Professional MBA
Automotive Industry

Factors Leading To Decision Making To Buy Electric Car - An Empirical Study In Kingdom Of Saudi Arabia

A Master's Thesis submitted for the degree of
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supervised by

MEng. Ján Lešinský, PhD., Assoc.Prof.

Hani Hassan Batawi

1328127

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Affidavit

I, **HANI HASSAN BATAWI**, hereby declare

1. that I am the sole author of the present Master's Thesis, "FACTORS LEADING TO DECISION MAKING TO BUY ELECTRIC CAR- AN EMPIRICAL STUDY IN KINGDOM OF SAUDI ARABIA", 54 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
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ABSTRACT

This research work explores the customers' decision making process in purchasing electric cars in Kingdom of Saudi Arabia (KSA). This consumer behavioural research has acquired a market summary which definitely enlightens the enrichment of materialising the strategy for the business of electric car products in KSA. To venture this research work in KSA, cities like Jeddah, Dammam and Al-Quasim have been chosen where a total of four hundred and fifty customers have participated to answer the questionnaires which are constructed on a basis of five point Likert Scale. A random probability sampling tool has been used to find out the level of customers' thoughts and opinions about energy efficient, environmental friendly, performance benefit, reduction of energy dependence and customers buying decision regarding the electric car products available in KSA. It is found through the descriptive analysis where all the variables have high mean scores which are more than four. From this research results with the aid of Pearson Correlation tests, it is found that all the relationships among energy efficient, environmental friendly, performance benefit, reduction of energy dependence are found to be positive and significant with the customers' decision making process in purchasing electric car products as all the p-values obtained significance at the 0.01 level (99% confidence level) for 2-tailed. The results suggest that the customers pay much importance on the mentioned variables in their practical life reflecting the electric car products' possible characteristics for the spontaneous support from the customers in future. At last the multiple regression analysis suggests that all the variables such as energy efficient, environmental friendly, performance benefit, reduction of energy dependence are significant with the customers' buying decision regarding electric cars in KSA. This descriptive type of research, the findings, and the most enriched recommendations have depicted a vivid scenario about electric car products available in the territory of KSA.

Keywords: Energy efficient, Environmental friendly, Performance benefit, Reduction of Energy Dependence and Customers' purchasing decision. KSA.

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CHAPTER 1
INTRODUCTION

1.1 Background of the study

Over 100 years have passed since the introduction of electric cars and today their popularity is increasing rapidly because of many reasons including the primary reasons of their origin. Electric vehicles are in great demand whether they are hybrid type, all-electric or plug-in hybrid type because consumers want low prices. Presently the sale of electric (inclusive hybrids) vehicle is over 3% of sale of new vehicles and it will reach up to 7% (6.6 million car sale annually) by year 2020 globally. Electric vehicles have become a topic of great interest and we are going to discuss this technology and its future developments and will also explore its history in detail.

The purpose of this paper is to carry out a detailed study on the electric vehicles including a brief introduction on the topic. The paper proceeds to describing about the electric vehicles along with describing about the details of various futuristic electrical vehicles. The paper proceeds to discussing the utility of electrical vehicles in Saudi Arabia. The focus of the paper remains on the enhanced utility of electric vehicles. The paper also discusses in details about the cars registered in Saudi Arabia during 10 years of duration.

The last sections of the paper consist of hydro electric vehicles and details about them. The manufacturers of such vehicles are also mentioned in this paper. The Master's Thesis (MT) then proceeds to describing electric mobility in which an analysis is presented on electric mobility while highlighting its importance and benefits.

1.2 Types of vehicles

CKD is the acronym for Completely Knock Down or Completely Knocked Down that is used as the term to identify a set of parts of a vehicle that can be combined and assembled together to make a complete vehicle. In Electric Vehicles (EVs), the CKD mainly consists of electric motors used to drive the vehicle, electric batteries to retain electric energy for consumption, main body of the vehicle, primary controls, charging / discharging circuit, wheels, and seats etc. A number of fields including automobiles, railways and even bus manufacturers use the term CKD for set of parts for the purpose of transportation, import and export. A CKD is generally a knocked down kit of parts that are essential for making the vehicle out of these parts. A CKD is normally imported from a foreign country to be assembled into a vehicle by a local manufacturer [28].

1.2.1 SKD vehicles

SKD stands for Semi-knocked Down that means that part in a kit are integral to manufacture the EV however, they don't make up complete vehicle and required some additional essential parts to be included while manufacturing the complete EV. An SKD kit for an EV may include one or more of the parts including electric motors used to drive the vehicle, electric batteries to retain electric energy for consumption, main body of the vehicle, primary controls, charging/discharging circuit, wheels, and seats [28].

1.2.2 Origin of electric vehicle

Electric car invention can't be attributed to single country or inventor. Rather it consists of series of events-from development of battery to that of electric motor-during period of 1800s leading to the first on road electric vehicle. During early century, some inventors belonging to US, Hungary and Netherlands and a Vermont blacksmith started playing with the idea of battery-operated vehicle and made some first electric cars on small scale.

At the same time Robert Anderson, from Britain, made the first raw form electric carriage and first practical from of electric cars was made after the mid-19th century by English and French inventors. Electric car had its successful first debut in US in 1890. This credit goes to a chemist, William Morrison living in Des Moines who made a six-passenger electric wagon type vehicle with 14 miles/hour speed.

This helped to further develop interest about electric vehicles. For next following years, electric transport from different auto vendors began to pop up in USA. Even at that time NY City had over 60 taxis that were electric type. Electric cars saw their peak by 1900, making one third majority of all on road vehicles. For the next decade strong sales were observed [27].

Electric Vehicles (EVs) as the name implies run completely on electric energy. They are driven by single or multiple electric motors having set of batteries at their backup. There are many benefits of EVs as compared to vehicles having internal combustion type engines (ICE).

- **High Energy Efficiency.** EVs show 59%-62% efficiency in converting grid station electric power to power driving the wheels while gasoline vehicles show only 17%-21% efficiency in converting electric power to the wheel driving power.
- **Environment friendly.** No tailpipe pollutants are emitted by EVs, though some power plants generating electricity may be emitting them. No air pollution is caused by electricity production from solar, hydro, nuclear or wind power generation plants.

- **Better and improved performance.** Electric motors used in EVs are quite smooth during operation and have good acceleration requiring less maintenance as compared to ICEs.
- **Less energy dependence**. Electricity being used in EVs can be sourced in domestic ways.

However, there are some battery-related issues faced by EVs [26]: -

- **Drive Limit.** Most of the EVs cover only 100-200 miles distance before their recharge while gasoline vehicles cover good 300 miles before refuel.
- **Long recharging time.** It takes 4-8 hours to fully recharge the battery set and even "rapid charge" up to 80% capacity takes minimum of 30 min.
- **Battery expenses.** Huge sets of battery are very costly and also need replacement once or several times.
- **Weight factor.** Battery sets are bulky and occupy considerable space in vehicle.

Electric cars make use of the energy reserved in battery for driving vehicle. Electric motors give safe and clean operation as compared to conventional IC engine. Electric cars have many associated pros & cons. EVs have fast acceleration but cover short range of distance as compared to combustion gasoline engines. EVs are pollutant free but they take quite long time in their recharge [30].

1.3 Type of future electric vehicles

- Hybrid type electric vehicles (HEVs)

HEVs are basically EVs which have on board gasoline engine for the generation of electricity and moving car in accordance with electric motor. In this type 300-mile range is also achieved same like the range given by conventional vehicle. With some proper software control, combustion engine interacting with battery produces low emitted pollution and high efficiency is also achieved.

HEVs are in sale since year 2000 in USA. Renowned example is Prius that was first introduced in 1997 by Toyota Japan. Prius, with the grand sale of more than 7 million cars, became the best-seller car in California. This reflected the highly positive attitude of consumers towards accepting these type of vehicles.

Plug-in hybrid type electric vehicles (PHEVs)

PHEVs are basically HEVs with additional battery space that provides 10-60 miles electric driving range. For example Chevy Volt drives up to 40 miles with battery before gasoline generator jumps in. This provides ease to recharge batteries at home

overnight and also providing a daily drive range not exceeded by most of public in US. PHEVs also give 300-mile range with which driving community is quite familiar.

Hydrogen fuel cell electric vehicles (FCEVs)

FCEVs are same as hybrid EVs but with two main differences. One being Fuel cell, which is an electrochemical object takes gases in the form of hydrogen fuel and oxygen from air to make electricity for electro - engine, is used in place of gasoline engine. Fuel cell is highly efficient almost three times more than conventional gasoline type and emits no air pollutants during the time of its drive.

Reaction of hydrogen and oxygen forms water which is emitted from tailpipe along with residual oxygen and nitrogen gases. Other is that hydrogen store tanks are used in place of the gasoline tanks. Time to refuel FCEV is same as that of conventional vehicle and fuel is being sourced domestically. Some challenges faced by FCEVs include the limited figure of hydrogen fuel stations nationwide. In US, California is leading in having major number of hydrogen fuel stations, with 51 stations expected to be functional by end of year 2015, reaching 70 by 2017 and eventually 100 by year 2020. Minimum of 68 stations are required to support FCEV acceptance in US [23].

1.4 Electric vehicles in Saudi Arabia

Countries liked Norway and Turkey the driving cost of 1000 miles on Prius is estimated to be around $2,000 due to increase in gasoline prices, whereas the same distance cost only $120 in Saudi Arabia. There is a great variation in the cost incurred in driving Leaf from $980 to $116 in Germany and Saudi Arabia respectively. According to a study the cost incurred in driving Prius 10,000 miles in Norway is $1,544 more than the cost of driving same distance with Leaf. Furthermore, the same distance would cost $1360 in Turkey and $986 in UK and $410 in US whereas in Saudi Arabia the figure trimmed down to $5. The concept of electric vehicles is more plausible and considerable in European countries due to have tax rate on petrol. But same is not the case with Saudi Arabia therefore electric vehicles are not introduced to Saudi customers [29]. Saudi Arabia will be the last country to go after electric vehicle as it is the largest oil producing nation and largest oil exporter worldwide. However it has been reported that currently a deal has been signed by a leading university of Saudi Arabia with Electromotive, a Brighton based beneficiary. Around 150 Electro charging stations will be installed by Electromotive through the campus of King Abdullah University of Science and Technology (KAUST). Several charging stations will recharge the electric vehicles and these vehicles will transport the students and staff members in campus premises to reduce carbon footprint in the university and also to improve the quality of air within the campus. Electromotive is facing challenges, as the charging units are planned to be installed in car parking area that have solid concrete and shallow flooring unlike the foundations that are typically installed on streets at 400 mm depth. According to the solution provided by the company, a modified ground plate is created and the mounting post and on that electrical cable will be integrated that are then fastened to solid surface. The managing director Calvey of Electromotive was hopeful about the deal. He

mentioned, that they are excitedly involved in this project as it has posed several challenges of technical nature, but the company is fully equipped with required set of skills and expertise to meet the demand of the university within given time for budget.

Figure 1: Electro Charging Stations [1]

This statement has further strengthened the Britain distinct and leading position in the manufacture of electric vehicles as Electromotive has already been exporting vehicles to Germany, Sweden, Netherland and Ireland [17].

The reason behind no electric vehicle trend in Saudi Arabia is understandable and it became far more evident in BMW i3 case. The electric vehicle of small size is widely distributed in all regions of world other than Gulf region. Reportedly there is a long list of customers waiting for i3 in many markets. Companies exporting electric vehicles have valid reasons for not shipping electric vehicles to the region where fuel is cheap and customers have no tangible demand for electric vehicles. However, these reasons are not much convincing as there is not research study that would have proved that people in KSA had any less demand for electric vehicles than other regions of the world.

The prices of fuel maybe are low but it is only in short run, there are numerous environmental hazards associated with fuel emission and these issues are largely ignored. The cities in KSA are having extreme levels of air born pollution and this limit become extreme in summers, this problem can be successfully tackle by replacing fuel cars with electric vehicles (mainly for movement in urban regions). The authority to being this huge change lies with the customers, companies making cars and the government. Currently customers are left with no other choice than what is manufactured by the car companies. Companies should play an important role in shifting the trend to electric vehicles by bringing electric vehicles in markets. Government can play fundamental, which it is not playing at the moment.

Consumers have low power on bring change, as they have little knowledge about what they actually missing, therefore it melts down to car companies to provide the opportunity to customers by offering them what is required to build infrastructure as done by car companies in other regions of the world. There should be convincing initiatives provided by the government to facilitate people in making a switch. As there are no direct taxes on car owning therefore a small portion of fuel subsidies can be utilize to divert people from fuel cars to electric cars.

The increase in environmental issues has attained the attention of KSA government and concerned authorities are considering on the solutions to tackle this problem effectively in coming future. The use of electric cars is one of the solutions and it needs support from law making bodies in encouraging people. Government can play a key role in helping companies to establish the required infrastructure.

The manufactures of electric vehicles have been successful in overcoming the previously reported issues of electric vehicles such as range anxiety not an issue anymore. Therefore electric cars should be made readily available to the customer market of KSA [19].

Al Futtaim, a Dubai based group has recently proclaimed to be the only dealer of electric vehicle especially of Fisker line in the Middle East and KSA region. This will be the first move in providing luxury hybrid vehicles in this part of the world. According to the signed contract Al-Futtaim will be entitled to ship Fisker solely in Saudi Arabia, Oman, Egypt, Qatar, UAE and Levant. The first flagship dealership will be provided to Al-Futtaim by Dubai Festival City's automotive park for Fisker.

Currently, Karma Sedan, an expensive vehicle, is supplied by Fisker, plans are in pipelines for small sedan named as Fisker Atlantic in upcoming years. These cars have an "EVer" powertrain which consists of a special type of 2.0-litre diesel direct-injection turbo engine. These also include a 175 kW of electric generator along with a 20 kWh of lithium-ion battery. There are two major electric motors connected with the wheels.

The installed generator has an equivalent of around 235 hp; however, in the Sports mode, it can go up to the value of 403, along with a ridiculously high value of torque as 1,330 Nm that is available starting from nil RPM. These cars are able to reach

100 km/h within around 7 seconds while having a top speed of around 200 km/h. The specifications of the models introduced in KSA may differ slightly from these.

