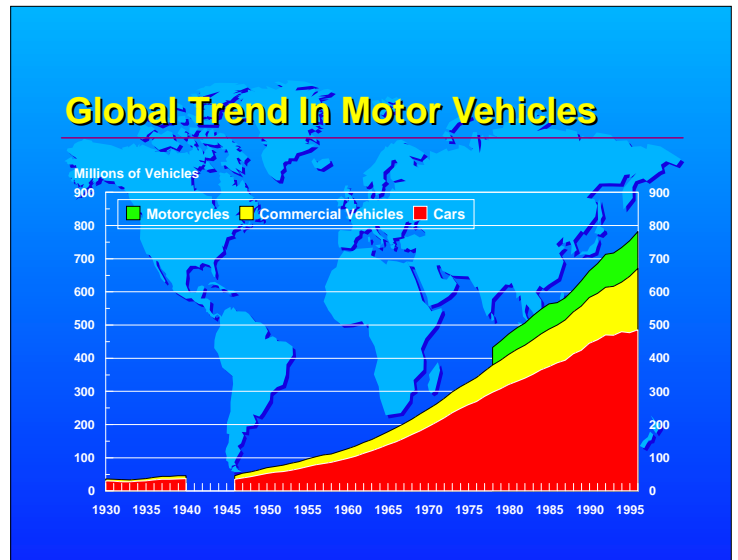
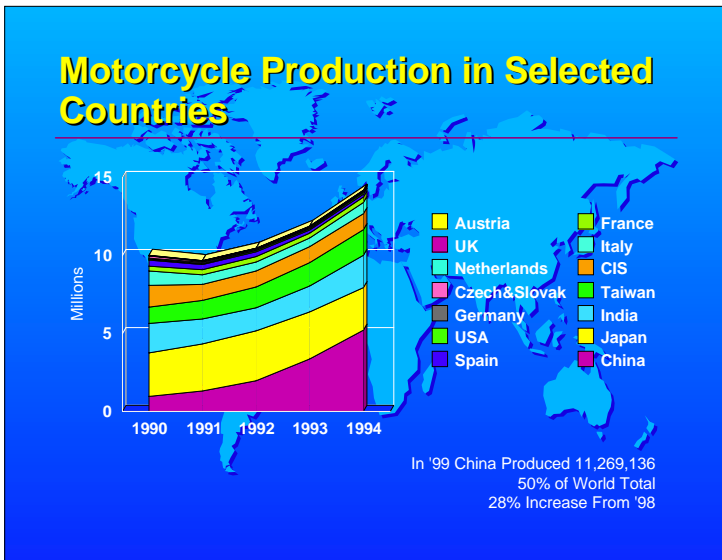
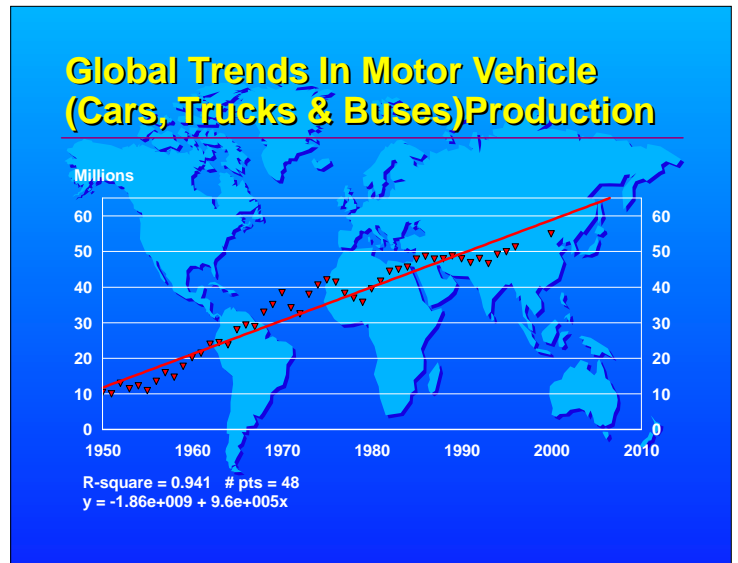
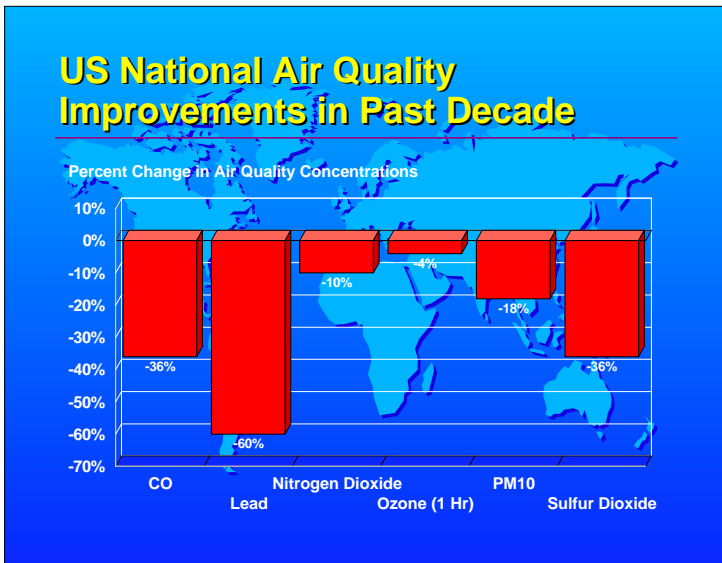
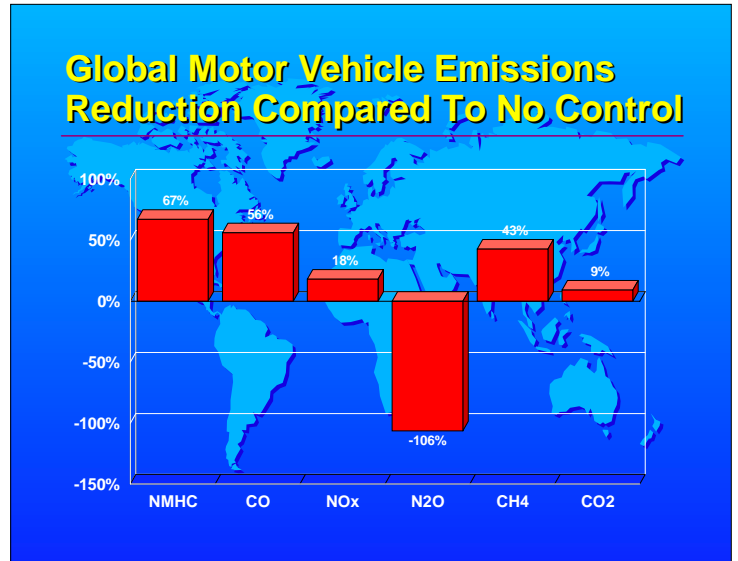


