Energy Use and Environmental Impacts of China’s On-Road Transport

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China’s Vehicle Population Is Growing Significantly
Transportation demand drives oil demand

Passenger transport in China
(100M person.km)

Freight transport in China
(100M ton.km)

Annual Car Production / million

Vehicle sales
New registrations (millions)

Source: China National Statistical Bulletin 2011
Growth of On-Road Transport Is the Major Driving Force of the Increasing Amount of Oil Import in China

In 1993, China became a net oil-import country, now the dependence on imported oil is close to 60%.
## Impacts of Atmospheric Components

<table>
<thead>
<tr>
<th></th>
<th>health</th>
<th>Haze</th>
<th>Acid rain</th>
<th>ABC</th>
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On-road CO and HC emissions have shown a decreasing trend, but PM and NO\textsubscript{x} emissions keep increasing.

Variation Trend in On-road Emissions from 1980 to 2012 (source: China MEP)
PM$_{2.5}$ Pollution has become a serious concern in China and vehicles are an important contributor.

- 40% days of nonattainment.
- Daily concentrations were 4 times higher than AAQS.
- It has caused great attentions from the government and the public.
SNA (sulfate, nitrate and ammonium) is the major component in PM$_{2.5}$ of Eastern China.
On-Road Transport Has Become a Major Source of Gaseous Pollutants (CO, VOC, and NOx) in China

Nationwide, contribution >20%

In Jing-Jin regions, YRD, and PRD, contribution >40%

In megacities, contribution >65%

Nationwide, contribution >20%
Transportation is an Important Source of BC and NO$_x$ Emissions

- **Emission Sources of BC in 2010**
  - Power: 32.6%
  - Industry: 51.7%
  - Residential: 15.6%
  - Transportation: 0.1%

- **Emission Sources of OC in 2010**
  - Power: 81.4%
  - Industry: 15.6%
  - Residential: 3.0%
  - Transportation: 0.001%

- **Emission Sources of SO$_2$ in 2010**
  - Power: 58.6%
  - Industry: 28.4%
  - Residential: 12.2%
  - Transportation: 0.8%

- **Emission Sources of NO$_x$ in 2010**
  - Power: 38.8%
  - Industry: 32.7%
  - Residential: 24.5%
  - Transportation: 3.9%
Annual NO$_x$ concentrations of over 100 Chinese cities in 2003 and 2012 shows that annual NO$_x$ concentrations are decreasing in large cities but increasing in medium and small cities.
A High Resolution, County-Level Vehicle Emission Inventory is Developed to Analyze the Spatial Distribution of Vehicle Emissions
A Large Number of On-Board Emission Measurements on Various Type of Vehicles Have Been Conducted in China

Gasoline Cars

Diesel trucks

Rural Vehicles
China’s Vehicle Emission Standards Are Following EU’s Standard System

- Year 1995: E0
- Year 1999: E1
- Year 2003: E2
- Year 2007: E3
- Year 2011: E4
- Year 2015: E5

- EU
- China
- Beijing
- Shanghai
- Guangzhou
- Shenzhen
- Nanjing
China’s Standards Are Years Behind the US and EU Level, and Oil Quality Is the Largest Bottleneck to Further Promote the Standards
### Standards for GV

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<tr>
<th>Country</th>
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### Standards for DV

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Policies for Reducing Oil Demand of Vehicles

❖ Fuel economy standards:

For light-duty passenger cars

- Stage I and Stage II: implemented in 2005 and 2008, respectively, improved the fuel economy by 15% (30 mpg in 2009);
- Stage III: Implemented in 2012, is expected to bring another 15% of improvement in fuel economy by 2015 (34 mpg in 2015);
- Stage IV: achieve 47 mpg by 2020;

❖ Advanced Vehicles:

Policies for Controlling Vehicle Emissions

- The new national ambient air quality standard was issued in 2012 and will be implemented in 2016, which
  - Tightens the annual NO\textsubscript{x} concentration from 0.08mg/m\textsuperscript{3} to 0.04mg/m\textsuperscript{3}.
  - Includes PM\textsubscript{2.5} and 8-hour O\textsubscript{3} for the first time.

- A national goal is set for NO\textsubscript{x} emission control in the 12\textsuperscript{th} Five-Year Plan
  - To reduce the national NO\textsubscript{x} emissions by 10% from 2010 to 2015.
  - On-road transport is the second largest NO\textsubscript{x} emission contributor after power plants, and thus is targeted as a key control sector.

- Emission standards
  - More stringent standards will be implemented in near future

- Accelerating vehicle scrappage
  - Subsidies are provided for scrapping old vehicles
Thanks!