Fisker Karma sedan facilitates the car driver to choose between two modes of driving that are stealth mode and sport mode. These modes provide relaxed electric driving and offers complete access to full power of vehicles respectively. The stealth mode offers emission free efficient operation range of 80 km, travelling beyond the range of battery, generator powered by petrol that provides automatic power for additional 400 km under normal conditions, so it offers extra range by simply stopping and filling at any gas station.

However in sport mode, the power is gathered from battery and generator powered by gasoline in order to facilitate the driver to achieve and maintain high and aggressive acceleration. The Karma sedan EVer powertrain practices double electric motors in order to drive wheels, therefore gasoline engine doesn't directly move the wheels [3].

1.5 Smart power grids based electric mobility

In providing the cost effective (inexpensive) electric mobility in future electric setup, the innovative and advanced semiconductor solution play a pivotal role in facilitating smart grid, with the help of which drivers will be able to recharge smartly with secure payments and grid back power feeding.

The smart technology in energy cycle is mainly due to semiconductors. Future power grids require multi-tasking. Like on one side grids are getting energy from different sources e.g. water, wind, sun and on other side they are dealing with demand peaks and drops. By advanced semiconductor solutions we make sure the efficient and continuous flow of electricity covering many thousand km distance from generation plant to user with minimum losses.

Reinforcing our sense of environmental responsibility and planned focus on efficient, mobile and secure energy, using semiconductor innovations we are able to change the pattern to market feasible and affordable electro-mobility [9].

The change of technology to electric mobility is complex and multidimensional. In market training phase which is headway now first sequence manufacture electric vehicles are heading the market and infrastructure build-up has started. Activities regarding electro-mobility are often confined to urban and thickly populated areas.

Though in Baden-Wuerttemberg, it will take long time to ensure wide area development of complete supply of electro-mobility services. But course of technology change is subjective to many factors and stakeholders. Due to its best location, Baden-Wuerttemberg can grow into a pioneer state in creation of sustainable mobility and its application such as green automotive technologies.

The company, E-Mobile BW is planning to enhance its operations through introduction of innovative technologies. Some of the features of its plans include adoption of electric vehicles and fuel cell based electric vehicles. The company is aiming to achieve its targets in a well-planned manner in order to facilitate a good growth in future.

Electric mobility refers to all vehicles being driven electrically-including bicycle, car, bus and other commercial vehicles. E-Mobil BW in its activity forms uses a method that accepts all forms of technology including different substitute drive ideas. Other than pure battery-operated electric vehicles there are hybrid type, plug-in hybrid and hydrogen fuel cell electric vehicles. There are many benefits and side effects of different drive ideas depending on their area of use and requirements.

Electric mobility provides a host of opportunities in terms of environmental, social and economic conditions. Electric mobility being the potential storage technology and aiding in reduced CO_2 emissions helps in environment protection and has direct impact on evolution to substitute power energy forms. Technology change also assures huge prospective for jobs, by connecting different branches and developing new work fields.

To develop this prospective for example Baden Wuerttemberg should keep a related production location even in the future. Whereas a change in technology also go together with a revolution in society. Having different means of transport (inter-modality) and car sharing changes the social living environment [10].

Adding more, Siemens not only involved in endorsing electric mobility on ground medium but it is also endorsing it in water and air medium. The company is working on developing electric ships demanding low fuel amount for propulsion. Siemens in collaboration with Fjellstrand, Norwegian shipyard, has worked on developing technology of world's first electric-operated car ferry. In terms of diversity, since early period of 20^{th} century, electric boats having Siemens made motors have been sailing through Konigssee Lake, Bavaria. However now their drive systems have been replaced.

Eventually for new electric mobility ideas to be successful they should be cost effective to consumers. Electric vehicles still are way expensive as compared to traditional cars. However it has been observed that some people- known as early adopters- have shown willingness to pay even a high price in the start.

Furthermore, it is possible to make electric cars more striking by launching some favourable and positive conditions, like set drive lanes, set aside parking area, and tax inducements. In the end, competition leads to innovating ideas and with market growth the prices are lowered enabling more people to purchase new drive system vehicles [8].

There has been a rapid growth in the demand of electric vehicles around the world. An analysis has been carried out by the Centre for Solar Energy and Hydrogen

Research in which a number of major countries have been studied regarding sales of electric vehicles in these countries. The total demand of electric vehicles worldwide is more than 740,000 vehicles as per the study. This includes an increase of around 320,000 vehicles in 2014 as compared to 2013 which clearly shows substantial demand increase in recent years. In 2012, the total vehicles registered around the globe were less than 100,000 vehicles whereas within 2 years this figure has increased to more than seven times which is a remarkable increase in the field of electric vehicles.

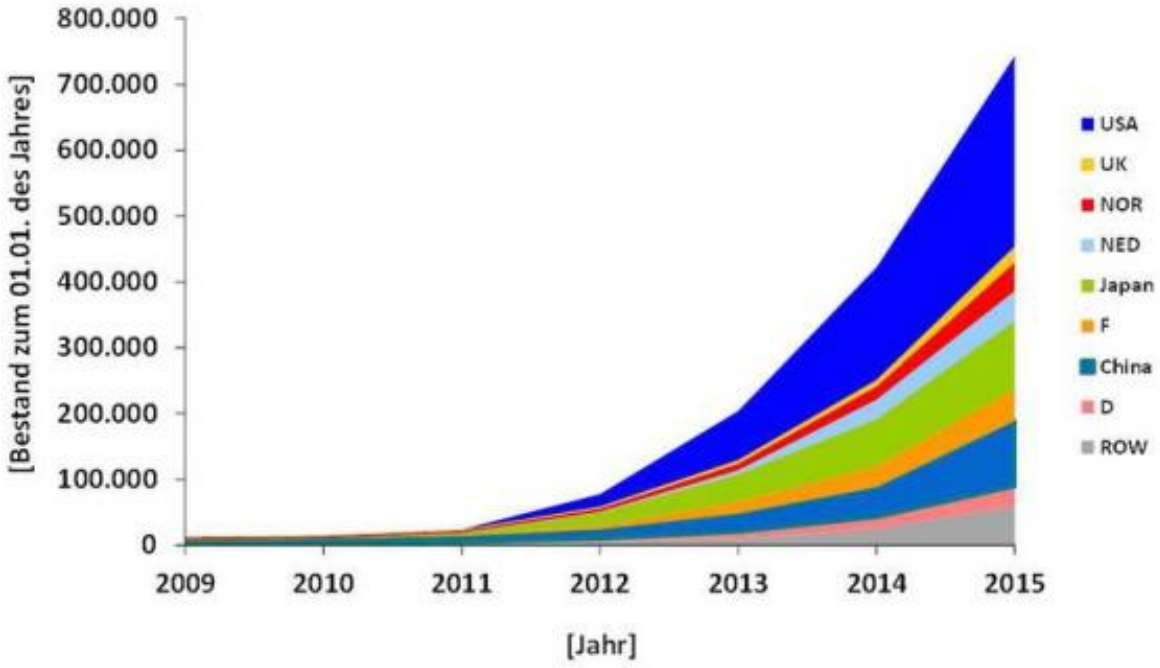

Figure 2: Trend of global EV registration [2]

As evident from the graph mentioned above, the growth in sales of EV throughout the world has increased during recent years. The largest increase is seen in United States where by the end of year 2014 the growth of EV on the road reached around 300,000 vehicles. The distribution of remaining countries and regions of the world in the growth of EV on the road has been shown in the graph that clearly indicate a on the road EVs level reaching to 800,000 vehicles by the start of the year 2015. Such an increase in the EVs on the road during recent year is a clear indicator of growth in the market for EVs and the potential it has in the future. This growth in EVs on the road is also an indicator of improvement of technologies in the manufacturing of EVs. It also indicates implementation of environment friendly measures by the people as well as automobile manufacturers [2].

The electric vehicles (EVs) market is changing at a rapid pace, the electric vehicles are mostly plug-in-hybrid (PHEVs), hybrid (HEVs) and battery electric vehicles (BEVs).The portion of electric vehicles in automotive industry is very small but highly significant. The governments of majority of countries are committed to increase the EVs penetration due to the benefits of several factors such as economy, environment and the energy security. Therefore, governments are putting huge pressure on automakers to manufacture EVs and offer attractive incentives for the customers to encourage them to buy.

In recent years the vehicles with efficient or less fuel consumption are taking over the market due to advanced level of alternative technologies. The efficiency of the vehicle is improved by making advancement in the efficiency of internal combustion engine (ICEs) by using technologies of stop-start, by the lightweight chassis and body panel material, increase use of diesel and engine downsizing. The expected future growth in HEV, BEV and PHEV is largely dependent on the expanding market of EV and the availability of EV in large formats of vehicles such as trucks and SUVs, an attempt to go outside small hatchback.

According to the findings of Navigant Research the global light duty (LD) EV market in coming years is expected to grow from 2.7 million to 6.4 million until 2023. This research has also provided the market sizing, forecast, analysis of market share for LDV market as well as light duty PHEVs, HEVs and BEVs. The global forecast till 2023 has been made for the yearly sale of LDV, and the vehicles currently in use are segmented. Segmentation is based on scenario (aggressive, base and conservative), key countries, world region, class, derivatives and most importantly automakers. Furthermore, forecasts are also provided about the vehicle class and automakers. The research has also covered an in depth details on the energy density of lithium ion (Li ion), prices of retail fuel and prices of Li-ion battery [20].

There are few leading companies such as Tesla, Nissan and Mitsubishi that are mainly involved in this revolutionary rapid growth. US including many other regions have seen tremendous growth rate and up to 69% growth in US and this ratio is equal to 290,000 EVs units in the US. This is a huge amount and in practical terms it means that every third EVs vehicle is in US considering whole world. The EVs growth in China is also very significant and only during 2014 around 54,000 EVs units have been registered. Technically this amount shows up to 120% growth rate that clearly beats the growth rate in US. The total number of EVs in China are estimated to be more than ~100,000. Japan is also prominently chasing this trend with 45% reported growth rate and total number of EVs is around ~110,000 units [2], however,Japan has over 4 mil. hybrids.

The analytical studies have shown that all these three leading countries have very supportive and facilitating policies and that is the main reason behind this humongous growth rate which is still on the rising edge. Whereas, the countries where the policies are not much supportive such as Germany the growth is very low or weak. According to a survey study the overall growth rate in the global market is reported to be ~76%, and

the reported registration of electric vehicles increases twofold from 2012 to 2014. Werner Tillmetz, the chief head of electrochemical technologies and energy division narrated that" if this present trend of growth continues relentlessly than the EVs will easily exceed 1 million units globally in few months". Highly sophisticated and efficient models are anticipated to be launched in the coming years to catch a big customer market worldwide [2].

1.6 Problem statements

Buying behaviour from the customers reflects products' individual image attributes. The exponential growth in the number of people transacting business electronically shows that the concept has revolutionized the marketing strategy by companies and business ventures [39]. However, in spite of the wide spread popularity of a product's attributes such as Electronic Car, the research community has not focused much on the attitudes and demands of electric Cars in in KSA that motivate them to go for a purchase. The lack of evidence and insufficient studies have made it difficult to retain customers in modern economic country such as , especially in KSA, where the users expect their needs to be fulfilled immediately completely and for free, when they are provided with more information to make choices on purchasing. Hence, it is mandatory for the traders in KSA to understand the attitudes of customers from the perspective of their purchase intention, who search various ways of sale of electric cars and make decisions on purchases. Furthermore, it is crucial to recognize the factors that influence consumers' involvement and accomplishment in their final purchasing behaviour. This study aims to find out the various preferences of customers who prefer to purchase without any second thought after finding its significant factors that influence them to make a purchase decision of electric cars on various selection strategies at their disposal. Many studies of this calibre have been carried out in various dimensions in both the developed and developing world. But here in KSA such studies are still lacking. This study intends to fill the gap by carrying out a country specific case study to make purchasing decision of customers in KSA. The results of this study will offer a good awareness of product image attributes that attract or dispel customers purchasing decision.

1.7 Research questions

What are the factors of the Customers' decision making to buy **Electric Car** in Saudi Arabia?

What is the relationship between **Energy efficiency** and customers' decision making in Saudi Arabia?

What is the relationship between **Environmental Friendliness** and customers' decision making in Saudi Arabia?

What is the relationship between **Performance Benefit** and customers' decision making in Saudi Arabia?

What is the relationship between reduction of **energy dependence** and customers' decision making in Saudi Arabia?

1.8 Research objectives

General

The main objective of this study is to investigate the customers' decision making factors in buying the electric car in Kingdom of Saudi Arabia.

Specific

The following specific objectives are aimed at this research study:

To identify the factors of the Customers' decision making to buy Electric Car in Saudi Arabia?

To find out the relationship between Energy efficiency and customers' decision making in Saudi Arabia?

To analyze the relationship between Environmental Friendliness and customers' decision making in Saudi Arabia?

To determine the relationship between Performance Benefit and customers' decision making in Saudi Arabia?

To investigate the relationship between Reduction of energy dependence and customers' decision making in Saudi Arabia?

1.9 Significance of study

If there would be no electric vehicle in this world especially in the future when the world's fossil fuel have been exhausted then there would be nothing left for humans to drive. Even in today's world, the on-road electric vehicles are more than 700,000 vehicles. Such a large number of electric vehicles and the increased growth every years clearly show a high dependence on electric vehicles. The dependence on electric vehicles has given hopes to humanity in reducing carbon emissions in future. If electric cars have been stopped from production and are vanished from the world then someday in future there would be high level of pollution everywhere resulting in health issues to humans as well as other species living in this world.

Another foreseeable future is exhaustion of fossil fuel which will collapse the system of transportation by humans. Humans heavily rely of fossil fuels which are not renewable source of energy. There is no production of fossil fuel going on anywhere in the world at the rate of consumption by the humans. This trend clearly indicates a need to alternate energy vehicles in order to sustain transportation system. The best alternate

transportation system for the fossil fuel based vehicles is a transport system that bases on use of electric cars.