Motor Vehicle Pollution Control in the Asia Pacific Region

Washington DC - November 21, 2000

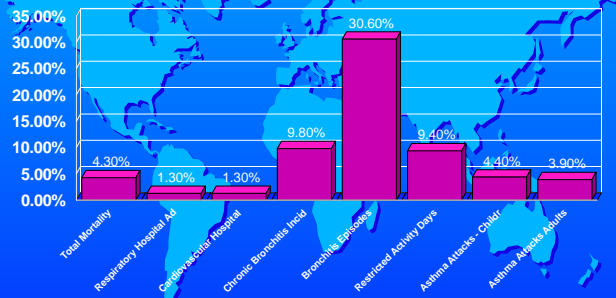


PM10 Study in Europe

(Lancet Medical Journal - September 2, 2000)

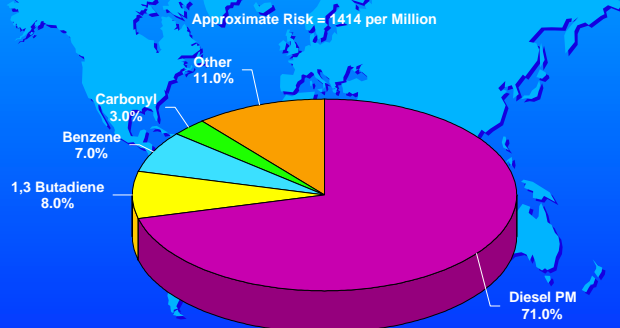
- ~6% of all deaths from PM10
- ~40,000 deaths per year in Austria, France, Switzerland; 2 times traffic fatalities
- Motor Vehicles responsible for ~50%
- People in Cities die about 18 months earlier than they would otherwise
- over 300,000 cases of chronic bronchitis; 500,000 asthma attacks; 16 million lost person days of activity
- Health costs from pollution from traffic ~1.7% of total GDP

