ELECTRIC VEHICLES IN CHINA: STRATEGIES OF LOCAL COMPANIES AND THE ROLE OF GOVERNMENT

Sergio Tadeu Gonçalves Muniz
Bruce M. Belzowski
Camille Cu
THE AUTHORS:

Sergio Tadeu Gonçalves Muniz
• Associate Professor - Federal University of Technology - Paraná (UTFPR), Brazil and Visiting Researcher at University of Michigan Transportation Research Institute (UMTRI), Automotive Futures Group.

Bruce M. Belzowski
• Managing Director of University of Michigan Transportation Research Institute (UMTRI) Automotive Futures Group.

Camille Cu
• Undergraduate Student at University of Michigan, UMTRI Automotive Futures Assistant in Research.
For the ICEV market, foreign brands are preferable, but the quality and engineering gaps are diminishing.

Rising affluence => sales cheaper domestic models; sales from foreign brands: domestic brands had only 29.5 percent of the car market in 2013 (LMC Automotive)

But in the EV market, more than 95% of the market are dominated by domestic brands: the price and government subsidies are crucial.

As August 2016, 96% of all EV sales in China are from local manufacturers; 2% left to Tesla, 1% to Porsche

China electric vehicle industry: 200+ carmakers, with currently about 4,000 new energy vehicle (NEV) models in development.
EVOLUTION OF EVS SALES IN CHINA

• China became the world’s leading automotive market in 2009.
• China surpassed the U.S. in 2015 to become the world’s biggest market for New Energy Vehicles (NEVs): comprising PHEVs, BEVs, FCEVs
• In United States: 0.8 vehicles/resident; in China: 0.1 vehicles/resident.
• Domestic automakers sold 331,092 units in 2015, according to the China Association of Automobile Manufacturers;
• So far, until September/2016, 288,000 units were sold this year (of which 247,500 were BEVs). (EV Volumes)
• Still far from Chinese Government Target => 5 million units by 2020
• ≈ 1 % of the 21.1 million passenger cars sold in China in 2015 were EVs (China Association of Automobile Manufacturers)
New Energy Vehicles (NEVs) Sales in China

Source: EV Volumes

Muriz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
GOVERNMENT INCENTIVES IN CHINA

• The Chinese government adopted in 2009 a plan to pull new energy vehicle (NEV) market. It has four goals:
  1. to reduce urban air pollution;
  2. to reduce its oil dependence from the Middle East;
  3. to reduce its carbon emissions;
  4. to create a world-leading industry that would produce jobs and exports.

• China has made going electric a top priority. The Federal Government wants 3 (was 5) million "new energy vehicles" (NEVs) on the roads by 2020.
• NEV subsidies applied only to BEVs and PHEVs, but not to HEVs such as the Toyota Prius.
• To qualify, PHEVs must be able to travel 50 kilometers (31 miles) in EV mode.
• In order to have access to subsidies, foreign automakers should develop NEVs with their Chinese joint-venture partners.
• The Chinese government started providing incentives of around US$ 15 billion for the industry. So far (early 2016), China invested about 37 billion yuan ($5.6 billion) in NEVs and will provide another 63 billion yuan by 2020 (Gao Feng Advisory Co.)
• The EV sales are spurred by government subsidies and permits:
  • subsidies can reach up to 60% sticker price of a car/bus;
  • exceptions from the lotteries for license plates in big cities.

Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
• Buyers can receive as much as 55,000 RMB (≈$8,400) for EV in subsides from the central government and up to 300,000 RMB (≈ $46,000) for a pure electric bus (excluding incentives from many local/provincial governments).

• In addition, users of NEVs are exempt from registration and usage restrictions (Shanghai plate cost ≈ $13,200; on a NEV ≈ $125 administrative fee).