If electric vehicles are vanished from this world and further production is stopped then there would be no means of using renewable energy for transportation since even solar vehicles are basically electric vehicles that run on the electricity gained from solar energy. This brings another insight of the uses of electric vehicles. Efficient electric vehicles mean efficient solar vehicles. Solar vehicles are by design a modification in electric vehicles so stopping production of electric vehicles and destroying existing electric vehicles would result in closure on solar vehicles.

At present, there are some issues such as "electricity consumption", "global CO2 emissions", etc., that touch all the activities in business and services. Thus, electric car usage in KSA plays an important role in this respect. This research is designed to help both academicians and practitioners understand the significant factors of buying decision from the customers in KSA. This research also can help the electric car manufacturers in their involvement in the movement of green campaign in KSA in order to plan to make the country green overall, especially in the car industry. As quality of environment can give the country the highest global reputation the research can boost up the motivation and interest in the government policy makers as well.

1.10 Scope of the study

To minimize the length of the research and to complete this work in the stipulated time, only the customers in different shopping mall taken into consideration in Riyadh and Jeddah in KSA. Nevertheless, once the readers go through this documented part of the research, they will gradually develop a beauty in their minds as they can see the overall significance of electric car for the environment in the society over here for the betterment of the socio-economic enrichment in KSA.

1.11 Content of this research

This research comprises five chapters:

- Chapter 1: Introduction and overview of the research
    - In this chapter, introduction highlights the reasons behind the study and states the purpose, problem statements, research questions, and research objectives, significance of the research and scope of the study.
- Chapter 2: Literature review
    - This chapter consists: Introduction, Background of study, past researches on the key items of the research such as CKD, SKD, EV and the associated variables of this research study.

- Chapter 3: Research methodology

    - In this chapter, the methodology used for the research will be described and be included the design of the research, collection of data, data analysis, validity and reliability of the test.

- Chapter 4: Findings and data analysis

    - In this chapter, findings of the research, data analysis and the interpretation of results of the study, pertaining theory will be discussed.

- Chapter 5: Discussion and conclusion

    - In this chapter the conclusions and recommendations of the research will be presented.

CHAPTER 2
LITERATURE REVIEWS

2.1 Introduction

Considering importance of presence of knowledge based implementation criteria in any organization, regarding its vast usages and great assistance to directors; any single money making firm should enjoy an effective implementation of this system in the company. Sole presence of a Knowledge based system without its basic usage-knowledge is useless, the same as its existence but an imperfect implication. The whole idea is about using the latest methods of gathering knowledge about what so ever happens in market, inside and outside the company, regarding internal managing system and administrative problems to external situations like competitors or social economy situations. Gathering information is one phase using those data to improve the profitability of firm is something different. It is not like having knowledge about competitors will make you survive in such a harsh situation of these days' market, the concept of knowledge based implementation comes tied to the concept of usages of that knowledge. What organizations know is very important but how they use it is more important, a surgeon with the knife is a human being you trust and let him tear up your body parts favourably because you know the result of using a very dangerous object by a skill full person, but what happens if the knife is in hand of night thief or a doctor without relative skills. That is how a good director and a bad one can use knowledge based stuff to harness the turbulent business attack waves. Gathering information costs and if the next step of implication is not planned well or forecasted before the gathering is finished, firm has just wasted the budget for useless information which will be old and useless just some months after finding. Even an inefficient way of usage is harmful and will lead the company in the wrong and dark side of its business. Therefore, the future of using the electric car in the kingdom is such a knowledge based environmental flourishment that the society can achieve its longitivity regarding its pollution free and affordability from its citizens.

In this research and its literature review part, the independent variables such as Energy efficient, Environmental friendliness, performance benefit and Reduction of energy will be described in detail. The dependent variable is customers' buying decision in the car industry. Several well-known researchers' opinions and works in this area will be discussed in this chapter as well. The literature review will both describe and critically review the related materials by pointing out the depth of the emotional inner feelings of customers. The research gaps will be identified at the end.

2.2 Energy efficiency

There are a number of alternative ways to reduce CO_2 emission other than employment of electric vehicles with low efficiency and poor battery. These ways include installation of coal plants capable of capturing carbon. Replacement of fossil fuel based plants with nuclear, combined cycle, wind, and hydro energy. A high number of electric vehicle production must be supported with a high level of increase in the electricity production through renewable means rather than fossil fuel combustion. There is a possibility that in future, the power sector industries would employ renewable energy production means more than at present that would support electric vehicles and meet the aim of EVs to reduce carbon emission [22].

EVs have fuel cost saving in long run; however, calculation of other factors are highly conservative for EVs. If the expected life of an electric vehicle is decreased for the purpose of conservative calculation while keeping in mind the battery longevity, and the gasoline based vehicle is considered to be retiring quickly, the net cost / ton of produced CO_2 will be around the same for both of these situations. The estimate of such calculation, as presented by Quorum, is around USD 120 per ton of CO_2 production. On the other hand, each ton of CO_2 has an industrial economic value of around USD 40 per ton [22]. The result of such calculation shows that the use of electric vehicle in present scenario is not a very much cost effective way of handling CO_2 emission. On the other hand, improvement of battery life and capacity, improvement of motor efficiency, and inclusion of solar panels in electric vehicle may actually realize the true benefits of it in terms of cost of energy consumption and zero emission in the environment.

2.3 Environmental friendliness

2.3.1 Global emissions by gas

There are few gases that are emitted as a result of different human activities, these gases are globally listed and the detail of each is as follows (7): -

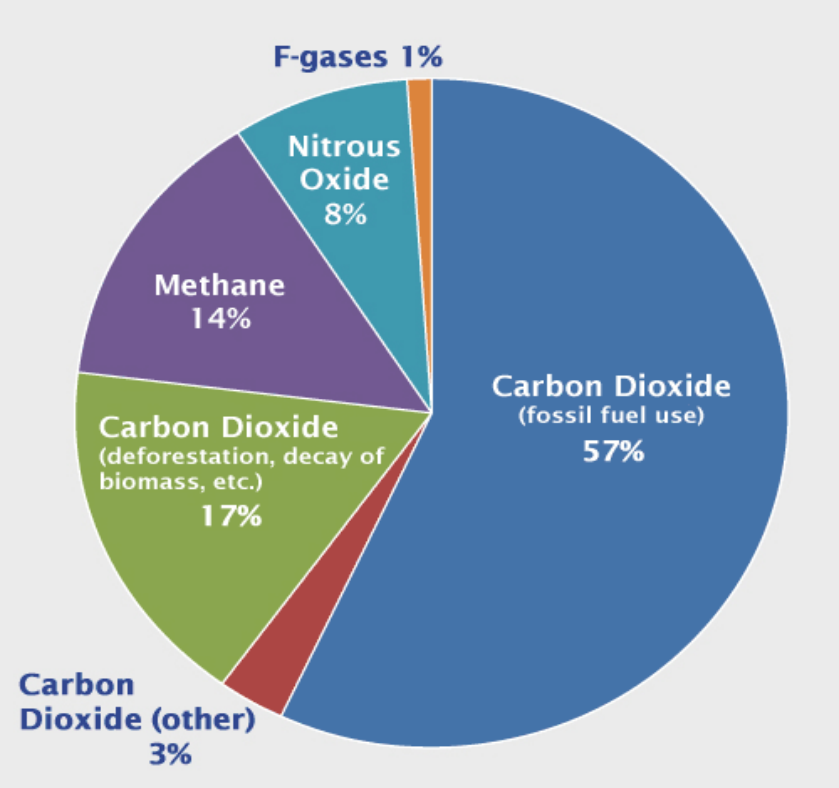

Figure 3: Gases from human activities by Environmental Protection Agency (EPA), [7]

- Carbon dioxide (CO_2) – The use of fossil fuel is the chief cause of CO_2. The methods used by people in using land are also an important factor in the production of CO_2, particularly in deforestation. However, CO_2 can be removed from environment by land through improvements in the texture of soil, reforestation and other related activities. The road transportation results in 15.2% of the total CO_2 emitted globally as indicated in following chart (Man-made Co2 Emissions):-

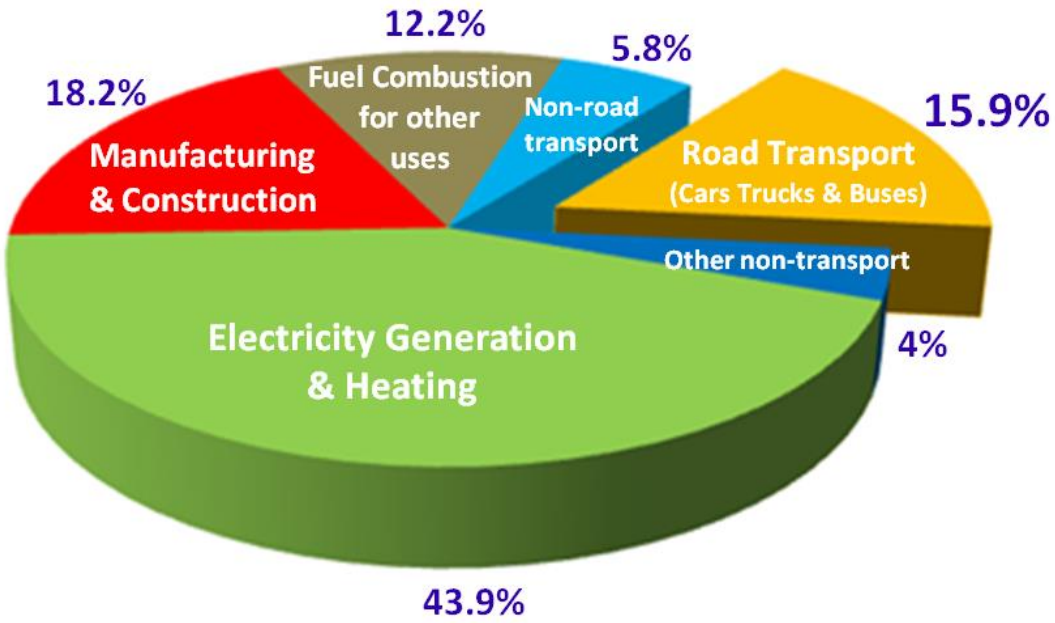

Figure 4: Share of Man-made CO_2 Emissions [30]

- Methane (CH_4) - waste management, energy use and agricultural activities, all these activities contribute to emission of CH_4.
- Nitrous oxide (N_2O) – The major source of N_2O production is agricultural activities, the extensive use of fertilizers largely responsible for its emission.
- Fluorinated gases (F-gases) –A large number of different customers' products, refrigeration and Industrial processes largely contribute to F-gases emissions, mainly include perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and sulfur hexafluoride (SF6).
- Black carbon (BC) is aerosol or solid particle that also contributes to global warming of the atmosphere.

2.3.2 Global emissions by source

There are numerous economic activities also contribute in the emission of greenhouse gases, a brief description of these activities is listed below [7]:

- **Energy Supply** The large scale burning of natural gas, coal and oil for heat and electricity are the chief sources of greenhouse gases production worldwide.
- **Industry** The industrial emission is mainly because of on-site burning of fossil fuel at various project facilities for the purpose of energy. The other noticeable emissions of industrial factors are due to processes such as metallurgy, transformation process of minerals and chemicals. These processes are not associated with consumption of energy.

- **Land Use, Forestry and Land-Use Change** CO_2 is the main gas that is produced by this sector from process such as deforestation, decay or fires of peat and land clearing for the purpose of agriculture. The important fact to realize in this case is, the production of CO_2 in this sector is in addition to that removed by ecosystem from atmosphere. The removed CO_2 is subjected to a great level of uncertainty according to recent studies and it has been established as a fact that globally the CO_2 removed by ecosystem is twice the amount of CO_2 lost due to deforestation.
- **Agriculture**. A large portion of greenhouse gases are emitted due to different agricultural activities worldwide such as livestock, agriculture soil management, biomass burning, and rice production.
- **Transportation** This sector has been chiefly involved in contributing towards heavy amount of greenhouse gases emission into the atmosphere mainly due to the burning of fossil fuel for air, road, rail as well as marine transportation. According to the estimates about 95% of the transportation energy of the world mainly comes from petroleum fuels, such as diesel and gasoline. A details of CO_2 emission by major countries is shown in below chart that indicates United States to be the top among these countries (World's CO_2 Emissions by Country): -

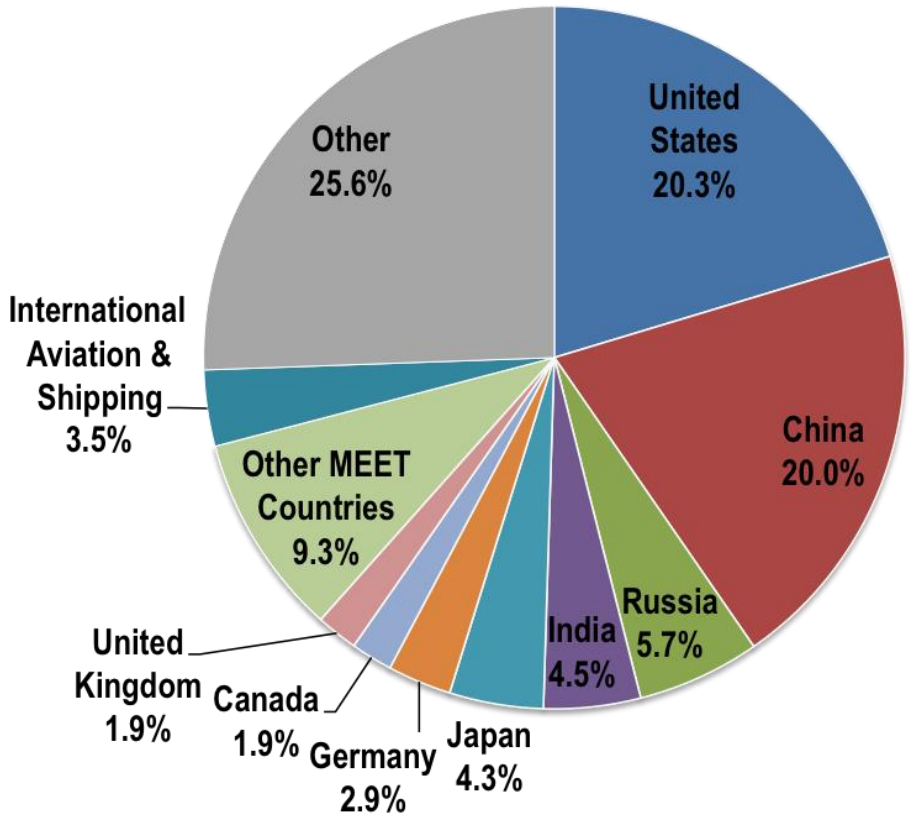

Figure 5: World's CO_2 Emissions by Country [30]

- **Residential and Commercial Buildings** A considerable amount of greenhouse gases are produced by this sector and the production is mainly due to fossil fuel burning or on-site generation of energy for the purpose of cooking or heat in the buildings or homes. However it is important to realize that this energy doesn't include the energy emission due to electricity.
- **Wastewater and Waste** There are three major sources responsible for the emission of greenhouse gases in this category. The first main role is played by landfilled methane (CH_4), second important source is waste water methane (CH_4) and last source is nitrous oxide (N_2O). A small portion of CO_2 is also produced due to the burning of waste material such as synthetic textile and plastic those are produced with fossil fuels.

