Professional MBA
Automotive Industry

Market Entry of Chinese Electric Car in Europe: Perspectives for product specification and distribution

A Master's Thesis submitted for the degree of
"Master of Business Administration"

supervised by

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Finally I would like to thank my family for their loving support during this program.

Affidavit

I, BA**. Nong ZHU**, hereby declare:

1. That I am the sole author of the presented Master's Thesis "Market Entry of Chinese Electric Car in Europe --Perspectives for product specification and distribution" 69 pages in bound, and I have not used any sources or tools other than those referenced or any other illicit aid or tool, and

2. That I have not prior to this date submitted this Master's Thesis as an examination paper in any firm in Austria or abroad.

Vienna, 15th. April 2013

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Abstract

Since 2009 China has stood as the biggest car and electric car manufacturing country in the world. Chinese car manufacturers, which include state-owned companies, joint-venture companies with foreign car manufacturers, and private companies. They are not only responsible for the production for most international car brands, but also have about fifty of their own car brands. An interesting phenomena is that all Chinese made electronic car brands are owned by Chinese private or state car manufacturers.

After 20 years of cooperation with most foreign car manufacturers, Chinese car manufacturers have acquired the experience, technology and know-how to make a normal car all by themselves. They are currently putting more effort into the production and integration of their own main 5 brands for local and international markets.

Chinese car manufacturers are pioneers as far as electric cars are concerned. They not only have the world's leading technology for appropriate battery, which is the key component of the electric car, but have also made the biggest amount of their own electric cars in the world, these are mainly sold in China. One should expect that they will also want to sell their electric car to Europe, at some point in the future.

The main purpose of this Master's Thesis is to research in advance, what kinds of product specification and distribution are needed for the successful launch of Chinese electric car in Europe. This Master's Thesis will use the past and current success of Japanese and Koreans cars in Europe as a benchmark.

After the general introduction and problem identification, this Master's Thesis will include historical literature analysis, statistical research of two potential entering markets (Austria and Bulgaria), scientific case study of two big Chinese electric car manufacturers (BYD and Great Wall), and representative interviews with related experts.

The main hypothesis and final conclusion will focus on: aside from technical innovation and cost advantage, the product specification for specific market and new dealer network strategy are the pre-requisites, that the Chinese electric car will need in order to enter Europe market successfully.

Abbreviation List

ACEA European Automobile Manufacturers Association
BER European Block Exemption Regulation
BDNT BYD-Daimler New Technology Company
BRIC Brazil, Russia, India, China
BYD Build Your Dream (Chinese Car Manufacturer)
CAAM China Association of Automobile Manufacturers
CCS Toyota Complete Customer Satisfaction system
CIA Central Intelligence Agency
CKD Complete Knock Down
CO2 Carbon Dioxide
EC European Commission
EV Electric Vehicle
EU the 27 countries of Europe Union
EU-NCAP European New Car Assessment Programme
FAW First Automobile Works (Chinese car manufacturer)
FTA Free Trade Agreement (between EU and other countries)
GDP Gross Domestic Product
GM General Motor Group (America car manufacturer)
MPV Multi Purpose Vehicle
MT Master's Thesis
NDRC Chinese National Development and Reform Commission
Nova Norm Verbrauch Abgabe
OEM Original Equipment Manufacturer
ÖAMTC Austria Automobile, Motored Touring Club
ÖVK Austria Verein für Kraftfahrzeugtechnik
PEV Pure Electric Vehicle
PHEV Plug-in Hybrid Electric Vehicle
PHP Passenger car per Hundred People
PVB Price Value Balance
SBU Semi Built Up
SUV Sport Utility Vehicle
SWOT Strong, Weak, Opportunity, Threat
TPM Toyota Total Productive Maintain
TPS Toyota Production System
VAT Value Added Tax
VW Volkswagen (German Car Manufacturer)

Chapter 1. Introduction

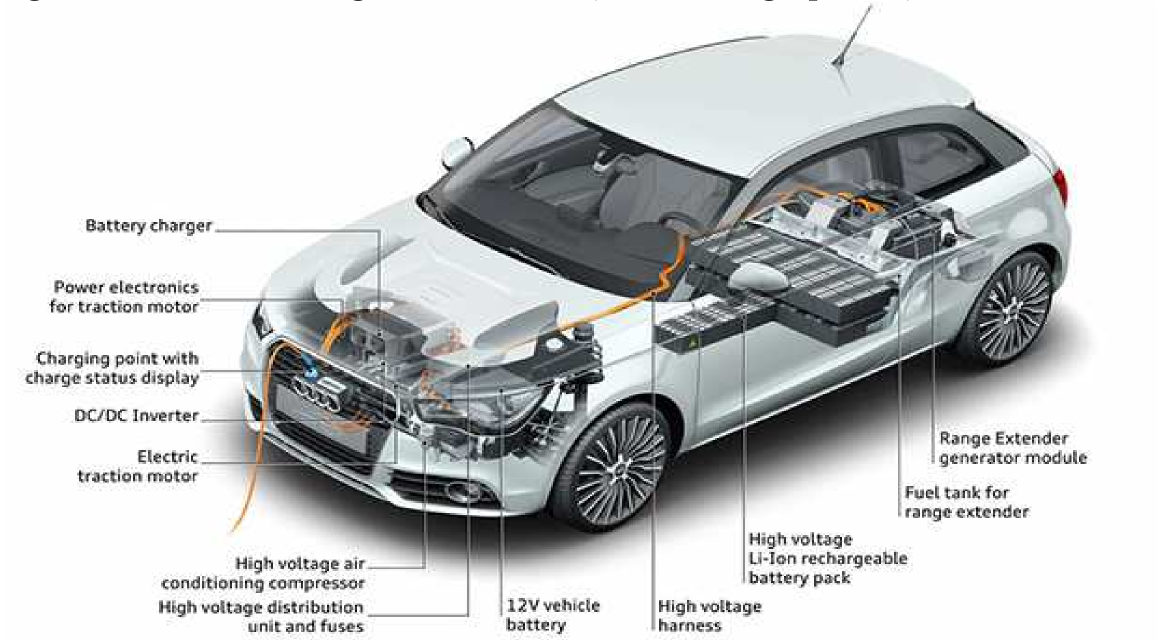
1.1 Definitions in this master's thesis

1.1.1 Definition 1. Electric car in this Master's Thesis (MT) includes 2 segments. Segment A is the pure electric vehicle (PEV), the rechargeable battery is its sole power source, its energy has strength of at least 50 kW, and its driving range is at least 100 km when full charged, the car's driving speed can reach up to at least 100km per hour. (Km/h).

Segment B is the Plug-in Hybrid electric vehicle (PHEV), this is also known as electric car with a range extender. It has two energy resources. Resource 1 is a rechargeable battery as electric power source which has an energy strength at least 25kW, and with a driving range of at least 50 km with a full charged battery, it can reach a driving speed up to 100km/h.

Resource 2 of PHEV is a normal gasoline combust engine as assistance to the battery, which can extend the driving range of the car, drive more suitable for high way or in bad weather or bad road conditions. During the driving with the combust engine, it can also transfer energy to the battery (charge the battery) inside the same car.

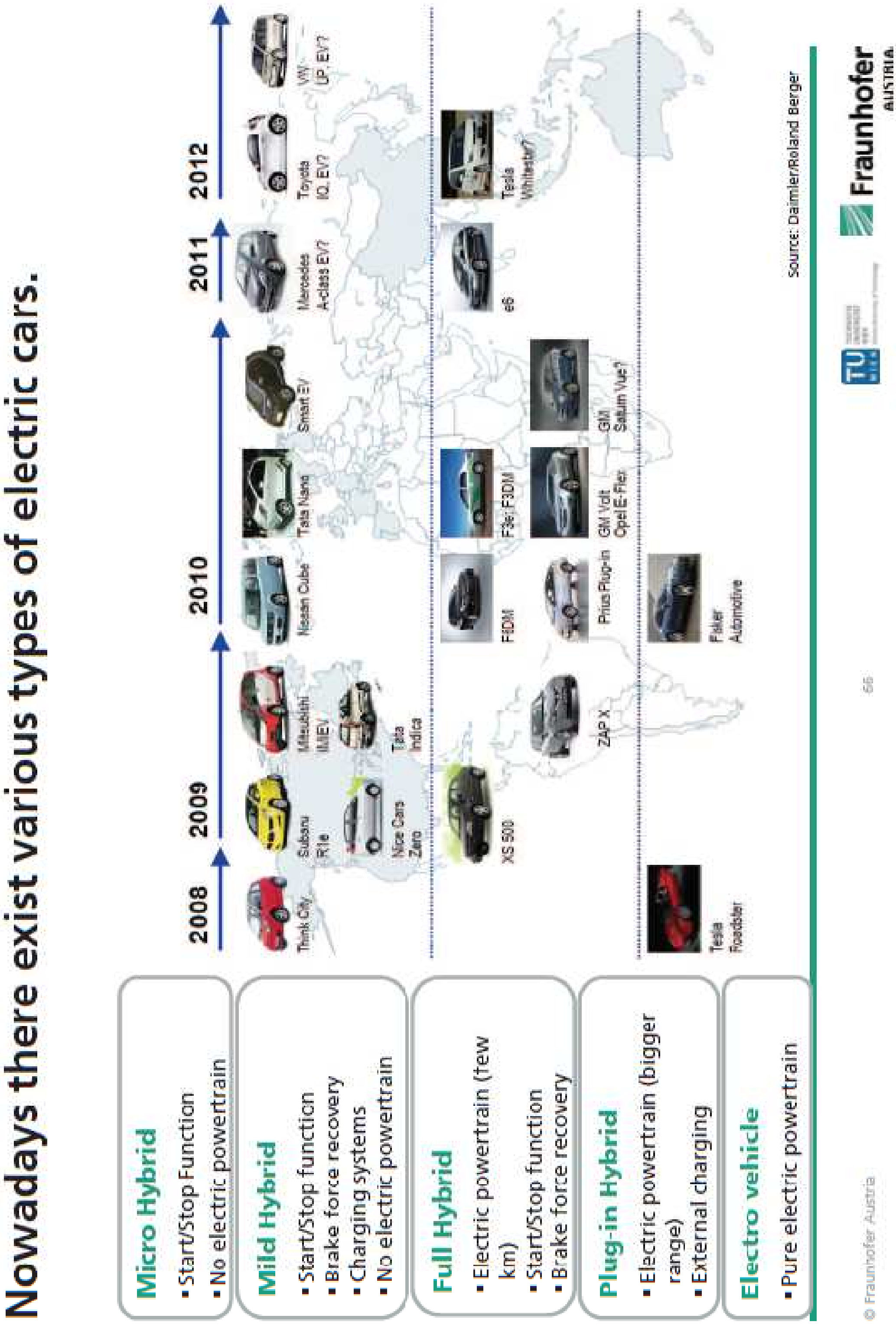
Figure 1.1 Instructive Diagram of a PHEV (source: Google picture)



The reason for making the above definition is, during our MBA excursion to Volkswagen Slovakia in Bratislava on 18th. October 2012, I found their assembled SUV model VW Touareg Hybrid and Porsche Cayenne S Hybrid all equipped with NiCad battery. According to their technician, its driving range with a full charge of this battery is only 3 to 5 kilometres.

Various models of electric cars have appeared on the market from 2008 to 2012 (see Figure1.2). People generally consider the Hybrid model to be an electric car, but this Master's Thesis focuses solely on the electric cars which are suitable and affordable for normal people and their daily usages.

Figure 1.2 various models of electric cars (source: Daimler/Roland Berger)



1.1.2 The second definition concerns Chinese electric cars. By definition this includes the electric cars that are produced by Chinese car manufacturers with their own Chinese brands, regardless of if these cars are made in China or in other countries, this is not the criteria.

1.1.3 The third definition concerns the European market. By definition in this MT Europe refers to the Europe Union 27 counties, the third largest car market after the Unite States and China.

1.2 Motivation of this master's thesis

One of my aims in joining this MBA program was to help the promotion of the Chinese car in Europe market. I already have nine years' experience in the car parts industry in Austria, and have visited more than ten car assembly plants in China for international and Chinese brands.

After the first lecture of Automotive Industry Overview and Technology, I already decided that the area of focusing my studies would be the Chinese electric car industry and its establishment in Europe.

It is only common sense to anticipate that the electric car will play an important role in the structural change in the automotive industry. Although the electric car has a very small market share and other limitations, it has huge potential for development and profit, particularly for the pioneers.

1.3 Research Problem Identification

China stands as the biggest car and electric car manufacturing country of the world since 2009. Chinese car manufacturers include joint-ventures with foreign companies, state-owned companies and private companies. They not only produce for many international car brands, but also have many of their own brands. They have gathered the relevant technology and know-how to produce a qualified car, specially the electric car within the last decade.

Among these Chinese car brands, BYD stands as one of the most renowned for electric cars in China and worldwide. It can be anticipated that these Chinese car brands will also attempt to enter the Europe market. Actually several Chinese car manufacturers such as Brilliance, Great Wall and BYD have already attempted to break the European market in the last five years, but have not achieved the desired success.

The main research task is to find out, besides technical innovation and/or price advantage, what kind of product specification and dealer network strategy would be are necessary for the successful launch of a Chinese electric car in Europe.

Chapter 2. Background Information

2.1 Brief of the Chinese car industry

2.1.1 China began to manufacture automobiles in 1955, with the support of the Soviet Union. The first commercial vehicle to roll off the assembly line in China was the 'Jiefang' (‘Liberation’) truck, manufactured by the Changchun No.1 Automotive Works (FAW) in 1956. Subsequently different automobile factories are build up in Nanjing, Shanghai, Jinan and Beijing. They mainly produced trucks, buses and tractors independently.

The passenger car industry was a minor focus of vehicle production during the first three decades of China’s socialist economy. FAW started the production of Hongqi (‘Red Flag’) limousines, and a passenger car called Fenghuang (Phoenix) in the early 1960s, the total quantity of production was about 100 units per year. All parts were imported from the Soviet Union, it is now termed as Complete-Knocked-Down (CKD), and this production of passenger car was closed in the early 1970s.

From the 1950s to the early 1980s, passenger cars were essentially the prerogative of China’s ruling elite. The Chinese government did not encourage the production of commercial cars for different reasons. Even in 1985, the country produced a mere total of 5,200 cars, the rest of the cars were just imported.

2.1.2 The Chinese government deemed the automobile industry one of the country’s so-called "pillar industries" in 1987. Steyr-Daimler-Puch , AMC Chrysler Jeep, Volkswagen and Audi had set up joint ventures in China in the late 1980s, many car and car parts companies followed thereafter. By the early 1990s, one million motor vehicles were rolling off the assembly lines annually.

With China’s entry into the WTO in December 2001, the automotive industry turned a new page. Foreign manufacturers were keen to grab a piece of the fastest growing auto market in the world. Sales of passenger cars soared from 750,000 units in 2001 to 1.2 million in 2002 and then nearly doubled to 2.1 million in 2003. Since 2009 the annual production of automobiles in China has exceeded that of the European Union, Unites States and Japan.

In 2012, the sales of passenger cars was 15,495,200 units in China, of which 1,056,000 units were exported. 3,811,200 units of the sales referred to commercial units. The worldwide sales in 2012 were 62 million units, which meant that China had 25% share of the world's car production and sales market.

2.1.3 The main problem is there are over 100 Chinese car makers and brands, (the big 39 Chinese car makers and their 44 brands can be seen in Figure 2.1 and 2.2, who took 41% of production and sales in 2012 in China. This issue has reduced the economic-scale and utilization of their capacity and resources increased the cost of production and marketing.

Figure 2.1 Chinese Automotive Companies Vs. Sino-Foreign Joint Ventures (Source: Chinese Association of Automobile Manufacturers, CAAM)

	Chinese Automakers	Sino-Foreign Joint Ventures
1	BAIC (Beijing Auto, Beiqi)	Beijing Benz, Beijing Hyundai, Foton Daimler
2	Brilliance Auto, Huachen Auto Group	Brilliance BMW
3	BYD Auto, BYD Company	Shenzhen BYD Daimler New Technology Co., Ltd
4	Chang'an Auto (Chana Auto)	Chang'an Ford, Chang'an-Mazda, Chang'an-PSA, Chang'an-Suzuki, Chang'an Changhe Suzuki
5	Changfeng Motor, GAC (Guangzhou Automobile Group Co.)	
6	Changhe Auto, Chang'an.	Changhe Suzuki
7	Chery Auto	Qoros Auto
8	CHTC Auto	
9	Dongfeng Motor (DFM, "Eastwind")	Dongfeng Nissan, Zhengzhou Nissan, Dongfeng Peugeot Citroen, Dongfeng Honda, Dongfeng Yueda Kia
10	Dongfeng Yulon	
11	FAW (First Automobile Works)	FAW Volkswagen, FAW Audi, FAW GM, FAW Mazda, FAW Toyota
12	Foday (Guangdong Foday Automobile Co., Ltd.)	
13	Foton, BAIC. (Beiqi Foton)	Foton Daimler
14	Fujian Motor	Soueast Mitsubishi, Fujian Benz
15	GAC (Guangzhou Automobile Group Co.)	GAC Honda, GAC Toyota, GAC Fiat， GAC Mitsubishi
16	Geely Auto	Volvo Cars
17	Gonow, GAC.	
18	Great Wall Motor (GWM)	
19	Hafei Auto, Chang'an.	
20	Haima	
21	Hawtai	Hawtai Hyundai
22	Huanghai, SG Automobile Group	
23	JAC (Jianghuai Auto)	
24	JMH (Jiangling Motor Holding)	Jiangling Ford
25	Jonway Auto	ZAP Jonway
26	King Long Motor (Xiamen Jinlong)	
27	Lifan Motors	
28	Liuzhou Wuling Motors, Co., Ltd	SAIC-GM-Wuling (SGMW)
29	SAIC (Shanghai Automotive Industry Corporation)	Shanghai GM, Shanghai Volkswagen, SAIC-GM-Wuling (SGMW), Nanjing Iveco (Naveco), Shanghai Sunwin Bus
30	SGMW (SAIC-GM-Wuling)	
31	Shuanghuan Auto	
32	Sichuan (Yema) Auto Industry Co., Ltd	
33	Sinotruk (China National Heavy Duty Truck Group Corp., Ltd.)	
34	Soueast Motor	Soueast Mitsubishi
35	Youngman Automobile Group Co., Ltd.	Youngman-Neoplan, Youngman-MAN AG, Youngman-Proton
36	Yulon Motor	
37	Yutong Bus	
38	Zhongxing Auto (ZXAuto)	
39	Zotye Auto	

F2.2 Top 20 Chinese car brands and sales in 2012 (source: internet research)

Note:

1. Commercial vehicles are not included here, of which Chinese brands dominate 90% of the market.
2. One company may have serval brands, here are the total units.
3. The big five car makers in China are SAIC, DongFong, FAW, ChangAn, BAIC.

