ELECTRIC VEHICLE INVESTMENTS FOR THE CHINESE MARKET

NITIPHA CHANGLUM

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……..…...……..…..
Miss Nitipha Changlum
Candidate

.....	.....
Asst. Prof. Pornkasem Kantamara, Ed.D. Advisor	Asst. Prof. Randall Shannon, Ph.D. Chairperson
.....	.....
Assoc. Prof. Annop Tanlamai, Ph.D. Dean College of Management Mahidol University	Asst. Prof. Astrid Kainzbauer, Ph.D. Committee member

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Nitipha Changlum

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NITIPHA CHANGLUM 5749168

M.M. (GENERAL MANAGEMENT)

THEMATIC PAPER ADVISORY COMMITTEE: ASST. PROF. PORNKASEM KANTAMARA, Ed.D., ASST. PROF. RANDALL SHANNON, Ph.D., ASST. PROF. ASTRID KAINZBAUER, Ph.D.

ABSTRACT

Global warming from high pollution level in many cities around the world is a big problem. China ranks in number one for the highest pollution level across the world. The Chinese government focuses on the electric vehicle industry to reduce this problem. This research project started from the interest of the investors to search for Electric Vehicle Industries in order to transfer the technology from Europe to invest in the in Chinese market. The research objectives are to understand the macro environment on the electric vehicle market in China by using the PESTEL Model, to suggest the possible strategies to the investors in order to transfer technology to Chinese market and to identify the potential targets or partnership candidates to support the strategies.

From the research finding, there is the business opportunity for the investor. The analysis of PESTEL in electric vehicle in Chinese market shows the government subsidy policy, the increasing demand from sale target, the consumer preference and behavior, the advancement in technology and charging infrastructure and the pollution level create the business opportunity.

The researcher suggests three possible strategies to transfer the technology to China through the electric vehicle manufacturer, the industrial lab for car design and the technology providers. Moreover, the researcher identifies the potential target for each strategy to be the business partnership in the future.

KEY WORDS: Electric Vehicle/ Chinese Market/ PESTEL Analysis

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CHAPTER I
INTRODUCTION

Nowadays many countries in the world are facing the same environmental problems. The global warming issue, especially in many cities, are facing big problems regarding the level of pollution. One of the main causes of high level of pollution is there are many private cars on the road; which produces Carbon dioxide. There are many possible ways to reduce the Carbon dioxide emission, and this may solve the environmental issue around the world. Both the environmental issue and the oil price is continuously increasing over the year. Consumers searching for new alternatives to satisfied their want, same with the producers that search for new alternatives to maximize profit.

The electric vehicle can solve the mentioned problems. The electric vehicle industry is an emerging industry worldwide. Electric vehicles (EVs) are of great value in three aspects: environment protection, grid construction, and economical efficiency improvement (Tan et al., 2014). Electric vehicles include battery electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), and fuel cell electric vehicles (FCEV). The electric vehicle industry has been around for many years, serving as an alternative for consumer in many cities. Many automobile manufacturers have launched the electric car model to attract the consumer.

1.1 Contextual Background

Blue Galaxy Consulting (BGC) is a consulting company located in Toulouse, France. The company provides its customers who are mainly the CEO or board members with key advices on business strategy; this is so they can reach sustainable growth in the long term. BGC activities encompass consulting on strategy, partnerships, M&A activities and fund raising. BGC has strong links with international investors in Asia and Middle-East.

The company is currently working for several customers that have strong international development needs in different sectors such as aerospace, fashion, education, and electronics. The consulting project will cover the business development in order to reach the Chinese and international market.

Today, there is a high interest from Chinese investors to acquire electric vehicle (EV) manufacturer from Europe. Chinese investors aim to manufacture cars in China through a technology transfer to address the Chinese market.

The researcher had the experience to work with Blue Galaxy Consulting Company for three months as a team to do the project which will be presented to investors who are interested in the electric vehicle industry and the possibility to transfer the technology to China.

1.2 Problem Statement

"How did the investors invest in electric vehicle industry in the Chinese market?"

As for the business opportunity in electric vehicle industry in China, there are many investors seeking to enter and invest in this business industry to get the profits. There is a high demand in electric vehicle industry as China is the country with the highest pollution in the world. Moreover, the government estimated the number of electric vehicle to be 5 million in 2020 and will launch the subsidy policy in many levels to support the electric vehicle industry and to decrease the emissions.

The Blue Galaxy Consulting Company and the researcher would like to take the advantage from this opportunity by purposing the various strategies and searching for the potential target for business partnership. The Chinese investors would like to acquire electric vehicle manufacturer from Europe with the aim of manufacturing cars in China through a technology transfer to address the Chinese market.

1.3 Research Objectives

The three objectives for this consulting company project are as follows;

1. To understand the rational of the investment interest in the electric vehicle market in China

2. To suggest the possible strategies to the investors in order to transfer technology to Chinese market

3. To identify the potential targets or partnership candidates to support the strategies

CHAPTER II
LITERATURE REVIEW

This chapter focuses on reviewing the existing literature on related topics which are the electric vehicle industry, the electric vehicle in Chinese market, and the relevant theories.

2.1 The Electric Vehicle Industry

As countries seek to address future energy requirements in a rapidly growing and changing world, achieving sustainable transportation has emerged as a vital mission. Electric vehicles (EVs), in particular, represent one of the most promising pathways to increased energy security and reduced emissions of greenhouse gases and other pollutants. The report of **Global EV Outlook-Understanding the Electric Vehicle Landscape to 2020 (2013)** is the main overview study of the electric vehicle around the world. In this report, there is the presentation of primary data collected from the Electric Vehicles Initiative (EVI) member governments. The Electric Vehicles Initiative (EVI) is a multi-government policy forum dedicated to accelerating the introduction and adoption of electric vehicles worldwide. The scope of the study is about the electric vehicle and related infrastructure deployment goals, policies, programs, and incentives, deployment progress, and investment in research, development, and demonstration (RD&D). All of which informs an analysis of global market trends and progress in electric vehicle deployment and the implications for technology and policy. Moreover, the report showed the identification of challenges to EV deployment as well as opportunities to address those challenges. In the last part of the report, it is an outline of areas of opportunity for governments and industry to accelerate adoption of electric vehicles.

Another study on the electric vehicle is **Evolution Electric Vehicles in Europe: gearing up for a new phase? (2014)**. This report is an initiative by the Amsterdam Roundtables Foundation and has been prepared in collaboration with McKinsey & Company. The report content draws upon McKinsey's insights in the electric vehicle sector and is enriched with interviews with representatives from public authorities, grid operators, smart grid solutions providers, charging technology companies, charging service providers, car manufacturers, and mobility service providers. This report intends to provide a fact-based perspective on the status and current developments of the e-mobility ecosystem in Europe and is structured into five chapters. "Chapter 1: Placing EV dynamics in industry context" will provide an overview of current EV adoption in Europe and the forces driving it, focusing on government, industry, and consumers. "Chapter 2: Cars, components, and cost" describes the current portfolio of automotive powertrains and how these might develop in the short and long run. The chapter elaborates on the technology development of battery packs and outlines drivers that will shape the future of the powertrain portfolio. "Chapter 3: Charging infrastructure" discusses the status of charging technology and the charging infrastructure roll out in Europe, describes charging behavior of the initial group of EV drivers, and highlights several public and private initiatives to drive further expansion of the charging infrastructure. "Chapter 4: Distribution and delivery" dives into the implications of a shift towards electric mobility for the power sector, outlining both challenges and opportunities for players involved. "Chapter 5: Innovative business models" details several of the more innovative approaches to mobility, which have the potential of disrupting traditional value chains and could enable further uptake of EVs.

The research project of **Creating the Clean Energy Economy: Analysis of the Electric Vehicle Industry (2013)** from International Economic Development Council is another interesting report. The research contents are introduction on the electric vehicle and the job creation potential by focusing on the United State electric vehicle market. Moreover, the research presented the solutions on the electric vehicle markets by reducing the cost of PEVs (plug-in electric vehicles), expanding charging infrastructure, Educating consumer perception and convention gas cars to be the lesson for electric vehicles. In a world where oil is a limited resource, an alternate source of transportation fuel – electricity – is not only a smart investment, but as some would

say, it is an inevitable one. Further, the switch to electric vehicles will generate demand for existing jobs and create new jobs as well. As study after study confirms, job growth in electric vehicle industries will outweigh any reduction of jobs in traditional fuel industries, resulting in net job growth. Electric vehicles create additional economic development opportunities by improving quality of life, reducing energy spending, and decreasing reliance on foreign oil.

There is the study on **Socio-Economic Aspects of Electric Vehicles: A Literature Review in *Evolutionary Paths Towards the Mobility Patterns of the Future*** (Hanke, Hülsmann and Fornahl, 2014). In this context the importance of electric mobility has especially grown in the public perception since the National Development Plan for Electric Mobility was published by the German federal government in 2009 and the eight model regions for electric mobility were established. The goal of the federal government is to bring a total of 1 million electric and hybrid vehicles on German roads by 2020 and establish Germany as lead market and lead provider of mobile electric mobility solutions. To achieve these objectives many questions on technical feasibility, ecological impacts or on the acceptance of the products by customers need to be answered for a successful market launch. Therefore this contribution gives an overview of important topics and issues related to the introduction of electric vehicles with a focus primarily on socio-economic topics.