Impact of PM10 On Public Health (For Every 10 micrograms/m3)



Lancet September 2, 2000

Average Los Angeles Basin Cancer Risk Apportionment



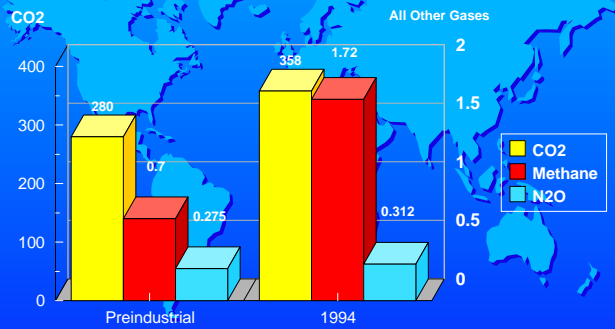
Adverse Effects From Vehicle Related Pollution

- Public Health Impacts
- Crop Damage
- Acid Rain
- Impaired Visibility
- Possible Climate Modification

Global Warming Concerns

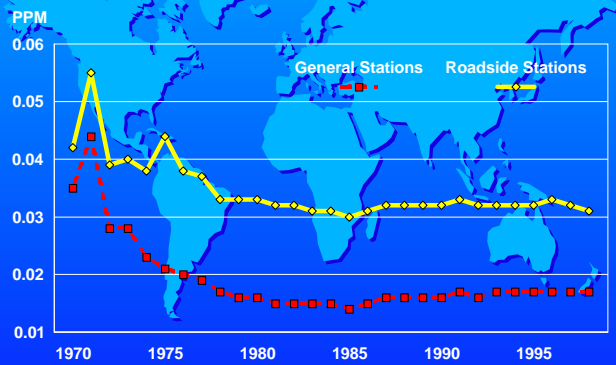
- IPCC - 1995
 - "the balance of evidence suggests a discernible human influence"
- IPCC - 2000
 - "there has been a discernible human influence on global climate"

Global Atmospheric Concentrations of Greenhouse Gases - PPM

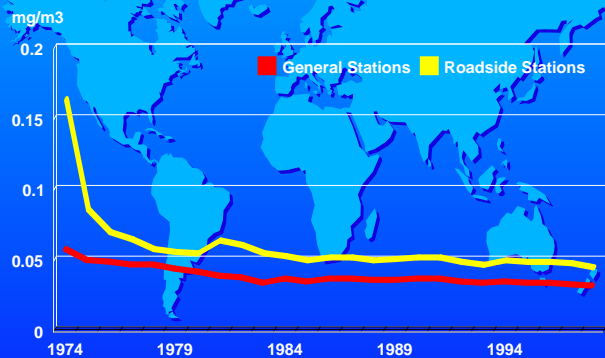


Source: IPCC

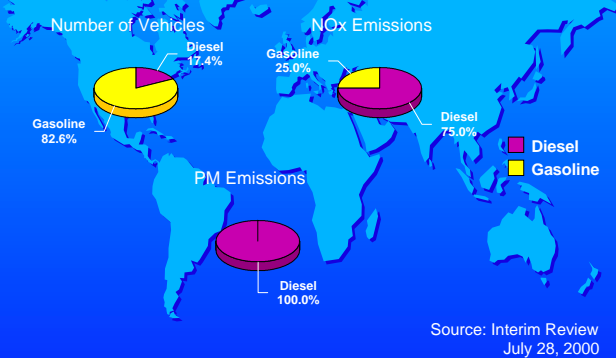
Nitrogen Dioxide Air Quality Trends In Japan



