market and was available worldwide in 2000. In the age when gasoline price still hiked, it made a name for itself in term of the energy efficiency. Together with all marketing tools, Prius became one of Toyota's bestselling cars in no time. Prius was marketed in over 90 countries around the world, with Japan and USA being its largest market. This model also supported an emerging environmental friendly trend which topped up its popularity in a developed country.

The second event that supported the first one was an introduction of a luxury electric sport car by Tesla Motors in 2006. Roadster was Tesla's first model which purely relies on lithium-ion battery cells. It was capable of 320 kilometres run in one charge and could accelerate from 0 to 100 kilometres per hour in merely 4 seconds. This was indeed an exceptional performance for an electric car. Considering about the actual use, an hour of recharging would allow it to go for 8 kilometres while one full charge would require 48 hours. The price started with USD 109,000 for a basic model in USA. It was truly a success for Tesla that they sold out their inventory and became the biggest car manufacturer in California. Tesla's move stirred the whole industry. Other giant car companies were motivated toward electric vehicles by their work.

After the revival of an electric car, it became a new light of hope for the consumers. However, from 2015 onwards, the gasoline price significantly decreased and kept running at half of its original. Some people say that it was because of the shell gas discovery. Some people saw it as political game. Whatever the reason, the interesting part is whether the electric power will fall again, or it is mature enough to continue. Some countries have invested a lot in the infrastructure. They may keep supporting. However, as for Thailand, this concept is very new. Its future is depending

on how people foresee the trend and the factors they consider to purchase an electric vehicle.

## **1.2 Problem Statement**

As the crude oil price was dramatically dropped in late 2014 and significantly fluctuated unlike any time before in this decade, the author would like to know how Thai people think about the substitute energy, whether or not it is necessary in Thailand, and how they see the oil price in the future. The author still believes that for a vehicle, sooner or later, Thailand will promote the use of a sustainable energy instead of relying on the gasoline power. Hence, this research will figure out the preliminary level of acceptance toward an electric car for Thai people, the criteria that they expect, and the ones that they do not.

## **1.3 Research Question**

What are factors influencing an intention to buy electric vehicles for Thai people (who are currently live in Thailand)?

## **1.4 Research Objective**

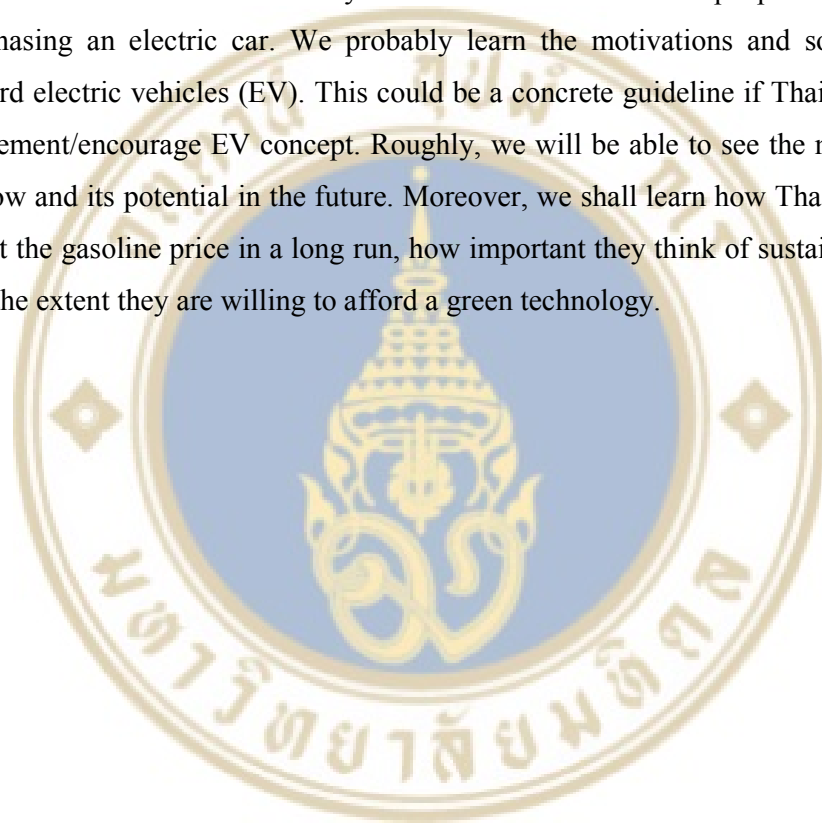
- To study the factors influencing an intention to buy electric cars in Thai market.
- To study the intention to buy the electric cars in Thai market.
- To study how Thai people think toward a green technology and sustainable energy.
- To study how Thai people see the gasoline price in a long run.
- To recommend what is essential for promoting electric cars in Thailand.

### **1.5 Research Scope**

The scope is Thai people who is currently live in Thailand and had experience in or currently consider to purchase a car.

### **1.6 Expected benefits**

The research is likely to show criteria that Thai people consider when purchasing an electric car. We probably learn the motivations and some concerns toward electric vehicles (EV). This could be a concrete guideline if Thailand wants to implement/encourage EV concept. Roughly, we will be able to see the market size as of now and its potential in the future. Moreover, we shall learn how Thai people think about the gasoline price in a long run, how important they think of sustainable energy, and the extent they are willing to afford a green technology.



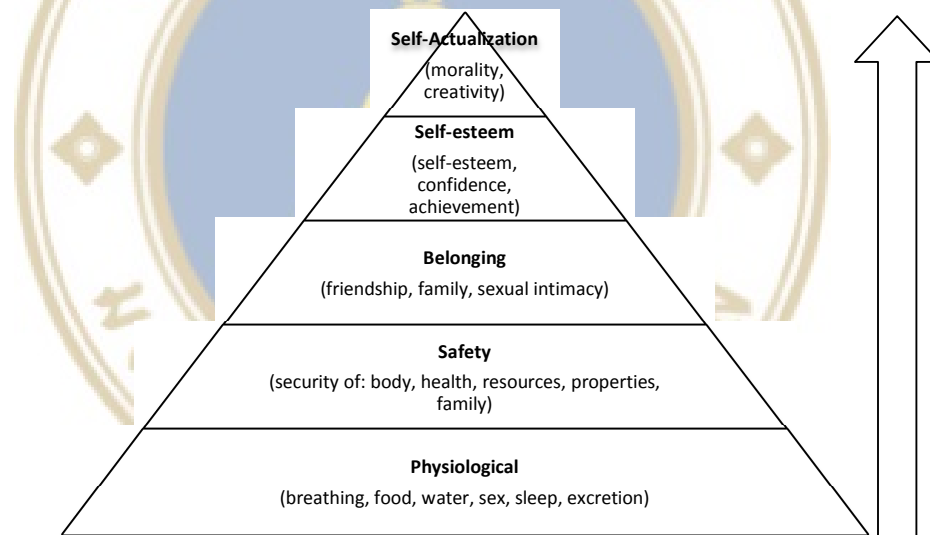


## CHAPTER II

### LITERATURE REVIEW

#### 2.1 Theory - Maslow's Hierarchy of needs (Maslow A.H., 1943)

According to one of the most referenced theories of motivation, Maslow's hierarchy of needs, humans are driven by five major needs (Maslow A.H., 1943). Maslow proposed that each human need has a different degree of importance/severity motivating us to do one thing in prior to the others. Hence, he grouped them into 5 major categories and displayed as a hierarchy shown in Figure 2.1.



**Figure 2.1 Maslow's hierarchy of needs**

Physiological needs basically are the fundamental physical requirement for survival. This level has the highest intensity because if those needs are not satisfied, the body will not be able to function properly following by death eventually. Some examples are the needs for food, water, and sleep. In present, it might also include the need for getting/making money which is a mean to exchange for all fundamental goods. If Physiological is satisfied, one will move on to the next level concerning how to keep the acquired resources and their body safe. In the modern world, this could also refer to the personal security and financial security. After assuring the survival,



one would seek for intimacy, love, friendship, social connections and the sense of belongingness to something/some communities. If the needs of belonging are not met, people usually found to be sensitive to loneliness, social anxiety or even depression. After that, one would be seeking for respects from the others and building up a confidence/self-esteem about oneself. This is when people wanted to get status, recognition/attention and fame. Lastly, if self-esteem level is achieved, self-actualization needs will rise. Depending on how soon one can achieved self-esteem, but usually, people in self-actualization level are most likely in the last period of their life. They would desire to reach their highest potentiality, become everything that they are capable of becoming, give back/service the society and serve a greater good.

## 2.2 Factors

Applying Maslow theory, there should be at least eight factors (independent variables) when an individual consider to purchase EVs in Thailand (dependent variable);

### 1. *Purchasing price*

According to the law of substitution, the purchasing price will indeed affect the consumer' decisions because with the same amount of money, they could buy another item that might provide a higher satisfaction. Or, they could look for another item that gives about the same satisfaction level with a lower cost.

### 2. *Operating costs*

Not only the initial cost, some consumers usually consider the total cost of ownership (TCO). That would include an operating cost such as fuel cost, maintenance cost and disposing cost as well. All of these costs will, again, be associated with the physiological needs.

### 3. *Durability*

The level of durability (life time period) will be another parameter to measure the worthiness of the money that consumers have to trade off with.

4. *Maximum cruising range*

The maximum cruising range per one charge would be another criterion that possibly alters the consumer's decisions. There is a risk associated with the safety if the vehicle could not bring us far. It would be reasonable to be afraid of a danger if the vehicles run out of the resource at an inappropriate place.

