Electric Vehicle Study in China

Finpro China
December 2010
Start of Electric Vehicle (EV) development

- China began its own R&D for Electric Vehicle under the national high-tech development program ‘863 Program’.
- National 863 Program was introduced during the 10\textsuperscript{th} 5-Year Plan (2001-2005). It included an allocation about USD 131 billion by the central government for EV Projects. An additional USD 300 million would be invested by local governments, enterprises, and institutes and universities.

Central Government is playing important role

- China’s central government has played a critical role in driving direction and development of the EV sector. The development so far and future growth is heavily depend on government’s policies.
- For the 11th 5-Year Plan (2006-2010), the central government planned to allocate USD 150 million for EV projects. The amounts invested by other entities are not yet available, but total spending must have considerably surpassed that of 2001-2005.
- Strategic priority was set to achieve technology breakthrough in pure EV while building HEV is mature with Japanese maker and FCV is not a realistic solution due to technical issue.
- During the transition towards mature Pure EV, HEV, PHEV and EREV are in central government’s priority

Aggressive target set by Central Government

- China aims at achieving annual production capacity for 500,000 units of new energy autos (including pure EVs, PHEVs and HEVs) by 2012, accounting for about 5\% of total passenger vehicle sales.

Pure EV as a final goal

- FCEV is hard to reach economy of scale in 10-20 years due to cost, technical know-how, maintenance and reliability.
- China FC development is far behind the like of Japan, Germany and USA.

China’s advantages on EV development

- China wants to become the technology hub for E-components
- China is backed by natural resources and R&D in EV development
  - Target of running 50-80km on one full charge would meet the requirement of most passenger car users
  - To leverage battery manufacturability, reliability and functionality
- China suppliers have successfully developed leading quality permanent-energized synchronous machines – at significant lower price than overseas competitors. Provided that China possesses majority of ”rare earths” and already good technology.
EV development in China can be traced back to 1990’s while China government has plans to build world class auto industry. With only 20 years, EV market in China is moving towards consumer market leading by government subsidies of up to USD 8800 per vehicle.
China Electric Vehicle Players

**EV Manufacturer (with registered models in MIIT)**
- FAW Group
- DongFeng Motor
- Chang’An Automobile
- Haima
- Chery
- Jiangnan
- Brilliance
- GM Buick
- SAIC

**EV Charging Station**
- State Grid Corporation of China
- China Southern Power Grid

**EV Battery**
- BYD
- Zhejiang Tienneng Group
- China BAK Battery
- Lishen
- Wanxiang
- Shuzhou Phylion
- Aowei Technology

**EV Trucks, Buses and Taxis**
- BYD
- ZAP
- Liuzhou Wuling Motors
- FAW
- Lujo EV
- Thundersky Energy Group
- Zonda Bus
Orange zone shows government’s involvement in R&D of Electric Vehicle while yellow zone represents partly government investment.
Government stimulus

Electric Vehicle Key Project (2002-2006) with an investment of USD 130 million

- The 10th Five Year Plan introduced the goal to commercialize and industrialize EVs. The National 863 Program set the Electric Vehicle Project and identified the FCV, EV and HEV as the priorities for the development of HEV. Joint R&D was initiated by the Government with businesses, academies and research institutions.

- An EV R&D mechanism was developed, 3 Horizontal Plans: FCEV, HEV and EV; 3 Vertical Plans: force assembly, driving electric motor and dynamic battery. It focused on the establishment of a rigorous process that is in alignment with whole vehicle R&D discipline, and proposed a basic principle of development oriented, key component and related materials linked, infrastructure development aligned, and policies, technical standards and assessment techniques simultaneously developed.

Energy Saving and New Energy Vehicle Key Project (since 2006) with an investment of USD 165 million

- The Energy Saving and New Energy Vehicle Key Project was initiated in the 863 Program in the 11th Five Year Plan, which included the R&D for all types of vehicle products and identified the new R&D model. The project covered the R&D of energy saving and new energy technologies, research of key components such as battery, motor and fuel cell engine, as well as the application of technical standards and tests.