The other study named ***"E-car industry analysis from the perspective of business model dynamics"*** (Debye, 2014). In this study, it used the PESTEL model framework with the additional factors demographics and regulations due to their importance for analysis the electric car industry. The emerging e-car industry faces several challenges like limited driving range and too high car prices. Firms operating in this industry need to create value and must find a solution to overcome these problems. Due to new technologies and an increasing need for sustainability more and more automobile manufacturers enter the e-car industry -not only established, conventional manufacturers, but also new entrants. In the paper resulting business model dynamics of the e-car industry are discussed and the business model of two exemplary e-car manufacturers are analyzed and compared. The purpose of this study is to gain an understanding of how new entrants of the e-car industry create value and compete with conventional automobile manufacturer. From the two cases BMWi and Streetscooter

Research GmbH it can be learnt that the e-car industry offers several possibilities for business models and that new entrants can, depending on their value proposition, find a niche in the heretofore not well developed industry. Like the case of Streetscooter shows, having a different mobility vision can be the starting point of success. Even if conventional automobile manufacturers like BMWi have a big advantage through established dealer networks, customers and brand image.

Table 2.1 Summary of Literature Reviews: The Electric Vehicle Industry

Topic	Relevant Findings and/or Methodology
Global EV Outlook-Understanding the Electric Vehicle Landscape to 2020 (2013)	- An analysis of global market trends and progress in electric vehicle deployment and the implications for technology and policy - The challenges and opportunity for the government policies and incentives
Evolution Electric Vehicles in Europe: gearing up for a new phase? (McKinsey ,2014)	- A fact-based perspective on the status and current developments of the e-mobility ecosystem in Europe : technology development of battery, charging technology and the charging infrastructure
Creating the Clean Energy Economy: Analysis of the Electric Vehicle Industry (IEDC, 2013)	- The solutions on the electric vehicle markets by reducing the cost of PEVs (plug-in electric vehicles), expanding charging infrastructure, Educating consumer perception - Electric vehicles create additional economic development opportunities by improving quality of life, reducing energy spending, and decreasing reliance on foreign oil.
Socio-Economic Aspects of Electric Vehicles: A Literature Review in *Evolutionary Paths Towards the Mobility Patterns of the Future* (Hanke, Hülsmann and Fornahl, 2014)	- Overview of important topics and issues related to the introduction of electric vehicles with a focus primarily on socio-economic topics - Technical feasibility, ecological impacts or on the acceptance of the products by customers need to be answered for a successful market launch
“E-car industry analysis from the perspective of business model dynamics” (Debye, 2014)	- Used the PESTEL model framework with the additional factors demographics and regulations for analysis the electric car industry

2.2 Electric Vehicle in Chinese Market

There are many studies and researches on the electric vehicle market in China. One of that is "**The Cultivation of Electric Vehicles Market in China: Dilemma and Solution**" (Tan et al., 2014). According to the Global warming has been increasingly concerning, and international society has been taking various measures to mitigate this issue. Many countries have stressed the status of electric vehicle promotion in future planning. As China is the world's largest carbon dioxide emitter, the Chinese government has taken various acts to reduce emissions, of which promoting electric vehicle is an effective one. The paper attempts to present a critical review of the current EV situations including the market sales, charging infrastructure, battery performances and policies in China. The survey of customer preferences and acceptance to electric vehicle indicate that purchasing behaviors are affected by four factors: charge inconvenience, short battery range, cost and psychological factors. According to the China's situation, recommendations including diversified energy supplement approaches, time-of-use charging price mechanism, vehicle-to-grid technology and enlarge price subsidy scope are proposed to accelerate the development of the electric vehicle industry.

According to the study of "**The impact of the government policy on the Chinese electric vehicle industry and business strategy management: Case of FAW**" (Li and Sun, 2011). The government policy is of great influence on the economy in the Chinese context. The Chinese electric vehicle company has to design the right business strategy to maintain and enhance its competitive advantages in order to respond to challenges. This study analyzes the five competitive forces of the Chinese electric vehicle industry and the effect of the government policies on the Chinese electric vehicle industry. The research uses Porter's Five Forces model and Porter's Generic Strategies theory to give the strategic guidance to the company. The term of the electric vehicle in this study referred to the electric drive vehicle used for transporting passengers, which is designed to typically have four wheels, and to have seating for one or more people. For the method, the authors use FAW Electric Vehicle Company as the case company in order to achieve the purpose of the research. The qualitative method is used in this study. The authors collect primary data through three interviews with the company managers. The research result showed that the government policies affect the profitability of the industry and the company through changing the five

competitive forces. FAW Electric Vehicle Company should maintain and enhance its relationship with the government. It should also maintain and enhance its competitive advantages through implementing cost leadership and differentiation strategies in different stages.

The **"China electric Vehicle Industry Report, 2014-2015**", the report provides the industry executives with strategically significant competitor information, analysis, insight and projection on the competitive pattern and key companies in the industry, crucial to the development and implementation of effective business, marketing and R&D programs. The report objectives are explained in the following; 1) To establish a comprehensive, factual, annually updated and cost-effective information base on market size, competition patterns, market segments, goals and strategies of the leading players in the market, reviews and forecasts. 2) To assist potential market entrants in evaluating prospective acquisition and joint venture candidates. 3) To complement the organizations' internal competitor information gathering efforts with strategic analysis, data interpretation and insight. 4) To suggest for concerned investors in line with the current development of this industry as well as the development tendency. 5) To help company to succeed in a competitive market. There is some explanation in terms of market segments from this report which clearly identify the trend and the competitors in the Chinese market. Almost 34,000 Chinese BEV passenger cars were sold in 2014, surging by 190% year on year; popular models were, in order, Chery QQ3EV, ZotyeE20, BAIC E150 EV, BYD E6, JAC iEV4, and Zotye Cloud 100 with their market share totaling as high as 85%. BEV as the ultimate goal of China's new energy vehicle development will still see new models launched by companies for participation in market competition. In 2014, China recorded PHEV passenger car sales of 17,500, 123 times that in 2013. In today's Chinese PHEV passenger car market, there are mainly BYD Qin and Roewe550 plug-in with the former holding a dominant position with sales of 14,747. In 2015, Chang'an Automobile, Dongfeng Motor, GAC, Volvo, etc. are planning to launch PHEV models, which will intensify market competition. At the same time, companies affected by the policy are expected to turn to the development of EREV (extended range electric vehicle) models.

Another recent paper is the paper from McKinsey & Company ***"Supercharging the Development of Electric Vehicles in China."*** (Gao et al., 2015). This paper looks

at the current EV ecosystem in China, and highlights potential lessons that can be drawn from successful experience in other countries. It then seeks to frame a set of questions and options to inform discussions about the policy framework required to enable the development of electric vehicles in China. This paper does not make or imply recommendations for action by government or industry players. The analyzing public policies in China and other countries can be summarized as follows: Giving consumers greater choice in EVs, both imported and locally-produced battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), can stimulate EV demand and foster competition. Policy support to new, non-traditional entrants could bring stronger competition on the supply side and spur incumbents to faster action. While one-off financial incentives to encourage EV purchases are important to stimulate early demand, recurring financial incentives such as free or discounted parking and highway tolls, and non-financial benefits such as sharing of dedicated bus lanes and dedicated parking, to name only a few, are just as important. Government has an important role to play in working with the automotive and utility industries and other infrastructure providers to define a consistent set of national standards for EV charging and infrastructure development, and to provide additional policy support for developers, landlords, tenants and consumers to jointly push for the faster rollout of charging facilities.

Table 2.2 Summary of Literature Reviews: The Electric Vehicle in Chinese Market

Topic	Relevant Findings and/or Methodology
The Cultivation of Electric Vehicles Market in China: Dilemma and Solution (Tan et al., 2014)	- The current EV situations including the market sales, charging infrastructure, battery performances and policies in China - Purchasing behaviors are affected by four factors: charge inconvenience, short battery range, cost and psychological factors
The impact of the government policy on the Chinese electric vehicle industry and business strategy management: Case of FAW (Li and Sun, 2011)	- The five competitive forces of the Chinese electric vehicle industry and the effect of the government policies on the Chinese electric vehicle industry

Table 2.2 Summary of Literature Reviews: The Electric Vehicle in Chinese Market (cont.)

Topic	Relevant Findings and/or Methodology
China electric Vehicle Industry Report, 2014-2015	- To assist potential market entrants in evaluating prospective acquisition and joint venture candidates - Clearly identify the trend and the competitors in the Chinese market.
Supercharging the Development of Electric Vehicles in China (Gao et al., 2015)	- The current EV ecosystem in China - Giving consumers greater choice in EVs, both imported and locally-produced battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), can stimulate EV demand - Government has an important role to play in working with the automotive and utility industries and other infrastructure providers

2.3 The Relevant Theory

For the relevant framework in this research, the researcher focused on the PESTEL analysis.