5. *Recharging place*

The station for the cars to be recharged would be another important factor. Similar to the previous, there is a risk associated with the safety if there is no adequate recharging station. According to one research that was conducted to measure the intention to buy EV in France, Germany, Italy, Poland, Spain, and UK, the criteria of 'able to charge at home without owning a private garage' was among the top three influential factors (Thiel et al, 2012).

6. *Recharging time*

While the conventional gasoline car took less than 15 minutes to be filled up, not so many people care about the refill time. However, as for the EVs, the recharging time is most likely to be much longer (around 1-2 hours). Hence, it would be another potential factor for the consumer to consider.

7. *Performance (speed/acceleration/handling)*

The performance of EVs such as the maximum speed, acceleration, and handling could also be factors to consider if the consumers are seeking for self-esteem and achievement when physiological, safety, and belonging are not their big concern anymore.

8. *Environmental impact*

The last and expected to be least influential factor is the environmental impact. Unfortunately, one of the most promoted aspects of EVs, the environmental friendly, seems to have the least impact to the consumers according to Maslow's hierarchy of need. There was one research conducted in Malaysia confirming that people saw the value of the cost more than the value to the Earth when purchasing a hybrid vehicle (Razak et al, 2014).

### 2.3 Previous Researches – European countries

As western countries were far ahead of Thailand or other countries within these regions in adopting EV concept, it would be beneficial to learn how their people thought about this technology. There was one research, which I must say, carrying a high credibility. It was a cooperation of Joint Research Centre, TRT Trasporti e Territorio, and Ipsos, three worldwide research company. An online questionnaire was distributed to car drivers in six countries (France, Germany, Italy, Poland, Spain and United Kingdom) that were responsible for more than 75 percent of passenger car sale in European Union in 2011. The sample size was quite large and well controlled. There were 623 respondents in France, 606 in Germany, 613 in Italy, 548 in Poland, 617 in Spain and 716 in UK, in total of 3,723 respondents (Thiel et al, 2012).

The methodology was quite interesting. In the main part of the survey, the respondents were shown a comparison of key variables (Price, Maximum cruising range, Recharge time, Operating cost, Carbon emission) between a conventional car and electric car. Then they would have to consider whether they will buy an EV or not. Later on, assuming that they were given a certain amount of money, they could choose to improve one of the electric car features. Then they will be asked again to choose whether or not they will buy an electric car. In the end, there were also two interesting questions in regarding to how they see fuel price in the future and how they expect the share of the electric cars would be in the future.

**Table 2.1 the comparison between EVs and conventional gasoline gas by features**

<b>Feature</b>	<b>Electric car features</b>	<b>Conventional car features</b>
Car purchase price	30,000 Euros or above	In the range of 20,000 Euros
Maximum range in one charge	150 km	At least 300 km
Recharging time	Not less than 30 minutes	5 minutes
Euros per 100 km	2 Euros	10 Euros
Carbon emission	Low	High

Before going into the main part, it is useful to see the results that represent the sample's background knowledge towards our concept. Regarding to the fuel price in the next five years, 65 percent of the total sample thought that it would 'increase a

lot', 26 percent said it would 'increase a bit', three percent for 'remain stable' and two percent for 'decrease a bit'. Literally, none expected it to 'decrease a lot' (Ibid). Though, it actually decreased a lot, as of 2016. This is one point to confirm whether or not this expectation had already changed.

Regarding to the familiarity level towards the EV concept, the mean score was only 5.5 where 1 means 'no knowledge at all' and 10 means 'full knowledge' (Ibid). However, there seemed to be a difference in the age. The respondents who were 18-34 years old had a slightly higher mean (5.8) comparing to 35-54 years old (5.4) and 55-74 years old (5.4). Even though the familiarity with this new concept was not very high, 40 percent of the total respondents expected that in the next 10 years, EVs would have more than 20% share in the market. 17 percent of the people even thought it could reach 40% of the market (Ibid).

At first, when the respondents were given a list of comparison between EVs and tradition cars, 39 percent of the total said that they had more than 50 percent chance to buy EVs while 10 percent said that they would never buy EVs (zero percent chance). There were some interesting facts on this data. In Poland, Spain, and Italy, for some reasons, the acceptable level seemed to be much higher than the other countries. There were 49 percent in Poland, 50 percent in Spain, and 54 percent in Italy which had more than 50 percent probability to buy EVs. Whereas, for France, Germany, and UK, the average was only merely 30 percent (Ibid). The research analysed further into the respondents' characteristics, and it seemed the people who were familiar with electric cars were more likely to purchase, the people who had an intention to buy a car in next 6 months and 1-2 years were prone to purchase, and the people who used car every day were more likely to purchase.

After that, the respondents were given another set of a comparison with a chance to improve one criterion of EVs at a time for three times. Each time, they were allowed to choose the same one. For example, if they chose to reduce price in the first step, in the second step, they could choose to reduce the price further or use this chance to improve the others. It reflected the degree of importance that the respondents thought towards what they chose. In the first step, the responses were to extend the maximum range in one charge (32 percent) and decrease the car purchase price (32 percent) equally following by the possibility to recharge the car at home even

though the respondents didn't have a private garage (25 percent). Improving recharging time and improving the speed were 9 percent and 2 percent, respectively (Ibid). After finishing all three steps, the most popular combination (17 percent) was improving purchasing price, extending the driving range, and possibility to recharge at home. The second was 12 percent which were leaving the price unchanged, reducing recharging time, extending the driving range, and possibility to recharge at home. The third was 9 percent which were reducing the price, extending the range, and improving the recharging time in exchange of giving up recharging at home. There was also a certain group that already satisfied with all aspects except the price. 11 percent of the respondents would not change anything but reduce the price for three times.

**Table 2.2 the criteria that the respondents may consider to improve**

<b>Feature</b>	<b>Starting Point</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>Price Driven</b>
Car Purchase Price	30,000 Euro	27,000 Euro	30,000 Euro	27,000 Euro	21,000 Euro
Range in one charge	150 km	200 km	200 km	200 km	150 km
Recharging time	2 hours	2 hours	1.5 hours	1.5 hours	2 hours
Recharge at home	No	Yes	Yes	No	No
Max Speed	120 km/h	120 km/h	120 km/h	120 km/h	120 km/h
Preference		17%	12%	9%	11%

Lastly, the respondents were asked if they would buy the EV that they improved in prior to the conventional cars. For combination A, 50 percent of the people had 50 percent chance to purchase while 5 percent will definitely not buy (zero percent chance). For combination B, 53 percent of people had 50 percent chance to purchase. For combination C and 'Price Driven', it was 56 and 58 percent, respectively. Before ending, the researchers gave another question to investigate on the group that was less likely to buy (less than 30 percent chance). 56 percent was still unsatisfied about the price, and 42 percent had concerns about the battery life time (Ibid).

Another interesting research was conducted in Germany studying EV market size and the purchasing intention for both conventional and electric vehicles.

According to Lieven et al. research in 2010, they separated the car uses into six main categories as the follows to see EVs possibility in each sectors;

1. First vehicles for all day use
2. Secondary cars for occasional and short-distance use
3. Family car for several people
4. Commercial vehicles (Taxis, for example)
5. Leisure cars to use during time off
6. Off-roaders

Through an internet survey of 1,152 respondents (35.9 percent female with 39.9 years old average age), the respondents were asked ‘which one out of the six categories were likely to be their next purchase?’ following by ‘would you prefer it to be an electric vehicle?’ The results were 4.2 percent might buy EVs as the first car, 6 percent might buy EVs as a secondary car, 5.6 percent might buy EVs as a family car, 15.4 percent might buy EVs as a commercial car, 13 percent might buy EVs as a Leisure car, and 50 percent might buy EVs as off-roaders (Lieven et al, 2010).

**Table 2.3 the type of car that the respondents were likely to buy next**

	<b>Number of potential buyers</b>	<b>Likely to buy it as EVs</b>	<b>Percent</b>
1. First cars	922	39	4.2%
2. Secondary cars	67	4	6.0%
3. Family cars	108	6	5.6%
4. Commercial cars	26	4	15.4%
5. Leisure cars	23	3	13%
6. Off-road cars	6	3	50%

As for the off-roader, the result was quite unexpected. The research might have too few respondents who wanted an off-roader. If a solid proof is needed, a larger survey might be required. However, according to the existing data, it seemed EVs had the biggest market in off-roaders, commercial cars, and leisure cars, respectively. Since each type of cars served a different purpose, people had different expectations/intentions to purchase. As for the commercial cars, price, durability, and



maximum cruising range were what people consider. On the other hand, for leisure cars and off-roaders, performance and price were the most influential.