Suspended Particulate Matter Air Quality Trends In Japan

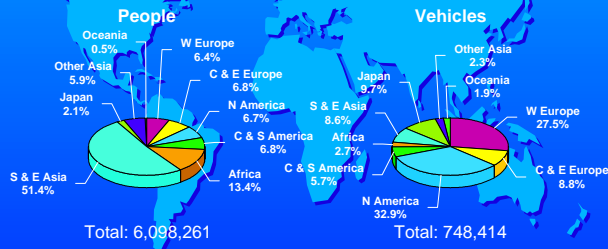


Emissions From Vehicles in Japan



Source: Interim Review July 28, 2000

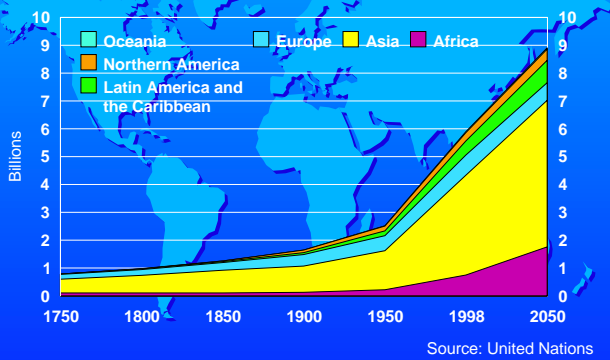
Global Distribution of Vehicles and People - 2000



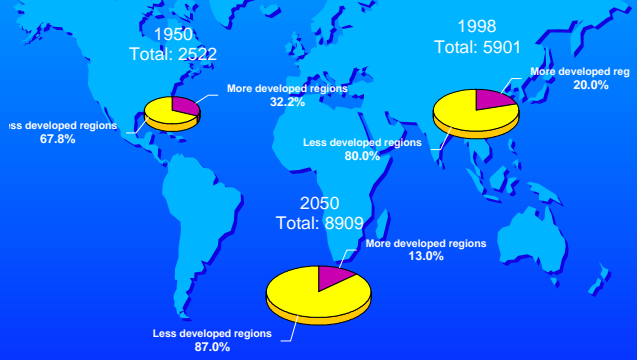
Drivers of Vehicle Population Growth

- Population Growth
- Urbanization
- Economic Development

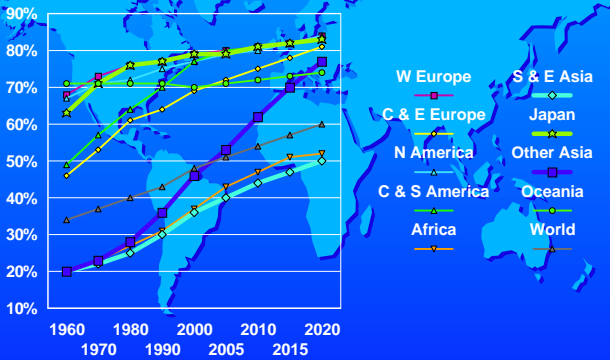
Global Population Trends and Projections



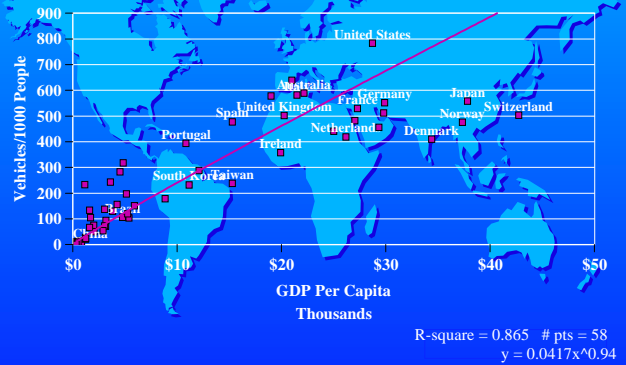
Shifting Distribution of World's Population

