

# China – EU Cooperation Project

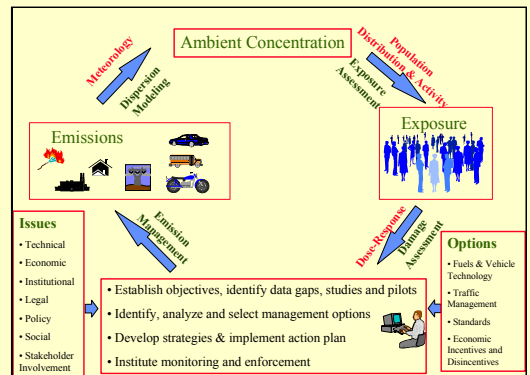
International Symposium  
December 8-0, 2002  
Beijing, PRC



Where It All Began!



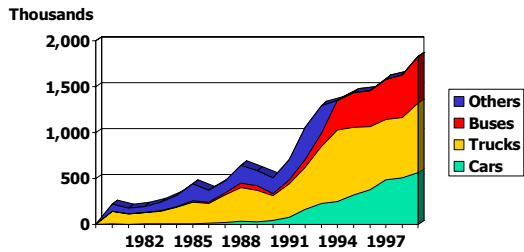
## Integrated Air Quality Management Framework



Five Sub-Projects  
New Vehicles & Fuel Quality  
I/M  
Lab QC  
National Database  
Economic Instruments



## Motor Vehicle Production in China

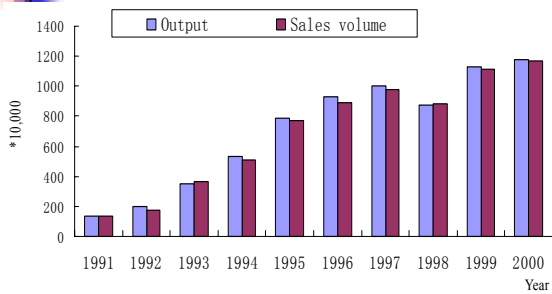


2002: First Three Quarters  
 Domestic Made Vehicles Up 34%  
 Passenger Cars Up 46%  
 Will Go Over 3 Million This Year



China Has A Growing Love Affair With The Car!

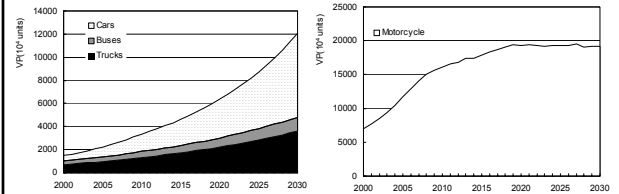
## Motorcycle Annual Production and Sales



22 Million and Growing Rapidly



## The Vehicle Population Is Expected To Grow Rapidly



A Median Estimate is 120 million Vehicles & 200 Million Motorcycles by 2030 – Tsinghua University

## Air Pollution Problem is Already Severe



## China: Urban NOx Problems

NOx Concentration in Chinese cities

year	No. Of cities	Non-attainment cities		Non-attainment for Class II standard		Non-attainment for Class III standard		Non-attainment cities for Class III
		number	rate (%)	number	rate (%)	number	rate (%)	
1995	88	32	36.4	3	3.4	0	0	
1996	88	27	30.7	25	28.4	2	2.3	Beijing, Guangzhou
1997	94	32	34.1	29	30.9	3	3.2	Beijing, Guangzhou, Shanghai
1998	96	32	33.3	29	30.2	3	3.1	Beijing, Guangzhou, Shanghai

## BEIJING: O<sub>3</sub> Concentration in 1997-1999

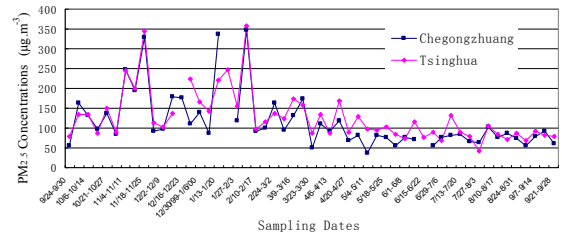
### Ozone concentration in Beijing

O<sub>3</sub> Concentration in Beijing

	Number of non-attainment days	Number of non-attainment hours	Max. Hourly concentration (µg/m <sup>3</sup> )
1997	71	434	346
1998	101	504	384
1999	119	777	

## Beijing: PM<sub>2.5</sub> Mass Concentration Levels 1999-2000

### Weekly variations



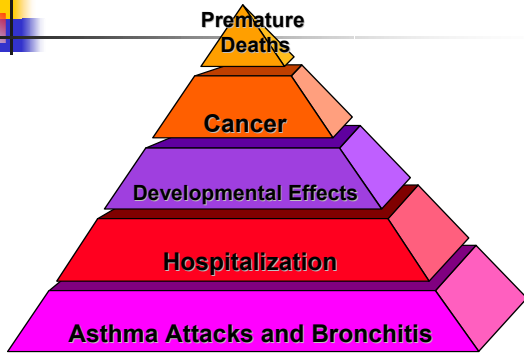
## Motor Vehicle Pollution in Urban Areas

