

Motor Vehicle Pollution Control: Lessons Learned Over The Past Fifty Years

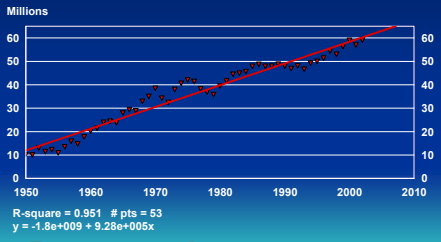
Michael P. Walsh
Hong Kong
December 13, 2004



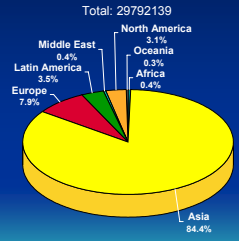
Overview

- Great Progress Has Occurred
- Serious Problems Remain
- Some Lessons Learned
 - Comprehensive Strategy
 - Sulfur in Fuels
 - MMT
 - Diesels and SUVs
- Comments on China Program
- Conclusions

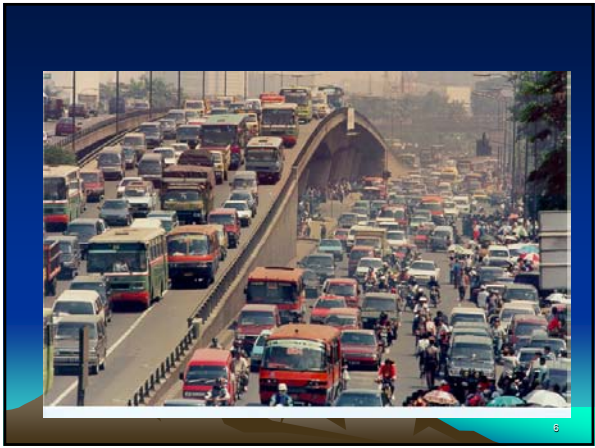
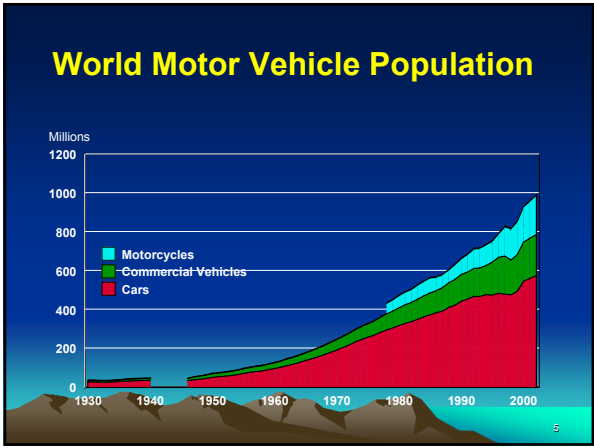
Global Trends In Motor Vehicle (Cars, Trucks & Buses) Production



