Towards A Green Automotive Industry

A Collaboration Model to Accelerate China’s Green Mobility Efforts

Bill Russo (罗威)
President and CEO, Synergistics Ltd.

November, 2013

Synergistics

www.synergisticsltd.com
Executive Summary:

- A structural shift of economic power from West to the East is taking place, with stunning economic growth most evident in China and India over the past 20 years. This growth momentum will continue, making the Asian economies the most important in the world for the steel industry.

- The world has entered a new era since 2008, with over half of the world population now living in cities, and this increasingly urbanized world challenges the established set of paradigms for personal and commercial transportation, especially in the densely populated urban centers in China.

- For the global auto makers, Asia Pacific represents the greatest opportunity for growth, and within Asia Pacific the greatest growth opportunity is in China. China’s automotive market has been experiencing explosive growth, surpassing the US in 2009 as the world’s largest market.

- However, China believes that its position as the leading automotive market creates an opportunity to drive the standards and architecture of future automotive technology. As a result, China has launched an ambitious program to electrify transportation, with significant implications for the auto and steel industries.

- China’s 12th 5-year plan identified 7 strategic emerging industries including energy efficiency & environmental protection, new generation information technology, bio-technology, high-end equipment manufacturing, alternative energy, new materials, electric vehicle.

- The steel industry must help shape the new green transportation “ecosystem” by proactively partnering with leading Chinese institutions to introduce light-weight environmentally friendly materials.
1. A Changing World
2. China’s Dominance Of The 21\textsuperscript{st} Century Global Auto Industry
3. China’s Challenge: Driving a Green Car Revolution
4. The Challenge of Reinventing Mobility
5. Towards a New Ecosystem for Green Mobility
The China Context - speed and intensity (1/2)

Shanghai

20 Years Ago

Now
The China Context - speed and intensity (2/2)
The world economic center of gravity is rapidly shifting back towards the East, and especially towards China

China’s Share of Global GDP
1500-2050F, by PPP (constant 2005 international $)

- US: 10%
- China: 28%
- Western Europe: 7%
- Latin America: 7%
- Japan: 3%
- India: 12%
- All other countries: 34%

Source: EIU, Nexis, World Bank, CEPII, Literature research; Booz & Company analysis

China’s Fall and Rise

- **China enjoyed cultural and political supremacy for two millennia in the pre-modern world (600-1750)**
  - Advanced water management techniques
  - Meritocratic imperial bureaucracy
  - Confucian code of virtuous conduct
  - Unchallenged military prowess

- **Following the “Great Divergence”, China experienced almost 200 years of upheaval and chaos (1800-1970s)**
  - Chinese explanation: aggression, opium
  - Western explanation: Industrial Revolution
  - Other factors: Malthusian crisis, Manchu hubris, shortage of raw materials (e.g., wood), etc.

- **China has re-emerged during the past thirty years (since 1980s)**
  - Selective regulatory liberalization (bidirectional)
  - Progressive FDI levels and integration of China-based activities into MNCs’ global value chains
Economically, China is already - or will soon become - the world’s largest market for many consumer and industrial products

**China’s Share of the Automotive Market**

- **Latin America**
  - Growth thru 2020: 2,899K
  - CAGR (2010-2020): 6%

- **North America (NAFTA)**
  - Growth thru 2020: 5,528K
  - CAGR (2010-2020): 4%

- **Asia Pacific**
  - Growth thru 2020: 12,626K
  - CAGR (2010-2020): 5%

- **Africa/Middle East**
  - Growth thru 2020: 1,264K
  - CAGR (2010-2020): 4%

- **Europe**
  - **Eastern Europe**
    - Growth thru 2020: 2,835K
    - CAGR (2010-2020): 6%
  - **Western Europe**
    - Growth thru 2020: 1,527K
    - CAGR (2010-2020): 1%

**Source:** Global Insight Data, Booz & Company analysis

---

<table>
<thead>
<tr>
<th>Mobile Phones</th>
<th>Beer</th>
<th>Dairy Products</th>
<th>Crude Steel</th>
<th>Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Global #1</td>
<td>▪ Global #1</td>
<td>▪ Global #3</td>
<td>▪ Global #1 (46.7% of total production)</td>
<td>▪ Global #1</td>
</tr>
</tbody>
</table>