A PESTEL or PESTLE analysis is a framework or tool used by marketers to analyze and monitor the macro-environmental or external marketing environment factors that have an impact on an organization. The result of which is used to identify threats and weaknesses which is used in a SWOT analysis. PESTEL stands for: P – Political, E – Economic, S – Social, T – Technological, E – Environmental and L – Legal. (ACADEMY, 2016)

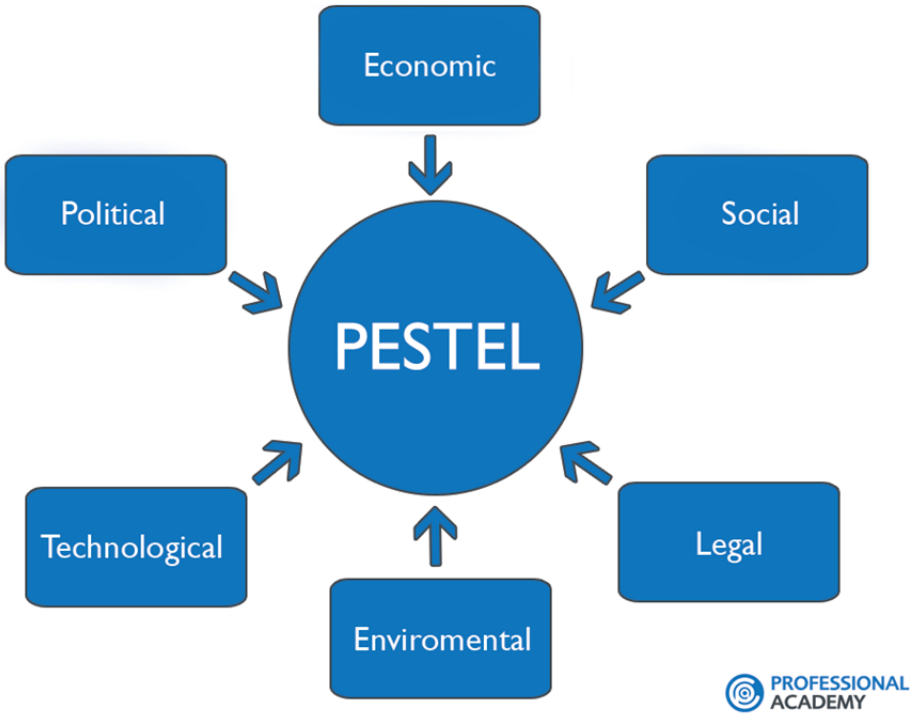


Figure 2.1 External Environmental Factors (PESTEL factors)
Source: ACADEMY (2016)

1. *Political Factors*: These are all about how and to what degree a government intervenes in the economy. This can include government policy, political stability or instability in overseas markets, foreign trade policy, tax policy, labour law, environmental law, trade restrictions and so on. It is clear that political factors often have an impact on organizations and how they do business. Organizations need to be able to respond to the current and anticipated future legislation, and adjust their marketing policy accordingly.

2. *Economic Factors*: Economic factors have a significant impact on how an organization does business and also how profitable they are. Factors include economic growth, interest rates, exchange rates, inflation, disposable income of consumers and businesses and so on. These factors can be further broken down into macro-economic and micro-economic factors. Macro-economic factors deal with the management of demand in any given economy. Governments use interest rate control, taxation policy and government expenditure as their main mechanisms they use for this. Micro-economic factors are all about the way people spend their incomes. This has a large impact on B2C organizations in particular.

3. *Social Factors*: Also known as socio-cultural factors are the areas that involve the shared belief and attitudes of the population. These factors include population growth, age distribution, health consciousness, and career attitudes and so on. These factors are of particular interest as they have a direct effect on how marketers understand customers and what drives them.

4. *Technological Factors*: According to the fast changing in technological landscape, this impacts the way of marketing in the products. Technological factors affect marketing and the management thereof in three distinct ways: new ways of producing goods and services, new ways of distributing goods and services and new ways of communicating with target markets.

5. *Environmental Factors*: These factors have only really come to the forefront in the last fifteen years or so. They have become important due to the increasing scarcity of raw materials, pollution targets, doing business as an ethical and sustainable company, carbon footprint targets set by governments (this is a good example were one factor could be classes as political and environmental at the same time). These are just some of the issues marketers are facing within this factor. More and more consumers are demanding that the products they buy are sourced ethically and if possible from a sustainable source.

6. *Legal Factors*: Legal factors include health and safety, equal opportunities, advertising standards, consumer rights and laws, product labeling and product safety. It is clear that companies need to know what is and what is not legal in order to trade successfully. If an organization trades globally this becomes a very tricky area to get right as each country has its own set of rules and regulations.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Conceptual Framework

This research is divided into three parts. The first part of the study is to analyze the external macro environment of the electric vehicle industry in China. The researcher uses the PESTEL model to point out which of the external factors have the influence on the business. The factor can either be positive stimulus or constraints. This step of the study can help the researcher clearly understand the business opportunities in the electric vehicle industry in China via each factor which are Political, Economic, Social, Technological, Environmental and Legal.

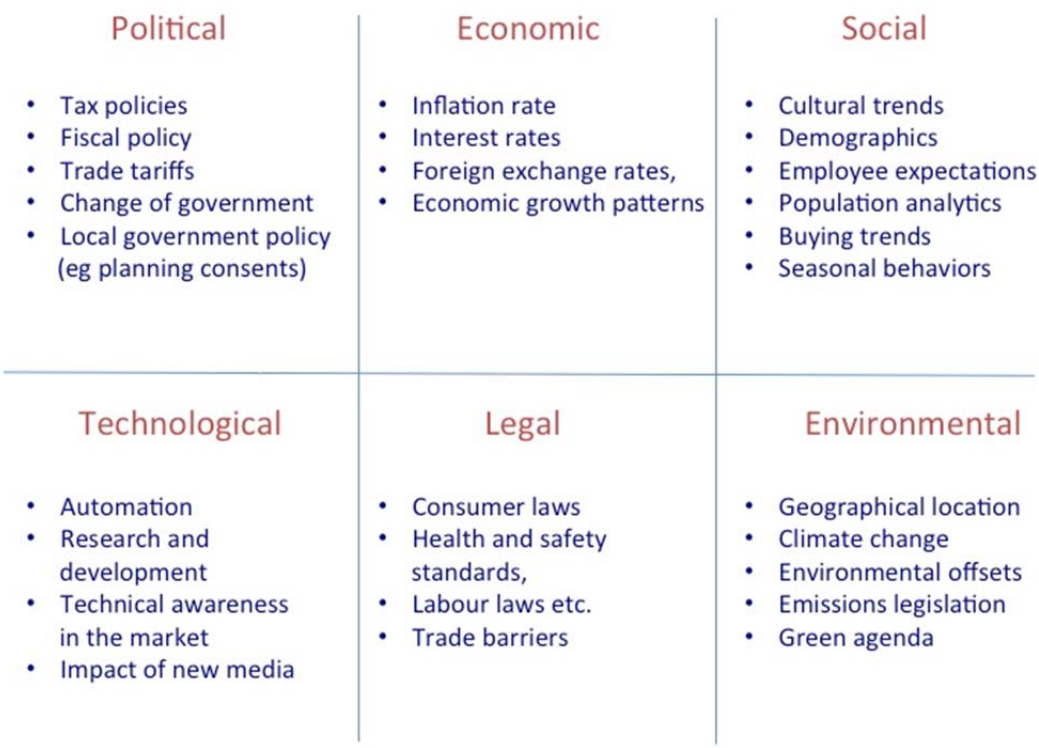


Figure 3.1 PESTEL Analysis Framework

Source: http://www.kevinappleby.com/wp-content/uploads/2014/07/Slide4.jpg

The second part is to suggest the possible strategies to the investors in order to transfer the technology to China. In this part, the researcher creates many alternative ways for the investors according to the business opportunities that have been found in the first part. The strategies are aims to help sustainable growth in the business industry which includes short and long term strategies.

The last part of the research is to identify the potential targets or the partnership candidates that are interested in the project. This part is the practical implementation of the real business case of this company project.

3.2 Research Method

In this research, the researcher used the secondary research by searching for information on the internet and some from the coordinator in the Chinese specific information. After the researcher has gathered all the information, the researcher used the secondary data to analyze the business opportunity in electric vehicle industry in China.

In the second part of the project, the researcher and the group worked with the BCG to suggest the possible strategies to the investors with the short term and long term strategies.

The last part of the study is finding potential targets and partnership candidates. There are many steps of working in this part to find the appropriate targets as showed in figure 3.2.

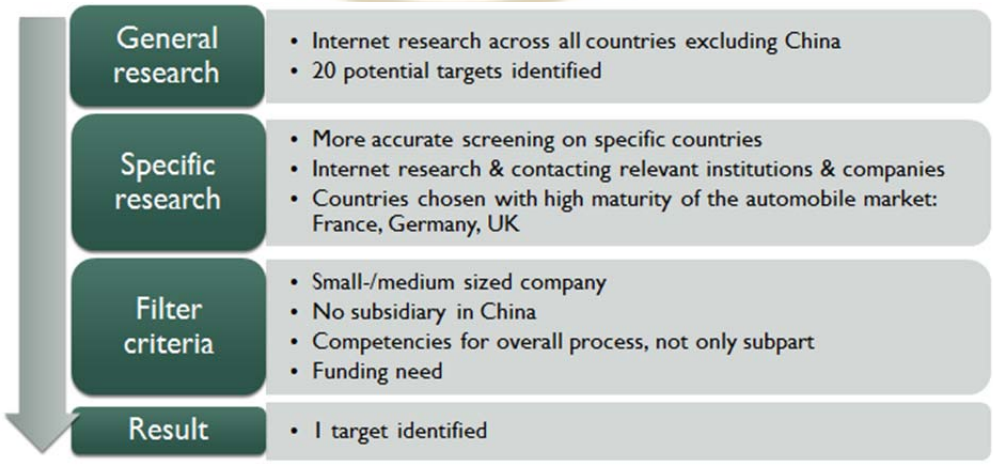


Figure 3.2 Research Method for Identification Potential Target

The researcher started with the general research from scanning and searching in the internet across all countries excluding China. After the general research, the researcher did the specific research by focusing on the specific countries which have matured in the automobile market; such countries include France, Germany and United Kingdom. To find the potential target, the researcher sets the filter criteria to delete some company from the lists. There three criteria are as follows; small-medium sized company, no subsidiary in China and funding needed. At the end of the identification potential target step, the researcher directly contacted to each company and explained the project to find the interested target.