The Global Market For New Motorcycles and Mopeds



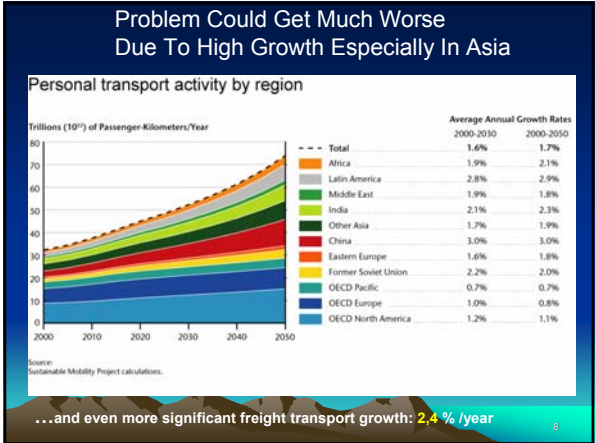
Source: Honda Facts & Figures



One Result: Serious Health Concerns

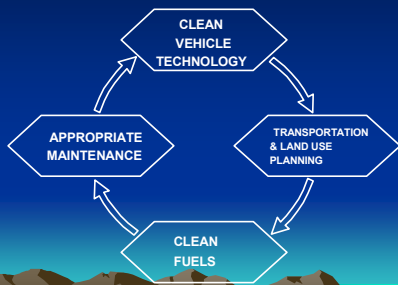
- WHO Concludes ~ 800,000 Premature Deaths Each Year From Urban PM; Most in Asia
- Numerous Studies in Europe & US Consistently Link PM With Premature Deaths, Hospital Admissions, Asthma Attacks, Etc.
- No Evidence of a Threshold
- PAPA Project Indicates Similar Effects in Asia
- Ozone, NO₂, Various Toxics Also Serious Health Concerns

7



Lesson 1: Solving the Motor Vehicle Pollution Problem Requires A Comprehensive Approach

ELEMENTS OF A COMPREHENSIVE VEHICLE POLLUTION CONTROL STRATEGY



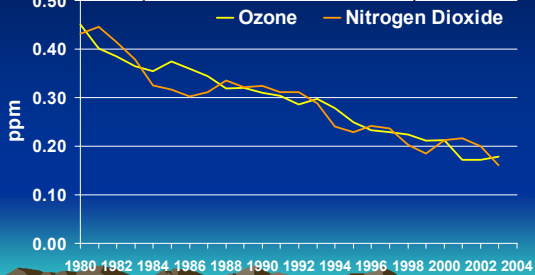
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**Los Angeles 1955: The Start of the Story
Air Not Breathable and no solutions.**



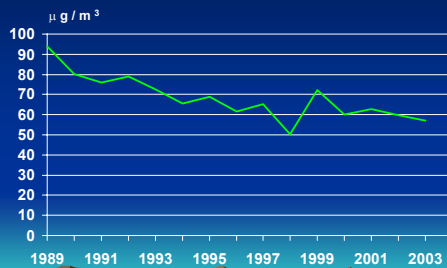
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Good Programs Can Improve Air Quality: California Trends (1-hour Peak Indicator)

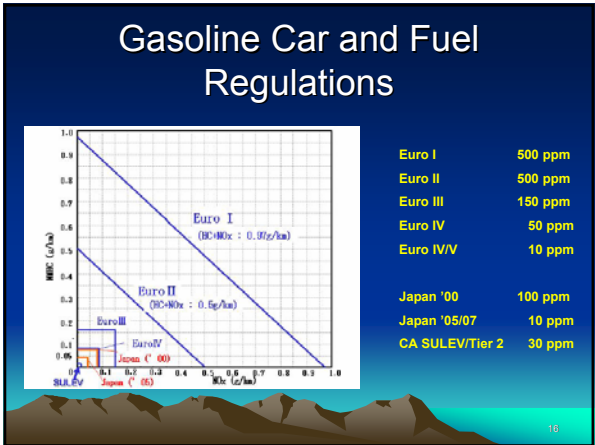
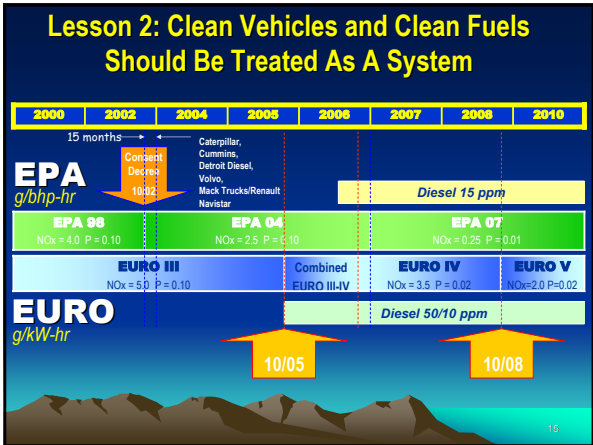
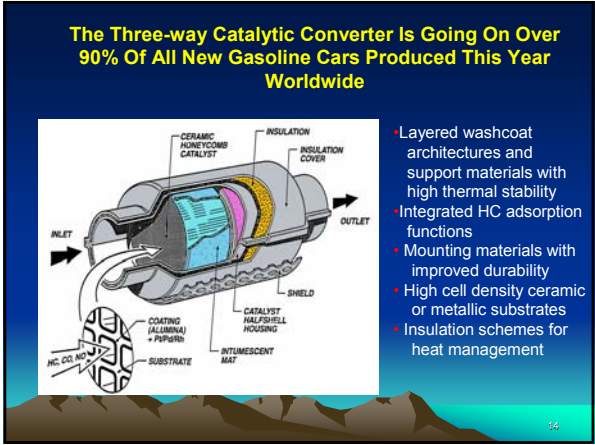
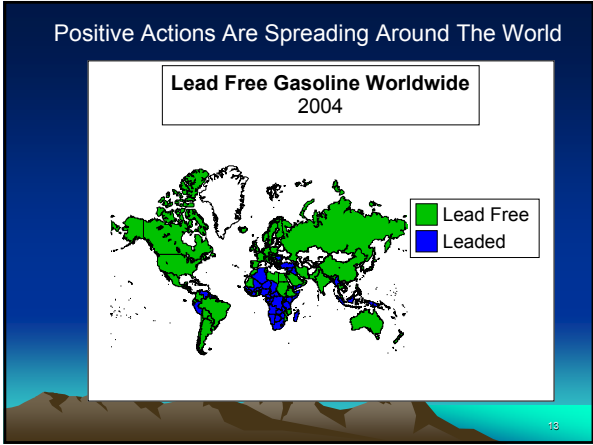