• Request for a Shanghai license plate: total of 187,533 bidders competed for 9,409 Shanghai plates (5% only) January/2016 (Global Times)

• Government Procurement: after 2nd half of 2015, local governments should dedicate 30% of their fleet purchases to NEVs. (China’s State Council).
THE SUBSIDIES AND THE BUBBLE

• Startups and local authorities invested in making NEVs: unqualified companies + far below the minimum scale required (average NEV makers ± 3,000 cars)

• The generous subsidies => started a gold-rush => Bubble

• But high subsidies encouraged cheating

• After frauds, China’s central government (CCG) imposes technology standards and limiting the number of startups to only 10 (compare it to today’s 200+ companies!)
Chinese authorities initiated an investigation earlier 2016:
  - the number of EVs sold in 2015 was about 30,000 units higher;
  - That’s a widespread subsidy fraud in many small cities;
  - Represents approximately 10 percent of total expenditures (CCG);
  - In 2015, about 108,000 NEVs were registered for plates in the first 10 months of 2015 (which represented only 63% of the 171,145 units supposedly sold in that period)

Common types of Frauds:
  - Electric vehicle producers simply shipped cars to fictitious customers;
  - Sell to their own car rental companies, which exist only for get subsidies;
  - Doctored invoices to inflate EVs subsidies: Suzhou King Long case (claimed to have sold 12,003 electric buses in 2015).
  - Sell or rent a provincial and/or a national license.
• The Ministry of Industry and Information Technology (MIIT) restricted the number of startup EV makers to a maximum of 10.

• The MIIT listed 17 technologies that companies intending to sell electric cars must attend

• It is estimated that 90% won’t meet the standards in two years.

• Some successful applicants: Beijing Electric Vehicle Co. (controlled by BAIC) and Hangzhou Changjiang (controlled by FDG Electric Vehicles Ltd.)
POLICY ADJUSTMENTS

• Inspired in California law on EVs;

• It’s a points-based system:
  • For carmakers: they are required to sell a percentage of EVs; progressive credits for making Evs; => possib. buy credits.
  • For buyers: credits/fee applied according on the distance they drive in full electric/gasoline mode.

• NEV subsidies initially applied only to BEVs and PHEVs, but in a recent shift, CCG will offer also incentives to HEVs

• Phase-out: CCG plans to gradually reduce the amount of subsidies by 20% for 2017-2018 and more 20% for 2019-2020 and will stop providing subsides after 2020.
CHARGING INFRASTRUCTURE

- Important challenge for the spread of electric cars in China
- Public authorities to build home charging stations within communities => conflicts with property management companies.
- In China’s big cities, most of people live in apartments; most of them have no EV charging port.
- The Beijing Administration plans to increase the number of recharging stations in the city from 20 to 100. Others cities are in the same direction.
## TOP 10 SELLING EVS CARMAKERS WORLD-WIDE

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Manufacturer</th>
<th>Oct-15</th>
<th>2015 YTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BYD</td>
<td>6,101</td>
<td>43,073</td>
</tr>
<tr>
<td>2</td>
<td>Nissan</td>
<td>3,115</td>
<td>42,012</td>
</tr>
<tr>
<td>3</td>
<td>Mitsubishi</td>
<td>4,144</td>
<td>36,623</td>
</tr>
<tr>
<td>4</td>
<td>Tesla</td>
<td>3,349</td>
<td>36,312</td>
</tr>
<tr>
<td>5</td>
<td>VW</td>
<td>3,774</td>
<td>27,755</td>
</tr>
<tr>
<td>6</td>
<td>BMW</td>
<td>2,937</td>
<td>25,470</td>
</tr>
<tr>
<td>7</td>
<td>Renault</td>
<td>2,568</td>
<td>20,136</td>
</tr>
<tr>
<td>8</td>
<td>Kandi</td>
<td>5,081</td>
<td>17,201</td>
</tr>
<tr>
<td>9</td>
<td>Ford</td>
<td>1,776</td>
<td>17,117</td>
</tr>
<tr>
<td>10</td>
<td>Zotye</td>
<td>2,609</td>
<td>15,384</td>
</tr>
</tbody>
</table>