## 2.4 Previous Researches – the United State

Moving onto another early adopter of this technology, the United State, a similar research was conducted by university of Delaware. It was web-based with 3,029 respondents. The primary independent variables were driving range, charging time, fuel cost saving, environmental impact, and performance (Hidrue et al., 2011). The goal was to indicate the factors that influent the willingness to pay for EVs. The respondents, firstly, will be asked about the type of vehicles that they are most likely to purchase next. Setting that as a target, the researchers would introduce two EV versions of their preferred cars (automatically generate by an online program). The respondents were told that other than the variable mentioned earlier, these EVs were perfectly identical to their preferred gasoline vehicles (such as interior, exterior, size, and look) eliminating non relevant factors. Each variable will be interpreted its value in term of the amount of money that the consumer had to trade off with. An example of the questions is as the follow;

**Table 2.4 a comparison between the respondent’s preferred cars and its EV version**

Vehicle Attribute	EV 1	EV 2	A preferred Gasoline car
Driving Range on Full Battery	75 miles	150 miles	
Time to recharge for 50 miles range	1 hour	10 hours	
Fuel Cost	USD 2.00/gal Gas	USD 1.50/gal Gas	
Acceleration	20% faster	20% slower	
Pollution	50% lower	95% lower	
Price	USD 16,000 higher	USD 3,000 higher	

Quite as expected, the fuel cost saving had the highest value among all variables. The consumers were likely to pay USD 4,853 more (as the purchasing price) for each USD 1/gallon lower fuel cost. The driving range had the second highest

value. If the EVs could increase the maximum range in one charge from 75 to 150 miles, the consumers were likely to pay over USD 5,600 more for the price. If increasing from 75 to 200 miles, the consumers were likely to pay over USD 9,200 more. If increasing from 75 to 300 miles, the consumers were likely to pay over USD 12,700 more. The increment was USD 75 per mile (75-150 mile range), USD 73 per mile (150-200 mile range) and USD 35 per mile (200-300 mile range). Recharging time was the third. The consumer was willing to pay around USD 2,000 more for the reduction from 10 to five charging hours. If from 10 to 1 hour, it would worth almost USD 6,000, and from 10 hours to 10 minutes, it would worth around USD 8,500 (Ibid).

Fourthly, improving the performance, from 20 percent slower to 5 percent slower than a preferred gasoline vehicle, would worth around USD 2,600 while from 20 percent slower to 5% faster and to 20% faster were worth around USD 5,100 and USD 7,300 respectively. Lastly, pollution reduction had the least impact. An improvement from 25 percent to 50 percent reduction over their preferred gasoline cars was worth about USD 1,900. From 25 percent to 75 percent and to 95 percent reductions were worth around USD 2,600 and USD 4,300 (Ibid).

## **2.5 Previous Researches – Malaysia**

In addition, there was a similar finding in a country that is pretty close to Thailand confirming that cost and environmental concern are the main drivers for people to purchase a hybrid vehicle. In Malaysia where the people share a significant similarity in cultures and characteristics with Thais, people see the value of this concept as it was cost saving more than environmental friendly (Razak et al, 2014). The respondents thought that it saved the fuel consumption, was very economical for maintenance, was a good value for money, and was able to get tax incentives from the government (Ibid). Even though the environmental factors were not as strong as the cost, it also had a positive relationship with the intention to buy a hybrid car. There was a high response toward ‘preserving the environment’ and ‘saving the environment for the next generation’ (Ibid).



The research also suggested the Malaysian government to support the promotion of hybrid cars by applying tax exemption and encourage the local manufacturers to generate a variety of choices for the consumers. The higher acceptance of this alternative power would lead to the lower pollutants and cost of living. Even though the sample size for this research was quite limited, Thai's and Malaysia's culture and economy quite resembled each other, so it was worth considering.

## 2.6 Previous Researches – Thailand

Lastly, in order to understand more about the competitors (in this case, other alternative powers), there was one good research that had been conducted quite some time ago. Its assumptions might not be up to date, however, it represented an interesting idea of measuring the intentions to acquire a vehicle in Thailand. According to Martin Goedecke's research in 2005, there were 3 main factors that affected the consumer's decision to buy vehicles (Goedecke, 2005). The first parameter, so called operation costs, consisted of fuel prices, fuel consumption, fuel tax, annual tax, and maintenance, for example. The second parameter, so called vehicle first costs, consisted of vehicle costs and sale tax. The last parameter, so called external costs, consisted of pollution from vehicle production, pollution from fuel production, pollution from vehicle disposal, pollution from vehicle operation, and indirect economic benefits, for example. Using these three parameters, the author wanted to find 3 things;

**Table 2.5 a list of the research's goals**

<b>Goals</b>	<b>A combination of;</b>		
1. Consumer Life Cycle Costs	Operation costs including tax	Vehicle first costs including tax	
2. Societal Life Cycle Costs	Operation costs	Vehicle first costs	External Costs
3. Tax	Operation tax	Vehicle first tax	External tax

The Consumer Life Cycle Costs (CLCC), basically, measured the acceptability of each technology to the consumers. It included not only the initial price but also the costs of owning the product. Societal Life Cycle Costs (SLCC) would affect the society in overall. The external costs were taken into considerations meaning it reflected the costs to maintain the environment due to the consequences of that technology. The parties that should consider on this were, for example, government and the policymaker. The technology that could provide the lowest SLCC meant that it was the most acceptable in the market as well as generated the lowest pollution.

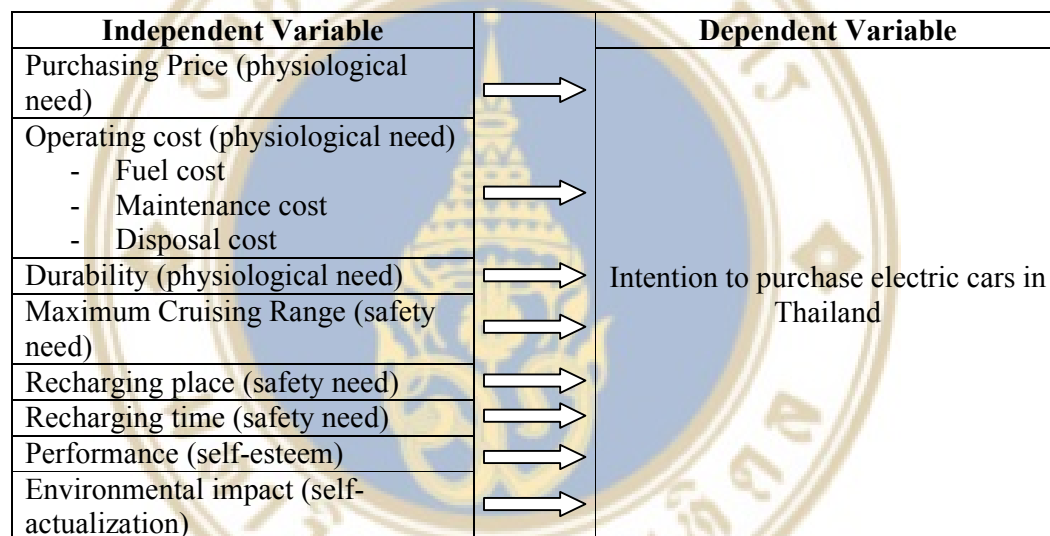
As a result, Thai society was prone to the natural gas vehicles (NGV and LPG) which had the lowest SLCC among gasohol (biofuel) vehicles, diesel vehicles, and hybrid/electric vehicles. The natural gas vehicles were, actually, not energy efficient. However, since the costs of the natural gas was very cheap (in Thailand as of 2005), the overall operation costs were significantly lower than the others. Even though there was a certain cost of modification (for turning gasoline vehicle to NGV) for the first time, it could be paid back very shortly by a difference between gasoline and natural gas price. Moreover, this technology was considered more environmental friendly than Diesel, Gasohol but still incomparable to the hybrids. One point to note is that hybrid/electric vehicles had the highest SLCC. In term of the energy efficiency and environmental friendly, it was indeed the best in the market, however, its initial cost was still very high comparing to the generic gasoline cars. Hence, people doubted that it would worth the fuel saving cost. This somewhat implied that the cost advantage for hybrid/electric cars will increase along with higher crude oil price and higher cost for environmental problem. This, again, raised the question about the future of an electric car in the current situation.

**Table 2.6 a summary of previous researches**

	<b>Data Source</b>	<b>Method</b>	<b>IV</b>	<b>DV</b>	<b>Finding</b>
1.	Goedecke. (2005)	Focus group, Secondary Data	Operation cost, Vehicle first cost, External cost	Societal life cycle costs, Consumer life cycle costs, Tax	CNG has lowest societal life cycle costs. Hybrid vehicles highest societal life cycle costs
2.	Lieven et al. (2010)	Internet Survey with 1,152 respondents	Price, Maximum cruising range, Environmental impact, Performance, Durability, Convenience	Criteria considered to buy conventional vehicles and EVs in Germany	Price, Maximum cruising range, Performance, and Durability were the top criteria for German market.
3.	Hidrué et al. (2011)	Internet Survey with 3,029 respondents	Driving range, Charging time, Cost saving, Environmental impact, Performance	Willing to pay for an electric car in the US	Cost saving, Driving range, Charging time were main drivers
4.	Thiel et al. (2012)	Internet Survey with 3,723 respondents	Price, Maximum cruising range, Recharging time, Recharging place, Operating cost, Carbon emission	Intention to purchases electric cars in France, Germany, Italy, Poland, Spain, and UK	Maximum cruising range, Price, and Recharging place were top three criteria.
5.	Razak et al. (2014)	Questionnaire survey to 100 respondents	Cost, Environmental concern, Brand	Intention to purchases hybrid cars in Malaysia	All three factors have a positive relationship

As we can see from the summary table, the findings of past researches comply with Maslow's theory of motivation. Most of the factors influencing the

intention to buy are associated with physiological needs (purchasing price, operating cost, durability), safety needs (maximum cruising range, recharging place, recharging time), self-esteem (performance), and self-actualization (environmental impact). Figure 2.2 below represents the framework of the research that was developed through the lenses of Maslow Theory together with the information gathered from previous researches. The hypothesis is that purchasing price, operating cost, durability, maximum cruising range, recharging place, recharging time, performance, and environmental impact are the eight major factors that contribute to the intention to purchase electric cars in Thailand. This research shall test whether the hypothesis is true and how strong each independent variable is to the dependent variable.