---

**China’s Share of Selected Commodities**

- **Mobile Phones**
  - 833M Users (2010)
  - Global #1

- **Beer**
  - 42B liters (2010 Production)
  - Global #1

- **Dairy Products**
  - 37.3M tonnes (2009 Production)
  - Global #3

- **Crude Steel**
  - 572M tonnes (2009 Production)

- **Paper**
  - 89.7M tonnes (2009 Production)
  - Global #1

Source: Global Insight Data, Booz & Company analysis
Asian countries, in particular China, now take the largest chunk of global steel consumption.
1. A Changing World  
2. China’s Dominance Of The 21st Century Global Auto Industry  
3. China’s Challenge: Driving a Green Car Revolution  
4. The Challenge of Reinventing Mobility  
5. Towards a New Ecosystem for Green Mobility
China contributed 32% of the global light vehicle sales increase from 2007 to date

Country share of incremental Global Light Vehicles Sales 1)
2007 - 2012

1) Includes A, B, C, D, E, F, MPV, SUV, light passenger car, and light truck
source: Global Insight 2010, Booz & Company analysis
China is still just entering the accelerated growth phase typical of emerging markets

Discussion

- A country’s threshold of mobility lies near US $10,000 GDP per capita (PPP), where automobile ownership accelerates.
- China is at the early taking-off stage of the S-curve.
- India remains fairly distant from the mobility inflection point, but continues to make steady progress.

Note: Each line of symbols represents a 19-year progression for one country, from 1990 through 2008, GDP Per Capita is in Purchasing Power Parity (PPP).
Source: Booz & Company analysis.
…and China’s continued economic development will stimulate auto industry growth for the foreseeable future

China Passenger Vehicle Installed Base (PARC) Forecast (2009-2030)

Key Drivers

- Car ownership in China is powered by the growing economy – the upside is substantial
- Government has been continuously guiding and supporting the industry’s development across manufacturing and distribution
- China’s financial system is less exposed and GDP growth is still very fixed investment driven, thus is less vulnerable to recent financial turbulence impact
- Highway network development provides foundation for more motor vehicle-based based transportation
- China is investing in infrastructure to support alternative propulsion

Note: Passenger vehicles contain sedans, MPVs and SUVs
Source: Global Insight 2010, OPEC, DGS Report, Booz & Company analysis
1. A Changing World
2. China’s Dominance Of The 21st Century Global Auto Industry
3. China’s Challenge: Driving a Green Car Revolution
4. The Challenge of Reinventing Mobility
5. Towards a New Ecosystem for Green Mobility
The world has entered a new era since 2008, more than half of the population lives in urban areas.

- More than half of the global population live in urban area since 2008

- At start of reform era, more than 80% of China’s population was in rural areas
- Majority of China’s population will reside in urban areas by 2015
- Creation of urban middle class fuels demand for personal mobility

Source: National Bureau of Statistics, UN, Booz & Company
With increasing pressure from air pollution, oil consumption and congestion, China is compelled to reinvent propulsion technologies.

### China to Reinvent Propulsion Technologies

#### Air Pollution
- Beijing, Xi’an, Shenyang, Shanghai and Guangzhou have been listed among the Top 10 cities with the worst air pollution. The massive growth of the automotive market only adds to the problem.
- The rapid growth of the automotive market worsens the problem. For example, Beijing’s automobile industry contributed 73% of the overall pollution problem in 2003.

#### Energy Consumption
- China imports two-thirds of its oil, and its ever-increasing thirst has had a dramatic impact on global energy prices.
- The gasoline and diesel consumption has accounted for half of the total consumption of petroleum products.

#### Traffic Congestion
- In the light of the current rate of development and gas consumption level, China will have over 150 million vehicles and petroleum consumption will exceed 250 million tons in 2020.

For alternative propulsion technologies such as clean diesel, hybrid and electric vehicles, China does not lead the technological development.

Source: Synergistics; Booz & Company analysis
As the leading automotive market, China has the opportunity to drive the standards and architecture for the global auto industry.

