From “Ford” to China

A Brief Introduction of Methanol Fuel and Vehicles in China (1980s-2014)

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Peking University
• R&D History
• Recent Pilots and Demonstrations
• Policy Review
• Updates on the Latest Work
• Future Trends
• Recommendations
R&D History - Research

• 1983-1985 6th “5 year Plan (5YP)”
  M15: 473 vehicles, 5 refill stations

• 1985-1991 7th 5YP Joint research with Germany
  M100 in Spark Ignited ICE: 10 VW Santana, 492 and CA6102 retrofitting
• 1995-1997 Shanxi Government & FORD
Methanol FFV prototype, LCA (Economic, Environmental and Energy) on coal conversion to Fuel
R&D History- Demonstration

• **1997-2001 National Methanol Vehicle Demonstration**
  Chinese domestic methanol engine: 495 (MPI)
  1\(^{st}\) phase: 100 mid-buses for Public transportation
  2\(^{nd}\) phase: 200 mid-buses

• **First time** for public transportation in real application
• 2003-2005  Clean Automotives Act
  50 bus (10m), retrofitted CA6102 Engine
• 2004-2011  National “863” Project on Bus Operation
  80 bus (10m), retrofitted CA6102 Engine
Methanol Vehicle Pilot by MIIT

- From 2012 to 2015
- 3 provincial areas: Shanxi, Shannxi, Shanghai
- 3 definitions:
  - Location, Fuel (M85&M100), Vehicle (New Engine and Vehicle registration)
• **Definition of Methanol Vehicle**
  - SI Engine: M85/M100, gasoline tank less than 15L
  - CI Engine: Diesel/M dual fuel

• **Methanol Vehicle Technical criteria (standard?)**
  - All regular vehicle requirements
  - TCH and Fuel Consumption not referred
  - Corrosion Resistance: GBT1690-2006
  - HCHO emission: light duty ≤10mg/km, heavy duty (SI) ≤ 50mg/km, heavy duty (CI, ETC) ≤ 25mg/km
• **Objective**: Assessment, vehicle and infrastructure standard, industrial policies

• **Test & Vehicle Registration**

• **Fundamental work done**: Engine & Vehicle R&D, Fuel standards & safety, infrastructure
<table>
<thead>
<tr>
<th>检验项目</th>
<th>标准限值</th>
<th>检验结果</th>
<th>符合性判定</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO[g/(kW·h)]</td>
<td>9.7</td>
<td>2.52</td>
<td>符合</td>
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<tr>
<td>THC[g/(kW·h)]</td>
<td>0.29</td>
<td>0.107</td>
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<tr>
<td>NOx[g/(kW·h)]</td>
<td>0.70</td>
<td>0.201</td>
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<tr>
<td>甲醛 [mg/(kW·h)]</td>
<td>≤50</td>
<td>23.3</td>
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</tbody>
</table>

2. 甲醛供液管路防腐蚀性试验

<table>
<thead>
<tr>
<th>检验项目</th>
<th>标准限值</th>
<th>检验结果</th>
<th>符合性判定</th>
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<tbody>
<tr>
<td>质量变化</td>
<td>≤5%</td>
<td>2.2%</td>
<td>符合</td>
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<tr>
<td>体积变化</td>
<td>≤15%</td>
<td>4.1%</td>
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<tr>
<td>力学性能变化（拉伸）</td>
<td>≤10%</td>
<td>5.8%</td>
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<tr>
<td>部件名称</td>
<td>通勤场合</td>
<td>产品型号</td>
<td>STJ5023XXY</td>
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<tr>
<td>注册地址</td>
<td>陕西省科尔维特技术开发区汽车工业区</td>
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<td>车号</td>
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<td>生产地址</td>
<td>陕西省科尔维特技术开发区汽车工业区</td>
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</table>

<table>
<thead>
<tr>
<th>外形尺寸(mm)</th>
<th>长：4030 宽：1820 高：1900</th>
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<tbody>
<tr>
<td>载货性能指标</td>
<td>销售质量(kg)：1800</td>
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<tr>
<td></td>
<td>累计质量(kg)：520</td>
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<tr>
<td></td>
<td>载客量(kg)：1200</td>
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<tr>
<td></td>
<td>准线总车质量(kg)：</td>
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<tr>
<td></td>
<td>轮胎规格：</td>
</tr>
<tr>
<td></td>
<td>轮胎胎宽：</td>
</tr>
<tr>
<td></td>
<td>轮胎胎高：</td>
</tr>
<tr>
<td></td>
<td>轮胎直径：</td>
</tr>
<tr>
<td></td>
<td>轮胎数量：</td>
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<tr>
<td></td>
<td>驾驶员人数（人）：</td>
</tr>
<tr>
<td></td>
<td>行驶限制（限载）：</td>
</tr>
<tr>
<td></td>
<td>反射器/安全带：</td>
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<tr>
<td></td>
<td>反光镜变色号：</td>
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<tr>
<td></td>
<td>反光镜标识符号：</td>
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<tr>
<td></td>
<td>车头识别代号（VIN）：</td>
</tr>
<tr>
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<td>其他：</td>
</tr>
<tr>
<td></td>
<td>说明：</td>
</tr>
<tr>
<td></td>
<td>油耗(mpg/100km)：</td>
</tr>
</tbody>
</table>

"Tongjia" Vehicle Registration Page on MIIT
Policy Review – National statements

• 2004 “China's Auto Industry Development Policy” issued by National Development and Reform Commission (NDRC)

• 2004 “China's key industrial technology development project list” compiled by NDRC.