CHAPTER IV
RESEARCH FINDINGS

4.1 Analysis of the Electric Vehicle in Chinese Market

The studies of the electric vehicle industry in the Chinese market according to the PESTEL Model are clearly expressed in details as follows.

4.1.1 Political

Political studies are related to government policies and tax policies. There are many studies which explain government policy. China promised to reduce its carbon intensity by 40%–45% by the year 2020, compared with 2005 levels. (Tan et al., 2014) Taking EVs great value into consideration, the Chinese government has put forth a series of policies and plans to initiate the EV industry. The government policy in China can explain the following.

1. *Tax Policies* (Tan *et al*., 2014) In light of Energy Saving and New Energy Automobile Industry Development Planning, producers of energy saving vehicle and its key parts can enjoy preferential policies via High and New Technology Enterprise Income Tax Preferential Qualification. The enterprises, which engage in technology development, services, and transfer consulting, can enjoy a business tax exemption policy.

2. *Price Subsidy Policies* (Tan *et al*., 2014) According to the regulation, the central government announced to provide lump-sum subsidy to electric vehicles via private purchase or use in pilot city. Additionally, it's settled to grant appropriate allowance for power battery production, battery charging station, and other infrastructure standardized construction. Finally, special funds will be arranged for directory review and inspection.

Subsidy standard is determined by the capacity of power battery molecule which means the electric vehicles that meet the qualifications would receive an allowance of 3,000 Yuan/kWh (482.01USD or354.449EUR). The highest subsidy for a plug-in hybrid passenger car is 50,000 Yuan (8033.613USD or 5907.477EUR) and 60,000 Yuan (9640.335USD or 7088.972EUR) for a battery electric passenger car. However, the financial aid will take on the decreasing mechanism, that is to say, after the sales of plug-in hybrid and battery electric passenger cars by each manufacturer separately target 50,000, the central government will lower the subsidy standard.

3. *National Level Subsidies*: The national level subsidy applies to all passenger cars that pass the qualification in China. The national subsidy for passenger car is based on range. In 2015, the national subsidies are 31.5K CNY for the range of 80 to 150KM, 45K CNY for the range of 150 to 250KM and 54K CNY for the range over 250KM. The number of subsidies changes every year. The amount of national subsidies in 2016 for passenger cars are based upon range as showed in the table below.

Table 4.1 The amount of national subsidies of passenger cars in 2016

Range R (km)		
100km < **R** < 150km	150km < **R** < 250km	**R** > 250km
25K RMB* ($3,860)	45K RMB ($6,948)	55K RMB ($8,491)

Source: Translated by Honglin Wu, and sourced from http://auto.sohu.com/20150430/n412208439.shtml

4. *Regional level Subsidies*: In the regional level, there is a local incentive such as free license plates for instance in Shanghai, the subsidy is around 74,000 Yuan ($11,959). Additionally, regional purchase subsidy for manufacturer in 40 cities also based upon range up to 25,000 Yuan. The subsidies will differ from each city; this is shown in table 4.2.

Table 4.2 Additional Regional Subsidies by City in 2015

Subsidies 2015 EV			
Rang R (KM)			
City	80 =< R < 150	150 =< R < 250	R >= 250
Beijing	31.5	45	54
Chongqing	31.5	45	54
Dalian	25.2	36	43.2
Guangzhou	35	50	60
Haikou	18.9	27	32.4
Qingdao	35	50	60
Shanghai	40	40	40
Shenzhen	35	50	60
Tianjin	31.5	45	54
Wuhan	31.5	45	54
Xi'an	31.5	45	54

Source: Translated by Honglin Wu, and sourced from http://www.autohome.com.cn/news/201502/862479.html

The requirements for the national and regional subsidies are: vehicles need to be locally-produced, warranty of 8 years or 120,000km for passenger cars, the speed must be equal or more than 100km/h for passenger cars, the minimum range is 100km and range is the decisive criteria for the amount of subsidy.

According to research, the government policy on the subsidy will take action five years from 2015 to 2020 and it will decrease over time. A subsidy in 2015 has been 20% less than 2013. Subsidies in 2017 and 2018 will be 20% less than 2016. Subsidies in 2019 and 2020 will be 40% less than in 2016

4.1.2 Economic

The current situation of electric vehicles in China in the economic perspective is increasing in , both for consumers and the government. In order to mitigate climate changes and reduce emissions, the Ministry of Finance and Ministry of Science and Technology jointly issued *the Notification of Energy-Saving and Electric vehicle*

Promotion in Pilot Demonstration Areas as the first specific policy to propose EV promotion in January 2009. From then on, Chinese government has committed to increase the proportion of EV in vehicle market. The target of government is to hold 500,000 BEVs and HEVs by 2015, and 5 million by 2020. (Tan et al., 2014)

According to a recent report from Pike Research (Electriccarsreport.com, 2012), a part of Navigant's Energy Practice, annual sales of PEVs will only reach 45,000 units by 2015, and there will be an increase of 152,000 vehicles in 2017.

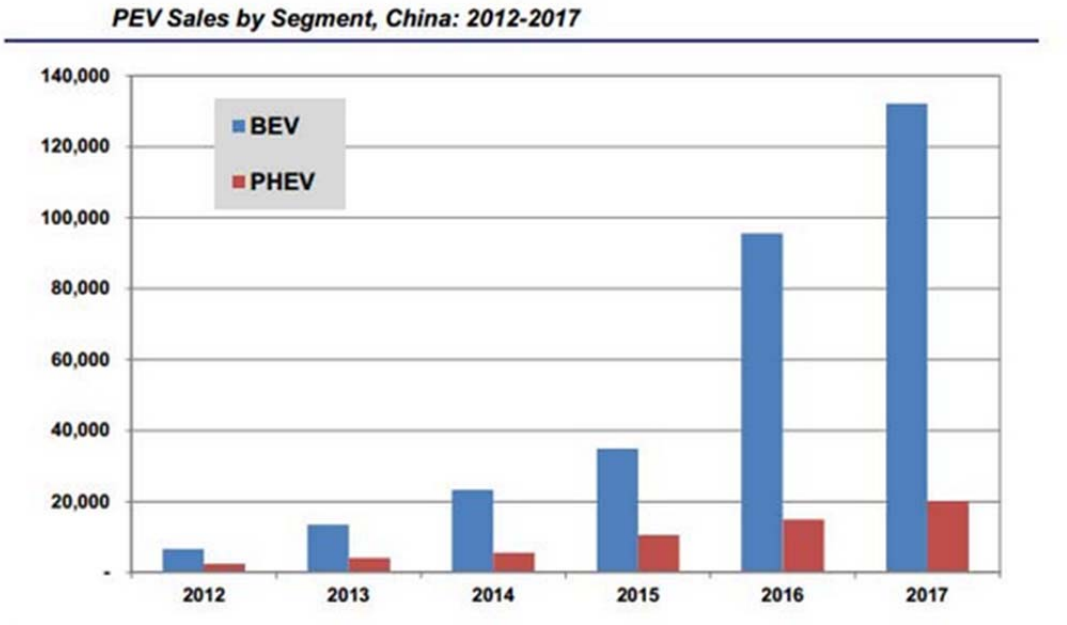


Figure 4.1 PEV Sales by Segment, China: 2012-2017
Source: Electriccarsreport.com (2012)

4.1.3 Social

In the social point of view, the researcher mainly discusses on the consumer concerns, preference and expectation in the Chinese market for electric vehicle. The target customer for the electric vehicle is the new generation of consumer who are concerned about the environmental problems, and would like to support the electric vehicle as a new trend. Nowadays, a car is not only a tool for transportation but a symbol of identity. The research study on the preference of generation Y (Deloitte, 2014) has shown that the top purchase criterion in choosing a car for the generation born in the 1990s are safety(54%), exterior design(47%), price(39%) and quality(38%).

For the consumer preferences, the mid-size sedan is the number one of the preferred of type of car for the Chinese consumer as shown in the following figure.

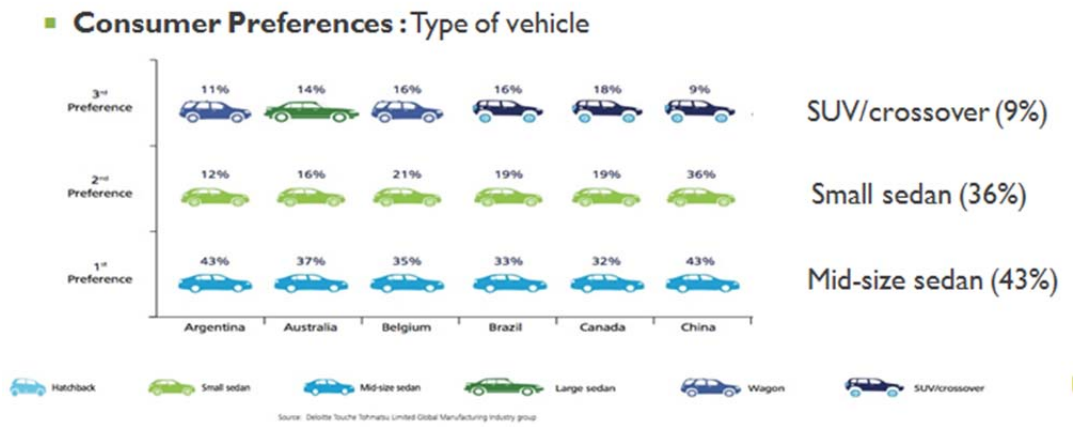
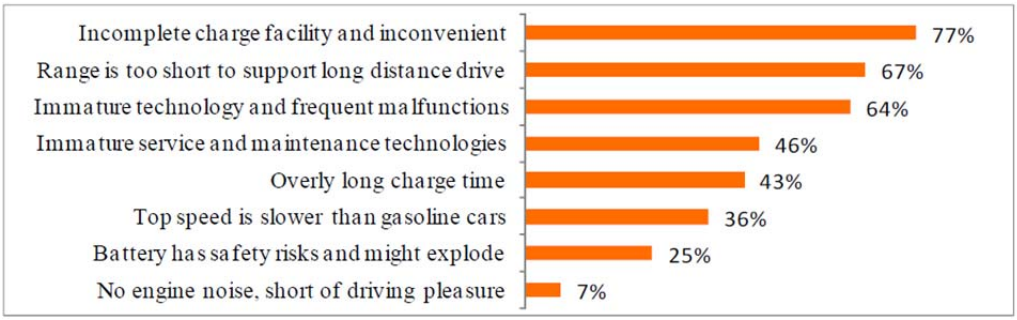


Figure 4.2 Customer Preferences on Type of Vehicle

Source: Deloitte Global Services (2011)

This research not only study about needs and wants of Chinese consumers, but also study about limitations and concerns of consumers to create a better understanding of consumer need and consumer behaviour for electric vehicle. The study of Chinese buyers' concerns about EV is demonstrated in figure below



Note: The reasons not to buy an EV is conducted among all respondents who refuse to consider EV in China.