Shanghai: A Lean, Green Detroit

“... In acquiring a stake in BYD, Buffett broke a couple of his own rules. "I don't know a thing about cellphones or batteries," he admits. "And I don't know how cars work." But, he adds, "Charlie Munger and Dave Sokol are smart guys, and they do understand it. And there's no question that what's been accomplished since 1995 at BYD is extraordinary...”

Source: Literature research
Three key shifts are driving a green revolution and ushering a new era of collaborative partnership

- **Emerging Market Growth Forces Global Redistribution of Assets**
- **An Increasingly Urbanized World Challenges the Established Transportation Paradigm**
- **Environmental and Economic Sustainability Drive Green Car Innovations**

**Revolutionary Changes Require a New “Eco-system” of Collaborative Partnerships**
Six major themes marked China’s “12-5” strategic plan

Six Major Themes of “12-5” Strategic Plan

1. GDP Growth Rate Adjustment
2. Boosting Domestic Consumption
3. Industry Upgrade and Innovation
4. Energy Saving and Environmental Protection
5. Regional Coordinated Development
6. Internationalization
In the “12-5” period, China has committed to developing seven emerging industries including new materials and electric vehicle

**12-5 Plan Strategy Highlight**

- Continue to increase value added
- Eliminate outdated capacity
- Develop advanced equipment manufacturing industry

**Seven Emerging Industries**

- Increase government support to develop the 7 emerging industries* of strategic significance
- GDP contribution of the 7 industries should increase to 8% by 2015 from the current 2%
- Cultivate the culture industry to be a leading industry
- Implication: the share of value added of GDP by the culture industry needs to double from the current 2.5% to 5%

**Leading Industries**

- China’s leading industries, such as steel industry and petrochemical industry, consume a larger amount of energy per unit of GDP, whose growth will not be sustainable with the limited reserve of energy

**Drivers for the Trend**

- China has very limited reserve of natural resources such as ore, oil, etc, which motivates the Chinese government to cultivate industries that are less natural resource consuming
- With China’s labor cost rising, Chinese industries have been losing edge in international competition
- It is necessary for China to transform its industry structure to make it more technology and innovation-driven

Note: 7 strategic emerging industries include energy efficiency & environmental protection, new generation information technology, biotechnology, high-end equipment manufacturing, alternative energy, new materials, electric vehicle

Source: China 12-5 plan; Literature research; Booz & Company analysis
High energy-consuming industries will be the prioritized targets in China’s national energy saving plan

Characteristics of energy consumption in China
- Industrials consume over 70% of energy
- Within the industrials sector, consumption of nine major industries accounts for ~80%
- These nine industries are the prioritized targets of the energy saving plan as they consume collectively over 50% of energy in China

Energy Consumption by Industry
2007;%

- Industrials: 71%
- Household consumption: 11%
- Transportation: 8%
- Others: 9%

Source: National Bureau of Statistics of China; Booz & Company analysis
China government has established their medium-term targets for NEVs, and planned around 5~10Mn PARC by 2020

### NEVs in 12th five-year plan and Energy Saving and New Energy Auto Industry Plan

#### Highlights
- **Number of BEV & HPV** on the road: 0.5Mn by 2015 and 2-5Mn by 2020.
- Industrialization of BEV and HPV will be the industry prioritization

#### Guidelines
- **R&D**: continue the country’s 3-by-3 R&D framework and increase its pace in EV commercialization
- **Infrastructure**: increase the network of EV charging stations
- **Technical standards**: set China’s own EV standards as well as participating in setting international standards
- **Expand the use of EV in the public transport sector**
- **Increase technical collaborations between EV stakeholders**
- **Develop technical and R&D talents**

### Alternative-energy vehicles development plan (2011-20)

#### Highlights
- **Financials**: Chinese central government to provide 100Bn RMB for the next 10 years in developing alternative-energy electric vehicles
- Number of **electric vehicles on the road**: 5~10Mn by 2020. Equivalent to 20% of all private passenger vehicles
- **Production capacity of BEV**: 1Mn a year by 2020

#### Program coverage
- R&D and technical developments
- Development of core EV components
- Commercialization, demonstration and roll-out pilot programs
- Establish network of charging stations in public places (such as car parks)

---

1) BEV: pure battery electric vehicles, HPV: plug-in hybrid power vehicles

Source: Literature research, Booz & Company analysis
1. A Changing World
2. China’s Dominance Of The 21st Century Global Auto Industry
3. China’s Challenge: Driving a Green Car Revolution
4. The Challenge of Reinventing Mobility
5. Towards a New Ecosystem for Green Mobility
The road to the new automotive world order will be challenging and will require significant transitions from today’s status quo

Key Challenges

- How can OEMs build up the new structures and capabilities required to develop alternative powertrain vehicles?