Another USD 15 billion over next 10 years

- The Ministry of Industry and Information Technology (MIIT) recently said China is to invest more than USD 15 billion over the next 10 years to support new-energy automobile production in order to make China the world’s largest new-energy automobile production country.
Electric Vehicle subsidies

- Announced on June 1, 2010, Chinese government is paying subsidies up to US$8800 per vehicle, to manufacturers. The program will be running on trial basis in 5 cities for private EV purchases.
- The first 5 cities chosen are Changchun, Hangzhou, Hefei, Shanghai and Shenzhen. These are locations of headquarters of major automakers.
  - Changchun
  - Hangzhou
  - Hefei
  - Shanghai
  - Shenzhen
- According to the official announcement from MOF’s website, the program highlights the followings:
  - Each Pure Electric Vehicle will receive subsidies up to USD 8800;
  - Plug-in hybrid vehicles will receive subsidies up to USD 7300 each;
  - All subsidies will be paid directly to EV manufacturers;
- 16 automakers in China have started receiving the government's clean-energy subsidy of USD450 for each green vehicle they sell since June 1 this year.

Research & Development

- It is expected the Chinese Government continues to support R&D of electric vehicles including infrastructure and battery with billions of USD in the next 5 year plan which will be announced early 2011.
- Government investment in state-owned R&D centres and universities (pls refer to details in slide 5)
10-cities and 1000-unit Plan

- Between 2009 and 2011 MOST has invested about USD 2.5 billion in a project aiming at establishing ten pilot areas all together with 10 000 EVs.
- The Government has devised the plan which is set to demonstrate the operation of 1,000 new EVs in ten cities each year to encourage people to buy them.
- Target is to demonstrate 1000 EV in at least 10 cities from 2010 particularly for public transport and government services.
- It is believed that that will be 30000 EV running by 2012.
- Subsidies for different EVs for demonstration purposes:

<table>
<thead>
<tr>
<th>Category</th>
<th>Type</th>
<th>Subsidy (USD/ Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger vehicle and light commercial vehicle</td>
<td>HEV</td>
<td>• Up to 7300 (by 5 grades of fuel-saving extent)</td>
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<td></td>
<td>Pure EV</td>
<td>• 8800</td>
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<td></td>
<td>FCV</td>
<td>• 36500</td>
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<tr>
<td>Bus</td>
<td>HEV</td>
<td>• 7300-61600</td>
</tr>
<tr>
<td></td>
<td>Pure EV</td>
<td>• 73000</td>
</tr>
<tr>
<td></td>
<td>FCV</td>
<td>• 88000</td>
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</tbody>
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On-going projects

• **National 863 Program**
  - Hundreds of companies and scientific research institutes are involved in government supported EV R&D efforts.
  - China aims to develop all three types of EVs with different priorities for timing
    - Pure EVs
    - HEVs
    - FCVs (regarded as an ideal for achieving zero emissions but involve the most challenging technology)

• **10-cities & 1000-vehicle Plan**
  - Currently there are 13 cities (Beijing, Changchun, Changsha, Chongqing, Dalian, Hangzhou, Hefei, Jinan, Kunming, Nanjing, Shanghai, Shenzhen and Wuhan) involved in the project
  - Chinese government plans to broaden the trial size to 20 cities

• **Public Transport project**
  - Aiming at enhancing the use of energy efficient and alternative energy vehicles in public transport
On-going projects

Roadmap of “863” Electric Vehicle Project
(The so-called “Three Verticals – V1, V2, V3, Four Horizontals” framework – H1, H2, H3, H4)

Source: InterChina Consulting Analysis
Municipality projects

- **Beijing**: purchased 800 hybrid buses from Beijing Foton
- **Shanghai**: hydrogen fuel cell car project was initiated by Shanghai Major Project Promotion Office as a 2008 Olympics project
- **Jinan**: promotes NEVs and plans to use HEV buses to replace some of the old bus system to meet the requirement of National Sports Meeting
- **Shenzhen**: is going to establish a charging station in the downtown area for NEVs; and the F3DM duel mode EV was first launched in Shenzhen which is the first mass produced duel mode EV in the world
- **Wuhan**: becomes new energy resource experimental unit for Nissan, and Nissan will contribute 300 hybrid buses to the city
- **Chongqing**: purchased hybrid buses from Chang’an Group
- **Changchun & Dalian**: partnered with FAW
Daimler AG