**Figure 2.2 the framework of the research to study factors influencing an intention to buy electric vehicles in Thailand**

### CHAPTER III

## METHODOLOGY

To answer the research questions, the more opinions we could collect led to the more valid/realistic data, and since we already had certain factors from the previous researches, a quantitative survey would be the best fit as it could reach a lot of samples in a limited period of time. We would be able to get a numerical data to back up the finding, and we do need this quantitative support to measure the preliminary acceptance of the concept and the strength of each factor toward the intention to buy. Hence, a close-end questionnaire was designed and distributed randomly. This would eliminate the potential bias of limiting into a particular group of samples.

Due to the time and resource limitation, the research could only study a small-scale sample out of the total population. As for the total, Thailand is among one of the biggest markets for automotive. According to Toyota website which usually reports the number of cars sold in each year, there were 799,632 purchases for all types of cars (including passenger cars, pick-up truck, SUV, and commercial vehicle) in 2015. The details were arranged by brands as shown in Table 3.1 below. It appeared that Toyota, Honda, and Isuzu were top three players, and Japanese brands were holding a major share of the market. Unfortunately, as of the present, there is no report for a hybrid car which might give us a better picture for electric vehicle market.

**Table 3.1 the total car sale in Thailand as of 2015**

	<b>December 2015</b>	<b>Accumulated in 2015</b>
Toyota	28,566	266,005
Isuzu	20,003	144,295
Honda	12,543	112,178
Mitsubishi	9,802	59,820
Nissan	6,342	51,193
Mazda	5,633	39,471
Suzuki	2,574	21,285
Hino	1,505	11,632
Subaru	340	2,641
Mitsu-Fuso	200	1,250
N-Diesel	-	0
Total Japanese makes	87,508	709,770
	<b>December 2015</b>	<b>Accumulated In 2015</b>
Ford	5,232	36,465
Chevrolet	2,304	17,456
Benz	2,769	12,841
B.M.W.	1,117	8,768
Hyundai	836	4,227
DFM	83	1,103
TATA	130	1,144
Volvo	189	1,795
Kia	94	636
Volkswagen	67	420
Proton	21	198
WuLing	9	157
Peugeot	26	71
Daewoo	-	19
Other makers	1,079	4,562
Total (Japanese and non-Japanese)	101,464	799,632

### 3.1 Instrument Development

The questionnaire was partly developed from the previous researches (Thiel et al, 2012)(Lieven et al, 2010)(Hidrué et al. 2011)(Razak et al,

2014)(Goedecke, 2005) addressing the factors influencing an intention to buy electric vehicle. The questions were developed from eight constructs (purchasing price, operating cost, durability, maximum cruising range, recharging place, recharging time, performance, and environmental impact). The purpose was to find the correlation between the independent variable and dependent variable. The questionnaires were kept to be short and simple to answer. Mainly it was composed of five sections;

1. Introduction
2. Screening questions
3. General questions
4. Specific questions
5. Demographic questions

The introduction was to state the background and objective of the survey following by one screening question as mentioned before. Then several general questions were to warm up the respondents and get some generic information such as “Are you familiar with a pure electric vehicle concept?”, “How would you forecast the oil price in the next 5 years?”, and “How often do you change a car?” After that, there will be specific questions related to each factor. The answers were arranged in a six level assessment scale (6 = Strongly Agree, 5 = Agree, 4 = Slightly Agree, 3 = Slightly Disagree, 2 = Disagree, 1 = Strongly Disagree). The even scale was to encourage the respondents to express an opinion (Garland, 1991). The research would like see either positive or negative impression toward each factor, so we didn’t leave neutral in the answer. When the respondents lean only a little to which side, we encouraged them to give the answer. Then this section would end by an intention to buy question asking if EVs are to be available in Thailand, whether or not the respondents would consider to buy it. Later on, the research will analyze the correlation between the answer to this question with the answer to factors questions. Before ending, the respondents would be required to answer several demographic questions which would allow us to learn roughly about their characteristics. The link to an online questionnaire was sent to the researcher's peers and co-workers who are currently live in Thailand. To complete the questionnaire, it was expected to be less than 15 minutes.



### **3.2 Data Collection**

An online survey, constructed in Google Forms, was distributed in total to 149 samples and came back with 149 responses (100 percent response rate). The screening question was ‘Do you have experience in or currently consider to purchase a car?’ which will help us to focus only on our target and increase the information reliability.

### **3.3 Data Analysis**

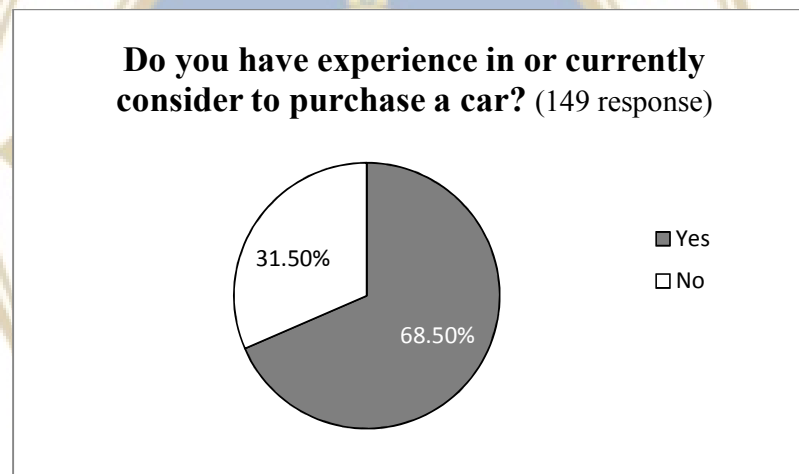
The Statistical Packages for Social Science (SPSS) Version 24.0, one of the most powerful and widely used software for the statistics analysis, was applied to process the data obtained from the questionnaire. Descriptive data such as mean, median, mode, standard deviation, frequencies and percentages were part of the analysis. The research will mainly focus on the exploratory factor analysis (EFA) identifying items of a questionnaire that 'stick together' and determining features that are most important. The factors that are insignificant will be removed (Osborne, 2009). The major figures from SPSS that the paper would be looking at were total variance explained, scree plot, rotated component matrix, the frequency table, cross tabulation, and correlation matrix.



## CHAPTER IV RESEARCH FINDINGS

### 4.1 Respondent Profile

In total, the research received 149 responses from 149 questionnaires that were distributed. However, the samples that we targeted were only 102 people who answered 'yes' in the screening question (68.5 percent of 149 people) meaning that they had experience in or were considering to purchase a car. Figure 4.1 shows the responses on the screening question.



**Figure 4.1 the response of the screening question confirming if the participants had experience in or were considering to purchase a car.**

**Table 4.1 the gender of the respondents**

		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	64	62.7	62.7	62.7
	Female	38	37.3	37.3	100.0
	Total	102	100.0	100.0	

Table 4.1-4.5 were the results generated from SPSS which Table 4.1 indicated that most of the respondents were male (62.7 percent) following by 37.3 percent of female. For the age range, Table 4.2 shows that most of the respondents are the middle age. There were 34.3 percent of '20-30 years old', 23.5 percent of '31-40 years old', 22.5 percent of '41-50 years old', 9.8 percent of '51-60 years old', 8.8 percent of 'above 60 years old', and 1 percent of 'below 20 years old'. By summing up the number of people who were 20-50 years old, they would be 80.3 percent of the total respondents. This should very well cover the main market for car drivers.

**Table 4.2 the age range of the respondents**

		Age range			Cumulative
		Frequency	Percent	Valid Percent	Percent
Valid	Below 20 years old	1	1.0	1.0	1.0
	20-30 years old	35	34.3	34.3	35.3
	31-40 years old	24	23.5	23.5	58.8
	41-50 years old	23	22.5	22.5	81.4
	51-60 years old	10	9.8	9.8	91.2
	above 60 years old	9	8.8	8.8	100.0
	Total	102	100.0	100.0	

As shown in Table 4.3, 48 percent of the respondents were Bachelor degree graduates. 44.1 percent were Master degree graduates. 3.9 percent were Doctoral degree graduates. 2.9 percent were high school graduates. 1 percent which was indicated as 'Other' was the respondent that graduated from a commercial school.

**Table 4.3 the education level of the respondents**

		Education level			Cumulative
		Frequency	Percent	Valid Percent	Percent
Valid	High School	3	2.9	2.9	2.9
	Bachelor Degree	49	48.0	48.0	51.0
	Master Degree	45	44.1	44.1	95.1
	Doctoral Degree	4	3.9	3.9	99.0
	Other	1	1.0	1.0	100.0
	Total	102	100.0	100.0	

As for the occupation, according to Table 4.4, most of the respondents were company employees (55.9 percent) following by 27.5 percent of a business owner, 7.8 percent of government staffs, 3.9 percent of students, and 2 percent of housewives. 2.9 percent were none of the mentioned and indicated as 'Other'.

**Table 4.4 the occupation of the respondents**

		Occupation			Cumulative
		Frequency	Percent	Valid Percent	Percent
Valid	Student	4	3.9	3.9	3.9
	Employee	57	55.9	55.9	59.8
	Business Owner	28	27.5	27.5	87.3
	Housewife	2	2.0	2.0	89.2
	Government Staff	8	7.8	7.8	97.1
	Other	3	2.9	2.9	100.0
	Total	102	100.0	100.0	

The income rate was quite well balanced. There were people from higher end and lower end answering the questionnaire making it more interesting to learn about their opinions. As summarized in Table 4.5, 26.5 percent were making 20,001-40,000 baht per month. 23.5 percent were making more than 100,000 baht per month. 20.6 percent were making 40,001-60,000 baht per month. With an equal percentage, there were 10.8 percent for those who made 80,001-100,000 baht per month and less

than 20,000 baht per month. Lastly, there were 7.8 percent who made 60,001-80,000 baht per month.

