Progress of Beijing in Control of Vehicular Emissions

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Air pollution caused by vehicular emissions
- Contribution to air pollution in Beijing (urban area, 1999)
  - PM$_{10}$: Exhaust PM$_{10}$ —— 7.0%
  - Road re-suspended PM$_{10}$ —— 32.8% ≤ 39.8%
  - NO$_2$: 68.4%
  - CO: 76.5%
- More significant contribution to fine PM (PM$_{2.5}$), which has greater adverse effects than PM$_{10}$
- Potential cause of photochemical smog

Control strategies and measures
- Land use and traffic planning
- Emission control of in-use vehicles
- Emission control of new vehicles
- Fuel quality improvement
- Clean Fuel vehicle technology
- Fiscal Incentives

Rapid increase of vehicle population
- China: Increase at 8.7% annually
- Beijing: Increase at 14.5% annually

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Sub-workshop Session 15: Air Quality Management Policies and Implementation

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Land use and traffic planning of Beijing

- Proper land use can decrease the traffic demand, so as to reduce the vehicular emissions

**Land use map up-to-date vs. the new city planning in Beijing**

- To accelerate the conversion of personal trip mode by increasing the share of public transportation
  - Subway & light railway in Beijing: to reach 300 km before 2008
  - Bus population per 10,000 persons will increase to 12+
  - Bus Rapid Transit (BRT) systems are under construction

- Enhancement of the construction of minor arterial roads, branches and intersections, to distribute the traffic volumes, is also important in Beijing

Emission control of in-use vehicles

- Inspection/Maintenance (I/M) Program
  - 1995: preliminary I/M with two speed idle tests
  - 1999: basic I/M with two speed idle tests, CO and HC emissions were significantly reduced
  - 2003: enhanced I/M with ASM tests, to control NOx emissions

**Reduction rates of CO and HC emissions by I/M programs with two speed idle tests in Beijing**

Note: Accumulative concentrations of CO emissions and HC emissions of 2452 tested vehicles at idle tests are set as 100%, respectively.

- To accelerate the retirement of old in-use vehicles that have high emissions
  - Heavy-duty vehicles: 160 new diesel buses (Euro 3) introduced replacing the old ones in 2002, with low sulfur diesel supplied
  - Light-duty vehicles: vehicles before Euro 1 are required to be inspected biannually and since late 2003 they are banned to run within the 2nd ring expressway

- To enhance the emission control of frequently used vehicles: faster retirement or retrofit program
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**Emission control of new vehicles**
- Introduction of more stringent emission standards step by step
  - Euro 1: Beijing —— 1999
    China —— 2000
  - Euro 2: Beijing —— 2003
    China —— 2005
  - Euro 3: Beijing —— 2005?
    China —— 2008?
  - Euro 4: Beijing —— 2008?

**Fuel quality improvement:** a close relationship with emission control technologies
- Fuel sulfur content will decrease with more stringent standards

**Clean fuel vehicle technology**
- Vehicles meeting the emission standards more stringent than current, no fuel limitation
- Cleaner gasoline or diesel powered vehicles are encouraged
- CNG/LNG vehicles: obvious lower PM emissions than current similar diesel vehicles, and less emissions of toxics and smog-producing substances
  Beijing has the largest CNG bus fleet all over the world with about 2000 dedicated CNG buses
- LPG vehicles: almost same regulated emissions as the gasoline vehicles with current similar technologies, while less emissions of toxics and smog-producing substances
  There are 600 dedicated LPG taxis and about 32,000 gasoline & LPG bi-fuel taxis in Beijing
- There are also about 20 pure electrical buses

**The fuel quality in Beijing**
- Sulfur content in the fuel will decrease further with Euro 3 standards for gasoline and diesel vehicles
- Olefins in the gasoline will also decrease
- Leaded gasoline was successfully phased out in Beijing during 1997-1998
Fiscal incentives
Increasing Significance

- Since late 2001, 30% deduction of tax was given to light-duty vehicles meeting Euro 2 standards in Beijing
- In early 1999, the tax of leaded gasoline was increased to make its price no lower than unleaded gasoline

Air quality in Beijing
- Since 1999, NO₂ annual average concentration remained at 0.07~0.08 mg/m³, while that of CO slowly decreased
- Ozone violation hours in Beijing fell since 1999, but rebounded in 2003, suggesting ozone pollution is still a serious concern

Forecast vehicle population in Beijing:
- 2008: 3.25 million
- 2020: 4.99 million

The fastest increase is happening around 2005!