• 2005 A suggestive report on promoting coal-based alcohol fuel to replace gasoline and diesel to President Hu Jintao and Premier Wen Jiabao

• 2007, “China's Alternative Energy Research Report” has completed by NDRC
• 2012 “12th 5YP on energy conservation and emission reduction” by state council

MIIT (Vehicle) vs. NEA of NDRC (Fuel)
Guideline on ICE energy conservation and emission reduction from state council office

Promotion of G/M Dual Fuel in Passenger vehicles; D/M Dual Fuel in Heavy Duty Vehicles, ships, gensets;

Quantitative target: "5 Mt oil substitute in ICE"
Policy Review – National Standards

- April 8\textsuperscript{th}, 2009, National standard of “Fuel methanol for motor vehicles”, GB/T 23510-2009, approved and issued by Standardization Administration of China, and also came into effect on Nov. 1\textsuperscript{st}, 2009.

- May 18\textsuperscript{th}, 2009, National standard of “Methanol gasoline (M85) for motor vehicles”, GB/T 23799-2009, approved and issued by Standardization Administration of China, and also came into effect on Dec.1\textsuperscript{st}, 2009.
<table>
<thead>
<tr>
<th>Issue Date</th>
<th>Province</th>
<th>Local Standards</th>
<th>Name</th>
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<tbody>
<tr>
<td>2002.08.23</td>
<td>Shanxi</td>
<td>DB14/T 93-2002</td>
<td>Methanol fuel for motor vehicles</td>
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<td>2008.01.14</td>
<td>Shanxi</td>
<td>DB14/T 92-2008</td>
<td>M5, M15 Methanol gasoline for motor vehicles</td>
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<td>2008.01.14</td>
<td>Shanxi</td>
<td>DB14/T 177-2008</td>
<td>Denatured methanol for methanol gasoline</td>
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<td>2008.01.14</td>
<td>Shanxi</td>
<td>DB14/T 178-2008</td>
<td>Blendstocks for methanol gasoline</td>
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<td>2008.01.14</td>
<td>Shanxi</td>
<td>DB14/T 179-2008</td>
<td>Fuel methanol(M85, M100) for motor vehicles</td>
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<td>2009.08.31</td>
<td>Zhejiang</td>
<td>DB33/T 756.1-2009</td>
<td>Methanol gasoline for motor vehicles</td>
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<tr>
<td>2010.09.22</td>
<td>Hebei</td>
<td>DB13/T 1303-2010</td>
<td>M15 methanol gasoline for motor vehicles</td>
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<td>2010</td>
<td>Guizhou</td>
<td>DB52/ -2010</td>
<td>M15 methanol gasoline for motor vehicles</td>
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<tr>
<td>2012.01.16</td>
<td>Shanghai</td>
<td>DB31/ 580-2012</td>
<td>M100 methanol fuel for motor vehicles</td>
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</table>
Updates on the Latest Work

- MIIT Methanol Vehicle Pilot
  HuaPu passenger cars SMA718
  Shanxi Jinzhong: 150, Shanghai Minhang: 18
• Shanxi Changzhi: 100 Yutong Buses ZK6100 (FAWJY engine)
• Shannxi Yulin Coal Group: 10 trucks (FAWJY engines, FAWJF & Shannxi Auto. Group)
• Shannxi Baoji City “Tongjia” postal car: STJ5013X & STJ5404, 15 in total
Updates on the Latest Work

- 27 provinces
- Methanol Blending (M15, M25, DME fuel etc.)
  - 2012: 10Mt methanol consumption of 36 Mt production (No.1 application)
  - Equivalent: 5Mt of 277Mt oil product
- Car Retrofitting (M85, M100)
  Over 100K, localized methanol fuel
A competition between alternatives with biased policies: electric, NG and Methanol Fuel

Policy is behind the market!
Driving forces: A multi-win situation

- Consumers: fuel cost and guarantee
- Methanol producers: Coal industry re-structuring
- Government: Energy Security, SMOG DISASTER across China, local fuel industry growth
- OEMs: FAW, Geely, Chery, Chengong, Tongjia, Shannxi Automotive Group, Beijing Automotive Group
• IARC of WHO: Out door air pollution– carcinogenic
• M15 for PM reduction
  Mass: GDI 78%  PFI 74%
  Number: GDI  56%  PFI  25%
• CA6SH-ME4 M100 (GB17691-2005, Eqv. Euro 5, ESC) VS. Emission Standards of Diesel Vehicle
Future Trends

- Third Plenary Session of the 18th CPC Central Committee -- a new leadership
- Report on Decisions on major Issues Concerning Comprehensively Deepening Reforms (including Energy sectors): Market
- End of Ethanol Fuel Incentives
- Reduction of EV incentives
- Price reform of NG
Future Trends

• No.1 Chinese methanol application in long term: Fuel
• Deepening & Expansion of MIIT pilot more provinces, more vehicle types
• More provincial promotions Shanxi: 60K methanol vehicles
• M15 National standard
Recommendations

• International joint research
  Technology, Economy, Environment, Energy Security, etc.
• A free competition between fuels and alternatives
• International policy interaction
• Joint Alcohol Fuel Alliance
Thanks

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