**Table 4.5 the income rate of the respondents**

		Income rate per month			Cumulative
		Frequency	Percent	Valid Percent	Percent
Valid	Less than 20,000 Baht	11	10.8	10.8	10.8
	20,001-40,000 Baht	27	26.5	26.5	37.3
	40,001-60,000 Baht	21	20.6	20.6	57.8
	60,001-80,000 Baht	8	7.8	7.8	65.7
	80,001-100,000 Baht	11	10.8	10.8	76.5
	More than 100,000 Baht	24	23.5	23.5	100.0
	Total	102	100.0	100.0	

## 4.2 General Information

Before getting into the main findings, it could be useful to learn about two assumptions. Firstly, it seems that our respondents were not so familiar with an electric vehicle concept. 38.2 percent did answer that they are ‘not so familiar’ and ‘not familiar at all’ while most of the respondents answered ‘moderately’ (35.3 percent). Table 4.6 summarized the answers on this question. Only 8.8 percent were confident that they were completely familiar with the concept. According to Table 4.8, the mean for this question was 2.83 out of 5 which were between ‘not so familiar’ and ‘moderately’.

**Table 4.6 the familiarity toward EV concept**

**How familiar would you say you are with an electric vehicle concept?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	14	13.7	13.7	13.7
	Not so familiar	25	24.5	24.5	38.2
	Moderately	36	35.3	35.3	73.5
	Somewhat familiar	18	17.6	17.6	91.2
	Completely familiar	9	8.8	8.8	100.0
	Total	102	100.0	100.0	

Secondly, the average Thai people seems to change cars every 5-8 years. According to Table 4.7, more than half of the respondents (59.8 percent) answered that they changed cars every 5-6 years and every 7-8 years. Table 4.8 also shows that the mean is 3.75 of out 6 which were between 5-8 years (1 = Every 1-2 years, 2 = Every 3-4 years, 3 = Every 5-6 years, 4 = Every 7-8 years, 5 = Every 9-10 years, 6 = More than 10 years).

**Table 4.7 the frequency for buying a new car**

**How often do you change a car?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Every 1-2 years	2	2.0	2.0	2.0
	Every 3-4 years	11	10.8	10.8	12.7
	Every 5-6 years	40	39.2	39.2	52.0
	Every 7-8 years	21	20.6	20.6	72.5
	Every 9-10 years	13	12.7	12.7	85.3
	More than 10 years	15	14.7	14.7	100.0
Total	102	100.0	100.0		

**Table 4.8 the descriptive statistics for questions regarding to familiarity toward EV concept and the frequency for buying a new car**

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
How familiar would you say you are with an electric vehicle concept?	102	1	5	2.83	1.144
How often do you change a car?	102	1	6	3.75	1.293
Valid N (listwise)	102				

From here on, the main finding will be arranged in order to answer the following research objectives;

- To study the factors influencing an intention to buy electric cars in Thai market.
- To study the intention to buy the electric cars in Thai market.
- To study how Thai people think toward a green technology and sustainable energy.
- To study how Thai people see the gasoline price in a long run.

### **4.3 Factors influencing an intention to buy electric cars in Thai market**

After doing the factor analysis, there were four main factors, which are the environmental impact, security, price and indirect benefits that seem to be influencing the customers' intention to buy electric cars. According to Table 4.9, the most powerful factor is related to the environmental impact. The respondents who agree with 'I would buy electric cars if it helps to preserve the environment' were likely to agree with 'I would buy electric cars if it contributes to saving the environment to the next generation' and 'I would buy electric cars if it emits less carbon'. It exemplified that Thai people nowadays put a high priority/value on the environmental impact. To

be honest, this finding was quite unexpected and put a challenge to Maslow's hierarchy of needs because environmental concern was associated with self-actualization and should be the last thing for the respondents to think of. A further analysis on possible reasons would be discussed later on in how Thai people think toward a green energy section.

The second most important factor is related to the security (distance and recharging criteria). The respondents seem to concern about how far the electric cars can go, and how long it would take to be recharged before going out again. This factor basically refers to how practical the electric car is. It is pretty logical as making distance is the most basic function/perk for a vehicle. This factor is also associated with safeness in Maslow's hierarchy of needs. People tend to concern about the potential dangers if they run out of electricity in unknown/inappropriate places.

Thirdly, it is all about the price. As mentioned before, the money nowadays is a mean for trading with essential goods such as food, clothes and shelter, and that is associated with human's physiological needs. However, this again opposes Maslow's theory as physiological needs come after safety. One possible reason should be about the nature of the product itself. Since a car's price is usually expensive no matter what source of power they use, the people who can afford it must have a certain disposable income. Plus, in Thailand, there are quite a lot of public/substitute transportations available (such as a bus, taxi-meter and subway), so the car is not considered as a necessary product but rather a luxury one. Hence, the people who can afford a car should already have a necessary mean for living. In this case, we found that the price of a car is not associated with physiological needs but the self-esteem which comes after safeness.

The fourth factor which is quite similar to the third one (still related to money) is the indirect benefits or perks from owning an electric car. The respondents did not consider only on the purchasing price but also the monetary benefit they can get. The incentive provided from the government and the fuel costs are among their major concerns.

**Table 4.9 rotated component matrix showing a group of factors that stick together**

**Rotated Component Matrix<sup>a</sup>**

	Component			
	1	2	3	4
I would buy electric cars if it helps to preserve the environment	.948			
I would buy electric cars if it contributes to saving the environment to the next generation	.942			
I would buy electric cars if it emits less carbon	.935			
I would buy electric cars if it can run 40 km from 30 minutes charge		.849		
I would buy electric cars if it requires 2 hours or less for a full charge		.836		
I would buy electric cars if it can run at least 150 km within one charge		.664		
I would buy electric cars if its price is 30-40% higher than gasoline cars			.939	
I would buy electric cars even though the price is 50% higher than gasoline cars			.774	
I would buy electric cars if its price is 10-20% higher than gasoline cars			.706	
I would buy electric cars if the government provides incentive for the purchasing				.847
I would buy electric cars only if the oil price increases				.632

*Note: Brackets in the original image group rows into four categories: Environmental impact (rows 1-3), Security (rows 4-6), Price (rows 7-9), and Indirect benefits (rows 10-11).*



Table 4.10 shows that the initial Eigenvalues was above 1, and the cumulative percentage was in a favourable range at 76.957. In addition, the scree plot in Figure 4.2 also shows a clear separation.

**Table 4.10 total variance explained table showing initial eigenvalues and rotation sums of squared loading**

Component	Total Variance Explained					
	Total	Initial Eigenvalues		Rotation Sums of Squared Loadings		
		% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.870	35.184	35.184	2.984	27.131	27.131
2	2.165	19.679	54.863	2.070	18.821	45.952
3	1.358	12.344	67.207	2.020	18.367	64.319
4	1.072	9.750	76.957	1.390	12.638	76.957
5	.734	6.673	83.630			
6	.622	5.656	89.286			
7	.531	4.832	94.118			
8	.330	2.998	97.116			
9	.175	1.589	98.706			
10	.103	.934	99.640			
11	.040	.360	100.000			



**Figure 4.2 scree plot generated from SPSS**

**Table 4.11 Pearson correlation between intention to buy question and each factor**

<b>Correlation</b>	
	If a full electric vehicle is to be available in Thailand, will you consider to buy it?
If a full electric vehicle is to be available in Thailand, will you consider to buy it?	1.000
I would buy electric cars if it helps to preserve the environment	0.562
I would buy electric cars if it contributes to saving the environment to the next generation	0.607
I would buy electric cars if it emits less carbon	0.601
I would buy electric cars if it can run 40 km from 30 minutes charge	0.324
I would buy electric cars if it requires 2 hours or less for a full charge	0.368
I would buy electric cars if it can run at least 150 km within one charge	0.454
I would buy electric cars if its price is 30-40% higher than gasoline cars	0.198
I would buy electric cars even though the price is 50% higher than gasoline cars	0.220
I would buy electric cars if its price is 10-20% higher than gasoline cars	0.328
I would buy electric cars if the government provides incentive for the purchasing	0.312
I would buy electric cars only if the oil price increases	0.356

Pearson correlation results are shown in Table 4.11. The environmental impact is still the most powerful factor. This correlation index points out that the people who agree with the questions related to environmental impact are most likely to agree with the intention to buy question. However, some of the results were not statistically significant, so a stepwise linear regression was applied to cut out insignificant factors.