2.3.3 CO_2 emissions vs. EV

The battery driven EVs do not need to combust fossil fuel to produce electricity rather these vehicles designed to extract electrical energy from a charged battery and convert it into mechanical energy with motors. There is no use of an on-board gasoline tank in battery driven EVs. The motors that are used by EVs are high voltage motors which are capable of producing high torque in order to enable the vehicle to carry its load and even drive uphill. The high voltage is provided to the high voltage motors from a high voltage battery pack that is charged through plugging the vehicle with a 110 or 220 volts outlet in case of United States and 230 volts in case of Europe [12].

Due to an increase in the EV production and sales and increased efficiency of other vehicles, a reduction in CO_2 emission from transport has been seen in the past few years. Following chart shows CO_2 emission for past 20 years (Less Foreign Oil, More Efficient Cars, And An Emissions Reduction: Some Good News From The White House): -

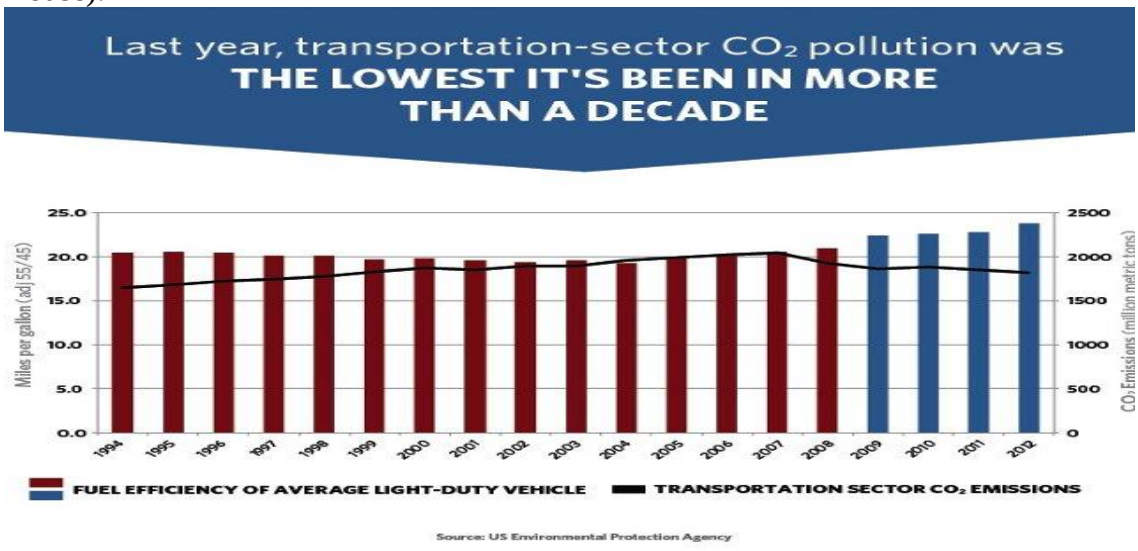

Figure 6: US transport & LDV - Trends of fuel efficiency [miles/gallon] and CO_2 emissions [mil.t]. [7]

The main advantage to environment from the battery driven EVs is that there is no emission of CO_2 or any other direct emission from in case of these vehicles. These vehicles are not completely considered as zero emission vehicles if their complete life is considered because the source of the electricity that is used to charge the battery pack of the vehicle can be resulting in emissions. Owing to the reason that electricity is cheaper as compared to gasoline, the battery driven electric vehicles consume lot less costly energy as compared to conventional vehicles [12].

2.4 Performance benefits

Pathway technologies are expected to utilize the emerging technologies and information in order to control automatic vehicles and to ensure sustainable transport. It will also be very helpful in booking, reservation, global positioning, congestion charging and the mobility management for monitoring. The role of technology has become very fundamental and it can be easily associated with institutional and behavioural changes [36].

EVs at a very first glance appear to be merely a drain on overall grid but with the development of smart and advance grid the ability to adopt latest information technology as well as the demand side management (DSM) has enhanced the role of EVs and made their role more efficient and broad. EVs have generated great challenges for any type of power grid and thereby the deregulation as well as distributed energy resources (DERs) associated with that power grid generates higher level of stress simply by enhancing the level of complexity and fostering security as well as reliability concerns. EVs is an important variable with which utilities must have to deal with. To a great extent, the adoption of new and advanced level of information technology and deployment of smart grid are together addressing many of these concerns. Whereas, utilities are searching for the methods for DSM programs to be able to effectively meet all the prerequisites of smart grids [32].

Information technology has shown many wonders to the business world and especially the emerging economies have uplifted the customer class. Communication networks, computers, cameras and other related electronic gadgets have increasingly become the commodity and bringing disruptive alteration to transportation and automobile at a huge level. The biggest proclaimer is searching on google for how to self-drive a car. These experiences are inspiring the customers to urge for automatic robot controlled cars that will eventually replace the driver with the in-built systems operated by radar, sensors, cameras, and are completely guided via detailed mapping. However, automakers have started to offer partial automation by incrementally providing features for instance automatic braking, lane-departure alarm, adaptive system for cruise control. Currently, these advance features are enhancing the capabilities of driver rather than replacing the driver. Based on present technology and level of demand it has been speculated that in near future the complete automation will take over this industry.

Regardless of the fact that from where the emergence of automated transportation took place it is important to realize that internet has brought in huge revolution. It has

been speculated in coming years that the magnitude of sophistication and advancement will be so high that it is totally unimaginable in today's world. Many of the electric vehicles have similar designs as the other existing cars but very soon the novel designs and unmatchable level of modifications will take over this sector. The size of EVs is expected to be considerably vary from pods to large vehicles built to move one to many passengers respectively and variety of consignments and goods. Electric vehicles will have the capacity to exploit the efficiencies and specialization of automated in-built systems. This would be a great step towards enabling self-charging and self-parking. The concept of smart transportation is also expected to successfully shift the long traditional expectations of customers from long-range and high carrying capacities, as it will always remain unreachable for EVs [5].

Smart Grid isn't merely small meters that are to be deployed at different stations countrywide. It is basically the electric grid modernization from poorly dumb wires to an extraordinary system of information technology that efficiently transports electricity. This reflects that shift will take place in electric grid from traditional centralized system of power generation mainly through fossil fuel burning to a system of grid that is overly populated with variety of numerous electrical generation stations, primarily having a huge amount renewable energy resource. Smart Grid offers a great opportunity to the service providers such as providing services related to frequency regulation and demand response, it will help in pulling off energy at key timings from grid [15].

IT applications in EVs

There are two types of functions featured by the Electric Vehicle IT system, one mainly used on-board and other used remotely through mobile or computer. Listed below are the main five functions that are used on-board the automobiles or vehicles [21]:

(1) Area map via Range forecast

This function is responsible to display map area through range forecasting, depending upon the data related to range and power. Vehicle navigation system can easily locate and set the desired destination. Drivers can easily show area mapping by displaying the recorded range forecast after their arrival at the destination. Area mapping is an essential need of modern drivers and this feature can be easily used in electric cars. This feature enables a local area mapping as well as mapping through internet and GPS depending on the installed system on the electric vehicle.

(2) Display of Power consumption

This function is responsible to show the rate at which the energy has been consumed by electric devices, cabin conditioning devices and the motor in the automobile. It also displays the details of what changes take place in range with as well as without control on cabin climate.

(3) Search option for charging station

In case of failure of battery power, the search option for charging station allows the user to search nearest charging station for EV. Charging of EV can be planned by the user through mapping of nearby charging stations with the help of this option in combination with the information technology. This option also shows the recommended charging stations according to the destination of the user in order to have efficient charging.

(4) Timer for charging

Electricity rates vary in almost every country as per the time of the day. At the peak hours, normally the electricity rate is doubled as compared to off-peak hours. This condition can be exploited by the user of EV through setting timer for not charging and charging the vehicle in the peak hours and off peak hours respectively. Such a setup will result in reduction of electricity charges for charging of EV.

(5) Route search for energy saving

Use of information technology enables the user of EV to electronically map the most efficient and cost effective route to the destination. Such a system scans all possible routes to the destination and recommends the best possible route that gives highest level of efficiency through traveling minimal distance to reach the destination. This system also proposes such routes that do not have mountain roads or heavy traffic that might result in consumption of more electricity. This system automatically estimates the remaining battery after taking the proposed route to the destination and reaching it. Such a setup enables the user of EV to plan trips in more cost effective manner.

In addition to the above mentioned functions of information technology system in electric vehicle, following three functions can be used remotely:

(1) Customized status/history check

This specific function available remotely allows the users of EVs to retrieve their driving history as well as a number of other forms of valuable information. Such information include average power consumption of the vehicle, ranking of power consumption, and total mileage in each charge. This information can be obtained on a personal computer, laptop and even mobile phone. The users of EV can record their results of driving related to environment friendly ways. Other forms of information in this function include eco tree records, power usage records, customized driving archive and travel history records.

(2) On-board climate conditioning

The climate conditioning system of the cabin of an electric vehicle can be controlled through remote means by employing this function. The user of electric

vehicle can turn on and off the climate conditioning system according to the requirements. If the user knows that he/she is going to go outside for a long trip in summer after 10 minutes then he/she can remotely turn the climate conditioning on in order to make the internal temperature of the vehicle according to their comfort level when they get into the vehicle for departure. This feature can be considered by few as reducing the efficiency of the vehicle; however, it is totally dependent on the user to set the timer of climate conditioning for their own comfort. After all, it is important to have a readily available cool vehicle in summer as compared to cooling it on the way while bearing heat and driving.

(3) Charging remotely

Another important feature of information technology systems in electric vehicles includes allowing the user of electric vehicle to charge the vehicle from remote distances. In such system, the user can send the charging or not charging commands through the means of internet with the help of their personal computer, laptop or even cell phone. The users is allowed to control the charging and not charging of the vehicle remotely in order to enable them to efficiently utilize the battery charge since frequent charging and discharging results in reducing the battery life and capacity.

2.5 Reduction of energy

The market share of electric vehicles is highly promising but there are three crucial factors that will determine the future dominance of EVs as mentioned below [16]:

- **Carbon emissions** - According to a research per km emission of CO2 by electric vehicles (EVs) was found to be 50% less compared to ICEs. This fact can be well understood as 116g of carbon dioxide is produced by EV per km compared to 252g of carbon dioxide produce by ICE. This analysis is significantly important in making correct assumptions about the electricity generation sources (such as gas vs coal vs renewable/nuclear), ICEs fuel efficiency and the efficiency of EVs battery. The additional demand for power for EVS will actually determine whether EVs have small carbon footprint compared to ICEs. However, there is an on-going research and innovation activities to enhance the efficiency level of ICEs and also to use modified fuel sources that have less carbon footprint compared to conventional gasoline.
- **Economics** - The moderately reasonable gasoline prices rule out the sense of electric vehicles currently available in the market for customers without any significant support from government. IF it has to be assumed that the prices of fuel may tend to increase in long-term would only then make some sense for EVs. Moreover, the biggest cost involved in the manufacturing of EVs is battery cost, it is expected to sharply decline in future due to tremendous innovations taking place in technologies.
- **Infrastructure** - However, it is important to realize that mostly people don’t drive any further than 40 miles on daily basis. Range anxiety has significant

influence on the purchase decision of EVs. The one best solution for range anxiety is PHEV but it comes with complexity as well as additional cost. The advanced future batteries will have comparatively longer range, but will have limit too. Businesses that are offering stations for fast charging or battery swapping will have to build special infrastructure to facilitate EVS, but the actual development of such infrastructure may take longer time than the expected.

The average price of a vehicle in US is $25,000 and pre subsidy electric vehicle is around $40,000. The average price per vehicle also includes diesel burners and heavy vehicles that are largely responsible to tip up the price. The small vehicles on gasoline that are considered as the most potential candidate to be replaced with EVs are very cheap, on average $20,000 .Therefore, EVs are $20,000 more costly than gasoline vehicles that are equivalent in efficiency. Presently, it can be safely assumed that an electric vehicle costs on average 20,000 USD more than an equivalent vehicle that runs on gasoline. On the conservative side of this picture, it can be assumed that an electric vehicle of an economy-of-scale would cost 30,000 USD more than an equivalent vehicle running on gasoline. Therefore, the marginal cost of producing an electric vehicle at the economy-of-scale would be around 10,000 USD.

There are two cases related to cost to be considered here: Making an instant switch versus only replacing the old vehicles. For instantly switching, about 150 million vehicles would have to be replaced on immediate basis and the value of gasoline care will be lost. This switching process is estimated to cost around $4.5 trillion. Whereas in case of gradually replace, the value of gasoline vehicle will remain intact until their lives end and only the marginal cost would have to be considered as it happens in any other business and the estimated cost would be around $1.5 trillion.

2.6 Customers' decision making

A customer typically goes through a few stages of decision making before deciding on purchasing a product. The initial stage is realizing that there is a lack or need of a product that must be fulfilled. In the next stage, the customer will find out more about the products that are able to fulfil this need. The amount of search that goes into finding information regarding the product is based on how important the product is to the customer.