Muniz, Sergio; Belzowsky, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
# TOP 10 SELLING EVS CARMAKERS IN CHINA

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Manufacturer</th>
<th>Sep-16</th>
<th>2016 up to Sept</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BYD</td>
<td>10,114</td>
<td>74,030</td>
<td>33.0%</td>
</tr>
<tr>
<td>2</td>
<td>BAIC</td>
<td>7,062</td>
<td>29,509</td>
<td>13.1%</td>
</tr>
<tr>
<td>3</td>
<td>ZOTYE</td>
<td>4,493</td>
<td>26,129</td>
<td>11.6%</td>
</tr>
<tr>
<td>4</td>
<td>SAIC</td>
<td>851</td>
<td>13,073</td>
<td>5.8%</td>
</tr>
<tr>
<td>5</td>
<td>CHERY</td>
<td>500</td>
<td>8,727</td>
<td>3.9%</td>
</tr>
<tr>
<td>6</td>
<td>JAC</td>
<td>1,055</td>
<td>7,656</td>
<td>3.4%</td>
</tr>
<tr>
<td>7</td>
<td>GEELY</td>
<td>923</td>
<td>7,359</td>
<td>3.3%</td>
</tr>
<tr>
<td>8</td>
<td>JMC</td>
<td>748</td>
<td>7,351</td>
<td>3.3%</td>
</tr>
<tr>
<td>9</td>
<td>KANDI</td>
<td>136</td>
<td>6,104</td>
<td>2.7%</td>
</tr>
<tr>
<td>10</td>
<td>TESLA</td>
<td>1,190</td>
<td>5,879</td>
<td>2.6%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>31,437</strong></td>
<td><strong>224,535</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

Source: EV Volumes

Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
## TOP 20 SELLING EVS IN CHINA

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Manufacturer</th>
<th>Sep-16</th>
<th>2016 up to Sept</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BYD Tang</td>
<td>2120</td>
<td>26788</td>
<td>11.9%</td>
</tr>
<tr>
<td>2</td>
<td>BYD Qin</td>
<td>3125</td>
<td>18391</td>
<td>8.2%</td>
</tr>
<tr>
<td>3</td>
<td>BAIC E-Series EV</td>
<td>2659</td>
<td>15457</td>
<td>6.9%</td>
</tr>
<tr>
<td>4</td>
<td>SAIC Roewe 550 PHEV / e550</td>
<td>851</td>
<td>13073</td>
<td>5.8%</td>
</tr>
<tr>
<td>5</td>
<td>BYD e6</td>
<td>1241</td>
<td>12890</td>
<td>5.7%</td>
</tr>
<tr>
<td>6</td>
<td>BAIC EU260 / D50 EV</td>
<td>3800</td>
<td>10147</td>
<td>4.5%</td>
</tr>
<tr>
<td>7</td>
<td>BYD e5</td>
<td>2094</td>
<td>9163</td>
<td>4.1%</td>
</tr>
<tr>
<td>8</td>
<td>Chery eQ</td>
<td>500</td>
<td>8727</td>
<td>3.9%</td>
</tr>
<tr>
<td>9</td>
<td>Zotye Cloud EV</td>
<td>1076</td>
<td>7725</td>
<td>3.4%</td>
</tr>
<tr>
<td>10</td>
<td>JAC i EV 4</td>
<td>1055</td>
<td>7656</td>
<td>3.4%</td>
</tr>
<tr>
<td>11</td>
<td>Geely Emgrand / Dorsett EV</td>
<td>923</td>
<td>7359</td>
<td>3.3%</td>
</tr>
<tr>
<td>12</td>
<td>JMC E100</td>
<td>748</td>
<td>7351</td>
<td>3.3%</td>
</tr>
<tr>
<td>13</td>
<td>BYD Qin EV300</td>
<td>1534</td>
<td>6798</td>
<td>3.0%</td>
</tr>
<tr>
<td>14</td>
<td>Zhidou D1 EV</td>
<td>2193</td>
<td>6479</td>
<td>2.9%</td>
</tr>
<tr>
<td>15</td>
<td>Zhidou D2 EV</td>
<td>898</td>
<td>6139</td>
<td>2.7%</td>
</tr>
<tr>
<td>16</td>
<td>Kandi K17 Cyclone</td>
<td>136</td>
<td>6104</td>
<td>2.7%</td>
</tr>
<tr>
<td>17</td>
<td>Tesla Model S</td>
<td>1190</td>
<td>5879</td>
<td>2.6%</td>
</tr>
<tr>
<td>18</td>
<td>Zotye E200</td>
<td>326</td>
<td>5786</td>
<td>2.6%</td>
</tr>
<tr>
<td>19</td>
<td>Changan Eado EV</td>
<td>234</td>
<td>3968</td>
<td>1.8%</td>
</tr>
<tr>
<td>20</td>
<td>BAIC EX200</td>
<td>603</td>
<td>3905</td>
<td>1.7%</td>
</tr>
<tr>
<td>-</td>
<td>Others</td>
<td>4131</td>
<td>34750</td>
<td>15.5%</td>
</tr>
</tbody>
</table>