**Table 4.12 Stepwise Linear Regression on 4 factors from Factor Analysis**

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.763	0.409		4.315	0.000
	I would buy electric cars if it contributes to saving the environment to the next generation	0.584	0.076	0.607	7.646	0.000
2	(Constant)	1.259	0.411		3.063	0.003
	I would buy electric cars if it contributes to saving the environment to the next generation	0.494	0.076	0.514	6.468	0.000
	I would buy electric cars if it can run at least 150 km within one charge	0.223	0.062	0.286	3.597	0.001
3	(Constant)	0.909	0.414		2.195	0.031
	I would buy electric cars if it contributes to saving the environment to the next generation	0.523	0.074	0.544	7.034	0.000
	I would buy electric cars if it can run at least 150 km within one charge	0.186	0.061	0.238	3.044	0.003
	I would buy electric cars even though the price is 50% higher than gasoline cars	0.178	0.061	0.215	2.904	0.005
4	(Constant)	0.085	0.500		0.169	0.866
	I would buy electric cars if it contributes to saving the environment to the next generation	0.493	0.073	0.513	6.773	0.000
	I would buy electric cars if it can run at least 150 km within one charge	0.173	0.059	0.221	2.903	0.005
	I would buy electric cars even though the price is 50% higher than gasoline cars	0.187	0.059	0.227	3.159	0.002

**Table 4.12 Stepwise Linear Regression on 4 factors from Factor Analysis (cont.)**

	I would buy electric cars if the government provides incentive for the purchasing	0.201	0.073	0.197	2.752	0.007
5	(Constant)	-0.149	0.503		-0.296	0.768
	I would buy electric cars if it contributes to saving the environment to the next generation	0.207	0.151	0.216	1.374	0.173
	I would buy electric cars if it can run at least 150 km within one charge	0.160	0.059	0.205	2.736	0.007
	I would buy electric cars even though the price is 50% higher than gasoline cars	0.208	0.059	0.253	3.531	0.001
	I would buy electric cars if the government provides incentive for the purchasing	0.201	0.072	0.197	2.801	0.006
	I would buy electric cars if it emits less carbon	0.337	0.157	0.339	2.151	0.034
6	(Constant)	-0.118	0.505		-0.233	0.816
	I would buy electric cars if it can run at least 150 km within one charge	0.166	0.059	0.213	2.825	0.006
	I would buy electric cars even though the price is 50% higher than gasoline cars	0.216	0.059	0.262	3.653	0.000
	I would buy electric cars if the government provides incentive for the purchasing	0.208	0.072	0.204	2.891	0.005
	I would buy electric cars if it emits less carbon	0.527	0.075	0.530	7.062	0.000

Apart from analysing independent factors among independent factors, Table 4.12 shows the relationship between each factor with the dependent variable (intention to buy EVs) using Stepwise Linear Regression. The final equation would be  $Y=0.53\text{Environmental impact}+0.26\text{Price}+0.21\text{Security}+0.20\text{Indirect benefits}-0.11$ . Still, environmental impact is the most powerful predictor of intention to buy EVs following by price, security, and indirect benefits. Unlike, Factor analysis, Regression

approach suggested that price is a little more influential than the security, which agreed with Maslow's theory.

From Table 4.13, this regression model has 0.536 R Square (became 0.517 after adjusted) and 0.774 Standard error of the estimate (SEE). R Square is on an acceptable level while SEE is a little high. Still, this is what we usually expect from the results related to psychological industry such as predicting a human behaviour (Solution center, 2014).

**Table 4.13 model summary of the stepwise linear regression**

Model Summary <sup>9</sup>									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
1	.607 <sup>a</sup>	0.369	0.363	0.890	0.369	58.457	1	100	0.000
2	.665 <sup>b</sup>	0.442	0.431	0.841	0.073	12.936	1	99	0.001
3	.697 <sup>c</sup>	0.486	0.470	0.811	0.044	8.434	1	98	0.005
4	.723 <sup>d</sup>	0.523	0.504	0.785	0.037	7.572	1	97	0.007
5	.738 <sup>e</sup>	0.545	0.522	0.771	0.022	4.625	1	96	0.034
6	.732 <sup>f</sup>	<b>0.536</b>	<b>0.517</b>	<b>0.774</b>	-0.009	1.887	1	96	0.173

#### 4.4 Intention to buy the electric cars in Thai market

According to our two questions regarding to the intention to buy electric car if it is available in Thailand and if is available next year, the results are shown in Table 4.14. The mean for 'If a full electric vehicle is to be available in Thailand, will you consider to buy it?' is 4.81 out of 6 which is skewed to 'agree' (6 = Strongly Agree, 5 = Agree, 4 = Slightly Agree, 3 = Slightly Disagree, 2 = Disagree, 1 = Strongly Disagree). Moreover, the mean for 'If a full electric vehicle is launched next year, will you consider to buy it?' is 4.20 out of 6 which is a little bit more than 'slightly agree'.

**Table 4.14 the descriptive statistics for questions regarding to the intention to buy**

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
If a full electric vehicle is to be available in Thailand, will you consider to buy it?	102	1	6	4.81	1.115
If a full electric vehicle is launched next year, will you consider to buy it?	102	1	6	4.20	1.275
Valid N (listwise)	102				

A further analysis on the age range of people who answered ‘slightly agree’, ‘agree’, and ‘strongly agree’ are shown in Table 4.15. For below 20 years old, 100 percent strongly agree. For 20-30 years old, 82.85 percent is skewed to agree side. For 31-40 years old, 91.66 percent is skewed to agree side. For 41-50 years old and 51-60 years old, 100 percent is toward the agree side. For above 60 years old, 88.88 percent is skewed to agree side. We have to admit that our sample for those who are below 20 years old was too small, so the results that represented this group might not be significant. Except for this group, it seems age range has a positive relationship with the intention to buy EVs.

**Table 4.15 crosstabulation between age range and the intention to buy question**

**Please indicate your age range \* If a full electric vehicle is to be available in Thailand, will you consider to buy it? Crosstabulation**

		If a full electric vehicle is to be available in Thailand, will you consider to buy it?						
		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
Please indicate your age range	Below 20 years old	0	0	0	0	0	1	1
	20-30 years old	2	0	4	8	14	7	35
	31-40 years old	0	1	1	5	10	7	24
	41-50 years old	0	0	0	7	8	8	23
	51-60 years old	0	0	0	1	5	4	10
	above 60 years old	1	0	0	2	4	2	9
<b>Total</b>		<b>3</b>	<b>1</b>	<b>5</b>	<b>23</b>	<b>41</b>	<b>29</b>	<b>102</b>

Table 4.16 shows the crosstabulation between income rate and the intention to buy question. For less than 20,000 baht income rate, 72.72 percent is skewed to agree side. For 20,001-40,000 baht income rate, 81.48 percent is skewed to agree side. For 40,001-60,000 baht, 80,001-100,000 baht, and more than 100,000 baht income rate, 100 percent is toward the agree side. For 60,001-80,000 baht income rate, 87.50 percent is skewed to agree side. It should be safe to assume that the higher income a person make, the higher possibility for them to buy electric vehicles.

**Table 4.16 crosstabulation between income rate and the intention to buy question**

**Please indicate your personal income rate per month. \* If a full electric vehicle is to be available in Thailand, will you consider to buy it? Crosstabulation**

If a full electric vehicle is to be available in Thailand, will you consider to buy it?

		Strongly Disagree	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree	Total
Please indicate your personal income rate per month.	Less than 20,000 Baht	0	0	3	1	2	5	11
	20,001-40,000 Baht	3	1	1	8	11	3	27
	40,001-60,000 Baht	0	0	0	5	11	5	21
	60,001-80,000 Baht	0	0	1	2	4	1	8
	80,001-100,000 Baht	0	0	0	3	3	5	11
	More than 100,000 Baht	0	0	0	4	10	10	24
	<b>Total</b>		3	1	5	23	41	29

#### 4.5 Thai people toward a green technology

From 4.3, after getting a bunch of factors from factor analysis, we urge to know the mean and the standard deviation for each question. Table 4.17 confirmed that questions regarding to the environmental concern indeed have the highest mean among all factors. Moreover, the standard deviations for those three are significantly

lower than the others. Comparing to the other factor related to money such as government incentive and the fuel cost, their mean is high (5.07 and 4.59 respectively) but still not as high as the environmental related. This truly proved that environmental concern is a powerful factor for Thai people. The question is why?

**Table 4.17 descriptive statistics on factors influencing the intention to buy**

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
I would buy electric cars if it helps to preserve the environment	102	1	6	5.21	1.137
I would buy electric cars if it contributes to saving the environment to the next generation	102	1	6	5.23	1.160
I would buy electric cars if it emits less carbon	102	1	6	5.15	1.120
I would buy electric cars if it can run 40 km from 30 minutes charge	102	1	6	3.85	1.485
I would buy electric cars if it requires 2 hours or less for a full charge	102	1	6	4.46	1.513
I would buy electric cars if it can run at least 150 km within one charge	102	1	6	4.36	1.427
I would buy electric cars if its price is 30-40% higher than gasoline cars	102	1	6	2.79	1.352
I would buy electric cars even though the price is 50% higher than gasoline cars	102	1	6	2.03	1.353
I would buy electric cars if its price is 10-20% higher than gasoline cars	102	1	6	4.25	1.424
I would buy electric cars if the government provides incentive for the purchasing	102	1	6	5.07	1.092
I would buy electric cars only if the oil price increases	102	1	6	4.59	1.254
Valid N (listwise)	102				

Our assumption is the emerging eco-friendly trend in present. Through various types of advertisement and campaign, people started to realize about the problem currently occurs to the Earth, and the potential it can develop to be in the



future. Hence, they started to look further away in the long term and caring about the next generation.

Another possible reason could lie on the flaw of Maslow's theory. According to Maslow's hierarchy of need, it is not possible that self-actualization needs such as environmental concern can overcome physiological needs. However, when Maslow did the research, he formulated the characteristics of self-actualized individuals by a qualitative method called biographical analysis. He looked at the biographies and writing of only 18 individuals which he personally thought that they achieved the self-actualization level already (Pearson and Podeschi, 1997). Hence, it was very subjective and has always been a weak point of his theory until now. For example, some people suggested that, without achieving self-belonging or self-esteem, sometimes humans could sacrifice oneself for the others.