Figure 4.3 Reasons not to buy an EV for Chinese customers

Source: Tan *et al*. (2014)

The most common customer concern about EV is the inconvenience of charging (77%), followed by battery range which is too short to support long distance drive. Another worry is immature technology and malfunction which can be regarded as safety and reliability. In other words, the consumer's concerns about EV are mainly about inconvenience of charging, short battery range, cost, safety, reliability, and psychological factors (added values like environmental friendly, symbol of status, taste, etc.).

4.1.4 Technological

For the technological issue, the researcher analyzed about the research and development in new technology. It is not only about the advancement in the battery technology, but also the investment on the charging infrastructure to enhance the electric vehicle market.

For the government construction policies in the future (Li and Sun, 2011) "*During the Twelfth Five-Year Plan, the number of the cities of the Electric Vehicles Demonstration Plan will increase to 25. By the year 2015, government will build around 2000 charging stations and 400,000 charge piles in these25 cities.*" said by Mr. Ouyang, the director of the national automotive safety and energy laboratory, Tsinghua University (Economic information daily, 2010).

According to the National Grid Company's plan, from the year 2011 to 2015, National Grid Company will invest 32,000,000,000 RMB to build 4000 charge stations. By the year 2020, the number of charge station will increase to 10,000 (Xing, 2010).

4.1.5 Environmental

For the environmental issue in China, the researcher focused on the high pollution level which is the biggest problem in the city. According to the high level pollution in China, it creates the opportunity for the Electric Vehicle Industry to grow in China. The data from *statista* is shown in Figure 4.4. The statistic reflects the largest producers of energy-related carbon dioxide emissions in 2015, based on their share of global energy-related CO_2 emissions. China was the biggest emitter of carbon dioxide; the country accounted for around 28.03 percent of global CO_2 emissions that year.

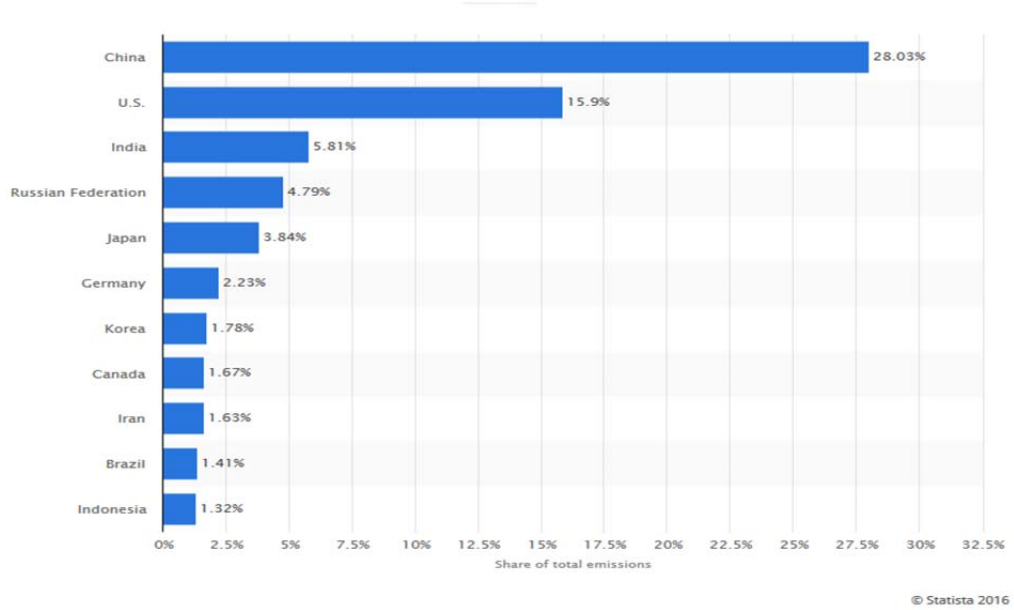


Figure 4.4 Global Energy-Related CO_2 Emissions

Source: Statista (2016)

Moreover, the trend of the CO_2 emissions in China from 2001 to 2011 is continuously increasing. This is shown in the following figure. This statistic shows the CO_2 emissions in China from 2001 to 2011. In 2008, around seven million kilotons of CO_2 had been emitted in China.

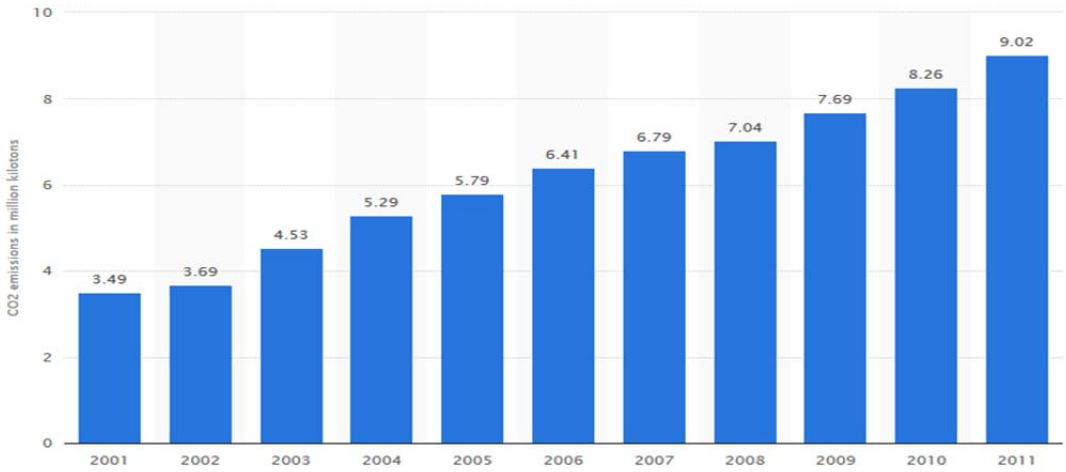


Figure 4.5 CO_2 Emissions in China (in Million Kilotons)

Source: Statista (2016)

4.1.6 Legal

The legal issue for the electric vehicle in China is controlled by the government policy. One important point is that the electric cars have to produce locally to get the benefit from the government subsidy. The legal issue is another issue that has an effect on the production and the investment in electric vehicle industry. The investors have to deeply understand and follow the rules and regulations in China before doing the business.

In conclusion, the analysis of the electric vehicle industry in China according to the PESTEL framework can show many competitive advantages to the investors to invest in the electric vehicle industry on the right time with the right strategies. As from the analysis on the environmental issue in China, there is the high pollution level especially in the city. Some emission comes from the usage of cars in the city. The government tried to introduce many policies to reduce these problems. The government subsidy on the electric vehicles that are produced in China is one of the main factors that create the business opportunity. This can lower the end price to increase consumer demand and lower the production cost to create the high return on investment.

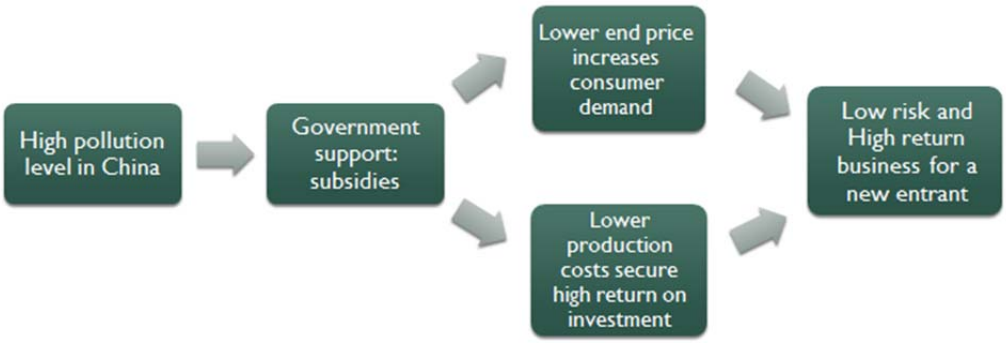


Figure 4.6 Executive Summary of EV Business Opportunity in China

To sum up the business opportunity of electric vehicle in Chinese market, the researcher concluded each factor of PESTEL analysis in the following table.