	(Brilliance)	(Great Wall)	
712,000	638,000	624,600	563,300
		(YiQi, XiaLi)	(FengShun)
491,400	456,056	344,000	279,000
	(Haima)	(LiFan)	
230,000	172,767	171,777	121,250

2.1.4 In order to integrate these Chinese brands, the Chinese National Development and Reform Commission (NDRC) issued a new policy on 23th. Jan. 2013. Through the merging and optimization to 2015, the top 10 car manufacturers will take 90% of the production share, and build up three to five worldwide big competitive car manufacturers and brands in China.

This task includes four distinct parts: car, parts, related services, and globalization. Overall aims are to encourage horizontal and vertical reorganization, promote mergers and acquisition, optimize product facility and marketing activity, and research and develop one's own strong technology, the creation of strategic alliances for specialization and cooperation. "Going-out" for global production and service network, enhancing the ability of international operations, and enhancing global competitiveness are also important goals that are kept in mind.

2.2 The Chinese electric car industry in general

The Chinese electric car industry is firstly based on the regular modern car industry. Chinese car manufacturers, which include state-owned companies, joint-venture companies with foreign car manufacturers, and private companies, after ten years of hard work (1990-2000), already have the experiences, technologies and know-how to produce a regular car independently.

They realized however that it would be very difficult to close the technology gap in internal combustion engine, to take over the leading position of traditional car design and develop from foreign companies which already have over 100 years' experience. Competing with Japan and Korean car in normal way would also prove to be a big challenge.

The second base is China's rechargeable battery manufacture industry, which leads the technology worldwide. China also holds the third largest reserve of global lithium after Bolivia and Chile, and has access to South American reserves. But China has very limited oil reserves and unsafe access to oil resources.

The global car industry has put more emphasis on fuel efficiency and environmental protection since 2000, and has developed the Hybrid model and electric motor for the future. The Chinese government also started the 863 Electric Vehicle Project in 2001, decided to skip over the combustion engine and Hybrid model, and focus on plug-in and pure electric.

A good example is the Chinese Car and battery manufacturer BYD (Build Your Dreams). BYD started its rechargeable battery business in 1995, and become one of the world's largest manufacturers of cell phone batteries, it created own leading technology by about 2000. BYD entered the car manufacturing industry in 2003, brought the reputed regular car to the market successfully in 2005.

BYD presented its first mass-produced, full hybrid vehicle F3DM at the Beijing Auto Exhibition in March 2008, this model stands as the electric car in China up until this point, and also has a leading position in battery technology and production quantity within the electric car industry worldwide.

Starting from 2010, more and more Chinese local car manufacturers have entered into the plug-in and electric car branch. They feel more independent and confident in competing with foreign car brands, because electric car is a new branch, and there is not a large technology gap. From another side, they also have the support of fiscal and tax policy, The Chinese economic and car market is growing rapidly compared to other counties.

The following figure (F2.3) shows the basic information of Chinese electric car manufacturers in 2012. All the following pure-electric cars are reported to have a top speed of 90Km/h and are already past the prototype or test phase, and ready for volume production.

Figure 2.3 Chinese electric car makers in 2012 (source: chinaautoweb.com)

	Pure-Electric Cars						
	Maker	**Model**	**Battery Type**	**Range**	**Top Speed**	**Est. Retail Price (Yuan)**	**Market release**
1	**Beijing Auto**	C30 EV	Lithium Ion	200	160		
2	**BYD**	e6	LiFePO4	330	160	300,000	released in 2010
3	**Chana**	Benni EV	LiFePO4	150	120	Less than 100,000 after rebates	
4	**Chery Riich**	M1	LiFePO4	120-150	120	149,800-229,800	Released on Nov. 5 2010
5	**Foton**	Midi EV	LiFePO4	150-200	160	100,000	
6	**Geely**	EK-2	LiFEPO4	180	150	100,000	
7	**Great Wall**	Haval M3 EV	LiFePO4	160	130		
8	**Hafei**	Saibao EV	Lithium Ion	180-210	130	180,000	
9	**Haima**	Freema EV	LiFEPO4	160	90	160,000	Public trial in 2011
10	**JAC**	J3 EV (iev)	LiFePO4	180	100	158,000	Sep. 2012
11	**Lifan**	320 EV	LiFePO4	100-150	100	100,000	
		620 EV	LiFePO4	200	120		
		620 EV	LiFePO4	200	120		
11	**SAIC Roewe E50**	E50	LiFePO4	180	130	234,900	Nov. 5, 2012
12	**Shanghai-GM**	Springo EV (Chevy Sail EV)	LiFePO4	130-200	130	25,800	Nov 2012
13	**Zotye**	5008 (Nomad II) EV	LiFePO4	200	100	210,000	early 2010
		M300 EV	LiFePO4	200	120	250,000	2010

An interesting phenomena is that most of the above China-made electronic car brands are owned by the top 10 Chinese car makers. They produce regular car, plug-in and pure EVs, Most of these electric cars use the LifePo4 battery, which is supplied by BYD.

According to China Association of Automobile Manufacturers (CAAM), the sales of pure EV in 2012 in China was 11,375 units, up 104% compared to 2011. The sales of the plug-in hybrid and dual model cars was about 147,000 units.

2.3 Chinese government supports electric car

China has limited oil resources, and has an increasing dependence on foreign oil from Africa, Russia, and the Middle East. They do not have control over their access to oil. China is also running up against environmental resource constraints. The country is already the top emitter of carbon dioxide and experiences widespread air pollution in urban centres, which is caused mainly by cars.

The Chinese government started the 863 Electric Vehicle Project in 2001, decided to skip over the part on the combustion engine and Hybrid model, focus on plug-in and pure electric instead. They have launched many new energy policies since their 11th. 5-Year Plan (Chinese National Plan) in 2006, with a detailed 863 new energy and energy saving project, and mid to long term scientific/technology development plan (2006-2020), they also released the Auto Industry Revitalization Plan (2009-2011).

There may be another means to reduce China's dependence on foreign oil; however reducing urban pollution, and making Chinese automobile companies globally competitive; providing alternative fuel vehicles. While there are many different alternative fuel cars under consideration (ethanol, natural gas, hydrogen fuel cells, biodiesel to name a few), electric vehicles are currently the most promising option. They are simply more efficient and promise a combination of lower fuel costs, lower emissions, and lower production costs compared with most other competitive alternative fuel cars.

In 2008, the Ministry of Science and Technology mandated that 10% of Chinese cars will run on alternative fuels by 2020 and called for 10 billion Yuan (US$1.5 billion) in research subsidies for following three years, which were intended for the research and development of alternative fuel vehicles. There is a lot of fiscal and tax support for electric car manufacturers as well as government subsidies for electric car purchasers (end users).

In 2008, the Ministry of Finance announced its commitment to promote alternative fuel vehicles in the country's thirteen largest cities: Beijing, Shanghai, Chongqing, Changchun, Dalian, Hangzhou, Jinan, Wuhan, Shenzhen, Hefei, Kunming, and Nanchang.

The mandate calls for public services to begin adopting alternative fuel vehicles in these cities and provides subsidies for the production and purchase of alternative fuel cell vehicles, including 50,000 Yuan (US$7,300) per hybrid and 60,000 Yuan (US$8,800) per fully-electric model produced by domestic car manufacturers.

Generally China has the overall ambition to become a market leader in electric vehicles, with hopes of being the electric automotive component technology hub by 2020. Their advantages are: a large domestic market, leading technology and know-how in this new field, sufficient raw material supply, low production cost, and a clear supporting policy of Chinese government.

The disadvantages are that without their own big strong brands and leverage of economic scale, there is less experience and limited opportunities for international expansion. There is also no sufficient business model for marketing. These are the main issues that this MT will raise.

Chapter 3. The Current situation of Electric Car

3.1 Why choose the electric car

Electric car is actually not a new product, the first electric car with a non-rechargeable battery appeared in 1847, the first officially approved electric car was made by M. Gustave Trouve in 1881, and the first gasoline operated vehicle was invented by Carl Benz in 1886. There were electric cars used in France and Japan due to the oil brevity during World War II, and electric cars are also used in specific branches in recent times. Examples of this include the Golf car, Airport drawing, and in the lunar exploration in Apollo mission.

3.1.1 Oil is not a renewable energy resource. Oil consumption increases continually, and fusion reservation falls continually, and then drives up the price continually. According to the information provided by Professor Lesinsky's lecture in our MBA study in 2011, that the natural oil reserve may be used up by 2080.

3.1.2 Debate over the replacement of gasoline engine with battery powered electric car became a hot topic after the oil crisis in the 1970s. The gasoline price were always increasing, customers preferred cars with less fuel consumption and high efficiency.

The electric car is more expensive to purchase but has lower maintains cost than a regular passenger car. From the economic view, the energy cost of electric vehicle is lower than that of normal gasoline vehicle. During our MBA study of Management Science in April 2012, we did an exercise using the spreadsheet of Model Risk, to compare the energy cost difference between normal and electric vehicle in F3.1.

If we assume that both cars drive 11,000 miles per year, last for 12 years, and have two types of engine: A- a conventional gasoline engine, which averages at 37.7 miles per gallon; B- a hybrid electric engine, which averages at 52.7 mi/gal on gasoline condition and gets 4 mi/kwh (mile/kilowatt hour) on electricity, half of the annual mileage is made from each energy source (engine).

If we examine the break-even extra cost (in terms of net present value) for the hybrid engine for gasoline price of US$3.50/gal and electricity price of US$0.15/kwh, Assume that the discount rate is 5%, the total saving for energy in 12 years is US$5,396, the detailed result see to the table in following page.

This is the case in USA, where the price of gasoline is at least 100% lower than in EU, the average petrol price in EU is $7 per gallon in 2012 (€1.42 per litre), and the average electricity price for private consumers in the EU is €0.112 /kwh ($0.15/kwh) in 2011. Which means the energy saved by using EV in the EU is doubled than that of in USA. The desire for an available EV on the EU market should be relatively high, even solely from an energy and economic point of view, and the perspective of an EV from an environmental part of view will be discussed in paragraph 3.1.3.

Figure 3.1 Energy Cost Comparison (source: Lehman & homework)

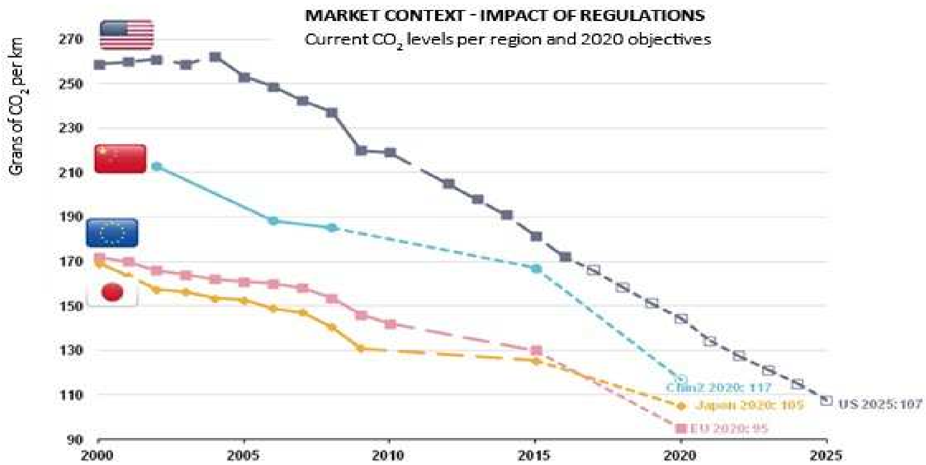
Gasoline Car		Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
Miles per year	11 000	Consumption in galon	292	292	292	292	292	292	292	292	292	292	292	292	3 501
Lifetime	12	**Consumption in USD**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**1 021**	**12 255**
Miles on gasoline	11 000														
Miles per galon	37,7														
Price per galon	3,5														
Hybrid Car		Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
Miles per year	11 000	Consumption in galon	104	104	104	104	104	104	104	104	104	104	104	104	1 252
Lifetime	12	Consumption in USD	365	365	365	365	365	365	365	365	365	365	365	365	4 383
Miles on gasoline	5 500														
Miles per galon	52,7														
Price per galon	3,5														
Miles on electric	5 500	Consumption in kwh	1 375	1 375	1 375	1 375	1 375	1 375	1 375	1 375	1 375	1 375	1 375	1 375	16 500
Miles per kwh	4	Consumption in USD	206	206	206	206	206	206	206	206	206	206	206	206	2 475
Price per kwh	0,15	**Consumption in USD total**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**572**	**6 858**
Discount rate	5%	**Saving**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**450**	**5 396**
Discounted Investment	**2 916**	Discounted Saving	5 127	4 870	4 627	4 395	4 176	3 967	3 768	3 580	3 401	3 231	3 069	2 916	**2 916**

3.1.3 The third reason why electric cars are a good option is the increasing concern about environment protection. Global warming is a worldwide hot issue for normal people and car consumers since 2000. Motor vehicle emissions play a big role in air pollution and the warming of temperature in urban area. The California Air Resources Board found during a recent study that 50% or more of the air pollution in Southern California is due to car emissions.

Car emissions are composed of the by-products that come out of the exhaust system or other emissions such as gasoline evaporation. These emissions include NOx, Valatie Organic compounds, Ozone, Carbon Monoxide (CO), Particulate Matter (PM), Carbon Dioxide (CO2), the most harmful by-product is CO2 emissions.

The CEOs of all car manufacturers are under pressure to reduce CO2 emissions, as a top sales strategy, it also improves their public image, otherwise they may face fiscal penalties from the government. PEV has zero CO2 emissions and PHEV has very lower CO2 emission. The EU, USA and China etc. have already set up their CO2 regulations from current to 2020 objectives. (See the diagram below).

Figurer 3.2 Current CO2 emission and 2020 objectives (resource: press research)



3.1.4 **Well to Wheel** analysis. When discussing the CO2 level of EV, one must consider where is the electricity made and the related CO2 emission during electricity producing process. (Well-to-tank, Tank-to-wheel, and Well-to-wheel).

Refer to the study from Hydrogen Centre Austria by Klell and Cona in 2009, if the electricity is created by coal and gas, the direct CO2 level produced by EV is 15%, the indirect CO2 level (mine, transport, burning etc.) is 75%, and the CO2 level by car with gas and gasoline is 85-90%. In this case, there is no CO2 improvement.

However the CO2 level produced by EV is 10% if the electricity is from photovoltaic, 5% from atoms, 4% from water, and 3% from wind. How to develop these new renewable energy resources will be another topic.

3.1.5 A further concern may be that car manufacturers want to establish a high level of credibility. So that they may be at the forefront of future research and development of EV. Not only car manufacturers and battery research organizations, but also many governments invest huge amount of resources into the development of battery or new energy. There is a slogan: **the future drives electric, and battery drives the future.**

Figure 3.3 Expert Comment on EV (resource: press research)

Mr. Rupert Stadler, chairman of Audi, stated in June 2008: "The hybrid hype is already over, tomorrow you will drive fully electric in city centres."
Mr. Thomas Weber, director of Daimler AG, stated in June 2009: "The vision of large-scale zero-emission-driving at affordable price won't become reality overnight."
Mrs. Angela Merkel, German Chancellor, stated in May 2011: "We want Germany to be the leading market and leading supplier for the electric vehicle industry."

Figure 3.4 Government supporting for battery & EV (source: BMV)

USA	-$2 billion each for battery technology and fuel saving vehicle -$150 billion for eco-friendly energy technology
France	-€400 billion for "Pacte Automobile" -€2.5 billion further investment for the next 10 years
Germany	-€500 billion economic stimulus package till 2011
Japan	-$22 billion for the development of cheap battery
China	-€1 billion for efficient power trains (2009/2011) -€2 billion allowance for thirteen regions for e-car purchasers

3.2 Problems and Focus

3.2.1 The main problem that exists regarding the EV is the high sales price due to high battery price.

In reference to our MBA lecture by Prof. Sihn in Oct. 2011, only 36% of potential customers are ready to buy a EV, and 75% of them would not invest more than 2000 Euro for a EV, Only 5% would invest more than 3000 Euro. The main reason for the high price of an EV is its high production cost (including battery).

Figure 3.5 production cost in percentage trend between e-car and normal car (Source: Oliver Wyman Study 2010)

Car types/year	**2010**	**2015**	**2025**
Pure e-car	247	235	168
Plug-in-hybrid car	225	190	146
Full hybrid car	154	144	130
Mild hybrid car	122	122	115
Internal combustion car	100	104	103

3.2.2 The second problem is the lack of charging-infrastructures and standards.

In comparison to the current gas station, the EV charging station is very sacred, you need special charging facility for 600 volt electricity to charge the battery of the EV, the process has over thousands of pulses per second, it is not as easy as charging a notebook’s battery or battery inside a normal car, which are usually only 12 volts.