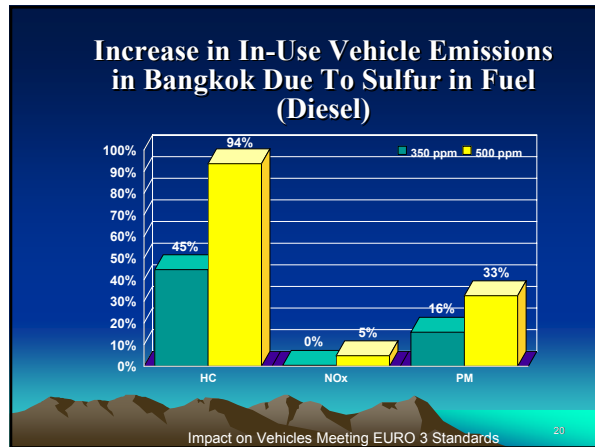
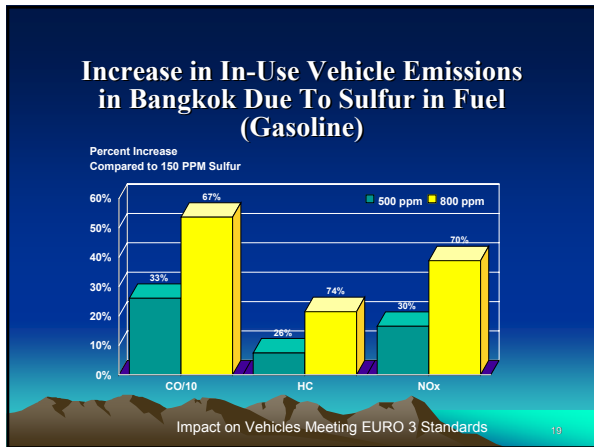
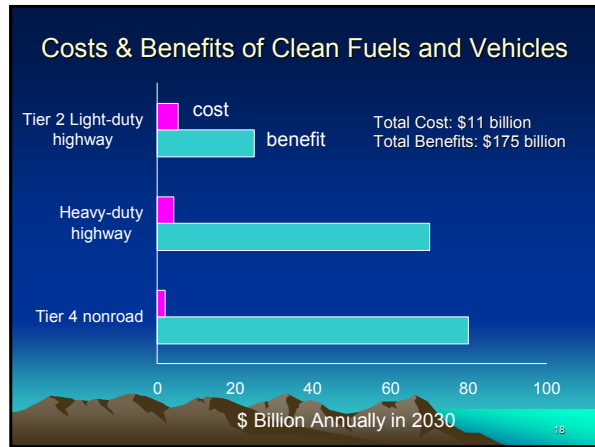
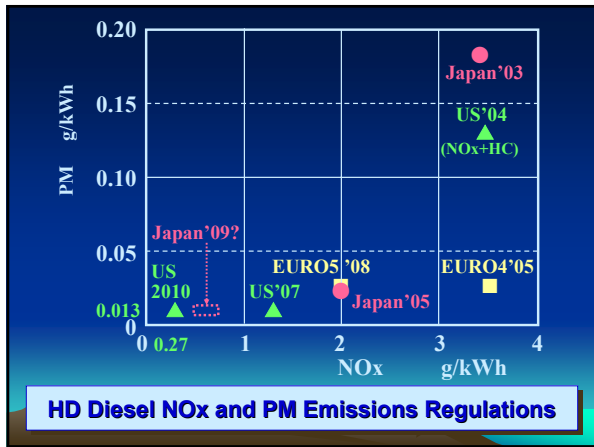
11