If the product entails spending a lot of money, this means that the customer will conduct an extensive search; otherwise the search level will be low. After this stage, the customer will consider all the advantages of the many brands that carry these products. Finally, the customer will make a decision to buy the desired product from the desired brand.

These stages are not always adhered to for every product that is intended to purchase. Some purchases are made based on prior purchases and experiences. For larger products that call for a higher and long term expenditure and use such as for cars and houses, the customer will take a long time to decide [37] . Customers will make a

wide comparison of the brands available via extensive information gathering and also past experiences.

In this research, it was found that customers' decision making on purchasing electric cars also goes through these different stages before arriving a particular purchase. They will gather information about the latest fashion and styles, quality of the cars and depend on feedback on others who may have purchased such vehicles.

2.7 Research gap and potential for new knowledge

To the best of the researcher's knowledge, after a thorough literature review, it is found that to date there has not been any research that has been conducted on the decision making process of purchasing electric cars in KSA especially from the viewpoint of the customers. Since it has not been done before, it may be challenging to find out the customers' point of view on this matter. KSA is a country that is represented by people of many varieties of tastes. There are many local and international products here that have met the needs of the local customers. Thus, the marketing of electric car products that are related to the environment would be quite difficult in KSA; this is the reason that it is essential to gather the opinions of the people in order to establish the right strategy to make electric car industry in KSA a successful one. In order to conduct a thorough research, from the literature review it was found that it is important to investigate critical factors and their influence on the decision making process of customers. This is the main reason for conducting this research and gathering sufficient information regarding the factors as mentioned above.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

In this chapter the applied methodology of the research in this research is described. This study addresses the customer's decision making in buying Electric Car in KSA. This chapter describes the sampling methods, target population, data collection and size, reliability and validity of the tools used in the study. This is a basic and descriptive analytical research to measure the customers' decision making and investigation of factors influencing this decision making in buying Electric cars. The research propose of study, is a hypothesis testing with type of investigation on correlations to test the relationship of factors that affect the buying decision. The extent of the research interference is minimal as the research collects data from surveys, or questionnaire. It will focus on non - contrived setting, which will be done in natural environment. The unit analysis to be studied is for group decision, prospects, and many points of view, that the time horizon for this research is as a cross – sectional as the questionnaire is the only tool distributed for this time to the respondents. Providing the research of methods which attached to the study of using primary data collected through questioners, distributed manually and technically through investigation panel, e-mails and online evaluation providers. This survey is designed to examine the structured study of approving the hypothesis of the four factors mentioned in the previous reviews of quality of the products towards the customers' buying decision. The qualitative method in this paper based on questionnaire, concluded distributed among the customers in order to achieve the research purpose.

3.2 Conceptual framework

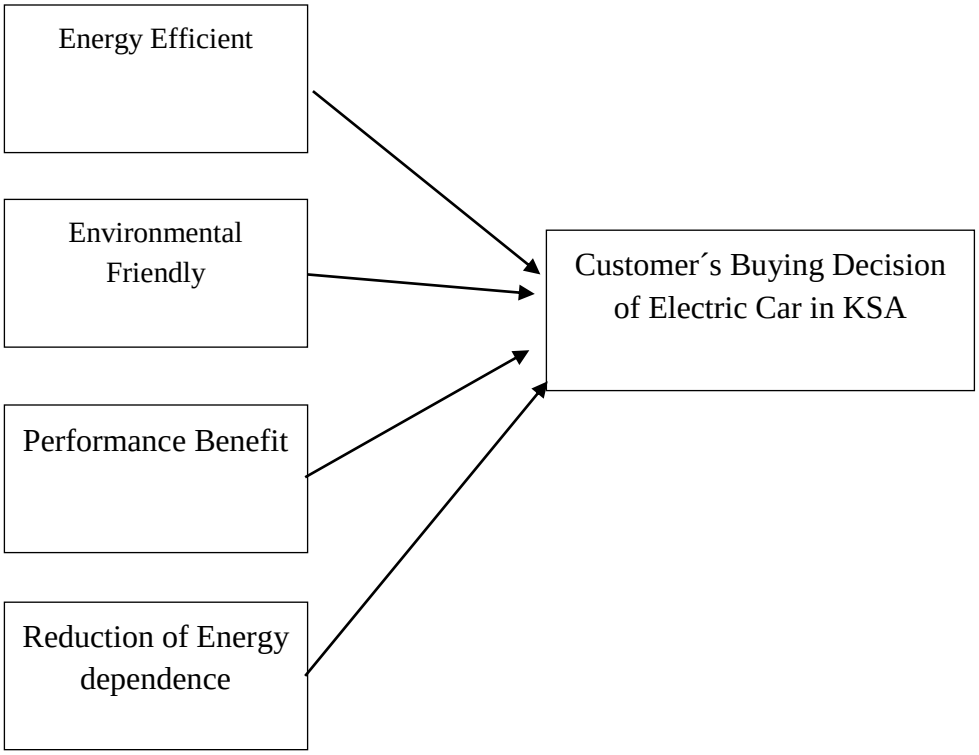

Figure 7: Conceptual Framework

Variables

Two types of variables are presented in this study, which include:

The Independent Variables – Energy Efficient, Environmental Friendly, Performance benefit and reduction of Energy Dependence

The Dependent Variable: Customers' Buying Decision

3.3 Hypotheses proposed in this study

The proposed hypotheses in this study need to be developed and designed in order to meet each of the objectives of this research successfully and to respond to the research questions as well. Thus, the researcher proposes the following hypotheses:

- H_1: A significant and positive relationship exists between Energy efficiency and customers' decision making in Saudi Arabia.
- H_2: A significant and positive relationship exists between Environmental Friendliness and customers' decision making in Saudi Arabia.
- H_3: A significant and positive relationship exists between Performance Benefit and customers' decision making in Saudi Arabia.
- H_4: A significant and positive relationship exists between Reduction of energy dependence and customers' decision making in Saudi Arabia.

3.4 Research design

Several sub-sections have been introduced in the research design which are described as follows in this study.

3.4.1 Type of research

This study utilizes the descriptive approach as it attempts to describe customers' decision making in buying Electric Cars in KSA.

3.4.2 The study's interference level

The interference level was maintained at a minimum by not showing any bias as this could interfere with the actual finding of this research. High interference level in a research will disrupt the findings and result in the findings being unacceptable or biased.

3.4.3 Unit of analysis

The unit of analysis in this research is customers in different shopping malls in KSA.

3.4.4 Research instruments

The research instruments in this study are mainly categorized into primary and secondary data approaches.

3.4.5 Primary data

The primary data is used in the process of collecting information for this research mainly through two methods including a survey questionnaire and an interview. The research conducted interviews, questionnaire, and observations. The interviews were conducted personally it included twenty-five customers in KSA. The interviews enabled the collection and sharing of opinions and interesting ideas from the respondents.

3.4.6 Secondary data

The secondary data was mainly collected from various databases and from online search engines including Yahoo and Google Scholar. Beneficial information was gathered utilizing the secondary research approach to improve the quality of this research.

3.4.7 Software used in this study

The data analysis in this study utilized the SPSS version 22.0 (Statistical Packages for Social Science) software. The questionnaire was arranged according to the research objectives and responses were entered into the software for further data analysis purposes.

3.4.8 The design of the questionnaire

The random sampling method was used to distribute the questionnaires in this study. A cross-sectional study utilizing a structured questionnaire with the 5-point Likert scale will be used to examine all the variables. A formative quantitative study will be performed to collect information regarding the attitude, knowledge, and practices of the research variables of this study. Therefore, it encompassed a structured and close-ended questionnaire that incorporated all the variables used in this research. Descriptive analysis will be utilized in most of the sections in the analysis. In addition, the multiple regressions will be used for factor analysis on the respondents' opinions towards the variables suggested in this research. The diversification in respondent's characteristics towards this system implementation could be defined by a formation of independent predictor variables. Pearson's correlation will be utilized to examine the relationship among respondents' knowledge and attitudes towards the variables.

3.4.9 Sampling

In this research, four hundred and fifty customers from various shopping malls were asked to fill up the questionnaires. The sample for this survey is comprised of respondents who are customers of various city malls such as Riyad, Jeddah etc. in KSA. The reason for choosing the places was due it being the cosmopolitan arena in the whole of KSA for its different cultural backgrounds of inhabitants' existence. The random sampling approach will be utilized for this research. The measurement used in this paper is the Likert Scale Method.

Due to the constraints of time and money, the number of samples gathered was deemed enough for this study although it does not represent all the customers in KSA. Nevertheless, the sample is a sufficient representation of customers from KSA and it would be sufficient in pointing out the various effective factors of customers' decision making in buying Electric Car in Malaysia.

3.4.10 Data analysis techniques

This study will utilize three various techniques to examine and analyse the gathered information from the four hundred and fifty (450) respondents.

3.4.10.1 Frequency distribution

Descriptive statistics will be used to examine the Frequency Distribution of the demographical dimensions of the respondents specifically factors involving age, race, nationality, income level, and educational levels. Demographical factors are important examining the factors of customers' Decision making.

3.4.10.2 Correlational testing

Correlational testing will be performed for verification of important relations between the dependent and independent variables in order to address the research questions and the proposed hypotheses.

3.4.10.3 Regression analysis

It is to make a valid model and find out the significant factors associated towards customers' decision making in KSA.

3.4.10.4 Scale reliability

Reliability is regarded as an important component of conducting a perfect research. In addition to having an acceptable research strategy, measuring the scale's reliability can help in managing the research and in verifying that the results are consistent, perfect, and compatible.

Airasian and Gay [33] proposed that reliability is the level of an instrument's capability to calculate what is intended to be measured to measure at a constant level. A higher reliability level gives confidence to the researcher that the findings gained in the research are constantly similar if the respondents were to re-do the questionnaires. In the field of empirical research, different reliability coefficients can be utilized. The analysis sets out the how all the constructs in the instrument measure similar constructs (Sweet & Grace-Martin, 2003). The reliability test is presented numerically utilizing the SPSS software and the coefficients differ from 0 to 1. An alpha or result that is closer to 1 shows a higher reliability level based on George and Mallery, [35].

Thus, the reliability test in this study will utilize the Cronbach's Alpha (p). The findings are demonstrated in the table below for all the different variables. After carrying out the pilot test for the questionnaire, the ambiguous questions from the questionnaires will be revised and designed according to the test prior to the distribution of the final questionnaire.

Table 1: Reliability Analysis Results of the Pilot Study.

No	Variable	Initial Question	Cronbach's Alpha
1	Energy Efficiency	5	0.72
2	Environmental Friendliness	5	0,79
3	Performance Benefit	5	0.84
4	Reduction of Energy Dependency	5	0.89
5	Customers'' Buying Decision	5	0.69

Table 2: All the Variables' Alpha Value

Cronbach's Alpha	Cronbach's Alpha According to the Standardized Items	No. of Items
	0.73	25

3.5 Chapter summary

In summary, this chapter classified and explained first by overview of the chapter which talks about the sample size and the area that questionnaires are to be distributed and also the area which is to be visited in terms of distribution of the questionnaires. Then, the chapter attempted to illustrate the framework of the study and indicated four independent variables and one dependent variable which was obtained from previous research related Journals. Four hypotheses will be tested via this framework. Furthermore, the research design also talked about the random sampling, cross-sectional study which was applied for the study; next it explained the five Likert scale to test the variables. Then this chapter showed which test it applied to analyse the data of the study. The reliability test was conducted among 31 people as customers, from which the researcher could get the mean score for all five variables including the dependent one to let the researcher know that the test is reliable to design the final questionnaire.

CHAPTER 4
DATA ANALYSIS AND DISCUSSION

4.1 Introduction

The focus of this chapter is the data which has been analysed from the distributed questionnaires. To this extent, in the beginning the frequency distribution of the demography profile have been described. Then the exploratory factor analysis of the construct is used to study the variables. This is then followed by reliability analysis in section. Furthermore, to describe the findings, two important analytical methods such as Correlation and Multiple Regression Analysis.

4.2 Frequency distribution

4.2.1 Demographic profile of respondents

In this part, the demographic features of the respondents, based on information obtained from the questionnaire, were analysed.

Table 3: Demographic profile

Description	**Percentage**
Gender Male Female	67 33
Age 18-25 26-33 34-41 42-49 50+	14.2 20.9 26.2 25.6 13.1
Income< SR 1000 SR 1001- SR 3000 SR 3001- SR 5000 SR5001 and Above	26.2 40 28.89 4.9
Education Undergraduate Diploma Masters Ph.D. O / A Level	28.4 37.3 14.9 5.9 14.0
Job Service Business	24.2 31.1

Students Others	30.9 13.8
Nationality Saudi Others (Internationals)	90 10
Marital Status Married Single	 46 54

4.3 Summary of the results

4.3.1 Gender

From the below **Figure 8.** shows that the percentage of male is around 67%. It denotes that the maximum number of customers to choose in this research is male and male has the dominant figure to give their opinions and suggestions. It will reflect on the outcome of this research as well. It is to be added here that in this research, respondents are chosen randomly without noticing their genders, races etc. and therefore, there is the least interference from the researcher in every step.

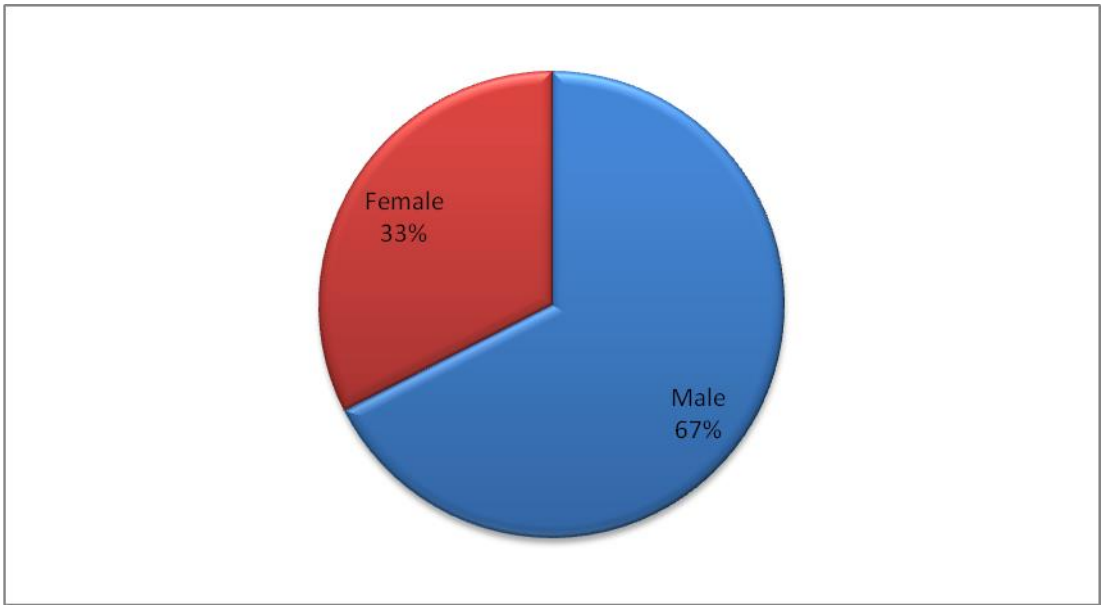

Figure 8: Gender

4.3.2 Age

The above chart age is seen that the percentage of 34-41 (26.2%) age group takes the lead where the percentage of 50 and above (13.11%**)** age group is the smallest.