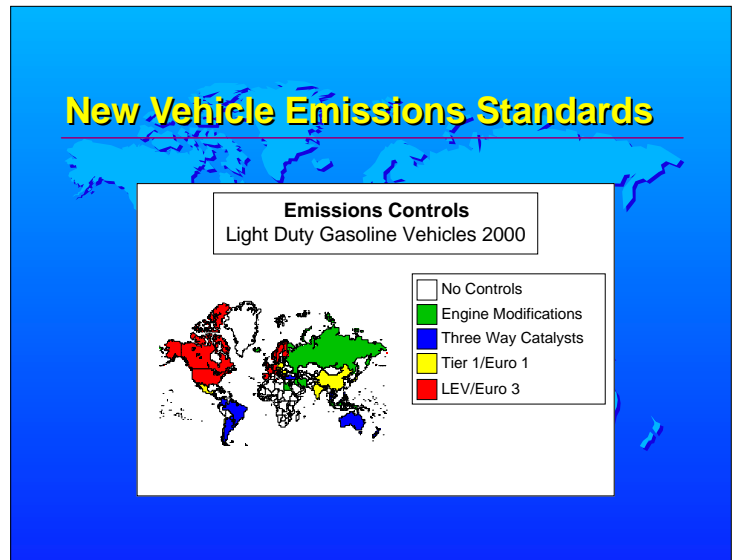
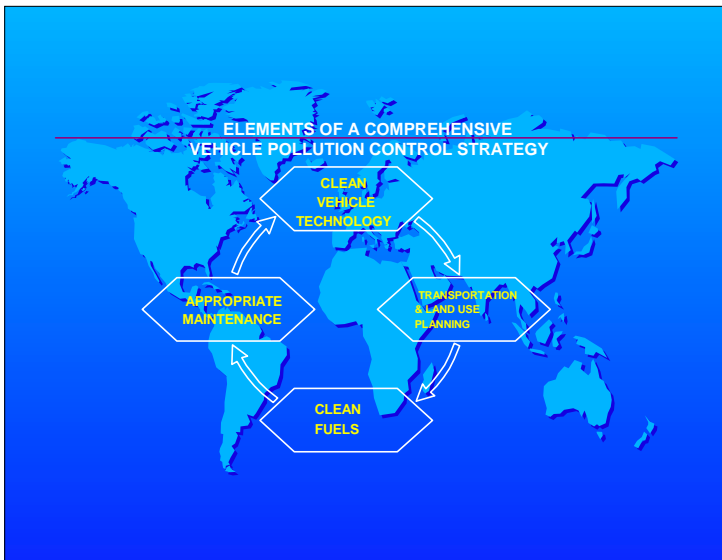
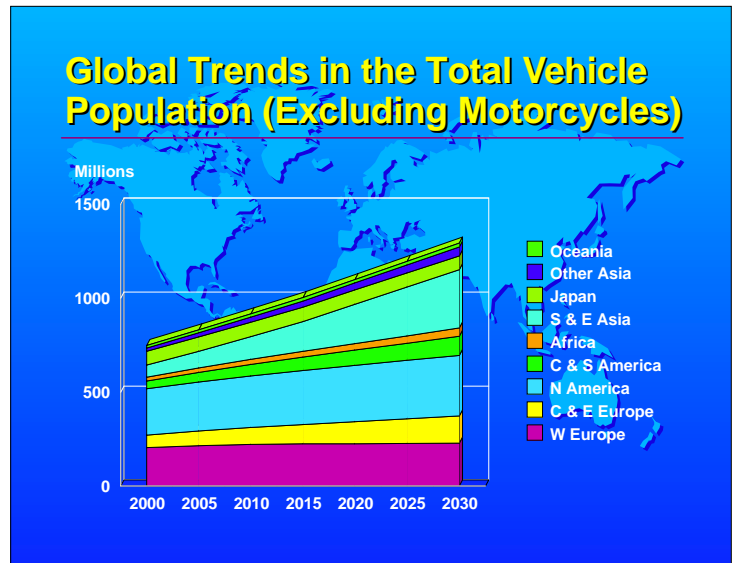