Due to the fact that electricity has 2x2 main types (200V/230V in high/low level) and five 5 different socket forms for normal electronic products in different areas, the EV manufacturers have developed their electric systems differently from that of the normal car, which makes EV charging even more complicated.

The full charging time for a PEV even with latest charging technology and facilities is much longer than that of full tank of a gasoline car. Refer to the model of BYD e6, its full charging time is 40 minutes.

Standards are necessary for various systems in the energy supply, various connectors and charging cables, various requirements for the charging stations, and safety precautions for the EV users.

3.2.3 The market share of EV within the whole car industry is very small even in China, as we learnt in chapter 2, the pure EV sales in China during 2012 is 11,375 units, even with the hybrid EV, it is still less than 1% in total car sales of 15,495,200 units. Such low sales make EV production, marketing activity and related infrastructures very expensive and difficult to maintain.

3.2.4 Another clear problem is the handicap of current EVs. The driving range of most current full charged EVs is less than 100 km in normal city conditions, when driving in cold or bad weather conditions, on highways or at high speed, in mountain areas, or using air-condition, then the EV's driving range and performance falls dramatically.

3.2.5 So the **focus, weakness and bottle-neck of the EV is clearly its battery,** many governments have invested huge resources to develop battery (see Figure 3. 4), it brings us back to our slogan once again: **the future drives electric, and battery drives the future.**

If we were to develop the EV battery, so that it can drive the car in similar conditions to the normal car, more and more consumers will buy and use PEVs or PHEVs due to their eco-friendly advantages, subsequently the market needs for such a battery will increase assumption to 50% and boost the economies of scale.

The drop of battery price can stimulate the public's needs. This is a possible means of solving the issue of the EV's high price, it can also improve the market share and the utilization of the charging facility.

3.3 Option, solutions and the future

What we could do before we reach such wonderful battery, because research is difficult to predict, and waiting is just a waste of time and chance. There are two options, one is to rethink the marketing of the PEV, and the other is to introduce a range-extender to PHEV.

3.3.1 Pure Electric Vehicle option

The new thought is that you cannot make a car to fit everyone's requirements. There are different car segments for different requirements. So it is important to not ask too much from the PEV, we should define its market position which the EV can do better than the normal gasoline car.

One mega car trend is small and fine, so called "smart-small" for the city and small families. This model has smaller size to solve the problem of extra space, its initial price, energy cost, and maintenance costs are also lower, it uses a smaller and efficient engine, its CO2 emissions are also lower, and do not need high speed in the city.

One of the current matured PEVs in the market is BYD e6 from 2010. It has a 4560mm length, 1822mm width and 1630mm height, and its weight is 2020 KG. Its driving range is 300KM with a fully charged battery, and full charging time is 40 minutes with a 100KW fast charging cabinet, or 6 hours with a standard 10KW charging pole (could be installed in the garage in home or office), it reaches the top speed of 140km/h.

After 2 years' operation of e6, BYD has also made some progress in battery technology, it is time to think about the optimization of the structure of this e6 under the "small-smart" trend. BYD already has a F3DM plug-in hybrid compact model, and also has the cooperation with Mercedes for its B class 2011 model.

If BYD can develop a new pure EV by reducing the size and weight, say at the size of about 4200L/1700W/1600H in mm and below 1500Kg weight, its driving range may relatively reach 400Km at top speed of 130km/h, this matches the compact class of normal car, which has the highest market demands in all classes.

This changing scenario is based on the existing battery technology, just changing the product specification, which is one of the two main concerns of this Master's Thesis, will be discussed in more detail in a later case study of BYD.

3.3.2 PEV or PHEV (with range-extender)

As we already know, the EV has the advantages of zero CO2 emissions, less energy and maintenance cost, is suitable for start and stop situations in the city area. But due to the battery limitation and it has too high an initial buying price, limited driving range, speed and conditions.

The normal combustion engine has exactly the opposite features. It has already been established that the PHEV can combine and optimize electric motor and combustion engine together. This means that a compact car that has both an electric motor and a combustion engine, is the result for different road conditions and situations.

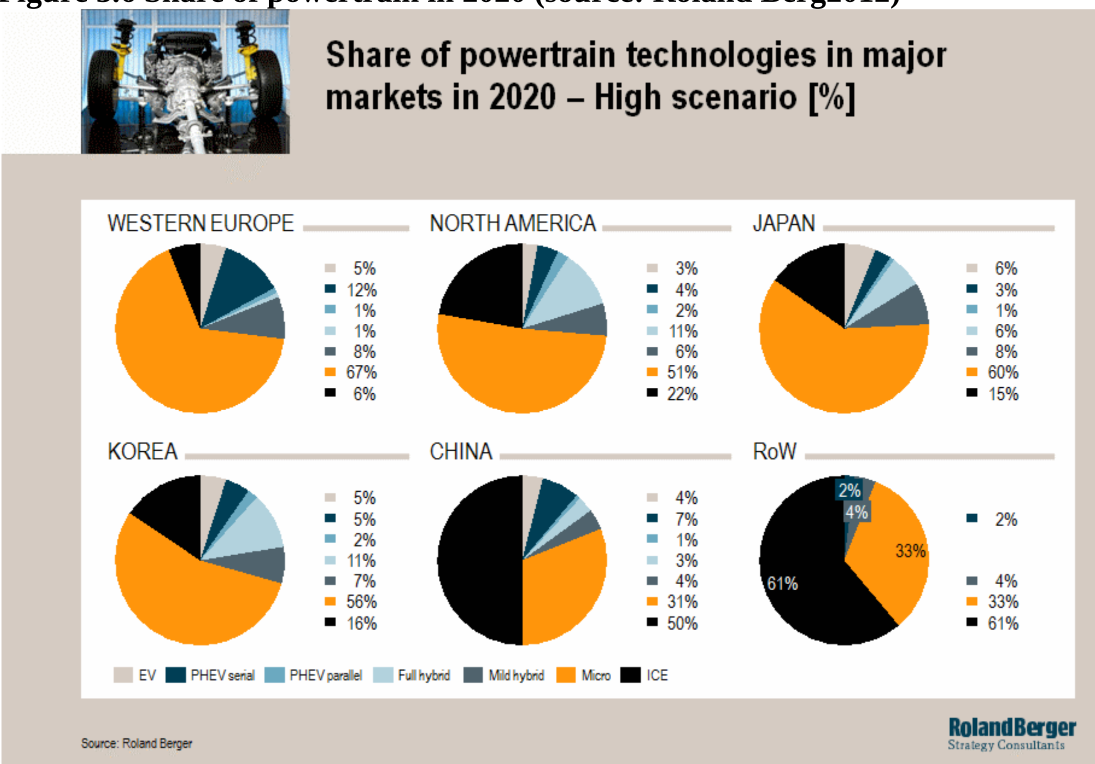
In this case, the battery requirement is not so high, which can reduce the battery price up to 50%, there is also no need for a strong combustion engine, which can also reduce CO2 emission up to 50%, because the CO2 emissions are zero when drive with the electric motor.

In reference to the study of ÖVK-Vortrag 2012 by Prof. Beidl and Prof. Hohenberg, EVs with combustion engine assist (e-Motor + CEA Concept) is the future of the EV. Before any revolutionary update of battery, the EV with ranger-extender will be more flexible for all driving conditions, this is a compromise for customer acceptance, price and cost, environment and regulations.

3.3.3 Current and future situation

Up until July 2012, the main PEV models were: Nissan Leaf, BYD e6, Tesla, Mitsubishi MiEV, Smart ED, Mia ev, Renault Fluence, Ford eFocus, BMW ActiveE. The main PHEV models were: GM Volt/Opel Ampera, BYD F3DM, Toyota Prius4, Fisker Karma. Estimated volume of PEV plus PHEV is 1 million units. In reference to the target of average 10% (EV+PHEV) in 2020, there is lot of potential.

Figure 3.6 Share of powertrain in 2020 (source: Roland Berg2012)



Chapter 4. Benchmark Study

4.1 Toyota

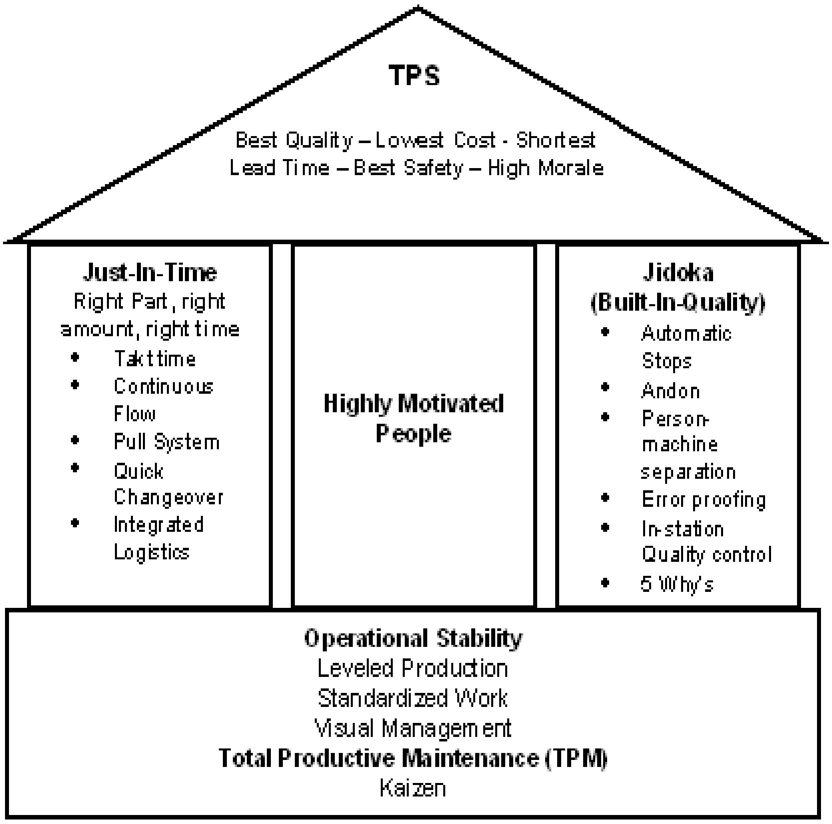
4.1.1 History and General

Mr. Sakichi Toyoda founded Toyoda Spinning and Weaving Company in 1918 in Japan, and then Toyoda Automatic Loom Works Ltd. in 1926 it achieved the leading position in that industry through good quality and principles such as "stop operation whenever anything irregular happens and never create defective products".

The Toyoda family had two visiting to Ford in 1929 and 1950, before and after they started Toyota Motor Company in 1937. Toyota had fully created the principles of Lean Manufacturing System by early 1960 in its Toyota Production System (TPS), which completely changed the car and even all manufacturing industries from mass produce to lean produce.

TPS managed to reduce the wasted time, material and manpower, improved the productivity, quality and supply chain/dealer network, and therefore surpassed all Western car makers. Toyota has been widely recognized as the most success car maker since 1960s, and is always the big top 3 car makers worldwide since 2000.

Figure 4.1 Toyota Product System (source: internet research)

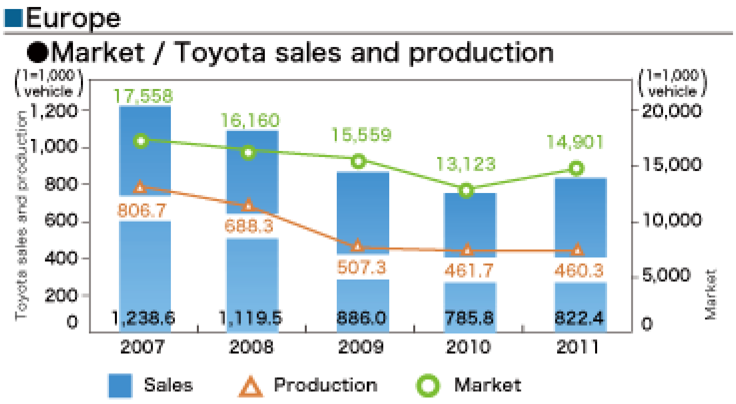


4.1.2 Launch in Europe

Toyota shipped its 400 Crown models to a Danish car dealer Erla Auto Import A/S in 1963. Denmark was Toyota's first European market. Toyota set up its European office in Belgium in 1970 when reached the annual sales of 10,000 units in Europe, Toyota set up its first European assembly factory in Portugal in 1971.

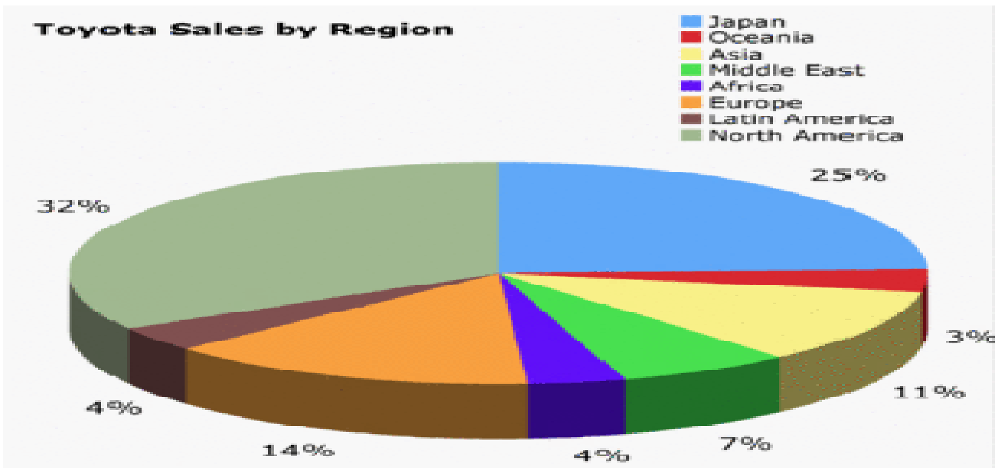
Toyota reached 1 million units in sales in Europe in 1976, and set up other part and assembly factories in the UK(1992), Turkey (1994), Poland(1999) and Russian (2005), Its main office, main design and training, R&D departments were though in Belgium. Toyota delivered its 10 millionth vehicle to a European customer in 2000.

Figure 4.2 Toyota sales and production in Europe (source: Toyota)



On 10th. January 2013, Toyota Motor Europe announced a 2% sales increase in 2012 in the declining European market, with a total of 837,969 units which represented a 4.5% Europe market share. The below figure (F4.1.3) shows that Europe (with 14%) is the third biggest market of Toyota's total world sales volume (after 32% in US and 25% in Japan), even bigger than Asia (with 11%) which is the fastest growing car market today.

Figure 4.3 Toyota sales by region (source: Toyota)



4.1.3 Success Points in Europe

Beyond Toyota's high standard production system, quality, technology and finance, there are also some further benefits that the company holds for the European market, they are as follows:

4.1.3.1 Right market gap

Toyota's first export market was Denmark, its import office was in Belgium, and the first factory was in Portugal, these markets were carefully selected because they did not have local car brands and nor the strong presence of other car OEMs. It is important to note that France, Italy and Spain had an informal restriction of cars from overseas during the 1960s.

So Toyota started with the fringe European countries first, and when they had settled there, the company moved into the more difficult markets like the UK, Germany, France, Italy and Spain etc. gradually.

4.1.3.2 Right product specification

The Toyota cars were shipped from Japan to Europe for the first 10 years, it was very difficult to satisfy the local demands as quickly as other local OEMs due to the lengthy delivery time and distant production site. So Toyota developed a different strategy, they concentrated on the compact car with pre-packaged and heavy loaded cars, which were on average 10% better in price/value than the same local models.

This meant that there were not that many Toyota models, variation or packages, but all models in compact class had the same packages such as air condition, ABS etc. that the European premier class had in that time, and its quality was almost the same. Through these methods, Toyota managed to conquer the European market.

4.1.3.3 Appropriate Models

The Toyota Corolla is a compact car model which replaced the Crown in 1966, and has been produced worldwide up until today. Corolla became the best selling model in the world, surpassing the Volkswagen Beetle and Golf in 1997. Over 39 million were sold as of 2012, it represents compact, comfort and stability.

The Toyota Prius is a midsize hybrid model that was created in 1997, it is the first and most sold mass-produced hybrid vehicle, and as of Oct. 2012, total 2.8 million units were sold worldwide, it represents hybrid new technology, clean and fine.

The Toyota Yaris is a small model, it is designed in Europe for European customers from 1999 to cover the gap of fine small car. One million Yaris were built in Europe till 2006. As of 2010, the first two generations of Yaris had achieved in excess of 3.5 million sales in over 70 countries. Starting from 2012 in Europe, Yaris also had the hybrid power train from Prius, which is a perfect combination.

4.2 Hyundai

4.2.1 History and General Information

The Hyundai Motor Company was established in 1967 in South Korea, its history was similar to Toyota, and followed the Toyota Production System completely, but the company's first model, the Cortina was released in cooperation with Ford Motor Company in 1968.

When Hyundai wanted to develop their own car, they hired Mr. George Turnbull, the former Managing Director of Austin Morris in UK and five other top British car engineers for body design, engine, chassis and development. They built the first Korean car model the Pony in 1975, with styling by Giorgio Giugiaro of ItalDesign and its powertrain technology is provided by Japan's Mitsubishi Motor Company.

Hyundai started to export the Pony (small class) to Ecuador in 1976, as export was its main target. The Pony could afford a much higher degree of quality and refinement in the lowest price auto segment than the Eastern-bloc imports in that period which were available. In 1985, the one millionth Hyundai Pony was built.