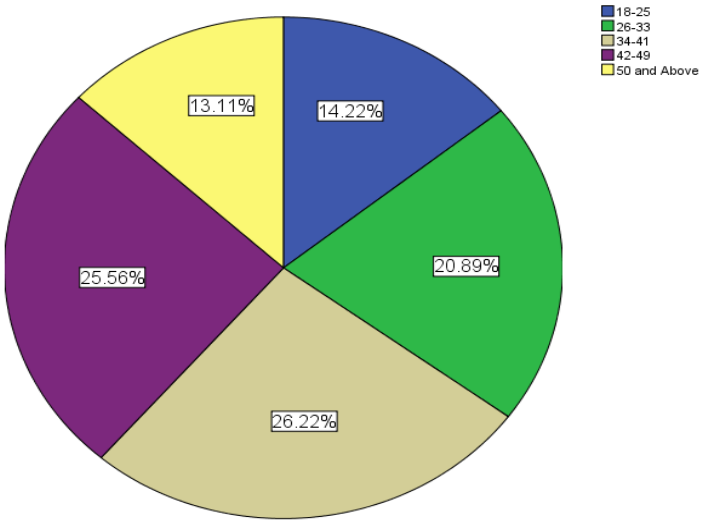

Figure 9: Age

4.3.3 Income

From the below Chart, the percentage of income level ranging from SR One thousand and One to SR three thousand is the highest (40%) and the income level ranging from SR four thousand and One to above, is the lowest (4.89%) one. Therefore in this research the lower income group has the influence in giving their suggestions and ideas and answering the all required questions in the questionnaires. It might reflect the price sensitiveness among the respondents before they judge the quality at first. This result brings a very good sign for the researcher about how pricing can be strategized to cater the most of the customers' buying decision towards Electric Vehicles in KSA.

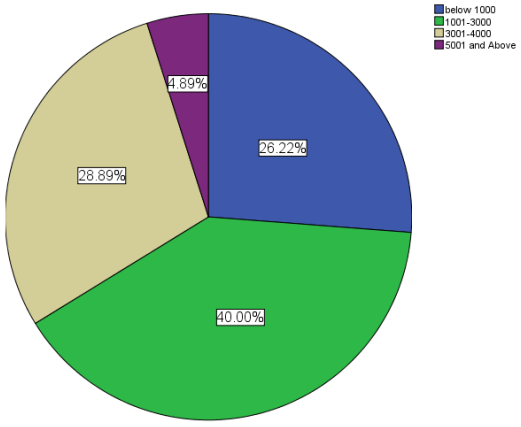

Figure 10: Income

4.3.4 Education

From this research study it is seen that percentage of Diploma (Completed and pursuing,37.3%) takes the lead where PhD (Pursuing and completed, 5.3%) is the smallest.

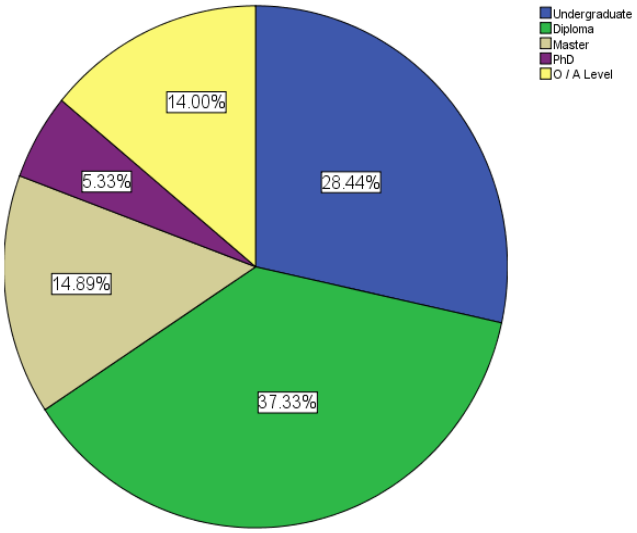

Figure 11: Education

4.3.5 Job

From the above Table and the Chart it shows, the percentage of Businessmen is the highest (31.1%)and the students are the second (30.89%).Thus in this research, the views and opinions from the respondents who are doing businesses and studying have been explored. The ideas and feedback from the eyes of commercialization of Electric Cars are very much welcoming. By obtaining their participation largely, it is expected that the research has earned its farm footing to establish its desired goal.

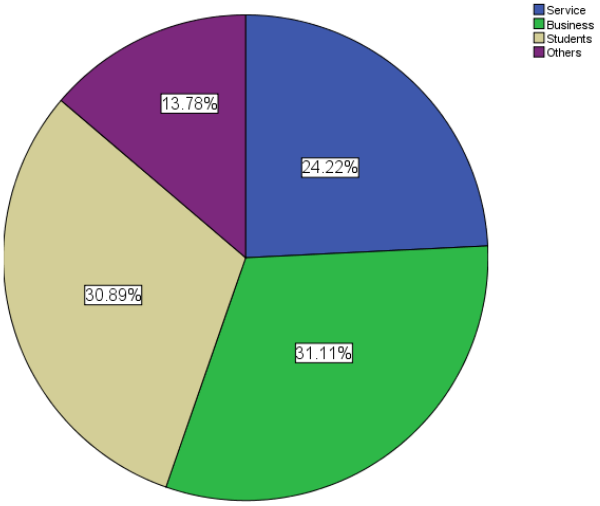

Figure 12: Job

4.3.6 Nationality

From the below chart it is found that around 90% respondents are from Saudi customers. Thus, the result brings a good direction to achieve the objectives from the Saudi customers in fruitful ways. But at the same time it will depict the international customers' opinions and feedback on the customer' decision making as well.

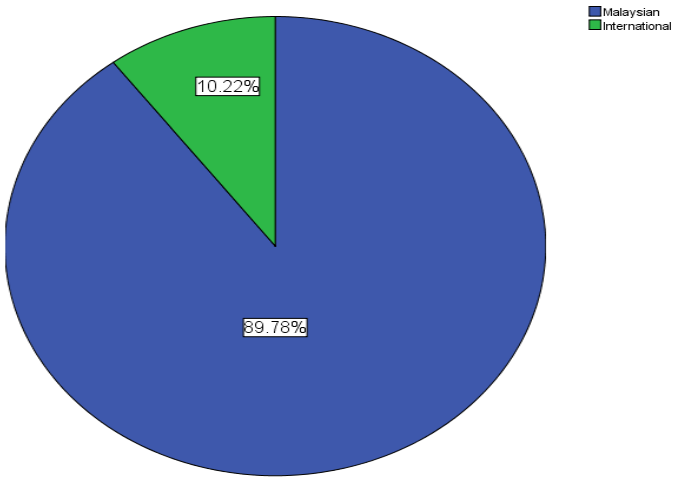

Figure 13: Nationality

4.3.7 Distribution of respondents by marital status

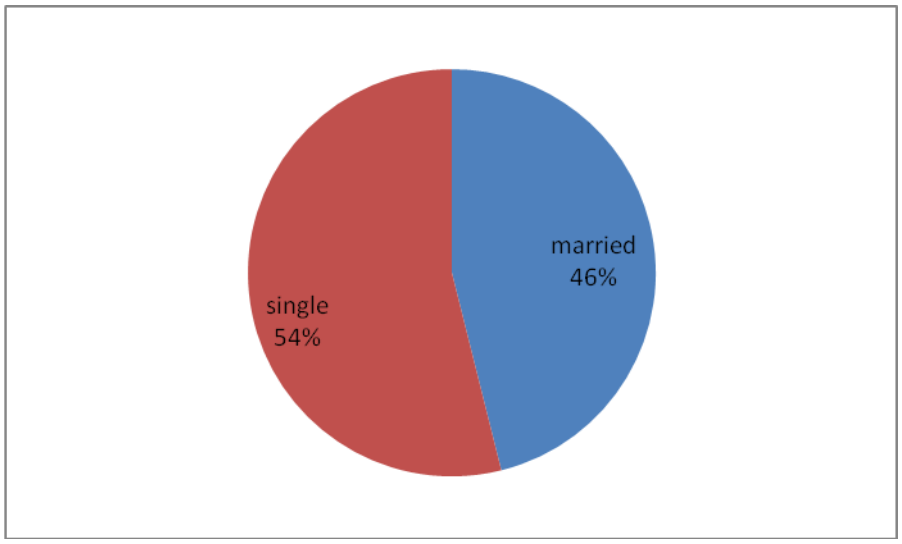

Figure 14: Marital Status

The above figure shows the percentage of respondents according to their marital status. The figure presents that 54% respondents are single who were more interested

about the topic of the research. The rest of the percentage is for married which is 46% percent.

4.4 Exploratory factor analysis

Exploratory factor analysis (EFA) can be interpreted as well-organized simplification of related tests and measures. It has been traditionally utilized as a mean to examine the likely underlying factor structure of a group of perceived variables without forcing presupposed structure on the outcomes. By executing exploratory factor analysis, the hidden factor structure will be recognized.

Factor analysis seeks to categorize the interrelated variables with each other and making more general variables. More precisely, factor analysis attempts to make the dimensionality of the earliest and original area less in order to provide an explanation to the new area [40]. It also tries to interpret the variance which exists in the noted variable with respect to hidden factors. Therefore, factor analysis provides us with not only the chance of acquiring explicit view of the data, but also the probability of utilizing the output in later analysis [34].

One of the statistics connected to factor analysis is Kaiser-Meyer-Olkin (KMO). It can be defined as an index which is used to capture the suitability of factor analysis. High values (between .5 and 1) imply that the factor analysis is proper. Values lower than 0.5 indicates that factor analysis may not be right and appropriate. Values between (0.5 and 0.6) are considered as miserable, between (0.6 and 0.7) as mediocre, between (0.7 and 0.8) as middling, between (0.8 and 0.9) as meritorious and more than point nine is called Marvellous, as shown in

Table 4: KMO

Result	KMO
Marvelous	> 0.90
Meritorious	> 0.80
Middling	> 0.70
Mediocre	> 0.60
Miserable	> 0.50
Unacceptable	< 0.50

ADAPTED FROM: [38] .

4.5 Quality differentiation KMO and Bartlett's test

The Kaiser-Meyer-Olkin (KMO) statistic is a measure and means of Sampling Adequacy, both for all-inclusive and each variable [38]. The overall KMO is shown in the "KMO and Bartlett's Test" table of factor analysis.

4.5.1 Energy efficiency

Based on the output that is obtained from SPSS, the KMO value of Energy Efficiency as shown in Table below is 0.737 which is in middling level. This value is greater than the acceptable level of 0.5. The High value of Energy Efficiency (between 0.5 and 1) implies that the factor analysis is proper. The Bartlett's test of Sphericity is also significant (Sig 0.00). Therefore, it can be concluded that the structure of the questions and the interrelationships are good enough to carry out future statistics analysis.

Table 5: KMO and Bartlett's test of energy efficiency

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.737
Bartlett's Test of Sphericity	Approx. Chi-Square	359.154
	Df	6
	Sig.	0.000

4.5.2 Environmental friendliness

Based on the output that is obtained from SPSS, the KMO value of Environmental Friendliness as shown in Table below is 0.731 which is in middling level. This value is greater than the acceptable level of 0.5. The High value of Environmental Friendliness (between 0.5 and 1) implies that the factor analysis is proper. The Bartlett's test of Sphericity is also significant (Sig 0.00). Therefore, it can be concluded that the structure of the questions and the interrelationships are good enough to carry out future statistics analysis.

Table 6: KMO and Bartlett's test of environmental friendliness

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.731
Bartlett's Test of Sphericity	Approx. Chi-Square	905.0854
	Df	10
	Sig.	0.000

4.5.3 Performance benefit

Based on the output that is obtained from SPSS, the KMO value of Performance Benefit as shown in Table below is 0.774 which is in middling level. This value is greater than the acceptable level of 0.5. The High value of Performance Benefit (between 0.5 and 1) implies that the factor analysis is proper. The Bartlett's test of Sphericity is also significant (Sig 0.00). Therefore, it can be concluded that the structure of the questions and the interrelationships are good enough to carry out future statistics analysis.

Table 7: KMO and Barlett's test of performance benefit

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.774
Bartlett's Test of Sphericity	Approx. Chi-Square	409.906
	Df	6
	Sig.	0.000

4.5.4 Reduction of energy dependence

Based on the output that is obtained from SPSS, the KMO value of Reduction of Energy Dependence as shown in Table below is 0.763 which is in middling level. This value is greater than the acceptable level of 0.5. The High value of Reduction of Energy Dependence (between 0.5 and 1) implies that the factor analysis is proper. The Bartlett's test of Sphericity is also significant (Sig 0.00). Therefore, it can be concluded that the

structure of the questions and the interrelationships are good enough to carry out future statistics analysis.