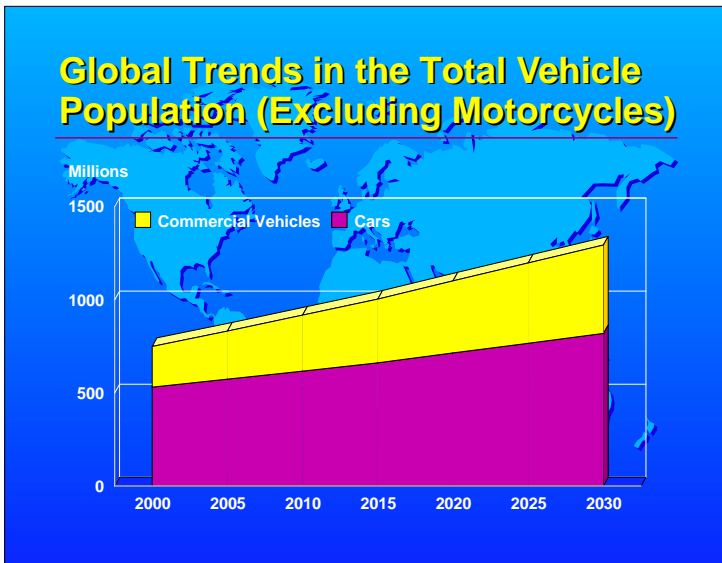
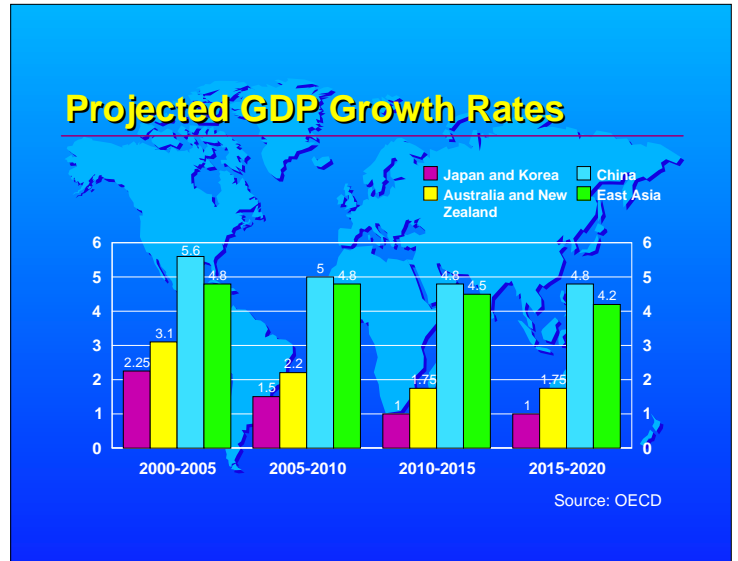
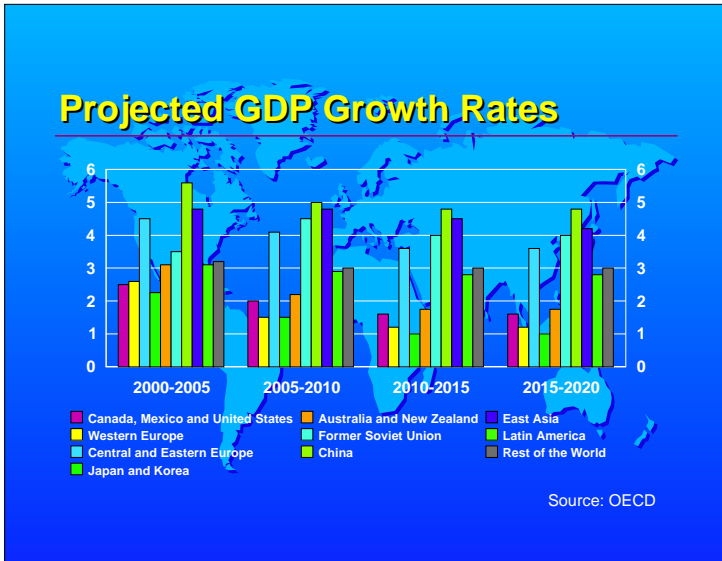