California PM10 Air Quality Trend (Maximum Annual Average of Quarters)

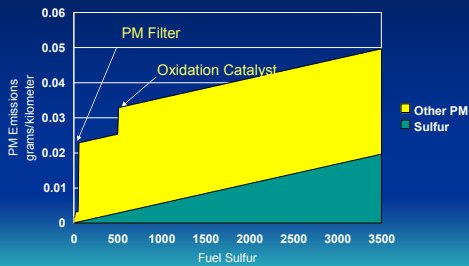


12





Linkage Between Fuel Sulfur and PM Emissions



Other Benefits from Sulfur Control

- Sulfur reduction reduces SO2 emissions.
 - Less sulfate formation in the atmosphere (about 1/3 of SO2 reacts to sulfate)
 - Reduced acid rain.
- Sulfur reduction reduces engine wear.
 - Reduction from 2500 ppm to 500 ppm reduces engine wear 10 - 20%; about 33% if starting out at 5000 ppm.
 - Greater engine wear with infrequent oil change.
- Retrofit Opportunities

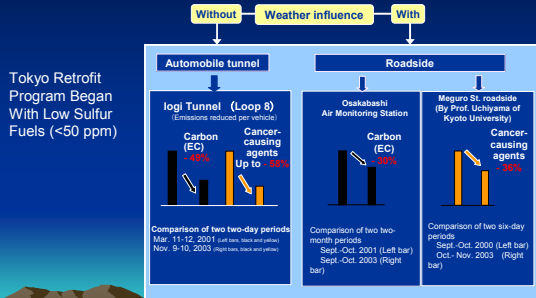
The Hong Kong Retrofit Experience

- ❖ Introduce Ultra Low Sulfur Diesel Fuel (<50 PPM)
- ❖ Retrofit in-use vehicles with emission reduction devices
 - ✓ About 80% of the eligible pre-Euro light diesel vehicles fitted with particulate traps or catalysts
 - ✓ Nearly 60% of the pre-Euro heavy diesel vehicles fitted with oxidation catalysts

Metropolitan Tokyo in-Use Diesel Program

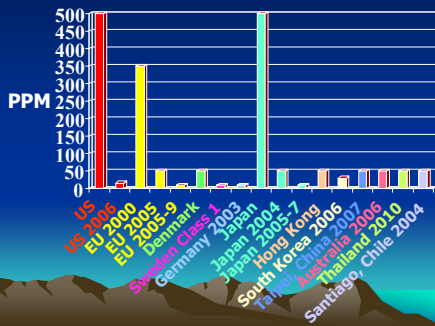
Tokyo Metropolitan Research Institute for Environmental Protection

Measurement results indicate that Diesel PM levels have been significantly reduced. (By the Research Institute for Environmental Protection)