Figure 4.4 Earlier Hyundai models Pony and Excel (source: internet research)

Hyundai began to sell cars in the US in 1986 with the new small model Excel, this model was sold 168,882 units alone in that first year, marketing it a big success. Excel was nominated for "Best Product #10" by Fortune Magazine, largely because of its affordability. The company began to produce models with its own technology in 1988, beginning with the medium sized Sonata in explosive production way, and reached the four million mark in 1990.

Hyundai began to overhaul its image in an attempt to establish itself as a world-class brand in 1998, it invested heavily in the quality, design, manufacturing, and long-term research of its vehicles. It added a 10-year or 100,000-mile (160,000 km) warranty to cars sold in the United States and launched an aggressive marketing campaign worldwide, such as Hyundai, which has also been one of the worldwide official sponsors of the FIFA World Cup and UEFA Europe etc. since 2002.

Hyundai has invested in manufacturing plants in North America, India, Czech Republic, Pakistan, China and Turkey as well as in research and development centres in Europe, Asia, North America, and the Pacific region since the 2000s, the company was ranked as the eighth largest automaker in 2008.

Hyundai Motor Group (with Kia) sold over 4.05 million vehicles in 193 countries through some 5,000 dealerships in 2011. It was the world's fourth largest auto maker behind GM, Volkswagen and Toyota.

Hyundai operates the world's largest integrated automobile manufacturing facility in Ulsan/Korea, which is capable of producing 1.6 million units annually. Hyundai is the world's fastest growing major car brand for two years running.

Hyundai brand power continues to rise as shown by its rank as 65th in the 2007 Best Global Brands by Interbrand and Business Week survey, with a brand value estimated at $6.0 billion. Public perception of the Hyundai brand has been transformed as a result of dramatic improvements in the quality of Hyundai vehicles.

Figure 4.5 Interbrand ranking 2011 (source: Automotive Interbrand)

Ranking	Brand	Brand value (USD Billion)	+ / - vs 2010	2011 overall ranking	2010 overall ranking	Automotive
1	TOYOTA	27.8	+6%	11	11	1
2	MERCEDES BENZ	27.4	+9%	12	12	2
3	BMW	24.6	+10%	15	15	3
4	HONDA	19.4	+5%	19	20	4
5	VOLKSWAGEN	7.9	+14%	47	53	5
6	FORD	7.5	+4%	50	50	6
7	AUDI	6.2	+13%	59	63	7
8	HYUNDAI	6.0	+19%	61	65	8
9	PORSCHE	4.6	+14%	72	72	9
10	NISSAN	3.8	new	90	-	-

4.2.2 Launch in Europe

Hyundai had strong relations with Europe (UK and Italy) since its set up and its first model Pony in 1975, and then exported it to Europe (Benelux region) in 1977, Toyota's initial launch in Europe in 1963 also took place in the same area. Hyundai's development in Europe had below three clear phases.

Phase 1. Private Importer (1977 to 1991)

Hyundai Pony was not initially as successful in Europe as was expected during the late 1970s. Even though it offered over 20% price discount to similar German car models, Pony didn't pass the emission standard in Europe and USA, and its quality was not widely accepted, its image was typical cheap car.

Hyundai's real start in Europe wasn't until the late 1980s. After the success of its Excel and Sonata models in the USA market, Hyundai paved the way for technological independence and aggressive production. These models were introduced to Europe by private importers in different countries, and fell into the market gap of cheap but acceptable car. In the mean time the Japanese cars were already improving and were on a middle class price level.

Hyundai's sales increased slowly in Europe, but this growth was primarily driven by its affordable prices. Even in the 1990s, Hyundai cars were still notorious for poor build quality and lack of attention to details. The total sales volume in 1990 in Europe didn't even reach 10,000 units.

Phase 2. Hyundai Motor Europe office (1991 to 2003)

Hyundai Motor Europe Office was established in Neckarsulm/Germany in 1991 as an attempt to conquer the European market. It followed similar footnotes to the Japanese car makers from twenty years prior, pursued an aggressive pricing policy.

Hyundai coupled with a generous standard package in the small and subcompact cars in order to sell the latest technologies to buyers, as price played a big role in the small car class, and most European brands put these new technologies in premium class first. The Hyundai sales in its first full year of 1992 was 28,000 units in Germany alone.

Hyundai also brought other new models like the subcompact Getz, compact MPV Matrix and compact SUV Santa Fe to Europe later. All these brands were successful, because these cars were not only cheap compared to the similar local & Japanese models, but also reached a remarkable level of quality compared to Hyundai in its first phase in Europe.

Hyundai's models excelled in the area of safety and security, even its small model Getz reached four stars of maximum five stars in the Euro NCAP crash test, during that time, even the German car brands in that class got the same results. Impressive test results, coupled with lower prices and new models pushed up its sales gradually, Hyundai managed to set up its foothold in Europe in the early 2000s.

Phase 3. Design, Develop and Produce in Europe (2003 to present)

After 10 years of increasing sales and aggressive marketing campaigns, Hyundai set up its own design and develop centre in Russelsheim/Germany (Opel 's headquarter) in 2003, it was the same location as Kia's European office (Hyundai fully took over Kia in 1998). Hyundai moved its European Office to Offenbach/Germany in 2005.

The Hyundai group (including Kia) hired many experienced, leading designers and engineers from Opel and other Europe OEMs, developed the new models (i-30, i-10, i-20, i-40, i-35 etc.) for European customers. Hired staff such as Peter Schreyer as the Chief Design Officer from 2006, Mr. Schreyer had previously worked at Audi (designing the Audi TT) and Volkswagen, and had won the Design Award of the Federal Republic of Germany.

Since the Frankfurt Motor Show in 2007, the Hyundai group has introduced a new corporate image to create a recognizable 'face' for the brand. Mr. Schreyer indicated that he wanted "a powerful visual signal, a seal, and an identifier. The front of a car needs this recognition, this expression. A car needs a face and I think the new Kia face is strong and distinctive. Visibility is vital and that face should immediately allow you to identify a Kia even from a distance. “

It is not secret that Kia produced its Sportage SUV at the Karmann factory in Germany from 1995 for the European market, until it opened its own plants in Zilina, Slovakia in 2005. Hyundai have also produced its cars for Europe in Izmit, Turkey since 1997, and opened its latest plant in Nosovice, Czech in 2009.

4.2.3 Points of Success in Europe

Outside of the Toyota's points of success in Europe in last case study (right market gap, right price/value product specification and right models), the Hyundai took over another Korean car brand Kia, which had already been set up in Europe earlier, this paved the way for entering Europe. The hiring of experienced designers and aggressive marketing activities, which created its new image, and quick responses and decisions about market requirements, resulted to increase its performance in Europe.

The Hyundai Group managed to conquer the European car market through above mentioned points, and even surpassed all of Japanese mentors in Europe in 2012. The most important is that its rapidly growing trend is still continuing, even many Europe car brands like Opel, PSA, Renault and Fiat have been losing their market share since 2000, some brands were sold out, and some brands grew slowly or kept stable in Europe.

In my opinion, put simply, the secret to of Hyundai's success is three A as below: **Attractive design, Affordable price and Acceptable quality.**

4.3 Trade Relations

4.3.1 Trade relations between Japan and Europe

The Japanese ambassador to Belgium was accredited as Japan's first Representative to the Europe Community in 1959 (which would later become the EU in 1993). However the establishment of a European delegation in Tokyo wouldn't be established until 1974. The first ministerial meeting between the two sides took place in 1984.

Although cultural and non-economic ties with the EU grew significantly during the 1980s, the economic nexus remained by far the most important element of Japanese-EU relations throughout the decade. Some West European countries like Italy and France tried to restrict Japanese goods (such as car) access to the newly integrated European market during the 1970s and 1980s.

In November 2012 the European Council decided to give the Commission 'the green light' to start the negotiations with Japan for the Free Trade Agreement. It would address a number of EU concerns, including non-tariff barriers and the further opening of the public procurement market. The figures below show the trade elements of both parties.

Figure 4.6 EU-Japan "Trade in goods" statistics

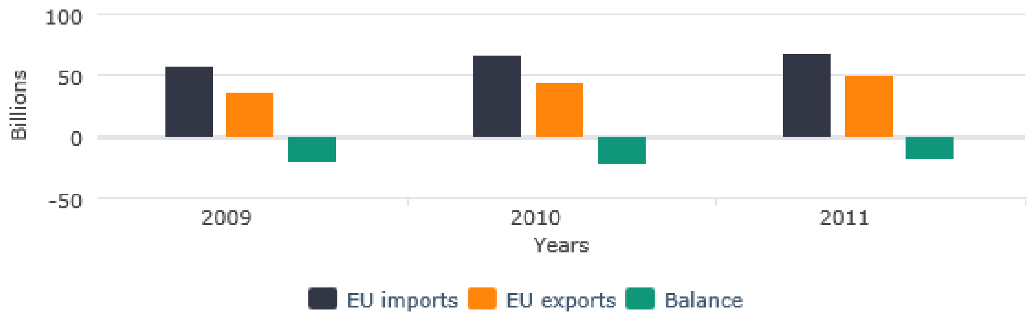
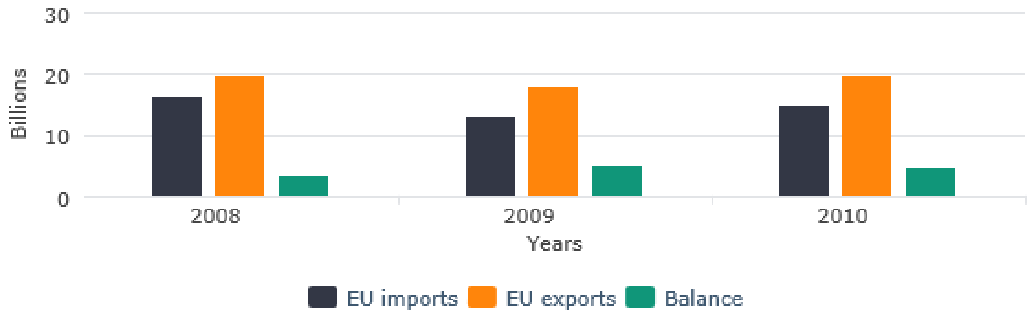


Figure 4.7 EU-Japan "Trade in services" statistics



In addition to the figures shown above, Japan had about 35 billion Euro more Foreign Direct Investment in EU in 2010.

(Source: European Commission trade statistics)

4.3.2 Trade relations between South Korea and Europe

The first EU - South Korea agreement created was the Agreement on Co-operation and Mutual Administrative Assistance in Customs Matters (signed on 13 May 1997). This agreement allowed the sharing of competition policies between the two parties. The second agreement, the Framework Agreement on Trade and Co-operation (enacted on 1st. April 2001). The framework aimed to increase co-operation in several industries, including transport, energy, science and technology, industry, environment and culture.

In 2010, the EU and Korea signed a new framework agreement and a Free Trade Agreement (FTA), this was the EU's first FTA with an Asian country and removed virtually all tariffs and many non-tariff barriers. On the basis of this, the EU and Korea decided to upgrade their relationship to a Strategic Partnership in October 2010. These agreements were provisionally put into force at the end of 2011. The figures below show the trade elements of both parties.

Figure 4.8 EU-Korea "Trade in goods" statistics

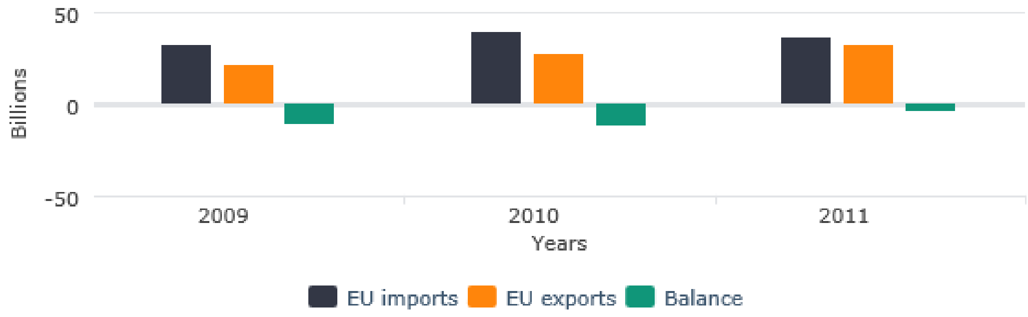
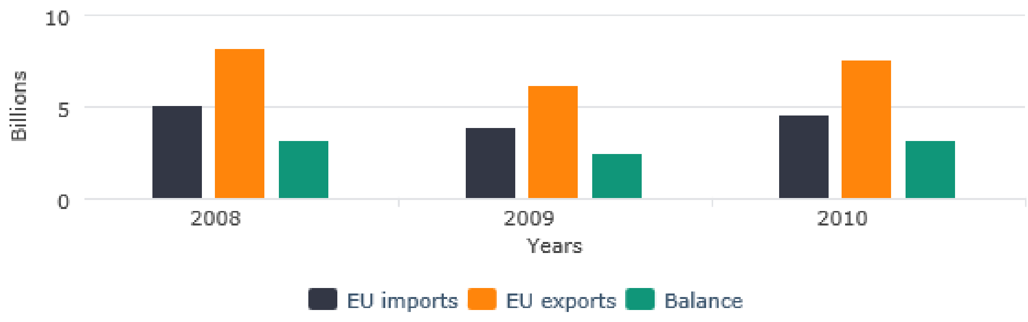


Figure 4.9 EU-Korea "Trade in services" statistics



In addition to the figures shown above, EU had about 14 billion Euro more Foreign Direct Investment in Korea in 2010.

(Source: European Commission trade statistics)

4.3.3 Trade relations between China and Europe

Relations were governed by the 1985 EU-China Trade and Cooperation Agreement. Since 2007, negotiations have been underway to upgrade this to a new Partnership and Cooperation Agreement. Dialogues and agreements were made with a primary focus on environmental protection and education. There are annual EU-China summit meeting.

The main obstacle in recent times has been the EU's military embargo to China, as well as China's big trade surplus to EU. There have been several disputes, such as the dispute over textile imports into the EU. China and the EU are seeking to increase cooperation today. For example China joined the EU's Galileo project with €230 million investment and has been buying Airbus planes in return for the building of a plant in China.

EU is China's largest trading partner, and China is the EU's second largest trade partner after the United States. Most of this trade is in industrial and manufactured goods. Between 2009 and 2010 alone EU exports to China increased by 38% and China's exports to the EU increased by 31%. The figures below show the trade elements of both parties.

Figure 4.10 EU-China "Trade in goods" statistics

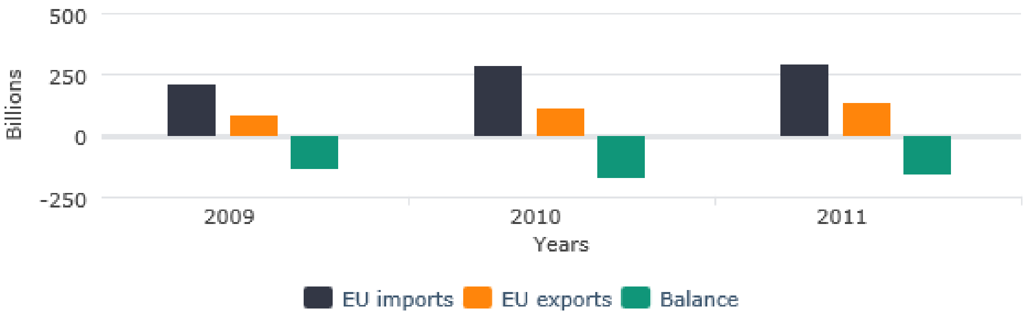
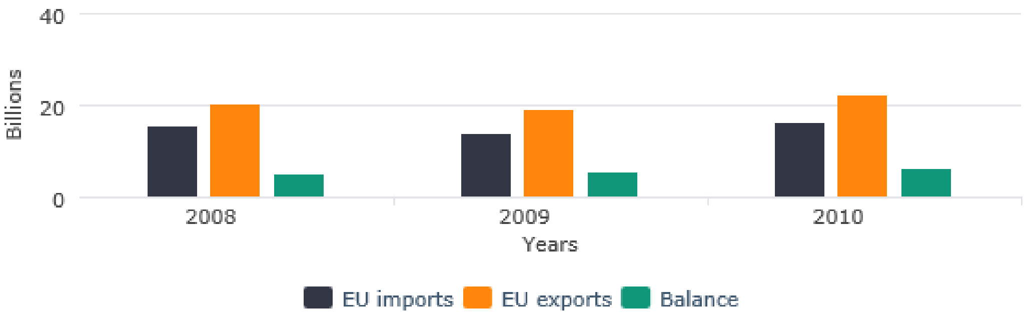


Figure 4.11 EU-China "Trade in services" statistics



In addition to the figures shown above, EU had about 7 billion Euro more Foreign Direct Investment in China in 2010.

(Source: European Commission trade statistics)

4.4 Summary and conclusion

4.4.1 Benchmark summary

Toyota and Hyundai can be compared when reviewing the following points: both brands are from far east Asia, entering markets in Europe are neutral countries without any OEM, both companies began business with compact and sub-compact models from private importers first, their cars are well equipped with better price value than local brands, they research and design in western Europe, and produce in eastern Europe, both get the type approval and meet the regulations of the NCAP and the Euro 3/4/5 standards.

The differences between the two are that: Toyota offers high quality and new hybrid technology, whilst Hyundai offers better design and aggressive marketing activities. Both brands are nevertheless successful in Europe. The above benchmark studies could be used as guideline for the introduction of the Chinese EV into the European market. The case studies of BYD and Great Wall will also be based on this benchmark study.

4.4.2 Trade relation conclusions

There is no additional tax on the car products from Japan, Korea or China, but there is a 10% general custom duty if import goods from outside EU countries are brought into EU. Therefore production in Europe for the European market will avoid such import custom duties, and it will also reduce the production and transport cost, all the while improving the brand's image.