- Motor vehicles contribute nearly 50% of NO<sub>x</sub> emissions in metropolitan cities
- About 1/3 of Major Cities Exceed ambient NO<sub>x</sub> NAAQS;
- CO concentration generally higher than national standard in traffic areas;
- Photochemical pollution emerging in big cities;
- PM Levels Tend To Peak in Evening when truck traffic is allowed;
- Vehicles becoming a main source of air pollution in urban areas.

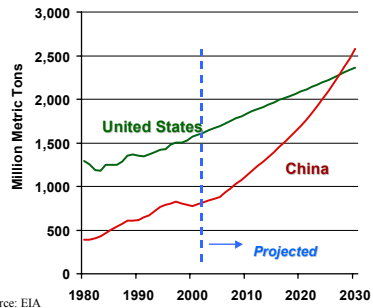
## Air Pollution Causes Adverse Health Effects



## Health Impacts of Air Pollution



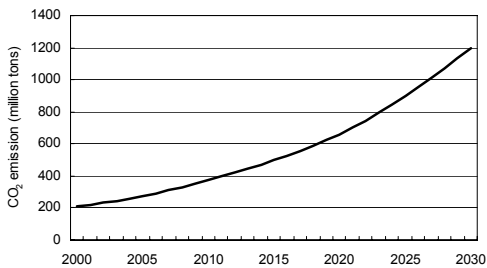
## Global Warming Carbon Emissions



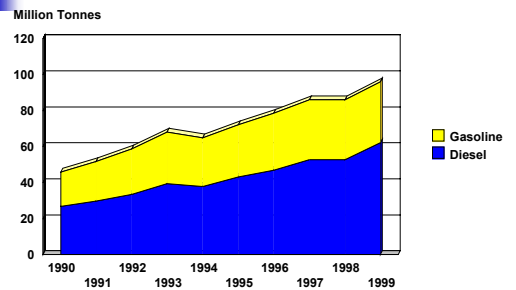
- Fastest carbon growth globally
- 2nd largest after U.S. in Energy: Production Consumption CO<sub>2</sub> emissions

Source: EIA

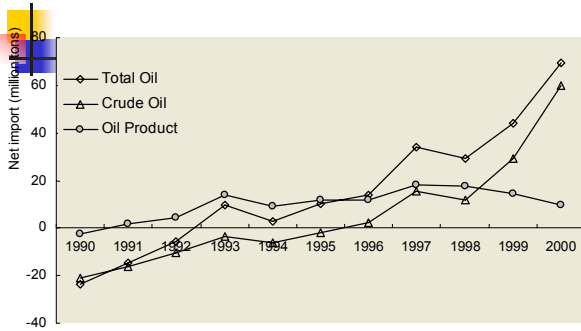
## Carbon Dioxide Emissions From the Road Transport Sector



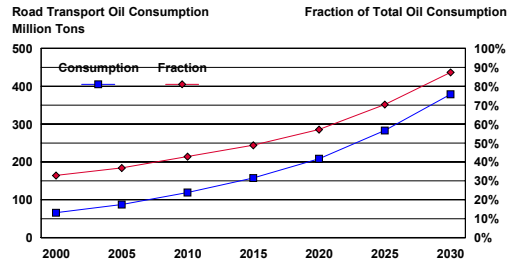
## Fuel Consumption Trends in China



## Oil Imports Have Been Rising Rapidly Since 1993

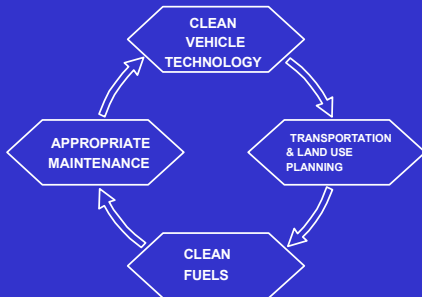


## Current and Projected Road Transport Oil Demand in China



Road transport oil demand will be 57% of the total in 2020, and 87% in 2030, making it the principal source of oil demand and oil imports at that time.