As for the author, another possible reason is the cultural difference. Referring to the famous Hofstede's cultural dimension, the people who grew up in a specific countries which has specific culture/norm would have distinct mind set from the people who do not share the same culture (Hofstede, 2010). All of the samples that Maslow used for his theory were western people which were, stated by Hofstede, Individualists. However, for Thai people/society, we are a strong collectivist. Unlike the Individualism culture, we are prone to living as a cohesive group and are more dedicated. This might be another reason that could explain why environmental concern is more powerful in Thailand.

#### 4.6 Thai people and gasoline price in a long run

Regarding to the future of the oil price, it seems that more than half of the samples expected to see the rise. From the responses toward the question related to the future of oil price represented in Table 4.18, 31.4 percent expected ‘increase a lot’, 30.4 percent expected ‘increase a bit’, 11.8 percent expected ‘remain stable’, 8.8 percent expected ‘decrease a lot’, 7.8 percent expected ‘decrease a bit’ and 9.8 percent said that they don’t know.

**Table 4.18 the forecast of the oil price in the next 5 years**

**How would you forecast the oil price in the next 5 years?**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Increase a lot	32	31.4	31.4	31.4
	Increase a bit	31	30.4	30.4	61.8
	Remain stable	12	11.8	11.8	73.5
	Decrease a bit	8	7.8	7.8	81.4
	Decrease a lot	9	8.8	8.8	90.2
	Don't know	10	9.8	9.8	100.0
	Total	102	100.0	100.0	

A further analysis was conducted and shown in Table 4.19, 100 percent of the respondents who were below 20 years old expected an increase. 65.71 percent of 20-30 years old expected an increase. 66.66 percent of 31-40 years old expected an increase. 69.56 percent of 41-50 years old expected an increase. 50 percent of 51-60 years old expected an increase. Surprisingly, only 22.22 percent of the respondents who were above 60 years old expected an increase. The results somewhat suggested that the younger the respondents were, the more likely they were toward the higher oil price.

**Table 4.19 crosstabulation between the age range and the future of oil price**

**Please indicate your age range \* How would you forecast the oil price in the next 5 years? Crosstabulation**

		How would you forecast the oil price in the next 5 years?					Total	
		Increase a lot	Increase a bit	Remain stable	Decrease a bit	Decrease a lot		Don't know
Please indicate your age range	Below 20 years old	0	1	0	0	0	0	1
	20-30 years old	12	11	3	4	1	4	35
	31-40 years old	10	6	4	1	1	2	24
	41-50 years old	8	8	2	0	4	1	23
	51-60 years old	2	3	1	3	0	1	10
	above 60 years old	0	2	2	0	3	2	9
Total		32	31	12	8	9	10	102

Table 4.20 shows the relationship between the income rate and the future of oil price. For people who were making less than 20,000 baht, 54.54 percent were skewed toward increase side. For people who were making between 20,001-40,000 baht, 62.96 percent were skewed toward increase side. For people who were making between 40,001-60,000 baht, 57.14 percent were skewed toward increase side. For people who were making between 60,001-80,000 baht, 62.50 percent were skewed toward increase side. For people who were making between 80,001-100,000 baht, 63.63 percent were skewed toward increase side. For people who were making more than 100,000 baht, 66.66 percent were skewed toward increase side. It seems that there was a slight effect of the income rate. The higher the income rate could lead to the higher agreement of the increase.

**Table 4.20 crosstabulation between the income rate and the future of oil price**

Please indicate your personal income rate per month. \* How would you forecast the oil price in the next 5 years? Crosstabulation

		How would you forecast the oil price in the next 5 years?					Total	
		Increase a lot	Increase a bit	Remain stable	Decrease a bit	Decrease a lot		Don't know
Please indicate your personal income rate per month.	Less than 20,000 Baht	3	3	1	1	0	3	11
	20,001-40,000 Baht	8	9	3	1	3	3	27
	40,001-60,000 Baht	7	5	2	5	1	1	21
	60,001-80,000 Baht	2	3	2	0	1	0	8
	80,001-100,000 Baht	6	1	1	1	0	2	11
	More than 100,000 Baht	6	10	3	0	4	1	24
	<b>Total</b>	<b>32</b>	<b>31</b>	<b>12</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>102</b>

#### 4.7 Discussion

From conducting this research, we found four factors (environmental impact, security, price, and indirect benefits) that expected to be most influential toward purchasing electric vehicles. The finding indicated that Thai people nowadays put the highest priority/value on the environmental impact following by security, price and indirect benefits. The environmental impact is basically related to how much the car releases carbon or pollutants into an atmosphere. As for the second most important factor, it is related to the security (distance and recharging criteria). The respondents seem to concern about how far the electric cars can go, and how long it would take to be recharged before going out again. Thirdly, it is all about the purchasing price. As mentioned before, the money nowadays is a mean for trading with essential goods

such as food, clothes and shelter, and that is associated with human's physiological needs. The fourth factor which is quite similar to the third one (still related to money) is the indirect benefits or perks from owning an electric car. The respondents did not consider only on the purchasing price but also the monetary benefit they can get. The incentive provided from the government and the fuel costs are among their major concerns. Even though the ranking of its sensitivity is not complied with Maslow's hierarchy of needs, all of these factors were also existed in the results of the previous researches in European countries (Thiel et al, 2012)(Lieven et al, 2010), United States (Hidrue et al, 2011), and Malaysia (Razak et al, 2014).

There are most likely three reasons making environmental impact the most sensitive/powerful factor rather than security, price and indirect benefits. Firstly, it is the emerging eco-friendly trend in present. Through various types of advertisement and campaign, people started to realize about the problem currently occurs to the Earth, and the potential it can develop to be in the future. Secondly, it is possible to be because of the weakness in Maslow's theory to define 'self-actualization'. Thirdly, it could be because of the cultural difference, according to Hofstede, between Thai people (collectivism) and Maslow's subjects (individualism).

As for the intention to buy electric cars in Thai market, the respondents are likely to purchase an EV if it is available in Thailand (probability is 4.81 out of 6). In addition, the respondents are likely to purchase an EV if it is available next year (probability is 4.20 out of 6). The probability is lesser than the first question which is safe to assume that the market has interests in the product. However, they hesitate to acquire them immediately after considering the readiness of supporting facilities. Age range did not affect much on the intention to buy. However, the income rate certainly has some effect. The higher income a person makes the higher possibility for them to buy electric vehicles. This should be because of EVs' price which is usually 20-30 percent higher than gasoline cars.

As for the prospect of the gasoline price in the next five years, 31.4 percent expected 'increase a lot', 30.4 percent expected 'increase a bit', 11.8 percent expected 'remain stable', 8.8 percent expected 'decrease a lot', 7.8 percent expected 'decrease a bit'. Comparing to the previous research (Thiel et al, 2012), 65 percent expected 'increase a lot', 26 percent expected 'increase a bit', 3 percent expected 'remain

stable’, 2 percent expected ‘decrease a bit’, none expected ‘decrease a lot’. The comparison is shown in Table 4.21.

**Table 4.21 comparison between the current and previous findings of oil price in next five years**

	<b>Previous research’s finding (Thiel et al, 2012)</b>	<b>The research’s finding (2016)</b>
Increase a lot	65%	31.4%
Increase a bit	26%	30.4%
Remain Stable	3%	11.8%
Decrease a lot	2%	7.8%
Decrease a bit	0%	8.8%

It seems people’s perception changed a little as time has gone. The results in 2016 show that people are starting to step away from ‘Increase a lot’. However, in overall, they still believe that the oil price will skew toward the increase side, but not as strong as in the past. It is possible that because they still had this assumption, the respondents were interested and would purchase an EV if it is available in Thailand (probability is 4.81 out of 6). Also, it seems that there was a relationship between the age range and the answers. The younger the respondents were, the more likely they were toward the higher oil price. Similar to the income rate, it seems that there is a slight effect towards the answers. The higher the income rate could lead to the higher agreement of the increase.

## CHAPTER V

### CONCLUSION

In conclusion, Table 5.1 summarized the main findings of this research.

**Table 5.1 conclusion of the findings**

<b>Research Objectives</b>	<b>Findings</b>	<b>Past Findings</b>
1. To study the factors influencing an intention to buy electric cars in Thai market	- Factor Analysis suggested environmental impact, security, price, and indirect benefits as the most influential factors.	- Not comply with Maslow's hierarchy of needs: Self-actualization is more influential than Physiological needs and Security. - The same factors existed in some previous researches (Thiel et al, 2012)(Lieven et al, 2010)(Hidrue et al, 2011)(Razak et al, 2014).
	- Stepwise Multiple Linear Regression suggested environmental impact, price, security, and indirect benefits as the most influential factors.	- Not comply with Maslow's hierarchy of needs: Self-actualization is more influential than Physiological needs and Security. - The same factors existed in some previous researches (Thiel et al, 2012)(Lieven et al, 2010)(Hidrue et al, 2011)(Razak et al, 2014).
2. To study the intention to buy electric cars in Thai market	- the respondents are likely to purchase an EV if it is available in Thailand (probability is 4.81 out of 6). - the respondents are likely to purchase an EV if it is available next year (probability is 4.20 out of 6).	- No past findings



**Table 5.1 conclusion of the findings (cont.)**

<b>Research Objectives</b>	<b>Findings</b>	<b>Past Findings</b>
	- age range did not affect much on the intention to buy - the income rate certainly affect the intention to buy	
3. To study how Thai people think toward a green technology	- Thai people in present became more aware of the environmental impact. The environmental related criteria have the highest score for a predictor to purchase EVs.	- Not comply with Maslow's hierarchy of needs and past research in Malaysia
4. To study how Thai people see the gasoline price in the next five years	- 31.4 percent expected 'increase a lot', 30.4 percent expected 'increase a bit', 11.8 percent expected 'remain stable', 8.8 percent expected 'decrease a lot', 7.8 percent expected 'decrease a bit' - the younger the respondents were, the more likely they were toward the higher oil price. - the higher the income rate could lead to the higher agreement of the increase.	- 65 percent expected 'increase a lot', 26 percent expected 'increase a bit', 3 percent expected 'remain stable', 2 percent expected 'decrease a bit', none expected 'decrease a lot' (Thiel et al, 2012)

### **5.1 Recommendation for promoting electric cars in Thailand**

Based on the research findings, the market is quite ready for the electric vehicle. Thai people are starting to be aware of the current environmental problems. The green technology is becoming an emerging trend that is widely accepted. Thailand is going in a proper direction to encourage the reduction of pollutions. There were many forms of advertisements/campaigns from the government, such as for cars and for home appliances, encouraging to reduce the carbon footprints. This trend needs a continuous support in order to keep the consumers acknowledged. The EV manufacturers, as well, should be able to catch the consumer's attention if they arrange the promotion/marketing campaign focusing on the environmental friendly aspect. The TVCs and printed ads that illustrate the eco-friendliness of EVs should be a good start.