When the cars are imported or produced in Europe, there will be no official concerning as overseas brands in the EU, both local and imported personal vehicles will have to pay tax or fee for NOVA, CO2 and VAT, which related to the different car models.

However in order to enter the European market , overseas cars will have to fulfil the related car regulations with European standards, which are quite high and vary from area to area. When we go back to the introductory stages of Chinese cars being brought into Europe, we can see that the Brilliance BS6 didn't meet the NCAP standards, failed in end 2007 ADAC crash test. The test result video was released to the public, which was a disaster of public image. As a consequence, another Chinese car maker, BYD had to postpone their plans for Europe in 2009.

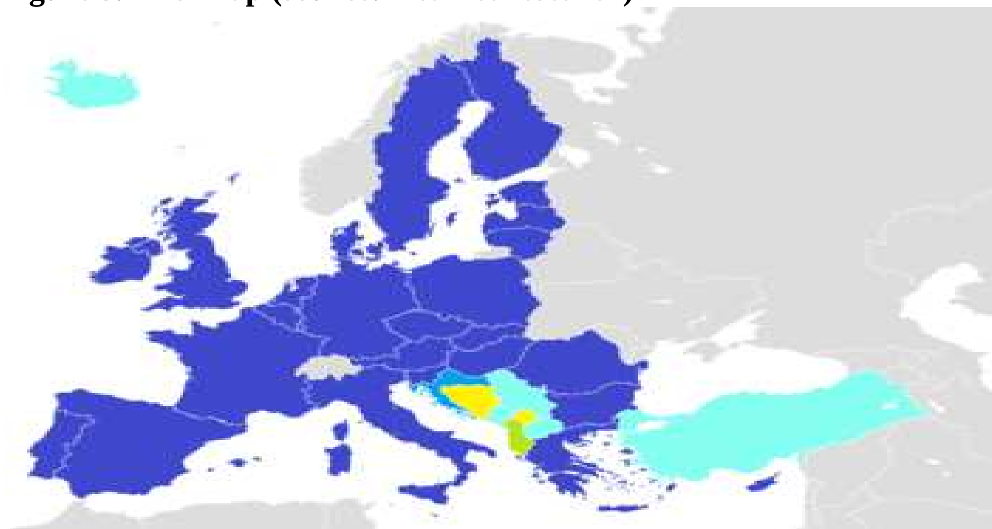
The Chinese EV doesn't currently have the European vehicle Type Approval, also has not done any crash test yet in Europe, hundreds of BYD e6 were imported to UK, Spain, Holland, Hungry etc. as Taxi in special cases. This topic will be discussed in later case study of BYD and Great Wall.

Chapter 5. Statistical Market Research

5.1 The European Car Market in General

The European Union (EU) compromises 27 member states, has technically been a single economic market since 2007. It should focus on internal free competition and movement of goods and services, but there are many internal obstacles and differences, that exist even in car markets, the general situation of European car market is shown in bellows.

Figure 5.1 EU Map (source: internet research)



Member states, Acceding: Croatia, Candidates: Iceland, Macedonia, Montenegro, Serbia, Turkey, Application submitted: Albania

5.1.1 Basic information.

According to the Euro statistics of 2010, the average age for the European car was about 8.2 years. The average annual distance travelled by a car in EU was about 15,000 km, about 33.7% of the European cars were diesel powered.

The EU has a combined population of over 500 million inhabitants, or 7.3% of the world population, the EU generated the largest nominal world gross domestic product (GDP) of 17.6 trillion US dollars in 2011, representing approximately 20% of the global GDP when measured in terms of purchasing power parity.

The EU started the common currency EURO in 2002 to replace several national currencies with central bank and monetary policy, the following 17 states use Euro as their official currency today: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherland, Portugal, Slovakia, Slovenia, Spain. Most of the other EU currencies have a fixed rate with Euro, asides from the British Pound.

5.1.2 Europe has strong OEMs, high quality, safety and environment standards.

The first car ever invented in the world was by Carl Benz in 1886 in Germany. Although Ford invented the moving assembly line for mass car production in 1914 in the USA, Europe had developed the car continuously, and had many strong OEMs prior to that year, such as Mercedes-Benz, VW, BMW, Opel, Porsche, Audi (Germany), Fiat, Lancia, Alfa Romeo, Ferrari (Italy), Renault, Peugeot, Citron (France), Jaguar, Land Rover (UK), Seat(Spain), Skoda (Czech) etc.

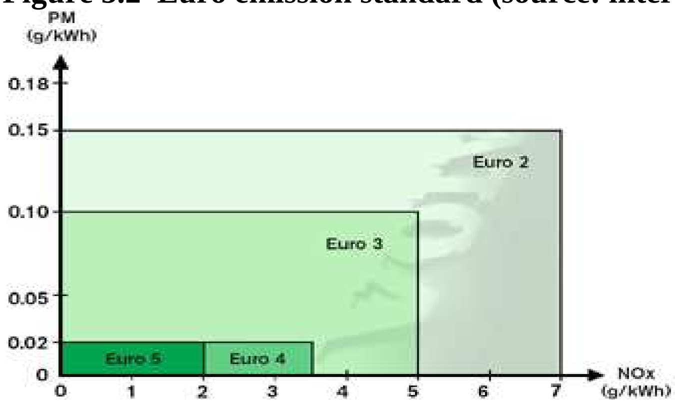
In addition to having higher quality requirements for all car parts, the EU also set up the vehicle safety rating system **European New Car Assessment Program** (Euro NCAP), it was based in Brussels (Belgium) and founded in 1997 by the Transport Research Laboratory and backed up by all EU member states (national transport departments).

Euro NCAP testing was not mandatory, with vehicle models either being independently chosen by the Euro NCAP or voluntarily tested by the manufacturers. In Europe, new cars were certified as legal for sale under the **Whole Vehicle Type Approval** regimen, which differed from that of the Euro NCAP. According to the Euro NCAP, "The frontal and side impact crash tests used by Euro NCAP are based on those used in EU legislation. Much higher performance requirements are used by Euro NCAP. The frontal impact speed used by Euro NCAP is 64 km/h compared 56 km/h for legislation."

The Euro NCAP also states that "Legislation sets a minimum compulsory standard whilst Euro NCAP is concerned with the best possible current practice. Progress with vehicle safety legislation can be slow, particularly as all EU Member States' views have to be taken into account. Also, once in place, legislation provides no further incentive to improve, whereas Euro NCAP provides a continuing incentive by regularly enhancing its assessment procedures to stimulate further improvements in vehicle safety."

The EU always leads the way for automotive and environment protection worldwide, since 2000 the EU has started the car emissions rating standard from Euro 1 to Euro5 today, these standards are worldwide accepted.

Figure 5.2 Euro emission standard (source: internet research)



5.1.3 The market is saturated and divided, market volume in each member state is small. There is high level of competition and less market gap.

Although EU has higher purchasing power parity, compared to developing countries such as Brazil, Russia, Indian and China (BRIC), the passenger car in EU had a long history, especially in those old EU member states. Most families already had a car, and many EU car OEMs were able to fulfil their demands and gaps, thus competition for outside cars was extremely high.

I prepared the table below to highlight this scenario compared to other regions.

Figure 5.3 Passenger cars per hundred people (PHP) worldwide (source: internet)

Area	Registered Car 2010	Population	PHP
EU27	234 millions	500 millions	46.8
USA	135 millions	314 millions	42.99
Japan	58 millions	128 millions	45.31
China	26 millions	1,344 millions	1.94
India	10 millions	1,241 millions	0.81

5.1.4 Current situation: the decline for demand of new car in the EU.

Most of the big global car maker suffered wounding reversals in Europe in 2012, as the EU saw its biggest year-on-year fall in new car registrations for two decades, manufacturers such as the PSA, Renault, Fiat Ford and GM experienced a sales decline in the region of more than 10 per cent. Further sales declines are also anticipated in 2013, which indicates the object failure by the continent's economy to mount any meaningful recovery from the 2008-09 financial crisis, and the Euro crisis in 2012.

According to the European Automobile Manufacturers' Association (ACEA), the total number of registrations in the EU in 2012 reached 12.1millions units, down 8.2 percent from 2011. The worst hit countries were those suffering from the biggest economic difficulties arising from the broad economic woes of the Euro crisis. Italy suffered a year-on-year fall in registrations of 19.9 per cent, France of 13.9 percent and Spain of 13.4 percent.

The worst hit manufacturer across the continent was Renault, which suffered a 19.1 per cent decline in car sales across the EU, also announced 7500 job cuts in France.

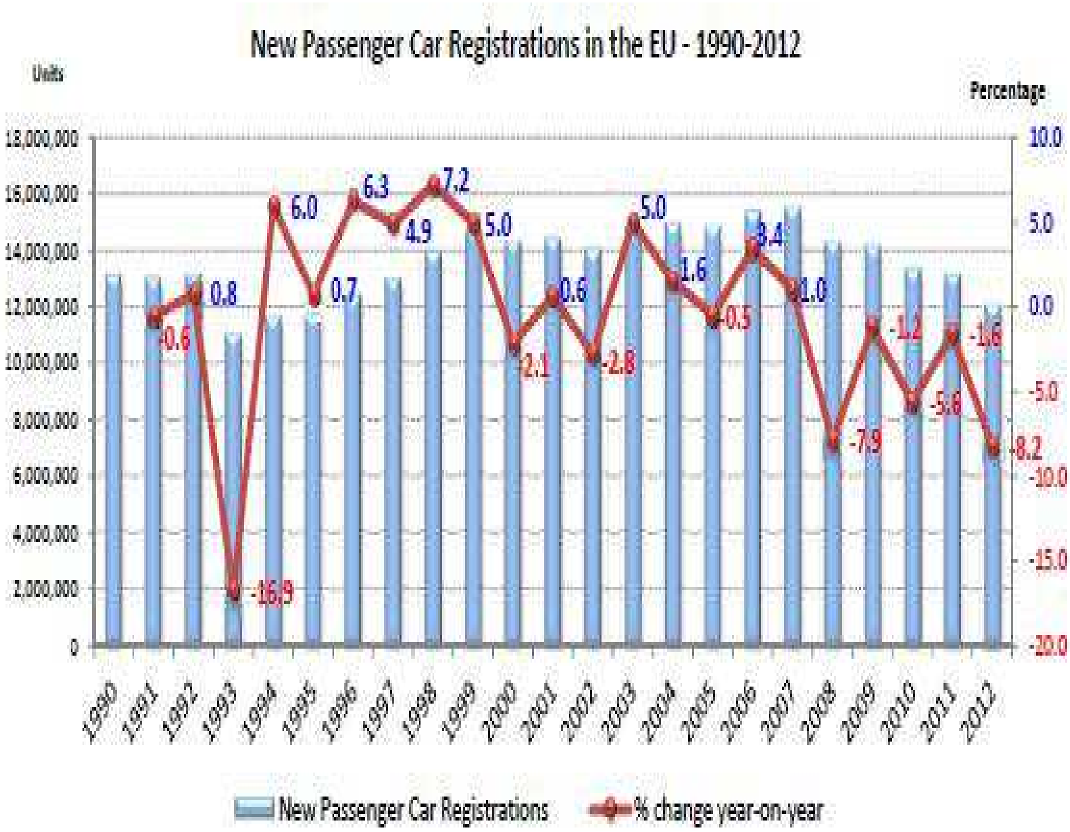
Sales in the EU by the VW Group, the continent's biggest carmaker, fell 1.6 percent, but reached 3 million units, a quarter of total EU registrations in 2012.

Only the Hyundai group increased its European market share from 5.1% to 6.1%. Also the new registered cars in UK rose 5.3% from 2011 to 2012.

Figure 5.4 New passenger car registration in EU 2012 (source: ACEA)

	Dec. '12	Dec. '11	% Chg 12/11	Jan - Dec '12	Jan - Dec '11	% Chg 12/11
AUSTRIA	18 421	23 358	-21,1	336 010	356 145	-5,7
BELGIUM	22 324	48 763	-54,2	486 737	572 211	-14,9
BULGARIA	1 985	1 209	+64,2	19 419	19 122	+1,6
CYPRUS	570	1 175	-51,5	10 967	14 544	-24,6
CZECH REPUBLIC	12 784	15 019	-14,9	174 009	173 282	+0,4
DENMARK	10 707	15 355	-30,3	170 763	170 036	+0,4
ESTONIA	1 041	1 156	-9,9	17 267	15 350	+12,5
FINLAND	6 410	6 891	-7,0	111 251	126 130	-11,8
FRANCE	160 314	187 817	-14,6	1 898 760	2 204 229	-13,9
GERMANY	204 331	244 501	-16,4	3 082 504	3 173 634	-2,9
GREECE	3 669	5 538	-33,7	58 482	97 682	-40,1
HUNGARY	5 048	3 262	+54,8	53 059	45 109	+17,6
IRELAND	316	371	-14,8	79 498	89 878	-11,5
ITALY	86 735	111 928	-22,5	1 402 089	1 749 739	-19,9
LATVIA	796	1 060	-24,9	10 665	10 980	-2,9
LITHUANIA	842	1 033	-18,5	12 170	13 223	-8,0
LUXEMBURG	3 072	2 642	+16,3	50 398	49 881	+1,0
NETHERLANDS	18 306	17 244	+6,2	502 528	555 843	-9,6
POLAND	21 141	27 324	-22,6	273 589	277 427	-1,4
PORTUGAL	6 342	11 248	-43,6	95 290	153 404	-37,9
ROMANIA	4 828	7 721	-37,5	66 436	81 709	-18,7
SLOVAKIA	5 074	6 595	-23,1	69 268	68 203	+1,6
SLOVENIA	2 489	3 280	-24,1	48 648	58 417	-16,7
SPAIN	51 197	66 457	-23,0	699 589	808 051	-13,4
SWEDEN	27 108	25 402	+6,7	279 899	304 984	-8,2
UNITED KINGDOM	123 557	119 188	+3,7	2 044 609	1 941 253	+5,3
EUROPEAN UNION (EU27)*	**799 407**	**955 537**	**-16,3**	**12 053 904**	**13 130 466**	**-8,2**
EU15	742 809	886 703	-16,2	11 298 407	12 353 100	-8,5
EU11*	56 598	68 834	-17,8	755 497	777 366	-2,8
ICELAND	544	272	+100,0	7 902	5 054	+56,4
NORWAY	9 369	11 550	-18,9	137 967	138 345	-0,3
SWITZERLAND	29 108	30 483	-4,5	328 139	318 958	+2,9
EFTA	39 021	42 305	-7,8	474 008	462 357	+2,5
EU27*+EFTA	838 428	997 842	-16,0	12 527 912	13 592 823	-7,8
EU15+EFTA	781 830	929 008	-15,8	11 772 415	12 815 457	-8,1

Figure 5.5 (source: ACEA)



5.1.5 The Electric car in Europe

There are many incentives and promotions for the EV in the EU and member states, As I mentioned in chapter 3, the gasoline price and environmental awareness are much higher in the EU, its aim in 2010 was to get 1 million EV in EU up until 2020.

This EV fever seems to have cooled down in the last two years, the reason is that aside from the handicap of the EV and lack of infrastructure, the European car makers are not in the leading position as far as the EV is concerned. According the proposal of the EU regulation in 2012, only cars with emissions less than 50g/km CO2 could qualify the incentives of EV. Most EU cars have not ever reached that standard till yet.

In the categories of series production and highway-capability, till July 2012 worldwide, the top selling model of PEV was Nissan Leaf (which sold 32,000 units), the top selling plug-in EV is GM Volt/Opel Ampera (which sold 20,000 units).

The registration amount and percentage of the EV in the EU is lower than that in USA, Japan and China. The EV is already seen as a new type of car, and therefore has difficulty as well as potential to break into European market.

5.2 Austria's Car Market

The reasons that I selected Austria as my research country were: for its location in the centre of Europe, it didn't have its own car brand, and that it is a developed country which joined EU in 1995, I was also to on-site research for this MT.

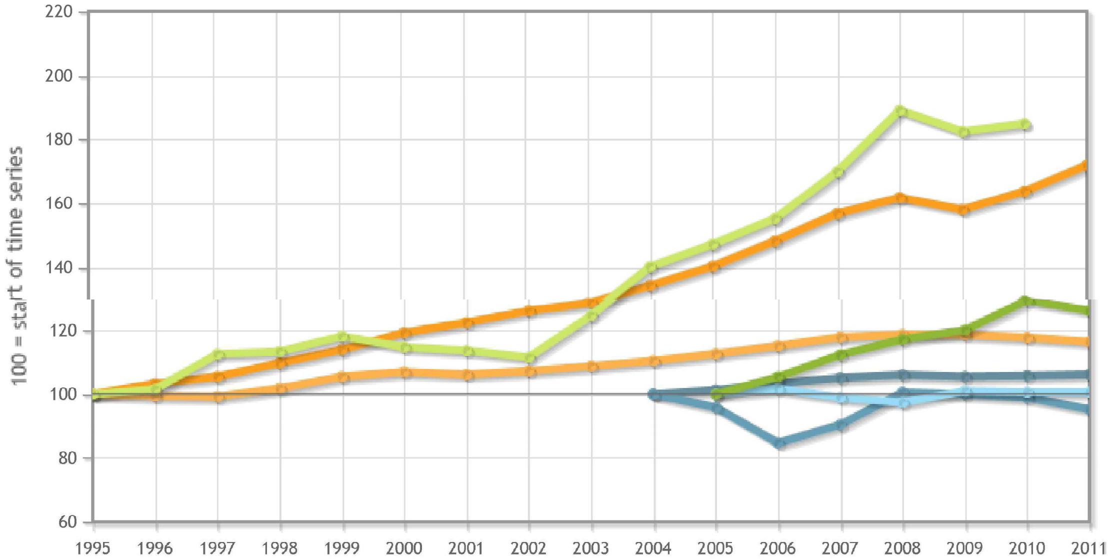
5.2.1 Basic information

Figure 5.6 Austria Geography (source: CIA website)

Figure 5.7 Austria States/Area/population 2012 (source: Wikipedia)

State	Capital	Area (km²)	Population
Burgenland	Eisenstadt	3,966	286,215
Carinthia	Klagenfurt	9,536	557,773
Lower Austria	Sankt Pölten	19,174	1,617,455
Salzburg	Salzburg	7,154	534,122
Styria	Graz	16,392	1,213,255
Tyrol	Innsbruck	12,648	714,449
Upper Austria	Linz	11,980	1,416,772
Vienna	Vienna	414	1,731,236
Vorarlberg	Bregenz	2,601	371,741
	Total	83,865	8,443,018 (2012)

Figure 5.8 Austria's public statistics (source: Statistik Austria)



The lines from up to down stand for: 1. Environment Protection Expenditure; 2. GDP; 3. Renewable energy; 4. Consumption; 5. Employment rate; 6.Overall life satisfaction; 7. Local environment.