Table 4.3 Summary of PESTEL Analysis on the Electric Vehicle Market in China

P – Political	Government Subsidy Policy on the National and Regional level
E – Economic	High Demand from the consumer because of the lower end price and government support
S – Social	Consumer preference and trend on the EV
T – Technological	Support from government to invest in charging infrastructure and the research and development on new technology
E – Environmental	To reduce the high pollution level in China
L – Legal	The EV has to produce locally to get the subsidy

4.2 Possible Strategies for Investors

The researcher analyzed the advantage of the business opportunity in investing in the electric vehicle industry and propose the strategies under the condition of technology transfer (i.e. the car has to produce locally). The reasons why the investors would like to get the technology transfer from the western countries is that there are competitive advantages in Western countries. In Europe, there is high maturity of automobile market, high technological knowledge, and high quality and innovation products.

The BGC and the researcher proposed the possible strategies to the investors to compete in the electric vehicle market to capture economic value through the short term and long term strategies. In the short term, which is one to three years in this study, the researcher propose to the investors to look into the company that can produce the electric vehicle within three years in order to take the advantage from the government subsidy policies. In this meaning, the researcher propose the electric vehicle manufacturers and the industrial lab for a car design that still exists to transfer their technology to the Chinese market. For the long term strategies for this study, the researcher purposed the alternative strategy to profit from offering the innovative product by technology provider like the battery company. This strategy can make the sustainable development for the business in the long run because of the advancement in the technology. All the three

possible strategies which are: 1) the proposing of the electric vehicle manufacturers, 2) the industrial lab for car design and 3) the technology provider had the same concept. All of them have to have the knowledge of design, prototype or industrialize the electric vehicle. Then, they have to do the technology transfer to China according to the condition that the cars have to be manufactured in China. The researcher cannot clearly identify which strategy is the best strategy, it depends on the investors how they would like to enter in this industry or in the Chinese market, how much money they have and how fast they are.

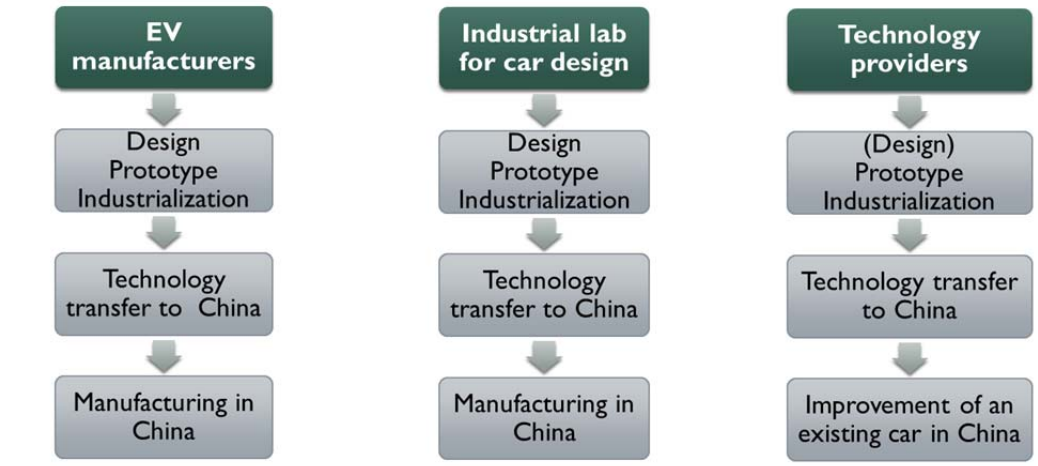


Figure 4.7 Three Possible Strategies for Investors

4.3 Identification of Potential Targets

4.3.1 Electric Vehicle Manufacturers

The following table shows the list of research finding of the electric vehicle manufacturers across the world such as North America and Europe. The table exhibits the country of the company, the car brand, the image, type of vehicle that present the category, range and price. The last column of the table shows the result of the analysis according to the specific criteria in this research.

Table 4.4 List of Electric Vehicle Manufacturers

Country/ Zone	Car Brand/ Name	Image	Type of vehicle	Result
NORTH AMERICA (USA except when it is specified)	American Electric Vehicles KURRENT		L6 Fuel type: All-electric Price: $10K (very cheap) Range / top speed: 40miles / 25mph (40km/h) Release date: Available now	Not Match
	COMMUTER CARS - TANGO T600		M1 Fuel type: All-electric Price: $108K Range / top speed: 80miles / 150mph (241km/h) Release date: Available now	Not Match
.	Dynasty Electric Car Corp. - IT SEDAN (Canada)		L6 Fuel type: All-electric Price: $19,000 Range / top speed: 30miles / 24mph (40km/h) Release date: Available now	Not Match
NORTH AMERICA (USA except when it is specified)	Myers Motors - NmG (No more Gas)		L7 Fuel type: All-electric Price: $35K Range / top speed: 30 miles / 75mph (120km/h) Available now	Not Match

Table 4.4 List of Electric Vehicle Manufacturers (cont.)

Country/ Zone	Car Brand/ Name	Image	Type of vehicle	Result
	Universal Electric Vehicles - SPYDER		M1 Fuel type: All-electric Price: $70K Range / top speed: 150 miles Release date: 2008	Contacted
EUROPE	ElBil Norge - Kewet Buddy (Norway)		L7 Fuel type: All-electric Price: $28K Range / top speed: /56mph (90km/h) Available now	Not Match
EUROPE	Venturi - Fetish (Monaco)		M1 Fuel type: All-electric Price: €297K (about $435K dollars) Range / top speed: 155 miles / 100mph (160km/h)	Not Match
	Lightning Car Company - Lightning GT (UK)		M1 Fuel type: All-electric Price: £150K ($293K in USD) Range / top speed: 250 miles / TBA (but fast) Release date : 2008	Contacted
	Think – City (Norway)		L7 Fuel type: All-electric Price: $34K in Norway,$15K – $17K in US Range / top speed: 112miles Release date: 2008 Europe, 2009 in the US	Not Match

Table 4.4 List of Electric Vehicle Manufacturers (cont.)

Country/ Zone	Car Brand/ Name	Image	Type of vehicle	Result
EUROPE	Twike - The Twike (Switzerland)		L7 Fuel type: All-electric Price: $27,500 Range / top speed: 80 miles Release date: Available now	Not Match
INDIA	Reva — G-Wiz		L6 Fuel type: All-electric Price: £8K Range / top speed: 70miles Available now	Contacted
SOUTH AMERICA (BRAZIL)	Obvio - 828e		M1 Fuel type: All-electric Price: $49k Range / top speed: 240 miles / 120 mph(190km/h) Release date: Late 2008	Contacted

The researcher has scanned a lot of car manufacturers from all the continents and contacted the potential candidate. Some companies were deleted from the lists because they are not matching the criteria such as the range of the car, the type of fuel and the price. Moreover, some companies that the researcher contacted are not interested to be acquired by the investors or be the partnership in this project. Some companies were known by the CEO of Blue Galaxy Consulting Company and he has his own preference in the process of selecting the targeting candidate because he knows some insight in the electric vehicle business players.

OBVIO is the result of the finding that the researcher thinks that it is the potential target. It is the electric car manufacturer from Brazil and seems interesting in

the project. Now the BGC is in the negotiation step with them to find the possible business opportunity to invest in the electric vehicle to the Chinese market.

4.3.2 Industrial Lab for Car Design

The following table shows the list of the finding of industrial lab for car design across the world, except China. The table exhibits the name of the company, the location, the condition and range of service, and the size of the company from the number of employees and annual revenue (if available). The last column of the table shows the result of the analysis according to the specific criteria in this research.

Table 4.5 List of the Industrial Lab for Car Design

Company	Location	Conditions	Size*	Result
Design Systems, Inc.	US, Canada, Mexico	Process engineering solutions, offering complete "Concept to Commission" services	200 employees	Not Match
2AM Group, LLC	USA	Technical service provider offering strategic & detailed planning, process implementation	94 employees	Not Match
Acutech Industries, Inc.	USA	Mechanical design & engineering consulting corporation	52 employees $5.5 million in annual revenue	Not Match
Auto/Con Services, LLC	North America, India	Expertise in designing effective manufacturing processes, automation systems & solutions	70 employees	Not Match
Hybrid Design Services, Inc	USA	Services in all aspects of vehicle design, simulation, development, prototyping & high-volume manufacturing	Employees estimate: 20 – 49 Revenue estimate: $1-$2.5 mil.	Not Match
Novall	France	Mechanical Engineering company specialized in industrial design, new product development, project management and industrialization	1-10 Employees	Not Match
FASTER	France	Designed, prepared & developed cars	-	Not Match

Table 4.5 List of the Industrial Lab for Car Design (cont.)

Company	Location	Conditions	Size*	Result
MK Automotive	France	Machining & Assembling of automotive parts and systems (Autowqmotive: high-end serial automotive, motor sports, trucks, industrial vehicles)	350 employees	Not Match
Protostyle	France	Realization & prototype design for automotive → concept cars, might be not really industrial cars	50 employees	Contacted
Beta Epsilon	France	Small and big series engineering, project from scratch to homologation		Contacted
EV Engineering	Australia	Partner of Premcar: Provide global automotive engineering services → Might not exist anymore	-	Contacted
Constin GmbH	Germany	Design, Engineering, Prototyping, Production → Might not have the competencies needed for a whole car	Small/mid-sized	Contacted
Gordon Murray Design	UK	- one of the 'finest automotive design teams in the World' - concept, design, prototype and development through to production	-	Contacted

The researcher has scanned a lot of industrial lab for car design from all the continents and contacted the potential candidate as the same process of selecting the electric vehicle manufacturer. There are many interesting potential target, but the research is in the process. Some companies were deleted out from the lists because they do not match the criteria, such as, the company size is too small and not well organized to produce the model car. Moreover, some companies that the researcher has contacted are not interested in being the partnership in this project. Also, the personal preference from the CEO of Blue Galaxy Consulting Company is another criterion in eliminating some companies from the lists; this is based on his experiences in this industry.