In addition, the manufacturers might consider to support/sponsor 'green' events in order to associate their brand with 'nature' and 'eco-friendliness'. Moreover, some recommendations for the EV manufacturers/sellers are to target middle to high income and middle age (30-50 years old) market as they have the purchasing power and they are willing to trade off the high initial price with a long term benefit. However, in order to foster growth of the EV, a supportive lead is required from the government. As of today, the price of a full electric vehicle is much more expensive than a conventional car already. Nissan Leaf, for example, is a full plug-in electric car that will cost around 2.4 million baht if imported. With this price, the consumer could switch to Toyota Camry 2.5G which has a similar acceleration that would cost only 1.5 million baht. Before the local car manufacturers decided to start production EV in Thailand, the government should consider to waive EV import duties or provide subsidies making EV more competitive in the market. This should be a prompt short term plan to make the consumer reconsiders on EVs. At the same time, this policy would be a message to the local car manufacturers that Thai government is starting to support EVs seriously. As for a long term plan, it is clear that a full EV is very new to Thailand and the recharging stations are not enough on the road. Looking back to NGV case study, the shortage of the stations was the main reason making NGV struggled in the initial stage. It took more than five years that the number of station increased as well as the NGV vehicle sales. Hence, the author recommends the operators to find the business opportunities at this very initial stage. Some areas to look at are commercial EV charging stations, EV maintenance service and supply chain establishment for EV parts. The business has a high potential to break even quickly once EV breaks new ground.

## **5.2 Benefit of the research**

Considering the benefits in term of the environmental impact and the cost, people forecasted that, within 5-10 years from now, electric vehicles should make its appearance in Thai market. This research could be a base study for a further analysis of the EV market. The parties that are related to EV promotion, both the government

sector and private sector such as EV manufacturers and the individuals/SMEs who are looking for an opportunity to get into EV business (commercial EV charging stations, EV maintenance service, EV parts seller), might find a use from this research.

### **5.3 Future work**

Due to the limitation on the time and resources, the research only studied a limited sample out of the total population. It would be beneficial to retest the hypothesis with a bigger sample to see if the results comply with the original findings. Plus, from the current finding, we only learned that there are certain factors which influenced the intention to buy an EV in Thailand. However, all of the reasons behind that answers are still the author assumptions. Honestly, we still lack of the concrete explanations/motivations toward the respondent's answers. A further qualitative analysis such as an interview or a focus group with the potential consumers should be done to confirm those assumptions for further applications.

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## APPENDIX A

### 1. Introduction

Good day Sirs/Madame.

We are Master's students from College of Management Mahidol University.

**Background** : Since a full electric vehicle is now a realistic concept and practically used in many countries, we would like to study the market acceptance for electric cars in Thailand. The electric car is a vehicle that is comparable to your car but that uses exclusively an electric motor to drive forward and batteries to store electricity. Kindly note that neither hybrid vehicles nor eco-car are considered here.

**Objective** : To study factors influencing the intention to buy the electric cars in Thai market.

It takes 10 minutes for completing this survey. Your fruitful information is very useful for our further actions.



### 2. Screening Questions

2.1 Do you have experience in or currently consider to purchase a car?

Yes, go to question 3.1 section)

No (Skip to Demographic section)

### 3. General Questions

3.1 How familiar would you say you are with an electric vehicle concept?

- Not at all
- Not so familiar
- Moderately
- Somewhat familiar
- Completely familiar

3.2 How would you forecast the oil price in the next 5 years?

- Increase a lot
- Increase a bit
- Remain stable
- Decrease a bit
- Decrease a lot
- Don't know

3.3 How often do you change a car?

- Every 1-2 years
- Every 3-4 years
- Every 5-6 years
- Every 7-8 years
- Every 9-10 years
- More than 10 years

### 4. Specific Questions

**Please specify the level of your agreement on the following statement:**

(Assessment scale: 6 = Strongly Agree, 5 = Agree, 4 = Slightly Agree, 3 = Slightly Disagree, 2 = Disagree, 1 = Strongly Disagree)

<b>Purchasing Price</b>						
1. I would buy electric cars if its price is 10-20% higher than gasoline cars.	6	5	4	3	2	1
2. I would buy electric cars if its price is 30-40% higher than gasoline cars.	6	5	4	3	2	1
3. I would buy electric cars even though the price is 50% higher than gasoline cars.	6	5	4	3	2	1
4. I would buy electric cars only if its price is lower than gasoline cars	6	5	4	3	2	1
5. I would buy electric cars if the government provides incentive for the purchasing.	6	5	4	3	2	1
<b>Operating Costs</b>						
1. I would buy electric cars if the oil price stays at this level	6	5	4	3	2	1
2. I would buy electric cars only if the oil price increases	6	5	4	3	2	1

3. I would buy electric cars if the maintenance cost is lower than gasoline cars	6	5	4	3	2	1
4. I would buy electric cars if the it can be resell at a better price comparing to gasoline cars	6	5	4	3	2	1
5. I would buy electric cars if it can save fuel cost	6	5	4	3	2	1
<b>Durability</b>						
1. I would buy electric cars if it can last longer than gasoline cars	6	5	4	3	2	1
2. I would buy electric cars if it can keep me safe	6	5	4	3	2	1
3. I would buy electric cars if there is no need to change gears frequently	6	5	4	3	2	1
<b>Maximum Cruising Range</b>						
1. I would buy electric cars that can drive in the city for all day long without recharging	6	5	4	3	2	1
2. I would buy electric cars if it can run at least 150 km within one charge	6	5	4	3	2	1
3. I would buy electric cars only if it can run as far as gasoline cars can do in one refill.	6	5	4	3	2	1
<b>Recharging Place</b>						
1. I would buy electric cars if it can be recharged at home	6	5	4	3	2	1
2. I would buy electric cars if there are enough recharging stations on the road	6	5	4	3	2	1
3. I would buy electric cars if it can be recharged without a technical knowledge	6	5	4	3	2	1

#### 4. Specific Questions (continued)

<b>Please specify the level of your agreement on the following statement:</b> (Assessment scale: 6 = Strongly Agree, 5 = Agree, 4 = Slightly Agree, 3 = Slightly Disagree, 2 = Disagree, 1 = Strongly Disagree)						
<b>Recharging Time</b>						
1. I would buy electric cars if it requires 2 hours or less for a full charge	6	5	4	3	2	1
2. I would buy electric cars if it can run 40 km from 30 minutes charge	6	5	4	3	2	1
3. I would buy electric cars if it can be fully charged within 1 hour	6	5	4	3	2	1
<b>Performance</b>						
1. I would buy electric cars if it has high maximum speed	6	5	4	3	2	1



2. I would buy electric cars if it has high acceleration power	6	5	4	3	2	1
3. I would buy electric cars if it has a good balance	6	5	4	3	2	1
4. I would buy electric cars if it has a good handling system (when driving at high speed)	6	5	4	3	2	1
<b>Carbon Emission</b>						
1. I would buy electric cars if it emits less carbon	6	5	4	3	2	1
2. I would buy electric cars if it helps to preserve the environment	6	5	4	3	2	1
3. I would buy electric cars if it contributes to saving the environment to the next generation	6	5	4	3	2	1
<b>Intention to Buy</b>						
If a full electric vehicle is to be available in Thailand, will you consider to buy it?	6	5	4	3	2	1
If a full electric vehicle is launched next year, will you consider to buy it?	6	5	4	3	2	1

## 5. Demographic Questions

Respondent's Personal Information:

5.1 What is your gender?

Male

Female

5.2 What is your age?

Below 20 years old

20-30 years old

31-40 years old

41-50 years old

51-60 years old

above 60 years old

5.3 What is your marital status?

Single

Married

5.4 What is your household income rate per month?

Less than 20,000 Baht

20,001-40,000 Baht

40,001-60,000 Baht

60,001-80,000 Baht

80,000-100,000 Baht

More than 100,000 Baht

5.5 What is your most recent education?

Primary School

High School

Bachelor Degree

Master Degree

Doctoral Degree

Others (Please specify \_\_\_\_\_)

5.6 What is your Occupation?

Student

Employee

Business Owner

Housewife

Government Staff

Others (Please specify \_\_\_\_\_)