Austria is a small-but-fine market economy (Service 69%, Industry 29%, Rest 2%), Its GDP per Capita was $42,500 in 2012 (worldwide ranking 19), its unemployment rate is 4.4% (lowest in EU), its political and finance system are stable, over 30% of Austria energy is renewable, although its tax and revenue level are also high(47.8% of GDP, worldwide ranking 26). In Figure 5.8, one can see that Austrian have high living standard and will pay more for products and environmental protection.

5.2.2 Austria's Car market

According to 'Statistik Austria', the registration of new passenger cars in 2012 decreased by 5.7% to a total of 336,010 units compared to the highest result in 2011 of 356,145 units. Both Diesel-driven cars (56.4% share) and petrol-driven cars (42.7%) faced decreases, although the share of alternative-driven cars (electric, gas, bivalent engine and hybrid) had a record increase of 27.8%. Their market share is still only 0.9% or 3063 units.

Among the top 10 brands in 2012, VW had a 18.3% share with a total of 61,627 units, followed by Skoda had 6.5% or 21,698 units, Ford had 6.4%, Audi had 6.2%, Hyundai & Opel both had 5.7%, Renault had 5%, BMW had 4.7%, Seat had 4.3%, Peugeot had 4.2%. Compared to 2011, the big share winners were: Skoda +6.6%, Hyundai +6.4%, Audi +4.4%; the big share losers were: Opel -25.7%, Seat -12.7%, Peugeot -10.9%, and Renault -9.9%.

The trend for reduced-emission vehicles had obviously increasing. 15% more passenger cars were registered in 2012 with less than 120 g/km (tax-averaged, total share of 30.9%). See the figure below for more details.

Figure 5.9 New car sales and emissions within Austria (source: Statistik Austria)

New Car Registration 2000 bis 2012 nach Antriebsarten und durchschnittlichen CO_2-Emissionen in g/km					
Report Year	Passenger Car				
	Diesel	Ø CO_2 Diesel	Benzin inkl. Felx-Fuel	Ø CO_2 Benzin	total 2)
2000	191 281	162	118 133	176	309 427
2001	192 681	161	100 833	175	293 528
2002	194 555	161	84 905	173	279 493
2003	214 505	161	85 586	170	300 121
2004	220 255	159	91 023	168	311 292
2005	199 908	161	107 856	165	307 915
2006	191 766	164	116 282	163	308 594
2007	176 746	164	120 424	161	298 182
2008	160 459	160	131 616	155	293 697
2009	146 962	153	170 847	148	319 403
2010	167 130	145	159 740	143	328 563
2011	194 721	140	159 027	138	356 145
2012	**189 622**	**138**	**143 325**	**134**	**336 010**
1) Vorläufige Ergebnisse. 2) Inkl. Pkw mit Alternativantrieb.					

According to the report from the ÖAMTC (Austria biggest car club) in March 2013, the registration of pure EV in Austria in 2011 is 631 units, in 2012 is 427 units (decrease of 32,3%) due to high purchasing price and lack of government allowance, which means only 0.1% of total new resisted car. The good news is that all electric cars in EU will use the same electricity charge plug.

5.2.3 Austria car market characteristics

1. The market is small and saturated, a total of 8.44 million people had 4.3 million vehicle registrations in 2012, while the passenger vehicle per hundred people (PHP) was 50.94, and thus the price competition between normal cars was extremely high.

2. The market is traditionally dominated by German brands with 43.2% of market share (VW Group 24.7%, Opel 6.8%, BMW Group 6.4%, Benz Group 5.3%), but was also open to outside new comers (Japan brands 11.5% and Hyundai Group 6.1%) in 2012.

3. The purchasing power is strong and young, over 50% of new cars (336,011) were sold to the age group of 24 to 39, and by leasing or by credit. Used passenger car registration reached at 808,384 units in 2012.

5.3 Bulgaria's Car Market

The reasons for selecting Bulgaria as my research country were: it located near Black Sea with harbour, it didn't have its own car brand, it is a developing country (joined EU in 2007), and 2 Chinese OEMs (BYD and Great Wall) already had assembly plants there.

5.3.1 Basic information

Figure 5.10 Bulgaria Map (source: CIA website)

Bulgaria changed their regime from communism to democracy in 1990 and joined NATO in 2004, the country has a population of 7.038 million, 108,489 sq. Km land and is rich in natural resources. Despite the favorable investment regime, including low and flat corporate/incoming tax, it still faces corruption, crime and unemployment (12.6% in October 2012).

Bulgaria's economy (Services 57%, Industry 35%, and Rest 8%) grew slowly after the 2008 finance crisis, and was mainly dependant on foreign investment and bank lending. Its GDP per Capita was$14,200 (worldwide ranking 91) in 2012.

Figure 5.11 Monthly average salaries in US$ 2011-2012 (source: Wikipedia)

Country	Austria	Bulgaria	Germany	Poland	Romania	Turkey	Greece
Gross	3174	543	4740	1061	663	907	1565
Net	2484	426	2865	759	480	634	1250

5.3.2 Bulgarian car market information

According to the statistics of ACEA in January 2013, the total new passenger car registration in Bulgaria in 2012 was 19,419 units, detail as below:

Figure 5.12 Sales of car brands in Bulgaria in 2012 **(source: internet research)**

Pos	Brand	2012	%	/11	2011	%	Pos
1	Volkswagen	2,648	10.7%	42%	1,863	8.3%	1
2	Toyota	2,069	8.4%	16%	1,786	7.9%	3
3	Dacia	1,977	8.0%	30%	1,521	6.7%	6
4	Skoda	1,757	7.1%	27%	1,383	6.1%	7
5	Ford	1,592	6.4%	-14%	1,854	8.2%	2
6	Great Wall	1,461	5.9%	966%	137	0.6%	24
7	Peugeot	1,425	5.8%	-8%	1,543	6.8%	5
8	Renault	1,289	5.2%	0%	1,290	5.7%	8
9	Kia	1,215	4.9%	150%	486	2.2%	16
10	Opel	1,085	4.4%	-31%	1,582	7.0%	4

Figure 5.13 The top 8 best selling models in Bulgaria in 2012 (source: internet)

Pos	Model	2012	%
1	Dacia Logan MCV	848	3.4%
2	Great Wall Steed	608	2.5%
3	Skoda Octavia	608	2.5%
4	Kia Sportage	602	2.4%
5	Ford Fiesta	579	2.3%
6	VW Caddy	527	2.1%
7	Great Wall Voleex C10	488	2.0%
8	VW Polo	457	1.8%

5.3.3 Bulgarian car market characteristics

1. The purchasing power in Bulgaria is generally low due to their low salary, Bulgaria has a similar population and compared to Austria, the difference is that the new car sales in the country is only 5.78% than that in Austria, low price cars are more popular in Bulgaria.

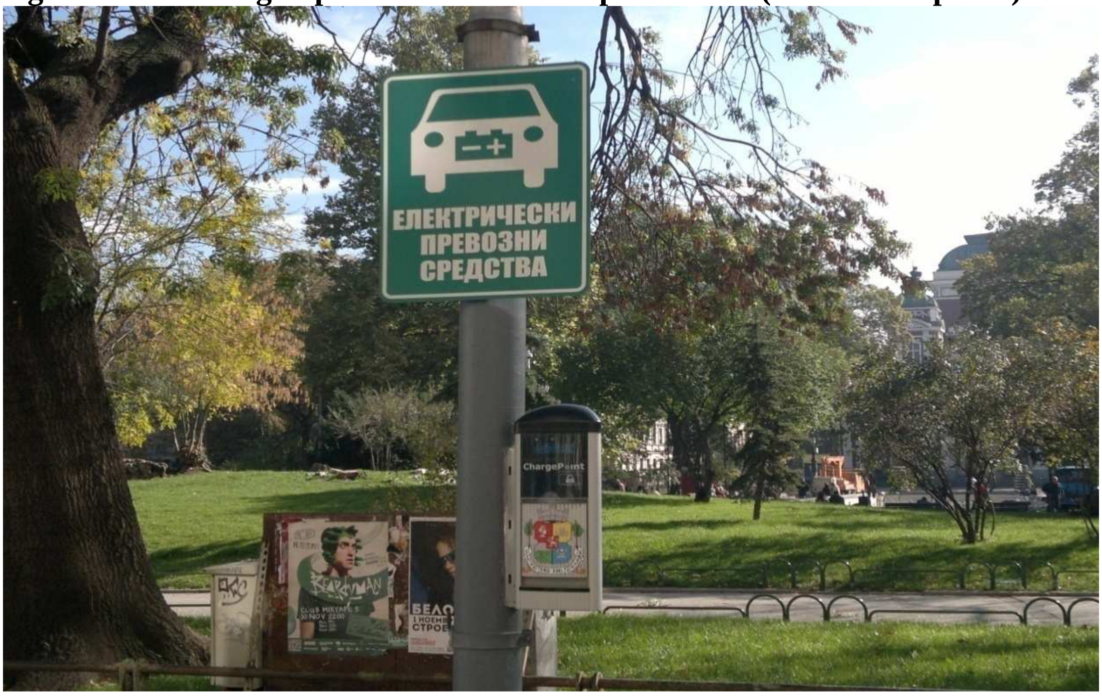
2. The registration for used-cars is over 10 times higher than for new cars. The import business for used-cars from Western Europe is much bigger than local new car sales there. In addition to this, there are also new registered new cars exported to neighboured countries, because the car tax and insurance in Bulgaria are at least two times lower than the EU averages.

3. The market is open, it hasn't dominated car brands. The top brand (VW Germany) has 10% of market share, the second (Toyota Japan) and the third brand (Dacia, France/Romania) have 8%, Great Wall (China) reached sixth position within its first full year, whilst its two models are within the top 8 national models.

4. The Bulgarian government strongly supported the local Great Wall assembly plant, they a similar scenario to Dacia in neighbouring Romania, and rescue its economy and lower the unemployment rate. This will be discussed in detail in the next chapter of Great Wall and BYD case study.

5. The Bulgarian government also strongly supported EV, already passed the legislation of a €2,500 allowance for each PEV, and reserved some free park place in the Sophia city centre. Below is the photo I took in November 2012.

Figure 5.14 Parking in park for E-Car in Sophia centre (source: self photo)



Chapter 6. Scientific Case Study

6.1 BYD

6.1.1 General Information

The name BYD stands for Build Your Dreams, Mr. Wang Chuanfu set up the company in 1995 in Shenzhen, south China. BYD began as a rechargeable battery factory for overseas brands, and became the largest Chinese manufacturer (top 4 worldwide) of cell phone batteries with its own leading technology by 2000, it has expanded to all types of rechargeable battery in subsequent years.

BYD Co. Ltd. created the wholly owned subsidiary BYD Auto in 2003, a year after its acquisition of the Qinchuan Automobile Company in north-west China in 2002, that company held the license, technology and production facility to make its own passenger car. The Chinese state encouraged the development of independent, local owned automobile manufacturers during that time, through this BYD Auto successfully brought its reputed normal car to the Chinese market in 2005.

BYD Auto presented the first mass-produced, full hybrid vehicle F3DM at the Beijing Auto Exhibition in March 2008, and presented the first mass-produced pure electric vehicle e6 in 2010, the company has held the top position for EV in China up until today, they also lead the field in battery technology and in the EV industry worldwide.

BYD Co. Ltd. currently has 5 main divisions: BYD Auto, which includes normal cars, hybrid cars, electric cars, electric buses; BYD Energy Storage, which includes all kinds of batteries; BYD Photovoltaic, which includes all kinds of solar power equipment; BYD LED lighting; BYD electronic products.

BYD Auto has a wide range of small and medium sized cars, and has three production plants in China with annual capacity of 800,000 units. During 2012 it produced about 610,000 vehicles, with a rank of 6 in local brands and a rank of 9 in all brands in China.

Mr. Warren Buffet spent $230 million on the acquisition of a 10% stake in BYD Auto in December 2008, BYD and VW Group signed an agreement for the possible cooperation in the field of lithium battery for hybrid and electric cars in May 2009, Business Week ranked BYD as the 8th most innovative company in the world in 2010, ahead of Ford, Volkswagen, and BMW.

BYD Auto and Daimler AG agreed to set up a 50:50 joint venture of the BYD Daimler New Technology Company (BDNT) in Shenzhen in April 2010, and then that new company received the business license from the Chinese government in March 2011 and focused on EV development for up-market in China. BDNT presented its concept car in 2012 with the new brand name of Denza.

6.1.2 The main BYD EV models and combined parameters

6.1.2.1 F3DM (Qin)

Figure 6.1 BYD F3DM model (source: internet research)

As above mentioned, the F3DM is firstly presented in March 2008, it was based on BYD's compact model F3 (takes two-thirds of all BYD cars). DM stands for Dual Model, a plug-in hybrid compact sedan, with an all-electric range of 40-60 miles (64-97 km) and a hybrid electric powertrain that can extend the range to an additional 300 miles (480 km), in practical it can drive 500 km in one full electricity-charging and full gasoline-tank. The all-electric range of its main competitor Toyota Prius 2012 model is only 14 miles (23km).

The F3DM has two alternating electric motors, a 50 kW unit that drives the wheels and a 25 kw unit can send power to the wheels or generate electricity through regenerative braking. At that point, the F3DM’s 1-liter 3-cylinder engine kicks in to bring the battery charge as close as possible to 30%, effectively extending the range of the vehicle, just as the Chevrolet Volt does.

The F3DM has a direct connection between the gasoline engine and the wheels that is useful when accelerating onto a highway, just like the Toyota Prius. Under high-load circumstances, the 68 PS gasoline engine combines with the electric motors to deliver a total of 168 PS (125 kW).

The F3DM is the world's first mass-produced plug-in hybrid car and went on sale to government agencies and corporations in China in December 2008 in the price of 149,800 Yuan (about US$ 24,000, without any subsidiary). During its first year on the market the F3DM sold only 48 vehicles. Sales to the general public began in Shenzhen in March 2010 with a total subsidiary of 50,000Yuan. 417 units were sold during 2010. Sales in China reached 2,279 units through to December 2012.

In April 2012 BYD announced that the F3DM would be replaced by the Qin, an updated model based on BYD’s new medium size model SuRui. SuRui has remote driving controls and the other latest technologies which were launched in September 2012. Qin will use the DM 2 technology (F3DM used the DM 1). Qin is a concept car currently, the official launch will be in end of 2013, so its combined parameters in the next paragraph, will refer to the features of F3DM.

6.1.2.2 BYD e6

Figure 6.2 BYD e6 model **(source: internet research)**

The 5-passenger e6 has been marketed as a crossover (MPV and SUV) pure EV. It was first sold in May 2010 with 40 units used as taxi in Shenzhen at the price of 369,800 Yuan ($56,900 without any subsidies). It was consequently sold to public in China in October 2011 at the price of 249,800 Yuan ($38,430) after subsidies. Since 2010 a total of 2,124 units have been sold in China through to December 2012.

The e6 was equipped with a 75kW motor and the BYD-developed Fe battery, for a range of 300km on a full charging in the urban conditions. This made it as the longest-range pure EV in the world. During braking, deceleration and downhill coasting, the vehicle's kinetic energy is also converted into electrical energy and stored in battery packs through regenerative-braking functions, there is further improving energy utilization to increase the e6's range.

The e6 featured the latest body/frame-integral construction. It is roomy and comfortable thanks its 2830mm wheel distance, with a battery pack protected in a compartment that is fully integrated into the vehicle. The battery pack's outer dimensions are: 175 cm in length, 95 cm in width and 30 cm in height.

There were at least 300 units of e6 which operated daily as taxi in Shenzhen through to the end of 2012, with a 20 million miles operation record. In 2010 the city of Los Angeles agreed to order 10 units of e6 and lease a further 20 units at the price of $35,000 before subsidies. BYD have managed to sell e6 to other 14 Chinese cities, Thailand, South America, Russia, Holland, Spain, the UK and many other countries, mainly as taxi since 2011. The Shenzhen Police Stationed ordered 500 units of e6 as police vehicles in January 2013.

I took this e6 Taxi at least 10 times in Shenzhen during August 2012. During this time I also talked with the drivers, my attitude and their opinions about e6 were mostly positive. It is spacious, comfortable, silent and smooth even in high speed. Most importantly it started up quickly and ran 280 km with full charging.

As a pure EV, it has zero emissions, offers a 10 years' guarantee, has a top speed of 140kmh, requires 40 minutes for full charging by a special 100KW fast charging cabinet, or 6 hours with a standard charging pole.

6.1.2.3 Denza (e3)

Figure 6.3 Denza model **(source: internet research)**

As above mentioned, Denza is a new high class pure EV brand special for China from BDNT, a 50:50 joint venture between BYD and Daimler. Its concept car was presented by Mr. Wang and Dr. Zetsche (chairman from two companies) in April 2012 at Beijing Auto Show, Mr. Wang indicated that BYD will put the updated electric power train from e6 into Denza, and Dr. Zetsche indicated that Daimler will contribute the platform, latest design and interior technology into Denza.