Global Urbanization is Occurring

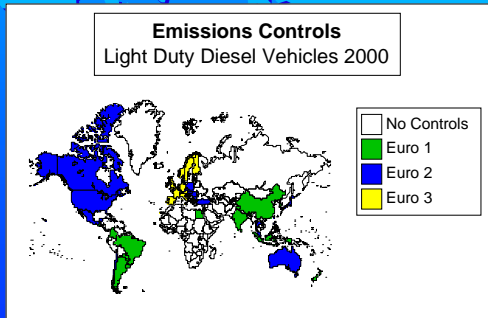


Vehicle Ownership Versus GDP Per Capita

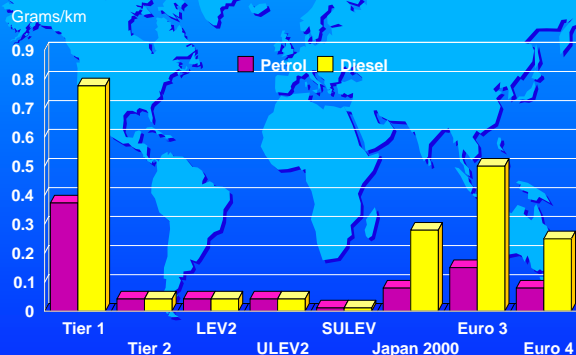




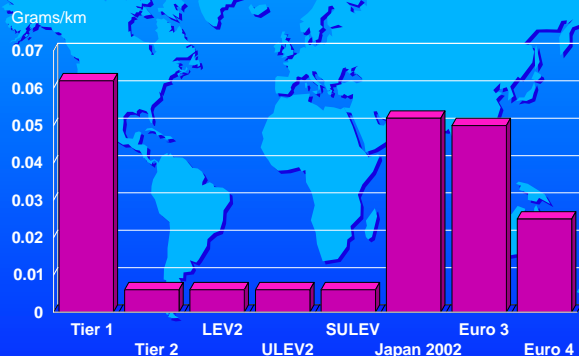
New Vehicle Emissions Standards



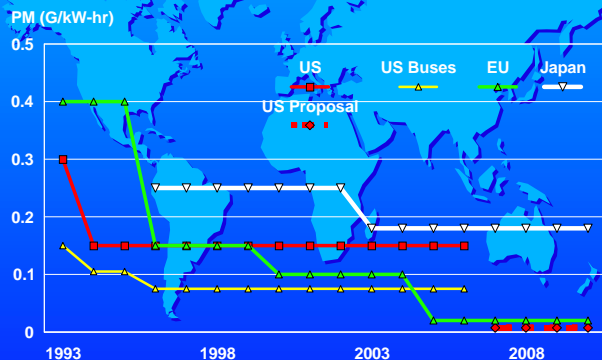
Global Trend in Light Duty NOx Control



Global Trend in Light Duty Diesel PM Control

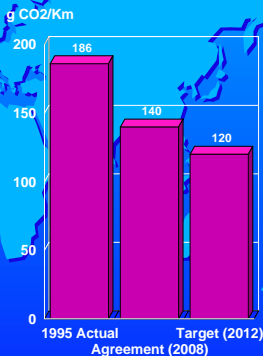


Global Trend in Heavy Duty Vehicle Emissions



European Agreement to Lower CO2 Emissions

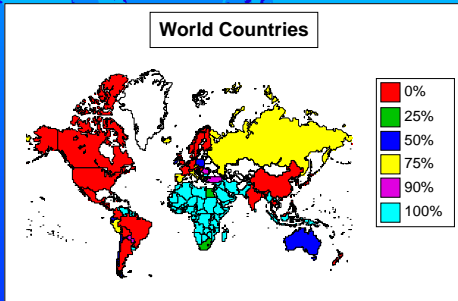
- Some 120 g/km cars in 2000
- Target Range of 165-170 g/km in 2003
- Review Feasibility of 120 g/km for Average car by 2012 in 2003



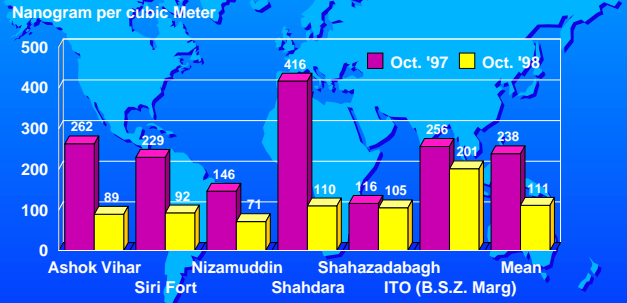
Why Are Fuels Important?

- Fuel Constituents Directly Affect Emissions
- Fuel Changes Can Immediately Impact on Emissions/Air Quality
- Fuel Composition Can Enable/Disable Pollution Control Technology

Leaded Gasoline Sales in 2000



Ambient Particulate Lead in Delhi (Pre and Post Unleaded Petrol)