(With cooperation from the Bureau of Construction)

Air Quality Needs Driving World to Ultra-Low Sulfur Diesel



25

Lesson 3: Be Very Cautious Regarding The Use of Metallic Fuel Additives

- ❖ Organo-metallic additives such as MMT are a cheap way to increase octane
- ❖ Experience with these additives shows that they can cause
 - Health problems
 - Technical problems
- Precautionary Principle Says Don't Use Until and Unless Proven To Be Safe

26

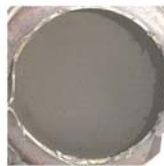
Implications of Recent Health Studies



"The finding that manganese transport out of the brain occurs via the slow process of diffusion, rather than via carrier-mediated transport, is important: it suggests that no mechanism exists to protect the brain from accumulating manganese. This finding has important implications for neurotoxicity resulting from chronic manganese exposure."

27

Potential Impact of MMT



California Civic 600 cpsi catalyst - 49,000 miles



Canadian Civic 600 cpsi catalyst - 49,000 miles

28

ICCT Conclusions Regarding MMT

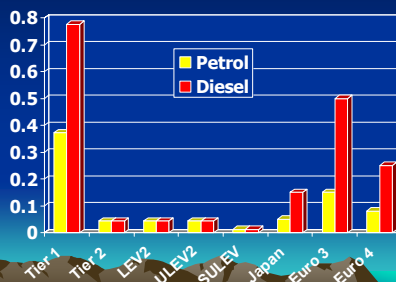
Consistent with the precautionary principle, the ICCT recommends that countries delay any use of MMT in gasoline at this time, pending the outcome of ongoing health-based studies and further review of the vehicle impacts.

Copies of the ICCT Report Available at <http://www.cleantransportcouncil.org/index.php>

29

Lesson 4: Vehicles Which Do the Same Job Should Meet Identical Requirements

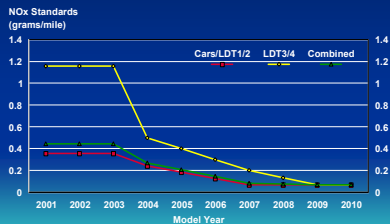
Light Duty Vehicle NOx Standards (g/km)



30

SUVs Should Have Same Requirements As Cars

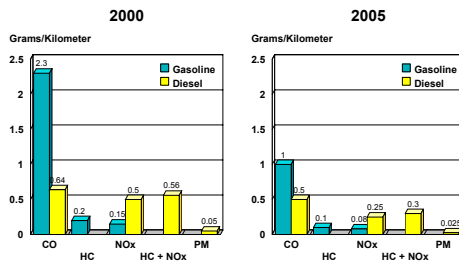
Tier 2 Standards



31

Diesels Should Have The Same Requirements As Gasoline Fueled Vehicles

European Auto Standards

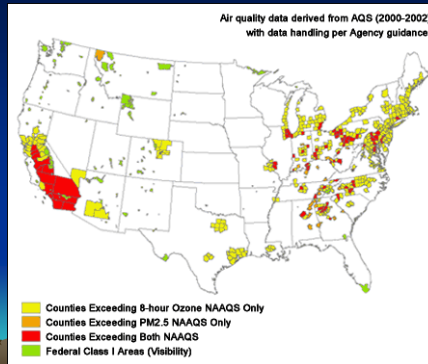


Lesson 5: Ignore Transportation and Land Use Planning At Your Peril



33

US Air Quality: Ozone and PM_{2.5} Present Significant Challenges



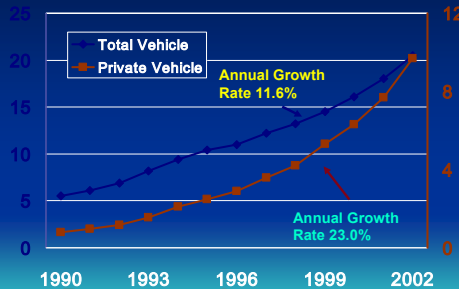
34

Applying The Lessons To China



35

Chinese Vehicle Population Growth Has Been Exploding (million)