Source: EV Volumes

Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and The Role of Government
• Company: Beijing Automotive Industry Holding Co
• Ownership: State-Owned Enterprise (SOE)
• Based in Beijing
• Founded in 1958
• ArcFox is a new EV brand under BAIC Electric Vehicle Division
• Opened R&D center in Silicon Valley, the first outside China: the BAIC EV R&D Center (2015)
Muniz, Sergio; Belzowsky, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
ICEV

Senova X25

BEV

EX200

Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Company: BYD Auto Co. Ltd., 100% ownership of BYD Company.
Ownership: Privately-Owned Enterprise (POE)
Based in Xi'an, Shaanxi Province.
Founded in 2003, following BYD Company's acquisition of Tsinchuan Automobile Company in 2002.
Joint-Ventures: has a 50:50 JV with Daimler AG => Shenzhen BYD Daimler New Technology Co., Ltd. => develops/manufactures luxury electric cars under the Denza brand.
BYD is the largest manufacturer of BEVs worldwide.
It is also producing its second generation of dual hybrid vehicles, known as Dual Mode.
The company is a world leader in the production of iron phosphate batteries used in their EV models.
Launched its first PHEV in 2008, the F3DM sedan and its first BEVs in 2010, the crossover sedan e6.
BYD climbed from the 7 position in late 2014 to the 1 position in under 10 months;

Muniz, Sergio; Belzowska, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
BYD “7 + 4 STRATEGY”

on road vehicle markets
1) Battery Electric Buses (Shuttles and Rapid Transit)
2) Battery Electric Taxis (used in 2 and 3 shift operations daily)
3) Logistics Vehicles (operated over 18 hours daily)
4) Private Vehicles for the Consumer Market
5) Battery Electric Motor Coaches
6) Construction Vehicles
7) Waste Management Vehicles

off-road vehicles for specialized applications
1) Mining Operations
2) Marine Ports
3) Warehouse and Logistics
4) Airports

Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Byon, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government.
• Company: Chery Automobile Co., Ltd.
• Ownership: State-Owned Enterprise (SOE)
• Based in Wuhu, Anhui.
• Founded in 1997
• Started to build EV in 2010.
• In 2016 launched the Tiggo 7, the first SUV to be based on the company’s modular platform, the T1X. The Company will build 5 T1X-based models, including one EV.

Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
ICEV
Chery QQ

BEV
eQ EV

PHEV
S18 / Riich M1

Muniz, Sergio; Belzowsky, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Muniz, Sergio; Belzowskis, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
• Company: Zhejiang Geely Holding Group Co., Ltd
• China’s largest privately owned (POE) automaker, based in Hangzhou, Zhejiang, founded in 2003.
• JV 50:50 with Kandi
• Bought Volvo Cars from Ford (2010) and the British taxi maker The London Taxi Company (2012), in which made the TX4, a licensed London Black Cab.
• Geely target NEVs to make up 90% of sales by 2020.
• Products: automobiles, taxis, motorcycles, delivery vans, engines, and transmissions.
• It sells passenger cars under the Geely and Volvo brands and taxis under the London Taxi brand.
• Priorities: building more charging stations; improving battery efficiency.
• Plans to launch in 2018 the SUV Lynk01 (HEV) in Europe and US using a Compact Modular Architecture platform developed by Geely and Volvo in Sweden. Plans also include PHEV and BEV.
Muniz, Sergio; Belzowsk, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
• Company: Kandi Tecnologies Group, Inc.
• Based in Jinhua.

Kandi Technologies Group Inc manufactures small vehicles including all terrain vehicles (ATVs), golf carts, motor cycles, motor scooters, go-karts and mini-cars EVs.

• JV 50:50 with JV (2013) 50:50, Kandi + Geely Automobile Holdings Ltd. (incl. Shanghai Maple) => Zhejiang Kandi Electric Vehicles (1 billion yuan ≈ US$160 million)

• Car-sharing agreement (2012) was signed with the city of Hangzhou to supply 20,000 electric vehicles for the city's pilot EV leasing program. "Long lease" is also available, from 1 to 3 year contracts.

• Made agreements with Geely, Alibaba, ZTE, Uber China, and Minsheng Bank to create a “Car-Share 4.0” connected EV system.

• EV Strategy: inexpensive commuter vehicles + battery-swapping
BEV

Kandi K11 EV (Geely-Kandi Panda EV)

Kandi KD-5011 (“Coco”)

Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Company: SAIC Motor Corporation Limited (informally SAIC, formerly Shanghai Automotive Industry Corporation)

Ownership: State-Owned Enterprise (SOE)

Founded in 1940’s, Based in Shanghai

Joint-Ventures: IJVs with VW: Shanghai Volkswagen Automotive (1985); with GM: Shanghai General Motors Co Ltd (1997); with GM in R&D: Pan Asia Technical Automotive Center (PATAC) (2011); with Iveco: Nanjing Iveco Auto Co Ltd

From PATAC: co-development of a new electric vehicle architecture: Sail electric concept

With VW: R&D and production agreement for BEVs and PHEVs in China (June, 2015).

Goal: all ranges of sedans under SAIC’s self-owned brands will gradually be equipped with PHEV technology.

Agreement with eHi (rental co. in China)
ICEV

Roewe 950

PHEV

Roewe e950

Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
ICEV
Roewe 750

HEV
Roewe 750 Hybrid

BEV
Roewe E50
• Company: Zotye International Automobile Trading Co., Ltd.
• Ownership: Privately-Owned Enterprise (POE)
• Based in Yongkang, Zhejiang
• Founded in 2005.
ICEV

Zotye 100

BEV

2015 Zotye Cloud 100

Muniz, Sergio; Belzowskii, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
ICEV

5008 Nomad II

BEV

5008 Nomad II EV

Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Zotye Zhidou E20 EV

Zotye E200 EV

Muniz, Sergio; Belzowska, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
CONCEPTS:

• Electric Vehicle’s Platforms:
  • Adapted Electric Platform (AEP)
  • New Electric Platform (NEP)

• Electric Vehicle’s Design:
  • New Electric Vehicle Concept Design (NED)
  • Adapted Electric Vehicle Design (AED)
Muniz, Sergio; Belzowskii, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Muniz, Sergio; Belzowski, Bruce; Cu, Camille. - Electric Vehicles in China: Strategies of Local Companies and the Role of Government
Thank You!