The Beta Epsilon is one of the potential candidates; it is located in France. It has multidisciplinary engineering skills and R&D in the mechanical field, and controls the entire process of design, development and prototyping of a vehicle (Beta Epsilon, 2016). Beta Epsilon supports the industrial lab for car design by the French manufacturer BEE. BEE Automotive, small series tourism automobiles, homologated road M1.

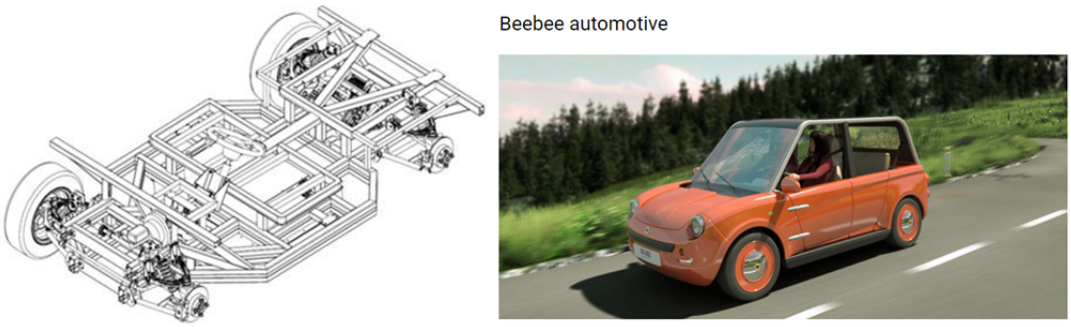


Figure 4.8 Beebee model by Beta Epsilon

Source: Beta Epsilon (2016)

4.3.3 Technology Provider

The subsidies are here for 5 more years in China, and the EV market will be consolidated after that period. The investor need to unlock innovation and create a competitive advantage to make the profit of the electric vehicle industry.

Main factors	Impact
Battery	Current 2 major battery technologies used in Ev : nickel metal hydride (NiMH) and lithium ion (Li-ion)
Battery Management system	Creating new opportunities for innovation in vehicle design
Technological ecosystem	Li-Ion battery are arriving at the end of their innovation cycle

Figure 4.9 Executive Summary for the Battery Technology

Investors will create new competitive advantages by finding: the new battery technologies like more capacity, density, power, charging time and life-span. The innovative approaches to EV are about new charging technologies and new energetic sources. The table below shows the list of technology provider that are interesting.

Table 4.6 List of Technology Provider

Technology Provider	Description	Competitive Advantage
Li-S batteries 	• Theoretical energy density 5 times greater than Li-ion, the patented by Oxis Li-S technology is lighter, safer and maintenance free, and ready to meet the demands of tomorrow • Li-s cells can withstand short-circuit without catching fire • Overcharge: when charged for 24 hours at a C/10 rate (0.16 A), no explosion or fire were observed and the cell reached a maximum temperature of 53^0C	5 times more energy, larger range and improved safety
EV Flash batteries 	• The electric vehicle will have a pack comprising of hundreds of EV FlashBattery cells that can store enough energy for a 300 mile (480 km) range on a 5 minute charge. This translates to 60 miles of travel on a 1-minute charge • StoreDot has succeeded in isolating and maximizing the charge transfer rate, and has enhanced it to heighten the superior characteristics of FlashBattery • Company contacted via email	Critically improve charging time 1 minute charge equal 60 miles
Qualcomm's Halo 	• Any parking spot fitted with Qualcomm Halo technology is a place to recharge your electric car. It's a simple, elegant way to power up, cable-free • Similar to the technology used to charge electric toothbrushes, just with more power and a more complex design	Life changing convenience, charging with no plugs and almost everywhere

Table 4.6 List of Technology Provider (cont.)

Technology Provider	Description	Competitive Advantage
NanoFlowcell	• To-date, many have tried and failed to find a simple, safe and sustainable solution for storing electricity. The flow cell is probably the first technology to enable the storage of large quantities of energy without suffering from decomposition or attrition • NanoFlowcell achieves five times more energy density than conventional flow cell technology, making it suitable for high-performance applications • Company contacted via email	5 times more energy density, longer ranges and inexpensive ionic liquid

From the list of the technology provider, the researcher would recommend the Li-S batteries from **OXISenergy**. Theoretical energy's density 5 times greater than Li-ion, the patented by Oxis Li-S technology is lighter, safer and maintenance free, and ready to meet the demands of tomorrow. Li-s cells can withstand short-circuit without catching fire.For overcharge, when charged for 24 hours at a C/10 rate (0.16 A), no explosion or fire were observed and the cell reached a maximum temperature of 53^0C. For the competitive advantages, there are 5 times more energy, larger range and improved safety.

CHAPTER V
CONCLUSION & LIMITATIONS

5.1 Conclusion

In conclusion, this research project happened from the interest of the investors to search for the technology transfer from Europe to invest in the Electric Vehicle Industry in Chinese market. The researcher got an opportunity to work with Blue Galaxy Consulting Company in Toulouse, France for three months. The project is conducted by the team of the researcher under the cooperation with the company. The three research objectives are to understand the macro environment on the electric vehicle market in China by using the PESTEL framework, to suggest the possible strategies to the investors in order to transfer technology to the Chinese market and to identify the potential targets or partnership candidates to support the strategies.

From the research findings, there is the business opportunity for the investor. The analysis of PESTEL in electric vehicle in Chinese market showed that the government subsidy policy, the increasing demand from sale target, the consumer preference and behavior, the advancement in technology and charging infrastructure and the pollution level create the business opportunity.

The researcher suggests three possible strategies to transfer the technology to China: 1) through the electric vehicle manufacturer, 2) through the industrial lab for car design and 3) through the technology providers. Moreover, the researcher identifies the potential target for each strategy to be the business partnership in the future.

5.2 Limitations

1. Most of the research finding is a secondary data that the researcher search from the internet

2. The limitation of time, the researcher has only three months to work with the Blue Galaxy Consulting with this project

3. The researcher and the team are not specialists in the electric vehicle industry or Chinese market

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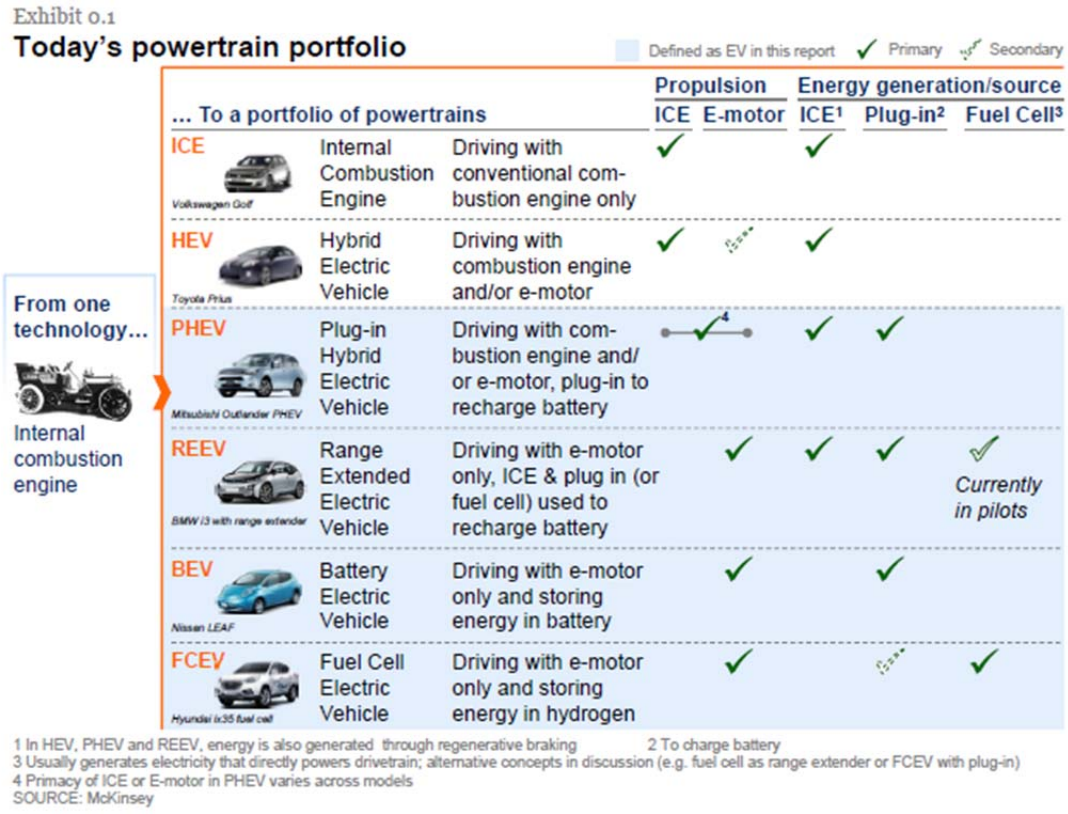
APPENDICES

Appendix A: ELECTRIC VEHICLE DEFINITIONS

ELECTRIC VEHICLE DEFINITIONS

(Evolution Electric Vehicles in Europe: gearing up for a new phase?, 2014)

Electric mobility relates to electrification of the automotive powertrain, and in this report, we will refer to EVs (electric vehicles) as all vehicles for which an electric motor is the primary source of propulsion. This includes plug-in hybrid electric vehicles (PHEVs), range-extended electric vehicles (REEVs), battery electric vehicles (BEVs) and fuel cell electric vehicles (FCEVs), but excludes (conventional) hybrid electric vehicles (HEVs).We will explicitly mention when hybrids are included in the definition.