Table 8: KMO and Bartlett's test of reduction of energy dependence

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.763
Bartlett's Test of Sphericity	Approx. Chi-Square	440.135
	Df	6
	Sig.	0.000

4.5.5 Customer's decision making

Based on the output that is obtained from SPSS, the KMO value of Customers' Decision making as shown in Figure below is 0.737 which is in middling level. This value is greater than the acceptable level of 0.5. The High value of Customers' Decision making (between 0.5 and 1) implies that the factor analysis is proper. The Bartlett's test of Sphericity is also significant (Sig 0.00). Therefore, it can be concluded that the structure of the questions and the interrelationships are good enough to carry out future statistics analysis.

Table 9: KMO and Bartlett's test of customers' decision making

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.737
Bartlett's Test of Sphericity	Approx. Chi-Square	359.154
	Df	6
	Sig.	0.000

4.6 Reliability analysis

Reliability come upon the front line as variables arisen from the total scales are utilized as predictor element in objective model. As total scales are collection of interdependent items developed to evaluate the hidden construct, it is crucial to get an understanding toward the fact that whether the same series of items would generate the same answers if the same questions are presented in a different form and give again to the same respondent. Variables are proving to be reliable only by providing fixed response over repetition of the test.

Table 10: Internal Consistency

Cronbach's Alpha	Internal Consistency
α≥0.9	Excellent
0.9>α≥0.8	Good
0.8>α≥0.7	Acceptable
0.7>α≥0.6	Questionable
0.6>α≥0.5	Poor
0.5>α	Unacceptable

ADAPTED FROM: [35]

The output from SPSS, the above

Reports that the overall Cronbach's Alpha for all variables of this research including independent variables and depended one, is 0.715. Based on The Cronbach's Alpha of this study, is classified as good.

Table 11: The Overall Reliability

Cronbach's Alpha	N of Items
0.715	35

From the above table it is found that the Cronbach's values of all the variables including independent and dependent ones are more than 0.7 which implies that the data gathered through distribution of questionnaires are reliable.

4.7 Mean results of all variables

Table 12: Mean results for all Variables

Variables	**Mean**
EE	4.45
EF	4.47
PB	4.43
RED	4.62
CDM	4.74

4.8 Discussion of the above results

The above Table shows that the average mean score for Energy efficiency is 4.45 and the figure denotes that the respondents' Average value of Energy efficiency is HIGH towards the customers' decision making in buying Electric car in KSA.

The above Table shows that the average mean score for Environmental Friendliness is 4.47 and the figure denotes that the respondents' Average value of Environmental Friendliness is HIGH towards the customers' decision making in buying Electric car in KSA..

The above Table shows that the average mean score for Performance benefit is 4.43 and the figure denotes that the respondents' Average value of Performance Benefit is HIGH towards the customers' decision making in buying Electric car in KSA.

The above Table shows that the average mean score for Reduction of Energy Dependency is 4.62 and the figure denotes that the respondents' Average value of Reduction of Energy Dependency is HIGH towards the customers' decision making in buying Electric car in KSA.

The above Table shows that the average mean score for Customers' decision making is 4.74 and the figure denotes that the respondents' Average value of Customers' decision making is HIGH towards the customers' decision making in buying Electric car in KSA. Thus, it shows the importance of customers' decision making. The policy makers cannot ignore this element when they make strategy to make the contribution for customers' decision making factors in KSA.

4.9 Output from correlations

Pearson's Correlation Analysis Matrix for the Independent and Dependent Variables

Table 13: Correlation

Variables	EE	EF	PB	RED	CDM
EE	1.000				
EF	0.133**	1.000			
PB	0.145**	0.227**	1.000		
RED	0.539**	0.319**	0.336**	1.000	
CDM	0.430**	0.406**	0.259**	0.542**	1.000

**Correlation is significant at the 0.01 Level (2- tailed)

4.10 Multiple regression analysis

Customer' Decision making is used as dependent variables of the model and independent variables are namely Energy Efficient, Environmental Friendly, Performance benefit and reduction of Energy Dependence. The regression equation can be shown as below:

Consumers' Buying Decision $=\beta_0+\beta_1$(Energy Efficiency) + β_2 (Environmental Friendliness) + β_3 (Performance Benefit) +β_4 (Reduction of Energy Dependency) + ε **(1)**

From the below tables, it shows that the R Square value is 0.803 which means that 80.3% of the dissimilarity in customers' buying decision can be demonstrated by the difference in Energy Efficient, Environmental Friendly, Performance benefit and reduction of Energy Dependence.

Table 14: Model Summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	.896a	.803	.793	.122

a. Predictors: (Constant), Energy Efficient, Environmental Friendly, Performance benefit and reduction of Energy Dependence

b. Dependent Variable: Customers' Decision making

From the ANOVA (ANalysis Of VAriance) table, the p-value is .000, which is lesser than .05. It indicates that at least one of the four independent variables (predictor variables) can be used to model Customers' buying Decision.

Table 15: ANOVA

Model		Sum of Squares	Degree of Freedom	Mean Square	F	Significant
1	Regression	16.127	5	3.137	38-402	.000a
	Residual	3.121	444	.017		
	Total	19.248	449			

Model		Sum of Squares	Degree of Freedom	Mean Square	F	Significant
1	Regression	16.127	5	3.137	38-402	.000a
	Residual	3.121	444	.017		
	Total	19.248	449			

a. Predictors: (Constant), Energy Efficient, Environmental Friendly, Performance benefit and reduction of Energy Dependence

b. Dependent Variable: Customers' Decision making

Table 16: Test of Normality

	Kolmogorov-Smirnova (KS)			Shapiro-Wilk (SW)		
	Statistic	Degree of Freedom	Significance	Statistic	Degree Of Fredom	Significance
Standardized Residual	.152	450	.221	.982	450	.250

4.11 Discussion

The normal distribution is found in the above Table where the p-value for the Kolmogorov-Smirnov normality test is 0.221 and Shapiro-Wilk test is 0.250. It is found that both the values are more than 0.05 which determines that the residuals are distributed normally.

Table 17: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Significance
		B	Standard Error	Beta		
1	(Constant)	.116	.260		3.447	.016
	EE	.241	0.086	.190	2.810	.004
	EF	.329	.100	.325	.288	.037
	PB	.165	.101	.138	1.628	.003
	RED	.322	.105	.419	4.213	.041

a. Dependent Variable: Customer Satisfaction

Customers' buying decision = .116+ .241 (EE) + .329 (EF) + .165 (PB) + .322 (RED)

Interpretation of the from the significant point of View

- The p-value for Energy Efficient is 0.004 which is less than .05. So, it concludes that Energy Efficient is a vital factor towards the buying decision from the customers.
- The p-value for Environmental Friendliness is 0.037 which is less than .05. So, it concludes that Environmental Friendliness is a vital factor towards the buying decision from the customers.
- The p-value for Performance benefit is 0.041 which is less than .05. So, it concludes that Performance benefit is a vital factor towards the buying decision from the customers.
- The p-value for reduction of energy dependency is 0.034 which is less than .05. So, it concludes that reduction of energy dependency is a vital factor towards the buying decision from the customers.
-

CHAPTER 5
DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Overview

This chapter includes the conclusion of this research and discusses the findings based on the research objectives. The research consists of the four main components of Saudi Arabia's customers. The research was aimed at finding out the ways in which these four factors affect customers' buying decision for electric cars. There are four objectives in this research and the association of each factor along the lines of the objectives will be explained thoroughly. The objectives of the research are listed in the following:

To find out the relationship between Energy efficiency and customers' decision making in Saudi Arabia.

To analyze the relationship between Environmental Friendliness and customers' decision making in Saudi Arabia.

To determine the relationship between Performance Benefit and customers' decision making in Saudi Arabia.

To investigate the relationship between Reeducation of energy dependence and customers' decision making in Saudi Arabia.

5.2 Discussion based on research objectives

5.2.1 Research objective 1

To find out the relationship between Energy efficiency and customers' decision making in Saudi Arabia.

The findings show that the relationship is significantly positive with the p- value being lower than 0.05 (positive Pearson correlation) thus indicating a significant link between Energy efficiency and customers' decision making in Saudi Arabia. Therefore, research objective 1 has been reached.

5.2.2 Research objective 2

To analyse the relationship between Environmental Friendliness and customers' decision making in Saudi Arabia.

The findings show that the relationship is significantly positive with the p- value being lower than 0.05 (positive Pearson correlation) thus indicating a significant link

between Environmental Friendliness and customers' decision making in Saudi Arabia.. Therefore, research objective 2 has been reached.

5.2.3 Research Objective 3

To determine the relationship between Performance Benefit and customers' decision making in Saudi Arabia.

The findings show that the relationship is significantly positive with the p- value being lower than 0.05 (positive Pearson correlation) thus indicating a significant link between Performance Benefit and customers' decision making in Saudi Arabia. Therefore, research objective 3 has been reached.

5.2.4 Research objective 4

To investigate the relationship between reduction of energy dependence and customers' decision making in Saudi Arabia.

The findings show that the relationship is significantly positive with the p- value being lower than 0.05 (positive Pearson correlation) thus indicating a significant link between Reduction of energy dependence and customers' decision making in Saudi Arabia. Therefore, research objective 4 has been reached.

5.3 Summary of research objectives and achievements

As previously mentioned in the first chapter, the findings of the research are associated with the objectives. The results show that all of the objectives have been reached. This research considered customers' behavioural elements as customers of the car industry based on their feelings, choices, emotions, and interests with a link to their fundamental demands in KSA. The highest priority was given to the psychological aspect in order to assess the customers' buying phenomenon, which would demonstrate the efficacy of the buying environment in the long-run among the customers in the car industry. The mean analysis revealed that factors' levels which are to be high. Thus, this shows that the variables have a high effect on KSA electric car industry.

This research has shown that a key found to be relevant, that should maximize levels of the factors in the customers' buying decision. Analyzing the results shows the detailed concentration of the management to be increased in its efficiency, applying as using it in decision making. The general point about the variables after analyzing data collected, are important confederation due to minimize chances of negative feedback on their influence or their impact.

There is evidence that the analysis discussion shows all these variables have a strong impact on customers'' buying decision. The manner of to be influenced by these factors machined in this study for the industry staff's productivity, creativity attached by brain storming to be synthesized and approved to be significant in order to get a

successful attachment with the potential customers and post sell customers. The correlation of the frame work is been accepted by grater majority of customers' demand levels. Furthermore, successful results shown the reliability and sustainability test are both perceived. All of which, implicated a great effectiveness of all the significant variables of this research study to be the main concern for customers' satisfaction role in their purchasing decisions. And they are to be implemented, practised and studied continually for extended application at any main courses for customers' enrolment which is a significant point for maximizing their number in the electric car industry in KSA.

5.4 Limitation

Each research has a specific limitation. One of the mentionable limitations in every study is time. This study is cross sectional (i.e. measured at a single point time) not longitudinal where the concept of decision making of the customers in the Electric car industry for Saudi Arabians over a period of time is to be taken into consideration. In this research, not all the customers in the consumers market in Saudi Arabia have been chosen and the number of the respondents is 450. Therefore, it restricts the generalization. Another limitation that this study may endure is about the respondent's answers although they tried to answer correctly but maybe there are some errors in comprehending the question or they did not answer properly. Hence, these answers might not provide an appropriate and accurate representation. Finally, generalization of finding is based on the few major cities in KSA only.

5.5 Recommendations

5.5.1 To the managerial implications

The findings of this research will contribute to the knowledge that is already available in the literature regarding the subject of consumers' tastes and demands in their decision making criteria in Saudi Arabia. It provides information that might be helpful in gaining a better insight and understanding of the matter of judgemental quality to comprehend in the electric car industry in Saudi Arabia. Managers should make sure to perform the understandings of the factors of customers decision making aspects right at the first time around, set standards for reliability of these factors, emphasize the importance of the factors to comprehend thoroughly in any of their training programmes, and to suggest methods that will result in its improvement. Furthermore, since the customers wish to be met with frontline staff members who are responsive and pay attention to every customers'' demands individually, the process of selecting and hiring the right staff members has a significant importance for service organizations such as electric car industry. Moreover, as the frontline staff have more contact and communication with the customers compared to the managers, the frontline personnel are the ones who hear and receive the customers' praises and complaints. Therefore, the management team needs to listen to their staff members who have more contact with the customers and are better aware of their problems in order to understand those problems and find a solution for them as fast as they can.

5.5.2 To the policy makers

A rise in the production and registration of electric vehicles as seen in recent years and already reported in this paper indicates that the electric vehicles have started to be operating in the fast lane on the roads. Adoption of electric vehicle at mass scale requires deliberations and consideration of its impact on various aspects. There are a number of milestones that are needed to be achieved in the field of EV before completely overthrowing gasoline based vehicles. Few of such milestones have been described below (6) : -

- **Batteries need to get cheaper.**

The battery cost for EVs is similar to the price of regular vehicle and it ranges between $12,000- $15,000. The real chemical breakthroughs are needed to improve the energy density of the EVs. However it can just be a question of production scale and the cost of batteries can be successfully reduced and cut in half in coming years as more factories would start to manufacture them. It is expected that the price of vehicle batteries would decline in the similar manner as did the laptop batteries. If china would take serious measures in reducing emissions than the scale problem would be automatically solved (6).

- **Drivers need to believe they won't be stranded.**

Presently, the charging stations are only available at California, it clearly indicates that it is almost impossible to take a plug-in EV to a long drive. Considerable amount of dollars have already been dispensed by the Energy department for deploying charging stations. But still a huge amount of money is needed to meet the actual demand. According to an estimate provided by the Automotive research center the cost per hybrid vehicle for charging infrastructure is around $2160. Employers have started to extensively offer charging stations to staff and NRG is openly selling stations to whoever wants. However, it is important to realize that it is not like regular gas stations, where the seller of the fuel can make a living out of the charging station while selling fuel. Such charging stations would be required to be installed as the public utilities at residence, workplace and through the highways. Such a setup will be arranged by the government in order to not only bear the financial burden of such huge infrastructure around the country but also keep the prices of electricity as per the federal rates for electricity without charging any additional cost (6).

If it is safely assumed that millions of running gas powered vehicles have to be replaced by electric vehicles then this would lead to the situation where they will be using far more electricity than the capacity of grid production, this will shift the reliance to solar and wind energy (6).