- Daimler AG signs Memorandum of Understanding with BYD Company Limited to establish a Technology Partnership for Electric Vehicles in China Stuttgart/ Hong Kong, March 1, 2010
  - Technology partnership for a new electric vehicle suited to the Chinese market
  - New brand to be created by Daimler and BYD
  - Dr. Dieter Zetsche, Chairman of the Board of Management of Daimler AG: “We continue to push ahead as a global leader in electric mobility. Daimler’s know-how in electric vehicle architecture and BYD’s excellence in battery technology and e-drive systems are a perfect match.”
  - Mr. Wang Chuanfu, Chairman and President of BYD Company Limited: “This technology partnership creates a win-win business model with complimentary competences. We are very excited about this opportunity to work together with Daimler, the inventor of the automobile.”

Dongfeng Motor Corporation (China) and Detroit Electric Holdings

- Chinese automaker Dongfeng Motor Corporation and Detroit Electric Holdings announced plans to jointly research, develop, market and sell fully electric vehicles in China. (New York Times, 1st of June 2009)

Renault-Nissan Alliance and China Ministry of Industry and Information Technology

- Renault-Nissan Alliance Partners with China Ministry of Industry and Information Technology (MIIT)
  - for Zero-Emission Mobility
  - Nissan to provide MIIT with electric vehicle information and propose a comprehensive plan, including a blueprint for a battery-charging network and programs for mass-marketing EVs.

Beijing Auto Works and Saab

- Beijing Auto Works, the buyer of Saab’s last generation 93 and 95 platforms, are planning to put an electric sedan into production later this year.
International Cooperation

U.S.-China Electric Vehicles Initiative

- **the launch of a U.S.-China Electric Vehicles Initiative**
  - **Joint standards development.** The two countries will explore development of joint product and testing standards for electric vehicles.
  - **Joint demonstrations.** The Initiative will link more than a dozen cities with electric vehicle demonstration programs in both countries. Paired cities will collect and share data on charging patterns, driving experiences, grid integration, consumer preferences and other topics.
  - **Joint technical roadmap.** A U.S.-China task force will create a multi-year roadmap to identify R&D needs as well as issues related to the manufacture, introduction and use of electric vehicles.
  - **Public awareness and engagement.** The United States and China will develop and disseminate materials to improve public understanding of electric vehicle technologies. For example the U.S.-China Electric Vehicles Forum in September 2009.

Electric Vehicle Initiative

- EVI commenced at the Clean Energy Ministerial in Washington, D.C. Participating countries pledged to continue discussions through high-level roundtables organized by the IEA during the Paris Motor Show in Fall 2010 and the Shanghai Motor Show in Spring 2011.
- Participating governments include China, France, Germany, Japan, South Africa, Spain, Sweden, and the United States. Other initial partners include the International Energy Agency.
The 12th 5-Year Plan & Future projection

The 12th 5-year plan

- Work has already commenced on the draft of the 12th Five-Year Plan for Energy (2010-2015).
- Chinese government to provide stronger support to Chinese car industry and hope to take the lead in electric vehicle
- Developing new-energy vehicle is ranked top in the 12th Five-Year Plan

Future projection

- By 2012, China is expected to reach 500K production capacity in EV sector
- By 2015, 1700 recharging station and 3 Million of charging pole will be ready.
- The China government decreed that 5 million electric cars will be traveling the nation's roads by 2020.
- According to banking giant HSBC, China will equate to 35% of the global electric-vehicle market by 2020.
- According to a report from the New Energy Vehicle Development Program drafted by the National Development & Reform Commission and the Ministry of Science & Technology, China will require new energy vehicles to account for 50% of “total auto making capacity” in China by 2020.
- The Chinese government aims for 5% of total car sales to be for new energy cars by 2011. This will be more than 600,000 vehicles (total sales of cars in China last year: 13 million). The government has announced that they will spend USD 3 billion for the promotion, manufacture and sale of new energy cars, focusing on EVs. (HSBC)
Case study 1: BYD

Company introduction

• BYD was started by Wang Chuan-Fu (the founder), a chemist and government researcher, in a 2000 square meter space with a target to compete with imported batteries from Japan by substitute workers for automated machine.