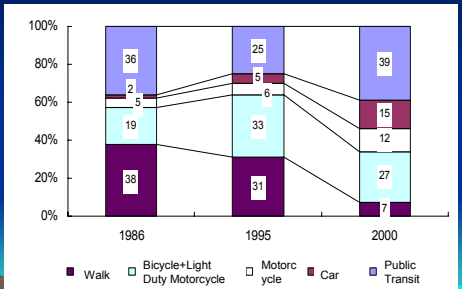
36

Most Vehicles Are in Cities



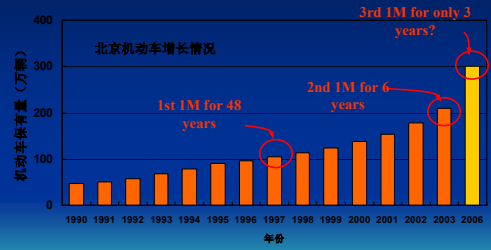
Modal Splits in Shanghai, 1986-2000

Shift From Walking & Bicycling to Cars & Motorized Transit



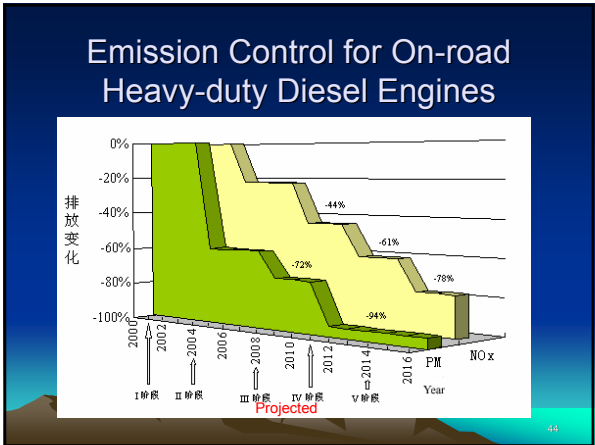
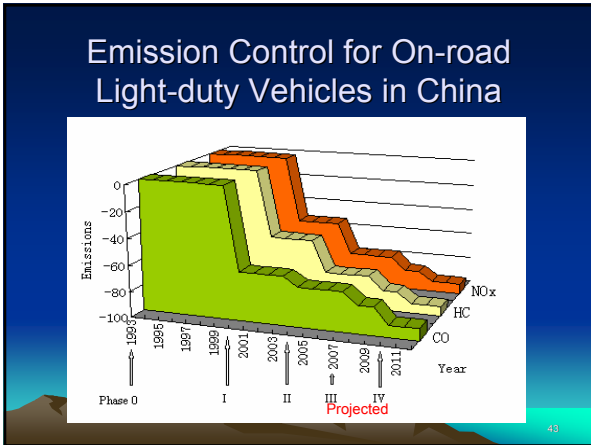
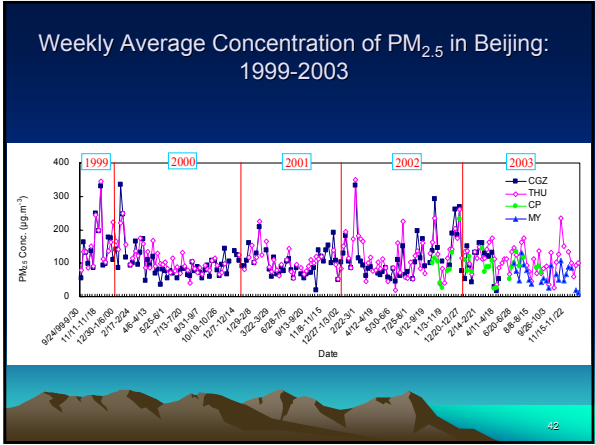
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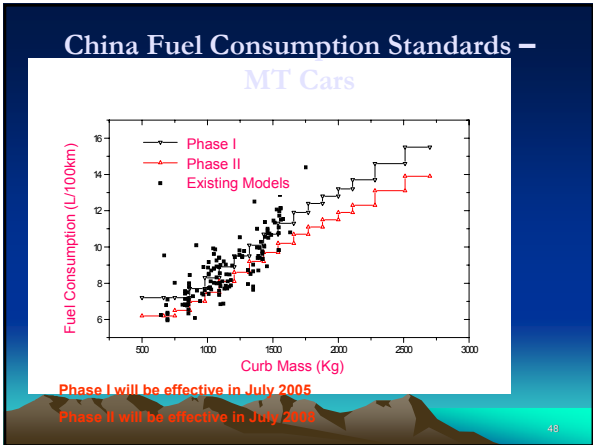
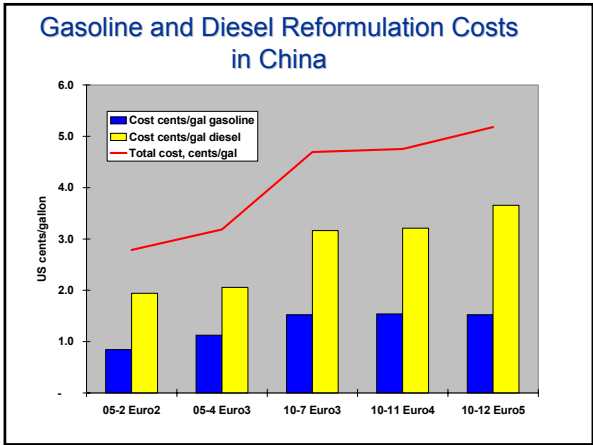
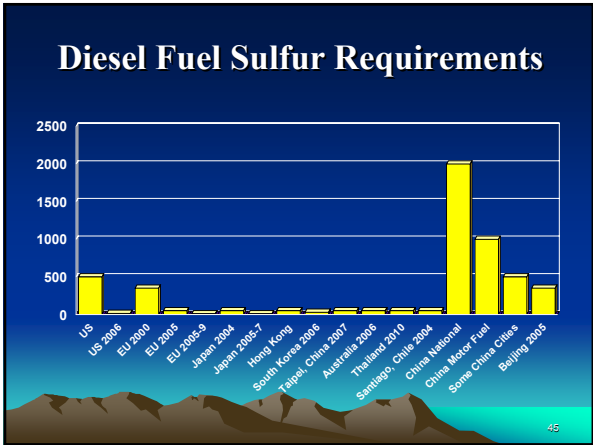
Vehicle Growth in Beijing is Exploding