In reference to Figure 6.3, Denza's concept car is based on a previous model of Mercedes-Benz B-class in 2011. The back, height and width have been extended about 10cm each, in order to leave enough room for the battery pack. For the combined parameters in the next paragraph, I will use the features of B-class of 2011 plus 10cm and e6 motor.

The main concern for this model is its price, although a price has not been disclosed yet, if we refer to the price of e6 however, we will see that the estimated price for Denza is about 450,000 Yuan ($72,000 before subsidies), it will be undoubtedly too luxurious for the average Chinese, which will have volume problem.

It is likely that BYD will develop a simple version of the Denza as e3 with a price of 250,000 Yuan ($40,000/€30,000 before subsidies) for volume purposes. The current sales price of Nissan/Renault Leaf (pure EV in compact class with a range of 200km and a top speed of 145 km/h) in Europe is about €37,000 before subsidies.

BDNT and its sales organization are both located inside the BYD Complex in Shenzhen. BDNT does not have product facility, Denza will be produced in the BYD Shenzhen plant, but will have an independent dealer system (neither BYD nor Benz), the estimated launch time is at the end of 2013.

In reference to the report of ChinaAutoWeb on 30/10/ 2012, the Denza prototype has passed the Chinese crash-safety testing and achieved the highest grade in the Chinese NCAP ranking system. 100 units of prototype have travelled over 100,000km each in four distinct regions in China. It also reported on 2nd March 2013, BYD and Daimler would contribute extra 430 million Yuan ($70 million) each side, in order to boost the registered capital of BDNT to 2.36 billion Yuan ($380 million).

Figure 6.4 BYD EV combined parameters (source: base on internet research)

Parameters / Models	**F3DM (Qin)**	**E6**	**Denza(estimate)**
Dimensions L/W/H in mm	4533/1705/1520	4560/1822/1630	4373/1877/1703
Wheel distance in mm	2600 (2660)	2830	2778
Power train	PHEV	Pure electric	Pure electric
Range in a full charge+tank	500km	300km	300km
Top speed in kmh	150 (180)	140	140
0-100 kmh seconds	10.5 (6.9)	14	14
Charge hours fast/standard	1/9 (0.7/4)	0.7/4	0.7/4
Gross weight in kg	1560 (1310)	2020	1500
Battery in kw	25+50 (110)	75	75
List price in USD	24,000 (32,000)	56,900	72,000

6.1.3 BYD's Efforts in Europe

BYD set up its Europe liaison office in Rotterdam, Holland in 2007, and started to negotiate and even signed import intention contracts with different Europe private car importers in 2008, like Emil Frey Group for Germany and France, Berge Group for Spain and Portugal, Auto Bink for Benelux and part CEE, Kölliker Group for Italy, and Denzel Group for Austria and part CEE.

BYD also managed to export about 100 units of its e6 model to Russia, Ukraine, Hungary, Finland, Holland, Spain, the UK and other countries, mainly as special taxi project based on specific country exception from 2011, although e6 still does not have the Europe Car Type Approval till now.

Meanwhile BYD bought the Mirae Hungary Industrial Manufacturer Ltd. Company in February 2008 and currently has its own factories in Komaron (Hungary) for battery products, there are also plants in Cluj (Romania) for electric products.

BYD also signed a 50:50 joint-venture company agreement with the Bulgarian energy giant Bulmineral in December 2012. The company, Auto Group Motors, have a plant in Breznik, 50 km west of Bulgaria's capital Sofia. It will assemble the BYD K9 pure electric bus first of all. The first K9 is expected to be rolled off in February 2013, and its electric car assembling is scheduled to be thereafter. Its production will be expanded further through the assembling of the entire BYD products, including battery and LED lights.

It is very clear that BYD is following the strategies of Toyota and Hyundai as a benchmark, they set up in a neutral country without an OEM, worked with private importers, and produced in eastern Europe. BYD had to postpone their plan for Europe in 2009, due to the bad crash test result of another Chinese car Brilliance BS6 in Europe during 2007 and 2008.

6.1.4 Meeting with BYD

I sent the proposal of this MT to BYD and asked for a case study from their company, they agreed in July 2012, I flied to Shenzhen and had a very successful meeting in the BYD headquarters on 20th. August 2012, the main partner was Mr. Wing Zhang, the brand manager for Europe from BYD Group Marketing Department, they gave me a lot of information and were very hospitable, I would like to take this chance to express my thanks.

Our discussion included five main parts, Introduction part (mainly from BYD side), Product part (current and future EV), Technical Part (battery and value-added apps), Cooperation part (merging and acquisition), Commercial part (launch in Europe). Below are some of the important points that were raised.

BYD Auto produced over 500,000 vehicles in 2011, 99% were normal cars with an internal combustion motor, and about two-thirds were compact class. Their current EVs are: F3DM, e6 and S6DM, the future EV models will be Qin, e6, Denza (e3). China is clearly their first market in which they aim to achieve the volume. Their main export market is the USA, BYD have even set up an independent headquarter in California for all BYD business in North America.

The leading and core technology of BYD is battery. Their research and development direction for the battery in short term is 5S in next five years based on the currently LiFePo4 used in e6:
Smaller: reduce 20% from 175L/95W/30H in cm, as well as the weight.
Stronger: from current 300km driving range increase to 400km in urban condition.
Safer: work efficiently in extreme conditions of hot, cold, crash etc.
Scale: reach the economic scale to reduce its cost and reach the dominate position.
Seal: provide the finished battery worldwide, but keep the secret of technologies.

Mr. Zhang admitted that in their internal assessment, some of their auto parts didn't meet the European standard, to get the European Type Approval is extremely exhausting for time, energy and money. Therefore it may not be worthy for the saturated EU market now, he indicated that their car is made for driving, not for such crashing. If the EU won't pass related regulation, BYD will export its EV to specific EU countries under current conditions.

BYD's current expectations for Europe are to export the battery, LED lights and other electric/electronic products related with the EV. BYD doesn't mind if European car makers use its parts to make their EV in Europe. It will be easier for European car makers to push through the EU to pass or amend related regulations.

We also discussed the case of Geely, another private Chinese automaker, which took over the Sweden brand Volvo from its Ford Concern in August 2010, Geely paid $1.3 billion in cash and $200 million in notes for that biggest overseas acquisition by a Chinese automaker. Through this deal, Ford managed to survive the car crisis of 2009, although Ford bought Volvo for $6.5 billion in 1999.

Mr. Zhang told me that Geely's purchasing capital came predominantly from Chinese banks with the blessing of Chinese government. Through this deal, Geely improved its image and acquired the know-how of luxury brand, this was due to the high demand and profit of luxury cars in China, currently dominated by BMW, Mercedes and Audi. In the meantime Geely also got Volvo’s dealer network in Europe, the USA and worldwide.

These actions led to the cooperation between BYD and Mercedes, BYD also plan for further acquisition and hope to reach out to Western car markets and technology if it has a chance to.

6.2 Great Wall

6.2.1 General Information

Great Wall Motors Co. Ltd. was founded in 1976 in Baoding, about 200km south from Beijing. It initially produced only trucks and entered the pick-up trucks market in 1998. Great Wall started to produce passenger cars in 2008. It is a publicly listed company in Hong Kong Stock market, the current chairman is Mr. Wei Jianjun (since 1997).

Great Wall has been China's largest Sport Utility Vehicle (SUV) maker since 2010, produced a total 676,000 kinds of vehicle in 2012, it is ranked third of local brands and ranked sixth of all brands in China. It has distinct names for its three vehicle type, SUV is Haval, passenger car is Voleex, pick-up truck is Wingle, there are also different segments under each vehicle type.

Great Wall has a very clear export mission, about 15% of 2012 sales are from its overseas markets such as Russia, Australia, South Africa and South America. It has owns research, design and develop centres, they worked closely with international partners like Autoliv, Delphi, Bosch, Ricardo, TRW, Siemens and Valeo etc. since 1998. It also got the parts from their plants in China, these activities have helped to improve its quality and international acceptance. The company also attended and sponsored the International Dakar Rally in 2010, 2011 and 2012, and will continue to support this activity.

Great Wall currently has 8 big overseas joint-venture knock-down factories in Russia, Iran, Nigeria, Ukraine, Egypt, Bulgaria, Indonesia and Vietnam. These knock-down exports are an easy way for Great Wall to gain the access and market shares in these countries, they also reduce the cost of transport, tax and after-sale services. Great Wall has a very effective system to handle these factories and markets, and plans to open further 24 similar factories worldwide by 2015.

Mr. Wei indicated in a press conference in Hong Kong in December 2012 that, its home and overseas market increased 19% in 2012. It wasn't effected by economic and car crisis in Western countries since 2009. Great Wall will concentrate on the SUV market. Its gross profit was 24.9% in 2012, and Great Wall will increase the sales price of its SUV in 2013. Great Wall has full support from the Chinese automobile policies, and will invest US$625 million to increase 20% of its product capacity, but it has no plan for overseas acquisition like Geely/Volvo.

In reference to the report from China Daily on 15/8/2012, Great Wall and the American company Coda Automotive Inc. signed an agreement in July 2012, to co-develop a PEV that is scheduled to hit the US market in 2014. That US company previously developed an electric car with another Chinese car maker. The agreement called for that Coda will provide the powertrain and distribution for that vehicle, with the rest built by Great Wall. This car model will be sold in North America with the Coda brand and in China with the Great Wall brand.

6.2.2 Great Wall EV model Haval M3 EV

Great Wall stated its target for EV in 2009 with the statement that they "made quite a huge investment in exploring technologies for new energy autos". It presented its all-electric SUV concept car Haval M3 EV at the 2010 Guangzhou Auto Show, and began its public run in the Chinese market in 2011, with an estimated sales price of 20,000 Yuan ($32,000 before subsidies).

Figure 6.5 Great Wall EV model Haval M3 EV (source: internet research)

Figure 6.6 Haval M3 EV features (source: internet research)

Length in mm	4058	Powertrain	Pure electric
Width in mm	1727	Battery type	LiFePO4
Height in mm	1604	Rated/max motor power	24/56 kw
Wheelbase in mm	2460	Rated/max motor torque	65/150 Nm
Gross weight in kg	1196	**0-50 km/h** time in seconds	6.5
Normal charging 220V in hours	8	Range in full charge at 60km/h in city condition	160 km
Ground clearance	135mm	Top speed in km/h	130

From the above figures it is clear to see that Haval M3 EV is a sub-compact crossover of SUV and normal car. That is the reason why this model has another name, Voleex C20 EV.

6.2.3 Great Wall's Efforts in Europe

Great Wall have started to sell small van and pick-up trucks in Russia and eastern Europe since 2006, as well as set up its first European knock-down factory in Russia in 2006. It also shipped 500 SUVs to Italy in 2006, and registered them as commercial vehicles in Italy without European Vehicle Type Approval, which is similar to the instance BYD exported its e6 based on specific projects and country exceptions.

Great Wall signed a contract with the Bulgarian company Litex Group in May 2009, in order to set up a joint-venture company Litex Motors in Sofia, and started the new construction of knock-down assembling plant in Bahovitsa , about 150 km south-east from Sofia. This plant started official production in February 2012 with 200 units of Voleex C10, a small car model with three stars in E-NCAP.

Figure 6.7 Great Wall Voleex C10 (source: internet research)

As mentioned in paragraph 5.3, Bulgaria joined the EU in 2007, which meant that the products made in Bulgaria have free movement within 27 EU countries without import duty. Bulgaria has the lowest land, labor and tax level inside EU, and a high unemployment rate.

The Bulgarian government welcomes foreign investment; Bulgaria has no local car brand or dominated car OEM, and its market is open for Chinese car, Great Wall reached sixth position in the first year. Its Pick-up and Voleex C10 were the number two and number seven of best selling cars in Bulgaria in 2012. Bulgaria also passed the legislation of €2,500 allowance for each EV and special parking advantages.

6.2.4 Meeting with Great Wall/Litex Motors

I sent the proposal of this MT to Great Wall Bulgaria (its partner Litex Motors) in October 2012 and asked for a case study from their company. I flied there, visited their factory and had a very successful meeting in Litex head office in Sofia on 6th. November 2012, the main partner was Mr. Ivo Dekov, the Commercial Director of Litex Motors, another is Mr. Peter Karaivanov, the General Manager of Mazda Bulgaria. They both gave me a lot of information and were very supportive during my time there, I would like take this chance to express my thanks to them.

Mr. Dekov told me that their factory with 150 employees was already running at full speed to assemble 4000 units of three models in 2012. It will run in 2 shifts to assemble 8000 units of six models during 2013, including the compact class Voleex C20R and its full electric version Voleex C20R EV, another name is Haval M3 EV. That factory has the potential through 2000 employees to assemble 72,000 units in three shifts.

About 100 workers, engineers and managers were sent to Great Wall China for three to six months' training and practice. All the knock-down parts and assembling machinery were shipped from Great Wall China to Bulgarian harbour directly by a charted medium size ship. The transport cost was much lower than through the harbours in Holland or Germany. An interesting thing was that there was no single Chinese from Great Wall stationed in Bulgaria up until today.

I asked him about the possibility for this factory to assemble for other Chinese car makers, he said that this decision laid in the hands of the board of both sides. He did not reveal the contribution percentage of both sides in that joint-venture or related financial information. Mr. Karaivanov told me that the harbour handling and storage cost in Bulgaria was one fifth compared to Holland, The transportation cost for a finished car delivered from Bulgaria to other EU counties was about 200-300 Euro.

Mr. Dekov was very satisfied with the sales figures from their first year. He also emphasised that all their vehicles assembled from 2013 would be certified according to EU regulations, with the full vehicle type approval. Litex Motors was not only the producer, but also the sole importer of all Great Wall vehicles in Bulgaria, Serbia and Macedonia at the moment, developments into further markets were currently under negotiation.

Chapter 7. Interview with Experts

In addition to the above mentioned meetings with BYD in China and Great Wall in Bulgaria, I set up the interviews below for the purpose of this Master's Thesis.

7.1 Experts from OEM

Ms. Iveta Todorova, Managing Director of Nissan Bulgaria
Mr. Peter Karaivanov, General Manager of Mazda Bulgaria
Mr. Thomas A. Schmid, Sales & Marketing Director of Hyundai Austria

7.1.1 Interview briefing

Each interview lasted about 2 hours, with the following briefing points:

1). The success of Nissan (Mazda and Hyundai) in Bulgaria (Austria) and Europe
2). The characteristics of car markets in Bulgaria (Austria) and Europe.
3). Important items for new car makers for entry into the European market.
(From the view of OEM and Distributor).
4). Opinions about product specification and distribution of the EV in general.
5). Advices for Chinese electric car makers in Bulgaria (Austria) and Europe.

7.1.2 Main topics

Design and develop area. In order to set a clear car concept, one needs to carefully study the customer needs, market gap, and the balance between technical achievement and cost factors.

To produce a car with over 3000 parts is a complex process, which relates to quality and operation management and supply chain management. In reality less than 30% parts and works are done by OEMs themselves, OEMs however have the full responsibility to fulfill the quality, safety and environmental requirement for the cars.

The European car market, in reference to Mr. Schmid, is much divided upon country and region. It has the strongest competition worldwide, where the requirements and PHP are very high, and the sales volume is relatively small due to the saturated market. This all forces the profit down to a very low level.

The average net profit of European car OEM was about 3% in normal circumstance. Over 50% of them were lost money in 2012. Most of them cannot make profit if solely within the European market. Considering the huge investment and efforts, the car business seems against the basic economic theories. To put it simply, a new method must be established.

7.2 Expert from Dealer Network

Mr. Michael Röck is the Marketing Director of Denzel Group Austria, the biggest private car importer in Austria in the last thirty years. Denzel current have the distribution and sales room for BMW, Mini, Hyundai, Mitsubishi, Alpha Romeo, Fiat, Lancia, Land Rover, Jaguar, Volvo, Ferrari & Maserati.

7.2.1 Concern from private dealer network

Lower dealer margin. Usually the OEM importer gives the local dealer 13 to 15%, already including all bonuses and promotion, however due to high competition, dealers have to offer customers over 10% discount. The average gross profit of a new car for the dealers is about 1-2%.

In order to cover the cost of personal matters, land and administration, the dealers have to rely on the related service, insurance, leasing, financing, used car and other business. Dealers also have to maintain diverse requirements from the OEM, including keeping certain dedicated area and staff for each car brand.

7.2.2 Block Exemption Regulation (BER)

BER is an exemption in a business line or industry, which debars organizations in the industry from some business activities in order to create competition. The regulation is highly known in the automobile industry due to the effect of the BER regulations from the EU Commission.

BER has affected the automobile distribution industry in the last decade. Prior to 2003 automobile owners in the EU region risked nullifying their vehicle warranty when the vehicles were serviced or repaired in workshops not belonging to the vehicle manufacturer or its dealers. This barrier was broken in October 2003, when the European Commission (EC) passed a law allowing vehicle owners the freedom of having their servicing and repairs done at their chosen workshop.