• In 5 years after the establishment, BYD became one of the world’s largest manufacturers of cell phone batteries.

• And the company then expanded their product portfolio to design and manufacture mobile handset and parts for the mobile giants like Motorola, Nokia, Sony Ericsson and Samsung.

• BYD entered the automobile business in 2003 by buying a Chinese state-owned car company even without any knowledge in car making but the team followed with a quick study.

• Today BYD is a company who employs 130,000 people in 11 factories.
Case Study 1: BYD - Business Units

IT Industry
- Rechargeable battery
- Charger
- Electro Acoustic Components
- Connectors
- LCD/ LCM
- Plastic casing

Auto Industry
- Whole-car manufacturing from high-end, medium-end and low-end fuel vehicles
- Electric car and dual mode car manufacturing
- Auto moulding
- Auto parts manufacturing

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Case Study 1: BYD Auto

BYD AUTO

- BYD Auto has fully integrated all aspects of automotive industry
- Currently BYD Auto has established large-scale industrial bases with its mold, R&D and vehicle manufacturing operation growing rapidly.
- Within 5 years, it has successfully unveiled 8 vehicle models, F3, F3R, F6, F0, F6DM, e6, S8 and F3DM.
- Its turnover reached USD 5.8 billion and car production reached 450,000pcs in 2009.
- Auto business is about 2/3 of total BYD’s business.

Models

- Non-EV models: F3, F3R, F6, F0
- EV models: F6DM, E6, S8 and F3DM
- Future development: F-series, S-series and M-series
- In EV market, BYD Auto believes there is no competitor (in EV sector) in the world. They are the most advanced in pure EV and hybrid. All EV solutions are developed by BYD itself with own IPR.
- BYD’s comment on Prius of Toyota is that it is only optimized use of energy but not really reducing the use of gasoline.

Production forecast

- 500,000 EV produced by 2015
- 1,500,000 EV produced by 2020

Current partners and investors

- BMW – engine (partner), according to Finpro’s interview with BYD
- Daimler – EV R&D (partner)
- Qing Hua University – R&D (partner)
- Volkswagen – engine and manufacturing (partner)
- Warren Buffet and Morgan Stanley (investor)
Case Study 1: BYD - performance yr 2008

BYD revenue

- 2003: $1 billion
- 2004: $1.5 billion
- 2005: $1.8 billion
- 2006: $2.2 billion
- 2007: $3 billion
- 2008: $4 billion

BYD net profit

- 2003: $50 million
- 2004: $100 million
- 2005: $150 million
- 2006: $200 million
- 2007: $250 million
- 2008: $300 million

BYD revenue by segment, 2008

- Cellphones and components: $1.7 billion
- Automobiles: $1.3 billion
- Batteries: $0.9 billion
- Other: $300,000
Company Introduction

• Founded in 1985, Shanghai Municipal Electric Power Company
• Shanghai Power is a subsidiary of the state-owned State Grid Corporation of China. It is the sole electric utility provider in Shanghai, operating the transmission, distribution, and sales of electric power in China’s biggest city. The company supplies electricity and electric power engineering and construction services to about 7.2 million customers, both residential and commercial.
• With more than 26 subordinate companies and 16,000 employees, Shanghai Power is the third-largest enterprise in Shanghai in terms of sales revenue and enjoys over 10% revenue growth annually.
Case Study 2: Shanghai Municipal Electric Power Company (SMEPC)

**Latest updates about SMEPC**

- The Shanghai Municipal Electric Power Company (SMEPC) and the Shanghai Ruihua Group Co., Ltd. has established a joint venture company - Shanghai Leibo New Energy Automobile Technology Co., Ltd. in 2007. Leibo mainly engaged in the development and manufacturing of hybrid power system of lithium-ion batteries + super capacitor for electric vehicles.