## ELEMENTS OF A COMPREHENSIVE VEHICLE POLLUTION CONTROL STRATEGY



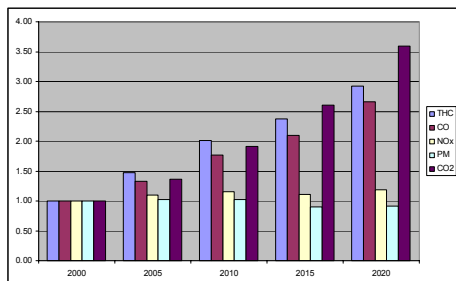
## Control Measures on Motor Vehicle Pollution

### Emission Standards For New Vehicles

Time Category	Before 2000	2000	2001	2002	2003	2004	2005
PC	ECE 1503	EURO I	←	←	←	EURO II	←
LDV&LDT	ECE 1503	←	EURO I	←	←	←	EURO II
HDDV	None	←	EURO I	←	←	EURO II	←
Motorcycle	ECER40	←	EURO I	←	←	←	EURO II

Beijing Will Introduce Euro 2 in 2003

## Motor Vehicle Emissions Trends in China With Current Program



## Overview of Fuel Quality

### Specifications for Gasoline

ITEM	LIMITS	
	GB 484-1993	GB 17930-1999 <sup>1)</sup>
Code of Standards	GB 484-1993	GB 17930-1999 <sup>1)</sup>
Lead (g/L, max.)	0.35, (0.45)	0.005
Sulphur (% Mass, max.)	0.15	0.08
Manganese (g/L, max.)		0.018
Phosphorus (g/L, max.)		0.0013
RON, Min.	90, 93, 97	90
(RON+MON)/2, Min.	85, 89, 92	85
Aromatics HC (vol. %, max.)		40
Olefins (vol. %, max.)		35
Benzene (vol. %, max.)		2.5
Vapour pressure		
Winter (Sep. - Feb.), kPa max.	88	88
Summer (Mar. - Aug.), kPa max.	74	74
Oxygen (wt. %, max.)		2.7

Note: 1) Implemented from Jan. 1, 2000

## Overview of Fuel Quality

### Specifications for Light Diesel in China

ITEM	LIMITS <sup>1)</sup>	
	GB 252-94	GB 252-2000 <sup>2)</sup>
Code of Standard	GB 252-94	GB 252-2000 <sup>2)</sup>
Cetane Number, min	45 (40)	45
Sulfur, %(m/m), max	0.2 (0.5, 1.0)	0.2
Flash point PM, °C, min	65 (45)	55 (45)
Ash, wt%, max	0.01 (0.02)	0.01 (0.02)
Acidity, mg/KOH/100ml, max	5 (10)	5 (10)
Oxidation stability, mg/100ml, max.	2.0	2.5
Density@20°C, kg/m3	—	—
CCR 10%, wt %, max	0.3	0.3

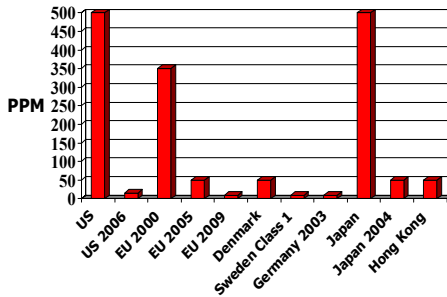
Note: 1) Limits in ( ) are for basic qualified diesel;

2) GB 252-2000 went into effect on Jan. 1, 2002.

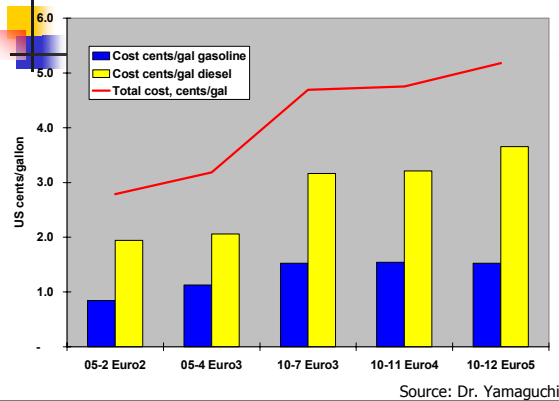
## Fuel Quality is Critical

- Very Low Sulfur Levels
  - Enhances All Catalyst Technology Performance
  - Necessary To Use Advanced Technologies
  - Other Benefits
- Other Fuel Properties Also Important
  - Detergents
  - MMT
  - Etc.