The ICE powertrain is dominant today and will be the primary source of propulsion in the near future. In the longerterm, several technologies will comprise the powertrain portfolio – including EVs. The speed of EV adoption will – outside of

regulation and government subsidies – largely depend on TCO developments, where the battery pack price is a critical component.

The current automotive landscape is comprised of six powertrains – of which three have ICE as the primary source of propulsion (ICEs, HEVs, and PHEVs1) and three have an electric motor as the primary mover (REEVs, BEVs and FCEVs) (Exhibit 2.1, 2.2).

Exhibit 2.1

Different powertrain technologies in detail

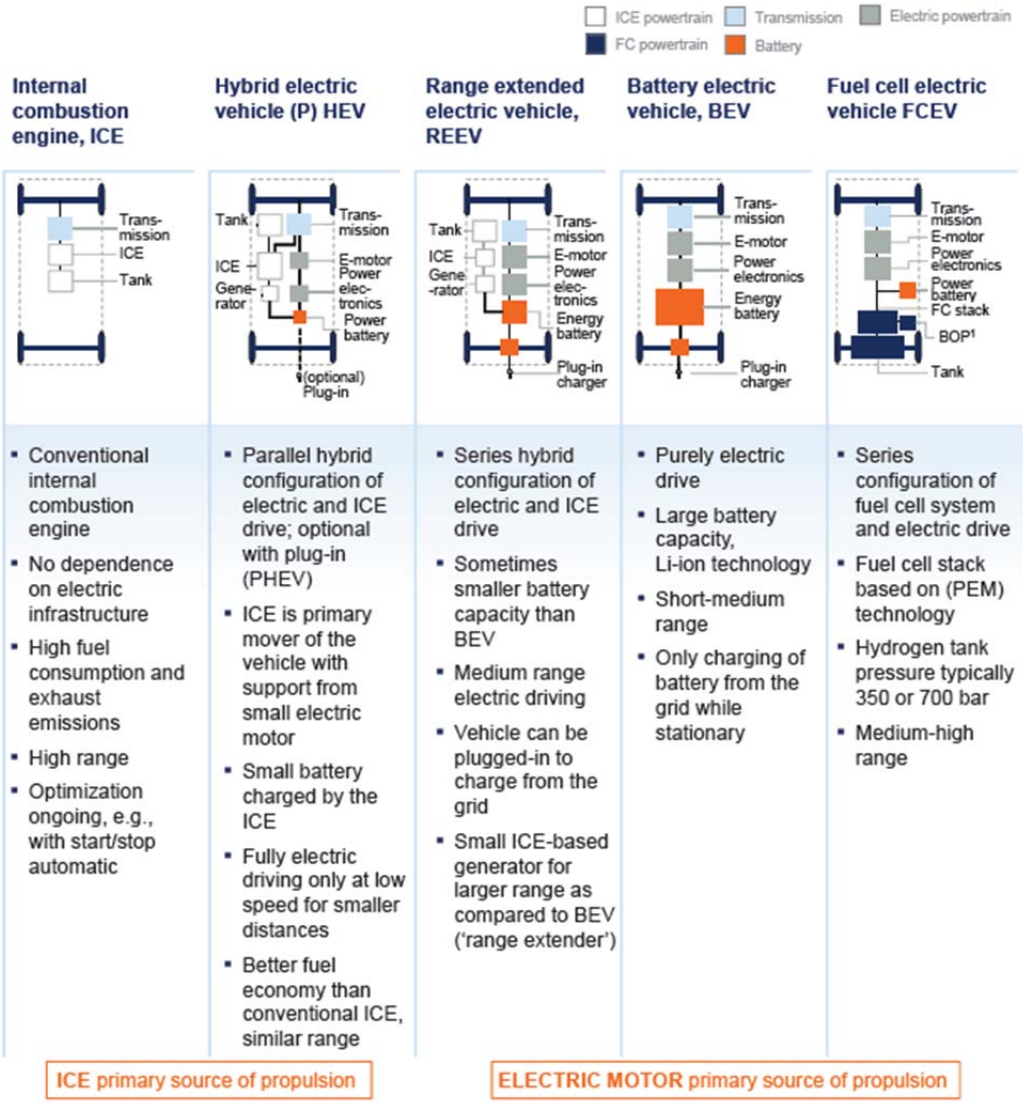


Exhibit 2.2

EV powertrains: Key benefits and hurdles

INDICATIVE[1]

	PHEV	REEV	BEV	FCEV
Environment	• Emission reduction because of battery and e-motor, but ICE still primary source of propulsion	• Substantial emission reduction compared to ICE – emission only when range extender is used	• Zero emission cars[2], far more efficient well-to-wheel than ICE	• Zero emission cars[2], far more efficient well-to-wheel than ICE
Benefits	• Use of existing fuel infrastructure • Similar range as ICE	• Extender provides higher range than BEV • Real electric car, less range anxiety	• Pure electric, zero emission car • Charging possible at home / office etc.; infrastructure growing	• Range is high • Refueling takes only a few minutes
Hurdles	• Low range on just e-motor • ICE is still the primary source of propulsion - substantial emissions on longer trips	• Additional complexity and cost compared to a BEV • Extender offers limited additional range	• Refueling takes long, even with fast charge at least 20-30 minutes • Relatively low current range • Infrastructure required, availability limited but growing	• Energy-intensive to produce hydrogen • Hydrogen infrastructure required – currently very limited

1 Indicative comparison of typical models of xEV powertrains - differences exist by car model and by country. Conclusions also depend on (and might change as a result of) multiple assumptions (for example regarding power mix)
2 Excluding electricity generation for charging the vehicle

Different electric powertrains require specific types of charging or refueling infrastructure (Exhibit 3.1). In fact, from all powertrains under consideration, only (full) BEVs2 and FCEVs are totally reliant on the new infrastructure to be deployed. BEVs will be the focus of this chapter.

Exhibit 3.1

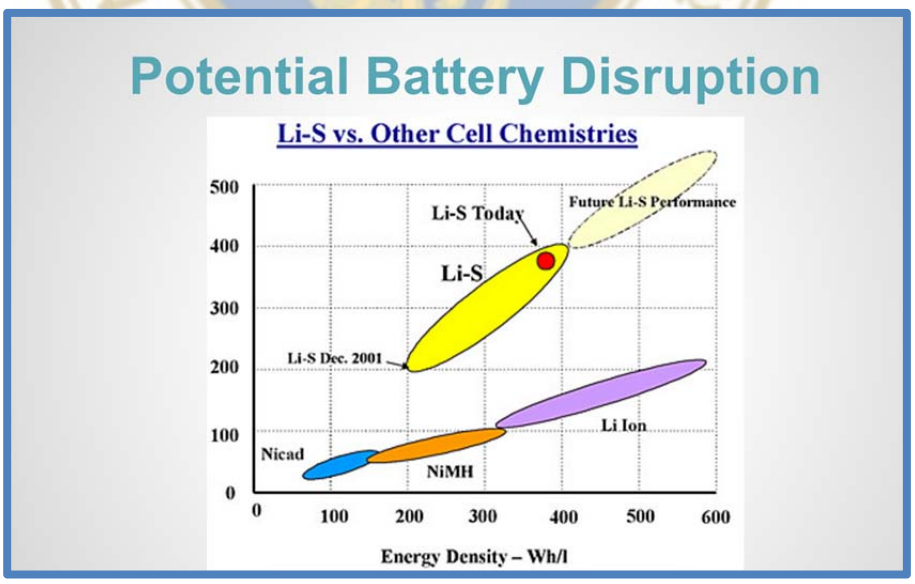
Electric powertrains: Charging infrastructure archetypes

Focus of Chapter 3

	Energy source				
	GASOLINE/DIESEL	HYDROGEN	BATTERY		
					
	Fueling gasoline or diesel at a petrol station	Fueling hydrogen at a hydrogen refueling station	"Wired" charging using a plug	Battery swapping	Induction charging
Description	Conventional gasoline or diesel refueling	Hydrogen refueling (similar to natural gas refueling)	Plugging in to a charging station using a cable and plug	Replacing a battery for a fully charged one at a special swapping station	Battery in the car is charged by wireless induction charging
Time needed[1]	5 min	5 min	4-8 hrs (slow) 20-30 min (fast)	5 min	~2-8 hrs[2]
Suitable for which power-trains	▪ ICE ▪ HEV ▪ PHEV ▪ REEV (gasoline)	▪ FCEV ▪ REEV (hydrogen)	▪ PHEV ▪ BEV suitable for plug-in charging	▪ Special BEVs suitable for battery swapping	▪ Special BEVs suitable for induction charging
Example car	▪ All ICEs	▪ Hyundai ix35 (FCEV)	▪ Renault Zoe (BEV)	▪ Special model of Renault Fluence	▪ N/A (few pilot cars)
Current availability in Europe	Widely available: ~131,000 stations	Very limited: ~80 stations	Limited availability: >20,000 (slow) >1,000 (fast)	Very limited ~50 stations	Not available (few pilots in progress)

1 Time need for full refueling or recharge. For fast-charging of battery, time to reach 80% of battery capacity is commonly used
2 Since induction charging is still in pilot stage, common duration and power level are not yet established; power levels of 22 kW have been achieved
SOURCE: Europia, Fuel Cell Today, Public sources, McKinsey

The battery technology and this is the result as off tomorrow



http://evobsession.com/our-ev-future/