- **Who should the OEMs partner with** in order to build and improve these capabilities?

- **Where and how do OEMs find the suppliers for new technologies?** How will these relationships be different from relationships with current suppliers?

- How can the supply chain be aligned to meet the needs of the new supplier landscape?

- How will infrastructure supply (e.g. electric charging stations) be built up?

- What changes are in store for the current manufacturing structure and how can they be managed most effectively? Engineering? Sales & Marketing?
Among different technology trends, sustainable mobility and mass reduction have been a key focus globally and in China.

Different Technology Trends

1. **Mass Reduction via Light-Weight Materials**
2. **Sustainable Mobility: the Reinvention of Automotive Propulsion**
3. **Telematics and Infotainment**
4. **Enhanced Safety & Comfort**

“Glocalization”: Global Products Adapted to Local Requirements

- **1. Gasoline/ Diesel ICE**
  - Mercedes E-Class

- **2. Biofuel ICE**
  - Chevy Tahoe E-85

- **3. Conventional Hybrid**
  - Mercedes E-Class Blue-Tec

- **3. Plug-in Hybrid**
  - Toyota Prius

- **3. Electric Vehicle**
  - Chevrolet Volt

- **4. Hydrogen Fuel Cell Vehicles**
  - i-MiEV

- **4. xEVs - Covered in detail**
  - Honda FCX Clarity
Steel accounts for more than 50% of the weight of an average passenger car.

**Materials in a Passenger Car**
(By % of total weight)

- Steel: 56%
- Others: 11%
- Glass: 8%
- Rubber: 4%
- Aluminium: 6%
- Plastics: 12%
- Iron: 3%

**Source:** SMMT, Corus, Booz & Company analysis
Several technologies will achieve incremental impact on fuel efficiency

<table>
<thead>
<tr>
<th>Technology</th>
<th>Fuel Efficiency Gain* (%)</th>
<th>Incremental Cost Per Car (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Downsizing (with Turbo or Supercharger)</td>
<td>13%</td>
<td>300</td>
</tr>
<tr>
<td>Direct Injection/Lean Burn</td>
<td>12%</td>
<td>400</td>
</tr>
<tr>
<td>Light Weighting</td>
<td>10%</td>
<td>500</td>
</tr>
<tr>
<td>Stop Start with Regenerative Braking</td>
<td>7%</td>
<td>550</td>
</tr>
<tr>
<td>Dual Clutch Transmission</td>
<td>7%</td>
<td>1,400</td>
</tr>
<tr>
<td>Variable Valve Actuation</td>
<td>6%</td>
<td>300</td>
</tr>
<tr>
<td>Electric Steering</td>
<td>5%</td>
<td>100</td>
</tr>
<tr>
<td>Reduced Mechanical Friction</td>
<td>4%</td>
<td>50</td>
</tr>
<tr>
<td>Electric Power Hydraulic Steering</td>
<td>4%</td>
<td>50</td>
</tr>
<tr>
<td>Stop Start</td>
<td>4%</td>
<td>200</td>
</tr>
<tr>
<td>Low Rolling Resistance Tires</td>
<td>3%</td>
<td>100</td>
</tr>
<tr>
<td>Aerodynamics</td>
<td>2%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

* Fuel efficiency gains are calculated as the individual technology impact to fuel efficiency immediately after it is applied to a base engine using state-of-the-art technology.