- A document entitled Proposals on Accelerating the Promotion of Shanghai New-Energy Vehicles Industry has been issued by Shanghai Municipal Development and Reform Commission and Shanghai Economy & Information Technology Commission in December 2009. According to the Proposals, Shanghai Municipal Government will offer a variety of supports for the development of new-energy vehicles and the production of key auto parts. Companies and institutions which provide service of new-energy vehicles will not only get fiscal and financial aid, but also have access to the supports of human resources and public procurement from Shanghai Government.

- Shanghai encourages the development of related infrastructures such as charging stations. Special funds will be provided by the Municipal Government for the fixed-asset investment.
Case Study 2: Shanghai Municipal Electric Power Company (SMEPC)

**Expectation from the Central Government**

- As an infrastructure provider, SMEPC hopes that Chinese central government could provide supports and subsidies on following aspects:
  - National Standard for charging stations relevant devices
  - Coordination between several stated owned enterprises on completion in disorder (for example, SGCC is completing with CNPC/PetroChina and CPCC/Sinopec on building charging stations for electric vehicles)
  - Subsidies for electric vehicle manufacturers and end-users
  - Land resources for building electric vehicle charging stations

**Innovation and charging solution**

- SGCC pays high priority on energy conservation, it organized China Electric Power Research Institute, Shanghai Municipal Electric Power Company (SMEPC) and other units to research and develop of charging network for electric vehicles and promote mass production of electric vehicles.

- Currently, SMEPC is using SGCC internal standard for electrical vehicle charging infrastructure. The Caoxi Electric Vehicle Charging Station has 9 units in total, 4 units are for small electric cars and 5 units are mainly for buses and construction vehicles. Every charging is managed and recorded by an IC card. Before charging, the driver can choose “instant recharging” or “reservation charging”. If the driver chooses the second mode, the vehicle will be charged according to the time set. There are 3 charging modes: automatic full, charging by time or by power available for selection afterwards. The whole process can be completed independently. This charging station currently has the capacity to meet charging requirements from electric vehicle with various voltage and capacitance.

- This management system was developed by SMEPC itself.
Case Study 2: Shanghai Municipal Electric Power Company (SMEPC)

- **Network Relationship between project companies (potential value chain map)**

  - **Infrastructure Provider:** SGCC
  - **Power System Manufacturer:** Leibo
  - **Electric Vehicles**
  - **Vehicle Manufacturers**
  - **Operators in Public Services Sectors:**
    - Electric Power Company
    - Public Transportation Co.
    - Governmental Departments
    - Post Office
    - Sanitation Untis
  - **Infrastructure:** Charging Stations
  - **Central Government Financial Subsidies**
Potential areas for Finnish technology

Components Manufacturers:
- Batteries
- Motors

Infrastructure:
- Charging technology
- Electricity production

Consultation & system integration

China EV Sector
Conclusion

- **Strong government support**
  - It is expected that government’s strong support is to be continued. Central government is crucial particularly in driving the formation of industry standards.

- **A long way to go**
  - Battery technology is to be overcome due to cost and economy of scale.
  - Infrastructure has to be convenient enough for consumer and citizen use. No. of charging station and charging pole are to be built. Debate is still going on whether plug-in charging or swapping battery type should be implemented.
  - Joint R&D opportunities is needed to leverage the “Know-How”, to improve vehicle performance and ultimately to speed up to reach critical mass and drive down cost.

- **Moving from public transport to consumer passenger car**
  - 10 Cities and 1000 Car program enable up to 20 cities to run trial of EV on public transport and government services which are with fixed routes. This is important before EV is reaching to consumer level.

- **China is optimistic**
  - With the solid fact that China is the biggest auto market and most of Chinese car buyer would be 1st time buyer, it is believed that EV in China would be easier to implement especially through different subsidies from the government.
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