## Diesel Fuel Specifications Around The World



## Gasoline and Diesel Reformulation Costs in China



## Vehicle Inspection and Maintenance (I/M) Program

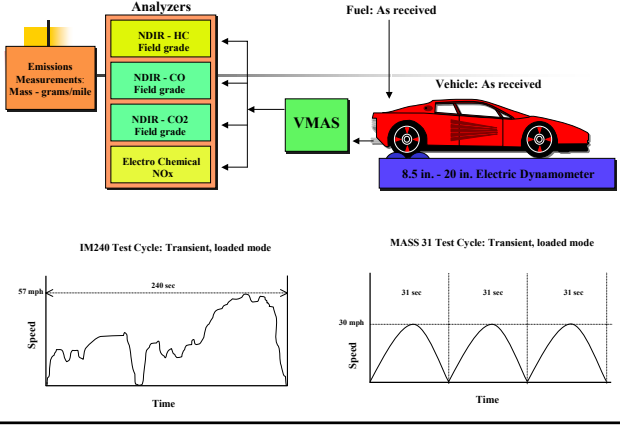
- Purpose:
  - To Assure that vehicle is properly maintained and used
  - Identify Dirtiest Vehicles With Defects & Get Them Repaired
- General Attributes:
  - Relatively short
  - Relatively simple
- Types
  - Idle
  - 2-Stage Idle
  - Steady Speed Loaded
  - Transient Loaded

## V-Mass

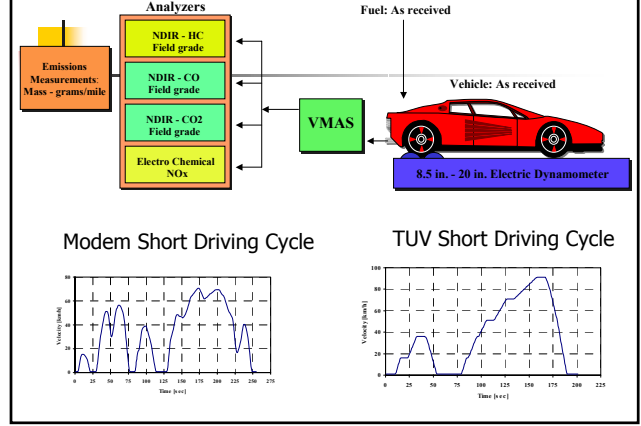
- Test Procedure
  - Uses IM240 test procedure or other transient cycle
- Measurement
  - Uses ASM-type equipment
  - Plus mass flow measurement device
  - Yields same measures as IM240
- Pros/Cons
  - Costs about the same as ASM
  - Good correlation with IM240
  - Appears to be nearly as effective as IM240



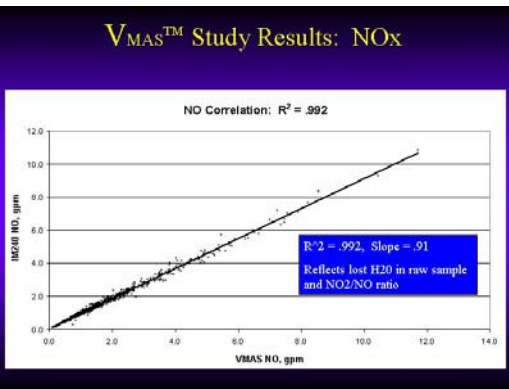
### Test Type: Mass 31 or IM240



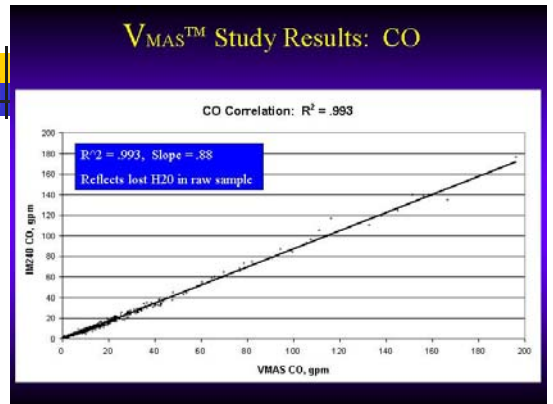
### Test Type: European Short Cycle



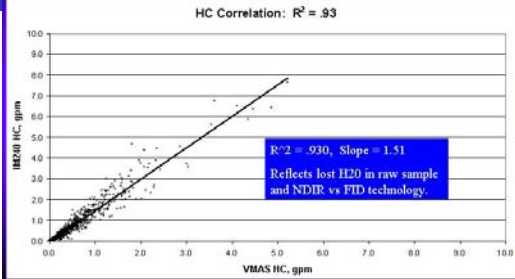
### V<sub>MAS</sub><sup>TM</sup> Study Results: NO<sub>x</sub>



### V<sub>MAS</sub><sup>TM</sup> Study Results: CO



## V<sub>MAS</sub><sup>TM</sup> Study Results: HC



## What To Do About Diesels?



## Laboratory QC

- Critically Important
  - Enforcement
  - Emissions Factors
- Much More Needs To Be Done
  - Golden Standard Gases
  - Training
  - Standardized Equipment
  - Etc.

## Economic Instruments

- Increasingly Important As Market Based System Introduced
- Study – Very Comprehensive
- Short Term Opportunities
  - Fuel Quality
  - Encourage Tighter Standards (if Fuel is Available)
  - Other...