Source: King Review, Deutsche Bank, NHTSA, Booz & Company analysis.
1. A Changing World
2. China’s Dominance Of The 21st Century Global Auto Industry
3. China’s Challenge: Driving a Green Car Revolution
4. The Challenge of Reinventing Mobility
5. Towards a New Ecosystem for Green Mobility
For automakers, “green mobility” optimization problems lie in the balance of the cost, weight and function.
Solutions for the “green mobility revolution” require a new eco-system of collaborative partnerships

3 Dimensions of the New Eco-system

- **Regulatory Innovation Frontier (Government)**
  - New policies (including subsidy policy) to support the commercialization of green transportation technologies

- **Technical Innovation Frontier (Auto Industry)**
  - Partnerships among key players to deliver deep, scalable solutions for future green transportation

- **Business Innovation Frontier (Cross Industry/Value Chain)**
  - Partnerships between other industries and auto makers/suppliers to develop new business model for future green cars
EV requires new lighter and stronger materials to replace relatively heavy steel body of conventional vehicles

1) Light vehicle means “Manufacturing of passenger cars & light commercial vehicles (< 6T), as well as parts Wholesale & repair not included”. Rounding effects may occur
Source: Booz & Company analysis
Generally we see four major material groups in the field of lightweight materials...

Overview Lightweight Materials in Structural Applications

<table>
<thead>
<tr>
<th>Light Weight Material</th>
<th>Product Characteristics</th>
<th>Current Application Areas</th>
<th>Future Application Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High Strength Steel</strong></td>
<td>- High Toughness, high yield strength</td>
<td>Body structure</td>
<td>Vehicle chassis</td>
</tr>
<tr>
<td></td>
<td>- High stiffness, critical for automotive uses</td>
<td>Frontend beam</td>
<td>Structural components/crash components</td>
</tr>
<tr>
<td></td>
<td>- Achieves a fatigue limit, good for long-term design without ongoing inspections</td>
<td>Already increased penetration</td>
<td>Seats, interior components</td>
</tr>
<tr>
<td><strong>Aluminum</strong></td>
<td>- Carbon fiber woven tows in a resin matrix</td>
<td>Space Frame</td>
<td>Pure chassis elements</td>
</tr>
<tr>
<td></td>
<td>- Highest stiffness, yield strength, lowest mass</td>
<td>Stringer</td>
<td>Interior decorative components</td>
</tr>
<tr>
<td></td>
<td>- Crash characteristics tend to destroy chassis components, making it very difficult to repair outside OEM factory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Magnesium</strong></td>
<td>- Very low weight, but low relative stiffness and yield strength</td>
<td>Engine block, mounts</td>
<td>Vehicle chassis</td>
</tr>
<tr>
<td></td>
<td>- Potential flammability issues and creep in high temperature applications, 630 °C flashpoint is low relative to steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Potential flammability issues and creep in high temperature applications, 630 °C flashpoint is low relative to steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbon Fiber Reinforced Polymer</strong></td>
<td>- Moderate yield strength, lower toughness, but much lower mass</td>
<td>Vehicle chassis</td>
<td>Chassis</td>
</tr>
<tr>
<td>(CFRP)</td>
<td>- Low to moderate stiffness on a mass basis to steel</td>
<td>Aerodynamic surfaces, sporting equipment</td>
<td>Interior structural components</td>
</tr>
<tr>
<td></td>
<td>- No fatigue limit, so structures must be over designed or expensive regular inspection must be performed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

-30-35%  -40%  -15-20%  -50% Up to x% weight efficiency compared to conventional steel in automotive

Source: Booz Allen Hamilton Technology Center, Booz & Company
CFRP is a promising material for EV in terms of light and strength; however, its manufacturing cost is expected to remain high.

**CFRP is light and strong**

Excellent performance in weight reduction:
- Weight reduce by 50%+
- Oil efficiency raise by 40%+

Excellence energy absorbing capabilities (e.g. application to F1)

**Example**

Tesla “Roadster”

Promoted in 2008, manufactured by Tesla
CFRP adopted in vehicle body and interior decoration, deducted weight to approx. to 1,000 kg (normally avg. weight for passenger vehicle 1,800~2,000 kg)

Outstanding performance:
- <4 seconds from 0 to 60 miles/hour
- Duration distance: >200 miles (322km)

Very expensive: US$ 109,000

---

**Expected Lightweight Material Cost Reduction Range**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Aluminum</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>CFRP</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Honeycomb</td>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>High Strength Steel</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>9</td>
</tr>
</tbody>
</table>