Source: He Kebin

40







- ## Conclusions
- Great Progress is Occurring Around the World in Reducing Vehicle Emissions
 - Success Requires A Comprehensive Approach
 - Serious Problems Remain & More Must Be Done
 - Several Lessons Can Guide Future Progress

- ## Conclusions (2) Lessons Learned
- Adopt A Comprehensive Strategy
 - Treat Vehicles and Fuels as A System
 - Unleaded Gasoline Key To Clean Spark Ignition Vehicles
 - Near Zero Sulfur Fuels Key To Future Progress
 - Very Clean Spark Ignition Cars
 - Very Clean Cars, Trucks & Buses
 - Possible Retrofits
 - Avoid Metallic Additives Such as MMT Until Proven Safe
 - Vehicles Doing Same Job Should Meet The Same Emissions Requirements
 - Cars & SUVs
 - Diesel & Gasoline
 - Transportation & Land Use Planning Are Critical

- ## Conclusions (3) Lessons For China
- Move Rapidly To Near Zero Sulfur Fuels
 - Concurrently Leapfrog To "State of the Art" Emissions Standards
 - Ban MMT Until Proven Safe
 - Build On Vehicle Fuel Economy Program
 - Expand Transportation and Land Use Planning
 - Expand Public Transportation (BRT) Systems