- **Policy supports are need to expand**

In past few years the state and federal government have introduced supportive rules for the alternative sources of energy, these includes direct subsidies, tax incentives, renewable and fuel economy portfolio and high occupancy of vehicle lanes. In US, the most important issue is the rule followed in California, where gigantic auto manufacturers are either required to ensure zero emission vehicle production or they are can accept credits from others who do. These kinds of steps should be widely implemented at federal and state level to encourage the production (6).

Following chart shows the historic impact of PTC expiration on the annual wind installation in terms of MW of energy:

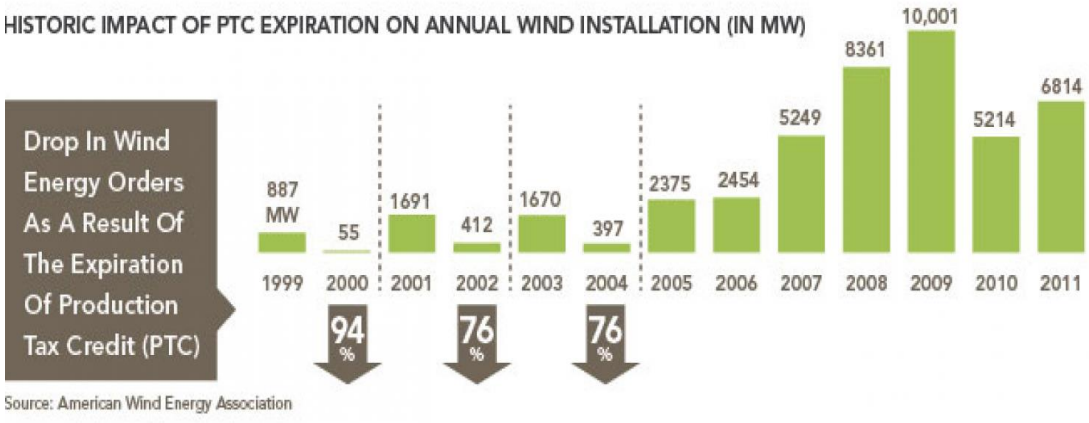

Figure 15: Historic Impact of PTC expiration on Annual Wind Installation [6]

- **Gas prices are needed to go higher**

Automobile manufacturer uses sticker price as the convincing feature for the customer as in EVs it pays off over the passage of time through considerable gasoline savings, this tradeoff looks more attractive as the prices of gases show hike up. However, near future seems steady for electric vehicles therefore the prices of batteries need to drop down as soon as possible (6). Following is the chart showing the prices of gasoline and crude oil in the United States that depict a steady increase over last 5 years. The recent drop of prices in the international markets are speculated to be of temporary nature which is expected to rise back to its original level in near future. If such a rise becomes a bouncing back of the prices resulting in another hike of oil prices, then

electric vehicles would become a more viable solution for almost all the users of vehicles around the globe. Such a situation is conditional to the installation of more renewable energy production plants.

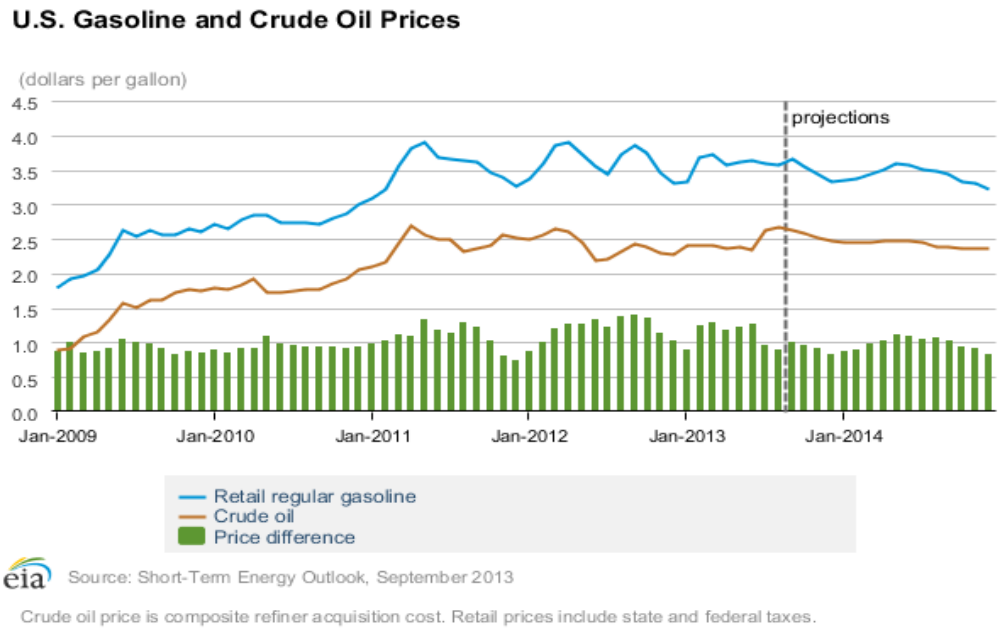

Figure 16: U.S. Gasoline and Crude Oil Prices [6]

- **More people are needed to try the electric vehicles**

The driving experience of electric and regular cars are to a great degree similar. Vehicle rental services such as Zipcar, they have recently started to include electric vehicle in their fleet. This is the most suitable way of introducing electric vehicles to people. The live experience of technology is very essential to get positive feedback from people. If people would have experienced and seen the latest technology only then they are likely to give significant consideration to it (6).

- **Customs' Rules for CKD and SKD**

The trickiest part in customs regarding EVs is the defining line between CKD and SKD. There were a number of cases in courts which can be considered while resolving the matter of defining a kit of EV as CKD or SKD. The very first issue in this regard can be considered about the issue of defining a CKD or SKD as the complete EV or not while importing the CKD or SKD kits. The issue becomes more important when there are few essential or non-essential parts missing in the kit that may or may not be needed

to assemble the complete vehicle. The second issue is regarding the exemptions or subsidies given by the government to the CKD or SKD items which needs to be given due consideration for the purpose of defining a CKD or SKD kit as a complete EV or not. Such problems not only arise in customs while importing or exporting CKD and SKD kits but the same set of problems are to be addressed in the central excise agencies.

A general principle is considered for applicability on the issue of drawing the line between SKD and CKD. The general principle that is applicable here is simply known as the General Rules for Interpretation of Schedule. In this case, the schedule aims at defining both the Central Excise as well as Customs schedules. The basic rule that is included in these general rules states that if a set of parts of an incomplete good is presented in front of customs and these parts together make up the essentials of a complete good then they are to be classified as complete good.

An examination of various issues pertaining to the judicial decisions is required to be undertaken as references in order to better understand the underlying legalities of the matter. Another relatively simple rule in the General Rules state that if all of the parts that are presented to customs are in the form of CKD and meet essential requirements of a complete good then they would be assessed as the complete good. Presenting the goods in CKD conditions, therefore, make the electric vehicle parts as complete electric vehicle for the purpose of taxation and other charges as levied by the customs of the exporting as well as importing countries.

Another major issue in importing and exporting of goods is the issue of considering an SKD as a complete article or otherwise by the customs if two SKDs from two different importers can make up one CKD or a complete electric vehicle. In such cases, the judgments of judicial cases reveal that the goods that have been imported by two distinct importers are not allowed to be clubbed together to form a complete article by the customs for the purpose of taxation etc. In case of electric vehicles, this means that if two different importers import two distinct set of parts of electric vehicles that are not SKD but when considered to be together then they form an SKD, then these two sets of part won't be considered as an SKD by the customs. This condition gives a relaxation to the importers regarding to worry about what other importers are importing.

Another relaxation that is given by the customs to the importers pertains to importing SKD in different consignments. If an importer imports two or more SKDs of an article in different consignments and these SKDs can form up a complete article even then the SKDs will not be considered as a complete article despite the importer is same for these SKDs. This rule brings an ease to the importers of electric cars who are allowed to import SKDs in different consignments according to their requirements without having to worry about what they are going to import or have imported in other consignments. In case of absence of some non-essential items in a CKD that is imported by an importer, the CKD will be considered as complete article for the purpose of taxation etc.

Another rule in the General Rules of Customs state that vehicles are to be considered as complete articles if the CKD that is imported does not contain seats. This rule clearly indicates that electric vehicles without seats are to be considered as complete articles without seats hence seats are non-essential parts of an electric vehicle in the view point of customs. Any other essential part missing in the imported set of parts will render it as incomplete article. A CKD pack that contains all essential parts of an electric vehicle that would result in an operational vehicle if joined together would be considered as a complete electric vehicle [18].

5.6 Recommendation for future research

This research study helps the policy makers realize which parts of their performance needs to be modified and improved in order for them to be able to satisfy the customers' demands and wishes more accurately and to a greater degree and create a more positive perception towards the Saudi Arabians customers service provision.

In order to achieve high quality in fulfilling their demand to help in decision making to purchase, there are four main criteria that need to be paid more attention to, and have to absolutely be attained. These aspects which are the prerequisites of quality improvement through knowing their decision making perceptions are:

- Focusing on the current market and their customers;
- Empowering the front line staff;
- Choosing the staff members from people who are well trained and are experts in their respective fields and are motivated to understand the customers' decision making attributes; and
- Having a clear vision about the quality of the service they want to provide by improving their ability to comprehend the decision making factors, the quality of the establishments, facilities and equipment's that have been provided for the customers, will be helpful in increasing the perceived variables for purchasing ingredients during their decision making and will therefore increase the quality of Electric car industry and the environmental friendliness in the country as well.

5.7 Conclusion

The change of technology to electric mobility is complex and multidimensional. There are many benefits of EVs as compared to vehicles having internal combustion type engines. A number of future electric vehicles have been designed and foreseen by engineers and scientists. There is an increase in Electric Vehicle registrations in most of the countries. The manufactures of electric vehicles have been successful in overcoming many issues of electric vehicles. Hydrogen and Solar vehicles are effective models of EVs in reducing pollution. The promise of affordable, clean and hydrogen powered vehicles is turning in to a reality due to the efforts of engineers and scientists in the field. There have been several innovations introduced in the field of EV that have highlighted the important of it over past few years.

A number of policies and rules for Electric Vehicles in CKD condition stipulate that in case of presenting all the part of an EV in CKD form that make up complete EV then they are to be considered for all purposes as the complete EV rather than separate parts. While importing separate parts of an EV from different sources, these parts are not allowed to be brought together for the purpose of making a complete CKD article of EV. Especially in the case where any essential element of the complete EV is missing from the parts imported then these imported parts would not be considered a complete article of EV. If a non-essential part of the EV is missing in the CKD imported then the CKD can be considered as a complete article of EV due to the fact that a complete EV can be made out of the imported CKD. The issue that may arise in this regard pertains to defining which parts are essential in a CKD and which part are non-essential. It can be decided by the manufacturers rather than importers in order to avoid any personal biasness. A simple definition can be that without an essential part, the EV is not considered to be operational if made into a complete article [18].

APPENDIX A Survey Questionnaire

Dear Honoured Citizens,

This survey is part of my MBA thesis and your participation is highly appreciated. The questions deal with your opinion of the electric cars' buying decision in KSA.

Thank you very much for your cooperation

Demographic Information

Please tick the response that suits you the most.

Respondents are requested in addition to ticking appropriately in the questions below, to provide ways to enhance or mitigate each of the factors in each question. This applies from question 2 up to question 10. Use of supplementary writing material is allowed.

Section A: Demographic Information

Instruction: The following are the characteristics of your demographic background.

Please tick (√) your answer in the corresponding boxes, unless specified otherwise.

1. Gender

Male ☐ Female ☐

2. Age

28-25 ☐ 26-33 ☐ 34-41 ☐ 42-49 ☐ 50 and above ☐

3. Marital Status

Single ☐ Married ☐ Divorced ☐

4. Education level

Undergraduate ☐ Diploma ☐ Master PhD ☐ O / A levels ☐

Others ☐ please state: _____

5. Income:

□ < SR 1000 □ SR 1000-RM2000
□ SR 2000- RM 3000 □ SR 3000-RM 4000
□ > SR 4000

6. Nationality

Saudi International

7. Job

Serivce

Business

Students

others

Energy Efficient

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

	1	**2**	**3**	**4**	**5**
EV gives more distance to run	**1**	**2**	**3**	**4**	**5**
EV gives less fuel consumption	**1**	**2**	**3**	**4**	**5**
EV saves a lot of cost on fuel	**1**	**2**	**3**	**4**	**5**
EV is the most cost effective	**1**	**2**	**3**	**4**	**5**
EV can boost up its longitivity by saving more energy	**1**	**2**	**3**	**4**	**5**

Environmental Friendliness

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

	1	2	3	4	5
EV doesn't pollute the air	1	2	3	4	5
EV doesn't contribute to the greenhouse gas effect	1	2	3	4	5
EV reduces significantly less CO2	1	2	3	4	5
EV helps to keep environment	1	2	3	4	5
EV products prove to be a green environmental element.	1	2	3	4	5

Performance Benefit

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

EV needs less maintenance cost	1	2	3	4	5
EV is user friendly the customers	1	2	3	4	5
EV lasts more than any other forms of vehicles	1	2	3	4	5
EV is compatible to run under any worst weather	1	2	3	4	5
EV can acquire trust from the customers for its trustworthy excellent services	1	2	3	4	5

Reduction of energy

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1	**2**	**3**	**4**	**5**

	1	**2**	**3**	**4**	**5**
EV gives better service quality by reducing the excess energy	**1**	**2**	**3**	**4**	**5**
EV can deduct much energy for its less emission of CO2	**1**	**2**	**3**	**4**	**5**
Better performance archives through through energy reduction	**1**	**2**	**3**	**4**	**5**
EV behaves same in hot and cold environment	**1**	**2**	**3**	**4**	**5**
EV contributes to the enrichment of the greenhouse gas effect	**1**	**2**	**3**	**4**	**5**

Customers' buying decision

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

I like Environmental friendly products as it attracts me to purchase.	**1**	**2**	**3**	**4**	**5**
I think the products offered by leading brands are always better.	**1**	**2**	**3**	**4**	**5**
I purchase products as advised by my family or friends	**1**	**2**	**3**	**4**	**5**
I select products according to my life style.	**1**	**2**	**3**	**4**	**5**
When I find the price is reasonable then only it gives me interest to purchase.	**1**	**2**	**3**	**4**	**5**

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