**Carbon Fiber Composite**

Fragmented use of carbon fiber due to:
- Remaining cost ineffectiveness
- Limited processability (low volume series high performance cars)
- Low side crash/ passenger crash safety performance

Source: Booz Allen Hamilton Technology Center; literature research; Booz & Company
Suppliers have become major automotive steel consumers as their share in production continues to increase

### China Automobile Use Steel Production

<table>
<thead>
<tr>
<th>Component</th>
<th>PV</th>
<th>HD CV</th>
<th>MD CV</th>
<th>LD CV</th>
<th>Micro CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Vehicle Sales, 2010 1H (’000 units)</td>
<td>6,720</td>
<td>613</td>
<td>190</td>
<td>1,181</td>
<td>311</td>
</tr>
<tr>
<td>Estimated Steel Consumption, 2010 1H (’000 Tons)</td>
<td>6,720</td>
<td>5,520</td>
<td>762</td>
<td>1,772</td>
<td>249</td>
</tr>
</tbody>
</table>

2010 full year forecast for auto industry 36 Million tons

### China Vehicle Sales, 2010 1H (’000 units)

<table>
<thead>
<tr>
<th>Component</th>
<th>PV</th>
<th>HD CV</th>
<th>MD CV</th>
<th>LD CV</th>
<th>Micro CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Vehicle Sales, 2010 1H (’000 units)</td>
<td>6,720</td>
<td>613</td>
<td>190</td>
<td>1,181</td>
<td>311</td>
</tr>
<tr>
<td>Estimated Steel Consumption, 2010 1H (’000 Tons)</td>
<td>6,720</td>
<td>5,520</td>
<td>762</td>
<td>1,772</td>
<td>249</td>
</tr>
</tbody>
</table>

2010 full year forecast for auto industry 36 Million tons

### Supplier Share in Production by Component (%)

<table>
<thead>
<tr>
<th>Component</th>
<th>2002</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>23</td>
<td>15</td>
</tr>
<tr>
<td>Powertrain</td>
<td>37</td>
<td>20</td>
</tr>
<tr>
<td>Engine &amp; auxiliary systems</td>
<td>50</td>
<td>36</td>
</tr>
<tr>
<td>Body structure</td>
<td>96</td>
<td>59</td>
</tr>
<tr>
<td>Body (exterior)</td>
<td>55</td>
<td>29</td>
</tr>
<tr>
<td>Interior</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Electrical systems/electronics</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

OEMs: China Automobile Use Steel Production

Suppliers can seize partnership opportunities as automakers increasingly depend on suppliers to deliver advanced vehicle technologies

Partnerships in product development breed strong relationship with OEMs, which in turn ensure steelmakers’ market and profit share in the future auto market.

**Chinese OEMs lack leading-edge technologies in fuel efficiency**

- Pollution reduction and fuel efficiency are top national priorities
- The most significant internal capability gap between Chinese and global OEMs is in advanced propulsion technology

**Baoshan collaborates with OEMs in product development...**

- Baoshan partners with Chinese OEMs such as Geely, Chery, Dongfeng, and Chongqing Chang’ An in a 500 mn RMB project to develop stronger and lighter materials

**Both Baoshan and Chinese OEM’s competitive positioning will be strengthened**

- Baoshan secured its market share against global leaders
- Chinese OEMs get the technology to possibly reduce vehicle weight by 10% and fuel consumption of 6-8%

---

Source: Bloomberg BusinessWeek “Baoshan Steel, Geely Seek to Cut Chinese Auto Weight” September 16, 2010, Booz & Company analysis
POSOCO has formed a technical partnership with Great Wall to deliver advanced material processing technology

- Body and Materials engineering are core capabilities for OEMs to deliver uniquely designed products that meet regulatory standards.
- Chinese OEMs seek to establish body engineering organizations to compete with global leading technologies.

POSOCO forms technical partnership with Great Wall Motor
- POSCO to help Great Wall implement high-strength steel, new hot pressing and hydraulic forming technologies.
- POSCO will also provide technical support for vehicles under development at Great Wall.

Both POSCO and Great Wall strengthen competitive positioning
- POSCO engages Great Wall as a development partner and creates a new business opportunity in China.
- Great Wall accelerates its development capability in a critical area and accelerates its emergence as a global auto company.