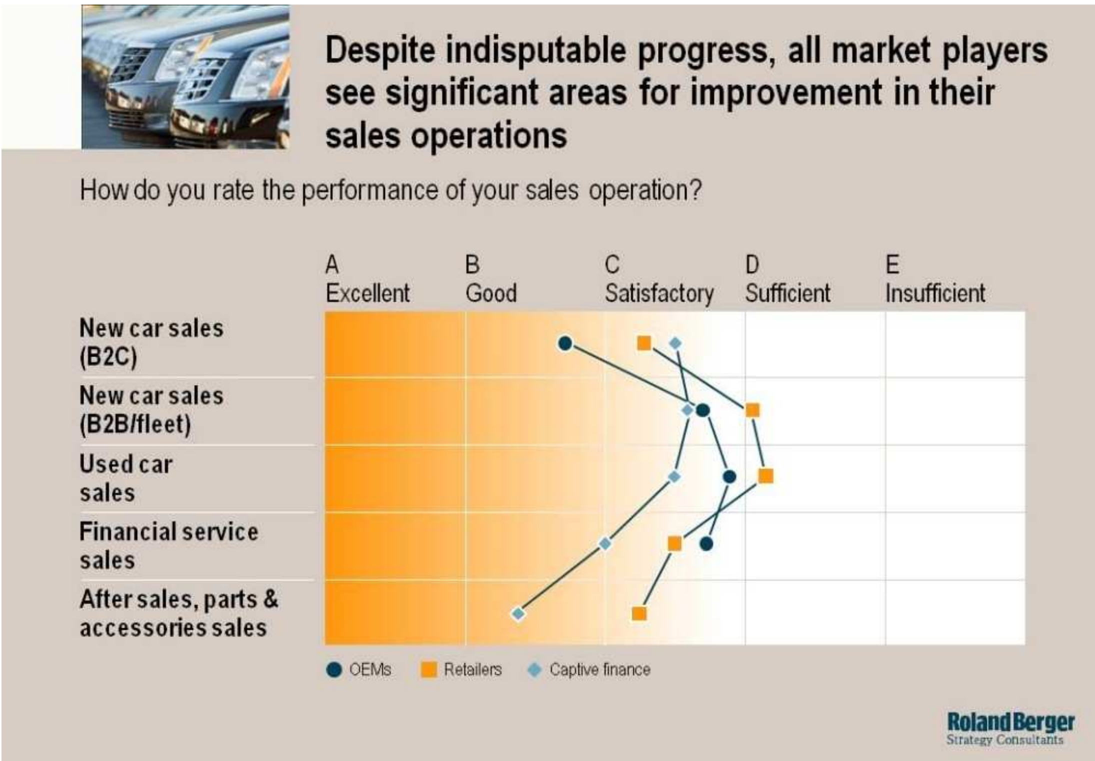
7.2.3 Relation between OEM and dealer

In the car distribution field, there are at least four levels: OEM production, OEM area marketing office, the OEM country importer or private importer, and lastly the sales outlet. Therefore there are complicated profit bargains and different approaches. When a brand want to enter a new EU country, OEM will select a private importer as a whole seller for that country, this means giving up a big profit share, so when that car market is mature, OEMs tender to build their own country importer.

There are some exceptions, such as Kia who operate directly in Austria, and Denzel who is the 100% owner of Hyundai Austria (Importer), Chevrolet who is through their mother concern GM in Opel dealer network. Theoretically the EU car brands do not need country importers from other specific EU countries.

The figure below (F.7.1) shows the relation between the car distribution levels and overall progress (OEM, Retailer, Service and Finance). Each party not only has to cooperate with another, but also has to share the profit. It will be important to provide better service to customers, in order to get the balance right and maintain a win-win situation.

Figure 7.1 Improvement of car sales operation (source: Roland Berg 2009)



7.2.4 The infrastructure for the electric car.

During the interview, we also discussed who should build the charging infrastructure for the electric car. In Bulgaria the trend is that the electric car users should have the charging facility themselves, in their private house or company (office) area.

There are 2 main contributors in Austria. One is the company eProvider, a joint venture of the energy provider Verbund, and the electric-giant Siemens. They will implement a national infrastructure network (about 4,000 sites) for EV and PHEV in the coming years.

Another is the loose cooperation of Wienenergie (the biggest energy provider in Vienna), and Wipark (the biggest parking and garage operator in Vienna), and the electric-giant ABB. They based predominantly in Vienna's city rand and garages. This is due to the high population density. As there are about 2.1 million people (Austria has 8.44 million), who live and work in Vienna with 414 flat square km in comparison to Austria's 83,865 square km, this means that the 25% population ratio is to an area of 0.5%.

7.3 Questionnaire

Mr. Röck also kindly provided the questionnaire "Denzel Asia Car Study". It was prepared by Denzel and Vienna University of Economics in 2008, with a successful sample size of 1022 people in Austria. One of the parts of this questionnaire deals with the Chinese car. Below are the relevant results:

1) Influence of characteristics on purchase decision?
39.69% vehicle type, 31.68% price, 17.34% country of origin, 4.54% warranty

2) Influence factor to purchase a particular new car model?
11.98% value f. money, 11.30 fuel consumption, 10.43 safety, 10.13 liability

3) From whom did you buy your current car?
73% from car dealer, 22% from private

4) What was the purchasing price of your current car?
47.13% below 10,000€, 33.81% between 10-20,000€, 13.52% between 20-30,000€

5) What kind of car do you drive now?
34% small, 22% station, 17% sedan, 12% MPV/small van, 3% SUV

6) How much money do you plan to spend on your next car?
27.52% below 10,000€, 47.01% between 10-20,000€, 19.10% between 20-30,000€

7) Share of your preferred vehicle type?
21% small & compact, 18.79% MPV/van, 15.64% large station, 12.99 small station, 12.77% sedan, 10.40% SUV

8) Share of preferred country of origin?
57.9% Europe/USA, 20.4% Japan, 9.2% Korea, 6.9% China

9) How sensitive is an Austria car users to a car from China?
22% would change their current car for a Chinese car if the quality/price are ok.
11.83% would probably buy a Chinese car in next two years (mostly male and young drivers)

10) How different do you expect the Chinese car to be in price?
49% similar to the traditional car, 32% to Japanese car, 12% to Korean car.

According to the conjoint analysis, small Chinese cars have the greatest potential in Austria, the market share for Chinese car could reach up to 6.73%.

Chapter 8. Establishing the Strategy

8.1 Entering strategy

8.1.1 From the benchmark of Toyota and Hyundai, the country which entering into Europe should have no strong local OEMs and brands, so it will be easy to build up its own brand. In terms of design and development, one should hire qualified local experts, who could meet the European taste and demand. As far as the production site is concerned, it should be located in Eastern Europe, this will reduce the cost of transport, labor, land and after-sale service etc.

8.1.2 It is not necessary to be the first EV supplier in the European market. Due to the fact that EV is a new product in the market, which needs new and special legislation, pricing policy, subsidies and infrastructure facility etc, it will be easier for European car makers to push these items first, when the market and these terms are clear, and then step in the Chinese EV makers.

8.1.3 It is clear that the price and profit of EV are higher than that of the normal car. In the beginning stages, related investment and develop costs need to be covered. Chinese EV makers should keep the cost and technology advantages to their competitors, and improve their own quality to fulfill the standard of European Vehicle Type Approval, and make sure that they **succeed on the first strike** when entering European market. The Chinese EV makers should take a lesson from the performance of Brilliance in 2007.

8.2 Product Specification Strategy

8.2.1 Both PEV and PHEV

Chinese EV makers lead the way in the creation of battery and PEV. There are currently already thirteen PEV makers ready for mass production in China, and some of their PEVs have already landed in Europe with decent level of quality and range, such as the e6 from BYD. Some new and improved PEV are on the way, such as the Denza or e3 from BYD and the Haval M3 EV from Great Wall. This illuminates the fact that the Chinese PEVs are the first choice.

Hybrid and plug-in Hybrid vehicle have been led into the market by Toyota for over the last five years, PHEV also has the deadlock of its size and weight due to its dual powertrain, however PHEV has a big advantage in price compared to PEV. It can also drive in all conditions with an extended driving range and high speed, and it can reach the EU CO2 emission standard. It has a much lower energy cost than the PEV even with a driving range of half electric to half combustion. F3DM or Qin additionally has the extra roof solar power edition. All of these point out why Chinese PHEV could also be the main choice for European customers.

Both PEV and PHEV offer more choices for the customers and markets, whilst the Chinese EV makers have competitive advantages in both areas.

8.2.2 Compact/sub-compact for retail, special model for fleet business

Due to the battery size, it is not possible to make a small car in PEV or PHEV, even though there are many PEV with two seats and a range below 50 km and a top speed below 50km/h. However there is not a large market for this type of car. According to the statistic from the ACEA, over 70% of the cars sold in Europe in 2012 were small to medium in size.

In terms of the retail business, one should concentrate on sub-compact and compact models. The Haval M3 EV from Great Wall is a sub-compact crossover, with a length of 4058mm and SUV style at the estimated price of Euro 25,000 before subsidies. It is pure electric with a range of 160km and a top speed of 130km/h. It is sure to be a hit in Europe, due to the fact that the current price of two seats PEVs in Europe is almost the same. Its main competitor, the Renault Zoe, a pure EV with a length of 4085mm and a range of 210 km and a top speed of 135km/h, its European price is about Euro 23,000 **without battery** and before subsidies.

Another two sales hits maybe the Qin and e3 from BYD. Qin is a medium size PHEV with a 1.5L turbo combustion motor and a 110kw electric motor, with a six speed dual-clutch transmission and other latest packages, its range is 500km with top speed of 180km/h, the estimated price is also about Euro 25,000 before subsidies. The price of a normal middle class car in Europe is almost the same.

The e3 will be a PEV in 4373mm length with a range of 300km and a top speed of 140km/h, with Mercedes B platform/style at the estimated price of Euro 30,000 before subsidies. Its main competitor in the market is the Nissan Leaf, a PEV in 4445mm length with a range of 200km and a top speed of 145 km/h, its European price is about 37,000 Euro before subsidies. This means that the e3 will have over 20% price advantage against the Leaf.

In terms of fleet business, BYD has already had success with Taxi projects in Spain, Holland and the UK, this may expand to other countries and middle class government car project. Another fleet business is BYD K9 pure electric bus, which has already experienced success in many EU countries, and may expand to other countries. The third fleet business may appear in the form of a middle size van for post office or packet delivery companies.

8.2.3 Full package with progressive price policy

Even the retailed sub-compact models should have the full middle class package, just like Toyota and Hyundai did before, this can attract customers and offer them a better price/value than the same European models. This can also reduce variations and increase delivery time, offer at least 5 years' guarantee to maintain the customers.

The price policy should be progressive. In the beginning stages should be a 20-30% discount compared to the main competitors in the same market. Some subsidies are needed in the initial period to build the market and volume. The price will then be increased gradually to a standard 10% discount to the benchmark.

8.3 Distribution Network Strategy

8.3.1 Private import first, joint-venture later

Due to the fact that the car is a complicated, big and high-valued technical product, selling and maintaining the car are also complicated, especially for new Chinese EVs in the new European market. So they must leverage the experience and knowledge of the local private owned importer groups to start the business in Europe. Most brands will usually change to their own national sales organization as soon as they have learned to understand the business in Europe better, this will unfortunately hurt the interest of the initial private importer.

As I mentioned in Paragraph 7.2, the relationship between the car maker, importer and retailer is complicated, especially after the European Block Exception Regulation will be enacted from June 2013. What Denzel did with Hyundai was, Denzel owned 100% of Hyundai Austria, Denzel also had about 30% showroom and retail facilities for Hyundai in Austria.

The new strategy in distribution could be the following: after a successful launch in a specific, Chinese EV makers and that initial private importer may set up joint-venture as a national sales organization, this will continue the success, reduce the uncertainty and investment, compared to change the business model completely as usual. It will be a win-win situation for all.

8.3.2 The assembler as an importer in a particular country

For the countries which already have assembling factories for Chinese EV, there is usually a joint-venture between the Chinese car makers and a local influential company. It will be more efficient to let the join-venture act as the assembler and importer, even part of retailers in that particular country, this will reduce the organization level and keep the profit, which Great Wall did with Litex Motors in Bulgaria was proved to be very successful.

8.3.3 Full stock of parts for better after-sale service

There is a proverb in the car sales branch that states that the dealer sells the first car, and the others are sold by reputation. Customer satisfaction is the top priority in any competitive business.

Chinese EV makers should create customer satisfaction system before even entering a specific country, like Toyota's Complete Customer Satisfaction (CCS), which is tracked at all stages of the customer experiences, from developing, marketing, retailing and after sale services, to make sure that customers' wishes and comments have been heard, and relevant actions have been taken that surpass their expectations.

This system is complemented by dedicated Customer Relations teams at each of Toyota National Marketing and Sales Companies, who interact throughout Europe to ensure that issues are handled with appropriately and acted on.

Toyota tops the customer satisfaction ranking in thirteen countries in the category of Sales, in nineteen countries in After Sales within Europe. Hyundai is also within the top five customer satisfaction ranking. It took about 30 years for Toyota, and 20 years for Hyundai to build up a good reputation in Europe. Hopefully the Chinese car will be able to build up a good reputation within 10 years after entering the EU.

One key performance item of customer satisfaction is after-sale and repair services. All related parts should be available within 3 working days within Europe. To achieve this target, Chinese car makers should create a central parts stock in a low cost country in EU, full-stock in this case is not wasted under the Lean system.

Due to the fact that the production of Chinese cars in Europe is mainly knock-down model, all parts will be shipped from China to specific assembling factory. There will be several assembling factories in Europe for the purpose of easy market-entering.
It will be better to build up a central parts stock in a low cost EU country, ship all parts in a full charted ship from China to that central parts stock, and distribute the parts to different assembling factories or repair shops inside Europe. Bulgaria will be a good choice for such central parts stock in my eyes.

As one can see from the above benchmark and case studies, BYD and Great Wall appear to be following these strategies now. BYD is more like Toyota regards to new technology and development. Great Wall is more like Hyundai regards to better design, price and marketing activity.

One should not however forget that the EV is a new product on the European and world market. Naturally the current situation is different from that of Toyota in the 1980s and Hyundai in the 1990s. Chinese EV makers should look to conquer the European market with their strategies.

Chapter 9. Conclusion

9.1 Final evaluation and trend

The Ministry of Science & Technology in China started the 863 Electric Vehicle Project in 2001, and the Chinese National Develop & Reform Commission (NDRC) continued that project with the mid to long-term plan (2006-2020) as part of its 11th Five-Year Plan of the state. The Chinese State Council issued the Automobile Industry Revitalization Plan in 2009. The NDRC issued a new policy on 23rd. January 2013, through merging and optimization till 2015, the top 10 Chinese car manufacturers will take 90% production share, build up 3-5 worldwide big competitive car manufacturers and brands in China.

China's leadership has made its goal to be at the forefront of electric vehicles and that will be implemented, joined together around 16 major Chinese companies from automotive, battery and oil branches to form a consortium, together they should aim to build marketable electric cars and create a stable infrastructure. Its target is that by 2030 about 80% of all electric cars worldwide are to be produced by China.

International industry experts proclaim that China may achieve this goal successfully, if they could build up such an electric car alliance, and provide the electric car for the mass market. It will also be their target to determine the standards of battery, charging station and plug-in connections, that alone would give them significant market advantages.

Meanwhile the experts also predict that the Chinese economic take-over is unstoppable, the car industry is just one example of how China's leadership want to re-settle the world´s new industry and political structure.

According to the study of Car Rental on 26/3/2013, the Chinese automobile industry is increasing its presence in overseas market, in its total produced 15 million vehicles in China in 2012, about 1.1 million vehicles are exported to overseas market, which is almost 30 percent more than the year before.

Chinese car makers have therefore primarily targeted at the emerging markets. During 2012, they sold 150,000 units of cars in Algeria, 90,000 units in Iraq, 90,000 units in Russia, 78,000 units in Iran, and 63,000 units in Chile. In addition to the car makers, Chinese commercial vehicle makers are also pursuing further thorough strategies. Approximately 85,000 units of trucks were exported by Dongfeng, 26,000 units by Sinotruk, and 23,000 units by FAW, totally increased 76 percent.

Their next secret weapon is the PEV, although the export quantity was not very high, and Chinese electric and battery makers have the advantages of cost, technology and home market quantity in PEV branches. It is predicted that Chinese PEVs will take 50% market share in that branch by 2020.

9.2 Conclusion of Chinese EV in Europe

Launching the Chinese EV in Europe is not the most important and urgent target for Chinese EV makers. The technology, regulation, local brands and infrastructure in Europe are not mature yet. And on the other hand, the potential volume in saturated Europe market will not be so high.

The trend and time are nevertheless heading this way, we can definitely expect this scenario to pan out by 2015. The purpose of this Master's Thesis was also to study and prepare related strategies in advance.

After the statistical research of two possible entering markets, history and trends, scientific benchmark and case studies, and related strategies analysis of Chinese EVs in Europe, I have already reached the main hypothesis and final conclusion of the Master's Thesis stated below:

Besides the technical innovation and price advantage, the product specification for the entering market and the new distribution network are the pre-requisites for Chinese EV manufacturers, who want a successful break-in to the European market.

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List of Tables and Figures

Appendix: Abstract in Chinese

硕士论文题目:

中国电动汽车进入欧洲的成功市场策略

研究提案简介:

中国现在是全世界最大的汽车和电动汽车生产国，不仅为大部分国际汽车厂商代工，而且有许多日益强壮的本国汽车厂商品牌。根据日本和韩国汽车在欧洲过去和现在的成功经验，未来有可能是中国汽车在欧洲登陆。本论文的一大假设和推论是，除了科技创新和价格优势之外，一种新产品/汽车要成功进入一个成熟新市场/欧洲，产品定位和销售渠道是其成功迈入新市场的两条腿。

计划研究方法途径：

1. 研究概念和问题定位
2. 中国(电动)汽车工业全景
3. 世界电动车全景
4. 日本和韩国汽车在欧洲成功的历史及现状的文献分析
5. 可能进入国家的相关统计资料(奥地利,保加利亚)
6. 对 2 家中国汽车厂商的科学个案研究(比亚迪,长城)
7. 对市场/生产/销售领域专家的采访和问卷调查
8. 确立市场进入,产品定位和销售渠道等策略
9. 结论