Partnerships with Chinese OEMs to create a win-win situation, and increase steelmaker’s market share and profitability.

The central government is playing a key role in shaping industry development

Official China at Work

SASAC

- Vehicle Manufacturers
- Battery Manufacturers
- Utilities Companies

Electric Vehicles Market

Note: SASAC: State-owned Assets Supervision and Administration Commission of the State Council
Source: Booz & Company analysis
It is important to carefully map-out of the key stakeholders and understand their specific roles/priorities

The State Council
Premier: Wen Jiabao

National Development and Reform Commission (NDRC)
- Responsible for controlling and coordinating economic and social development plan

Ministry of Industry and Information Technology of People’s Republic of China (MIIT)
- Responsible for designing regulations and policies for industry sector

State-owned Assets Supervision and Administration Commission (SASAC)
- Responsible for managing auto industry from a technical supporting perspective

Ministry of Commerce of People’s Republic of China (MOFCOM)
- Responsible for administering China’s foreign trade, economic cooperation and foreign investment

China Automotive Technology & Research Center (CATARC)
- Responsible for conducting regulation and policy of industry, and developing new technology

Other Associations
- Responsible for very select individuals (5-7) that need to be targeted for auto/heavy industrials in most govt. associations (automotive department)
- For CATARC, multiple stakeholders are present for different technical standards
- Proactively developing relationships with key individuals are vital to business in China

Source: Literature research; Expert Interviews; Booz & Company analysis
In the published “Guidelines to New Material Industries during Twelfth-five Year Plan”, steel is not named as an option for NEV.

New Material Industry and China’s Twelfth-five Year Plan

- Led by the state council, China has issued the 12th five year plan and guidelines to pillar industries through MIIT, NDRC, Ministry of Finance, Ministry of Technology and other administrative bodies
- New Materials was considered one of the seven emerging industries that has strategic importance to China’s development

The scope of New Materials covers premium steel with “high strength, tenacity, heat and corrosion resistance”, together with five other strategic new materials.

However, in section on the need for new materials for new strategic industries, only Aluminum and Magnesium Alloy were named as preferred materials…Steel was not named as a preferred material for energy saving and alternative energy vehicles.

Steelmakers must proactively lobby for the inclusion of steel in energy saving and new energy vehicle applications.

Source: Expert interviews; Literature research; Synergistics Limited analysis
Conclusions:

Executive Summary:

- A structural shift of economic power from West to the East is taking place, with stunning economic growth most evident in China and India over the past 20 years. This growth momentum will continue, making the Asian economies the most important in the world for the steel industry.

- The world has entered a new era since 2008, with over half of the world population now living in cities, and this increasingly urbanized world challenges the established set of paradigms for personal and commercial transportation, especially in the densely populated urban centers in China.

- For the global auto makers, Asia Pacific represents the greatest opportunity for growth, and within Asia Pacific the greatest growth opportunity is in China. China’s automotive market has been experiencing explosive growth, surpassing the US in 2009 as the world’s largest market.

- However, China believes that its position as the leading automotive market creates an opportunity to drive the standards and architecture of future automotive technology. As a result, China has launched an ambitious program to electrify transportation, with significant implications for the auto and steel industries.

- China’s 12th 5-year plan identified 7 strategic emerging industries include energy efficiency & environmental protection, new generation information technology, bio-technology, high-end equipment manufacturing, alternative energy, new materials, electric vehicle.

- WorldAutoSteel would like to help shape the new green transportation “ecosystem” by proactively partnering with leading Chinese institutions to introduce light-weight environmentally friendly materials.

Key Implications

- Green innovation in auto industry will dramatically change the steel makers’ way to play in the auto sector.

- The global steel makers must collectively seek a means to influence policies related to new material applications via leading industry and academic institutions.

- Steelmakers must build solid partnerships and find opportunities to get involve in the new green car eco-system
  - Technical frontier: partner among steel makers
  - Business frontier: partner across value chain among OEMs, auto suppliers
  - Regulator frontier: cooperate with green car policy makers

Steelmakers must be proactively involved in the development of the new eco-system for green mobility in China.