Avg. Reduction 53%
Source: CPCB

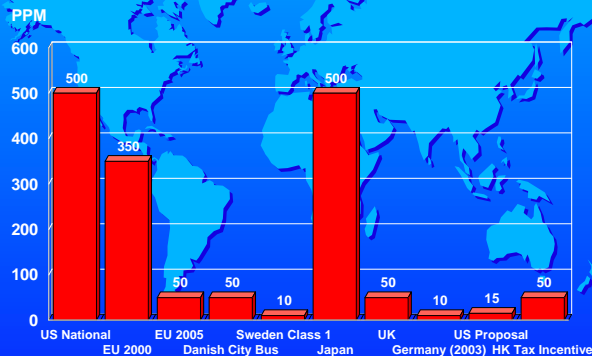
Low Sulfur Gasoline

- Sulfur Poisons The Catalyst
- Impact is Irreversible
- Future Low Emissions Technologies Even More Sensitive
- CO, HC & NOx Emissions All Improve With Low Sulfur Gasoline

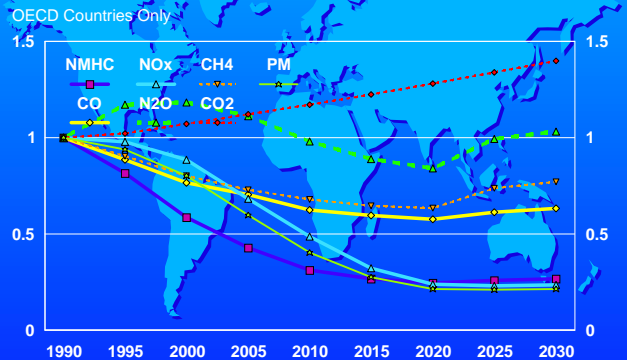
Need For Low Sulfur Diesel Fuel

- Lower Sulfur Lowers Direct PM Emissions and SO2
- Lower Sulfur Allows the Use of Some Advanced Diesel NOx/PM Control Technologies
- Lower Sulfur Improves Performance of Other Advanced Technologies

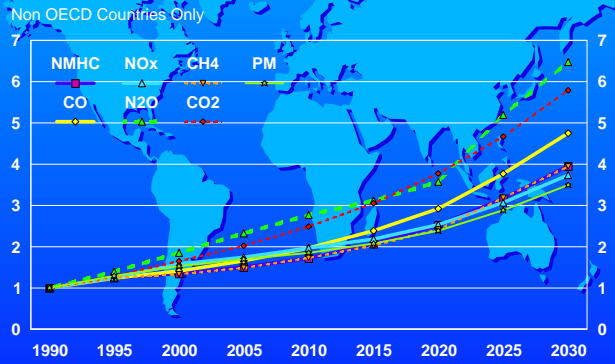
Diesel Fuel Sulfur Specifications



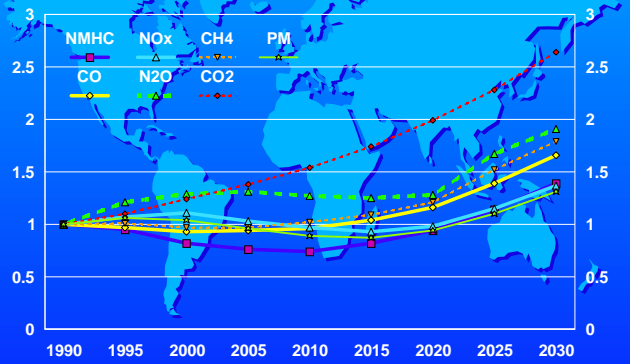
Global Trends in On Road Motor Vehicle Emissions (Normalized to 1990)



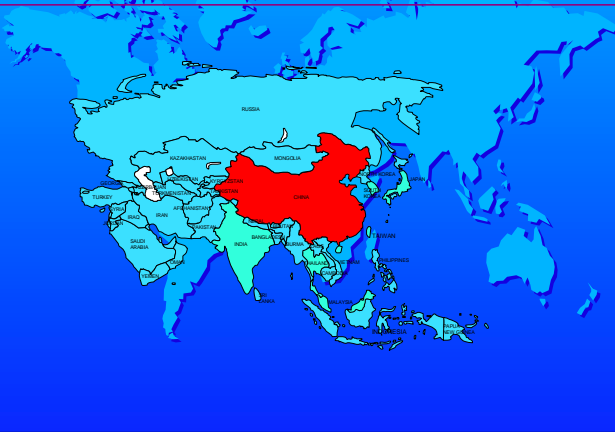
Global Trends in On Road Motor Vehicle Emissions (Normalized to 1990)



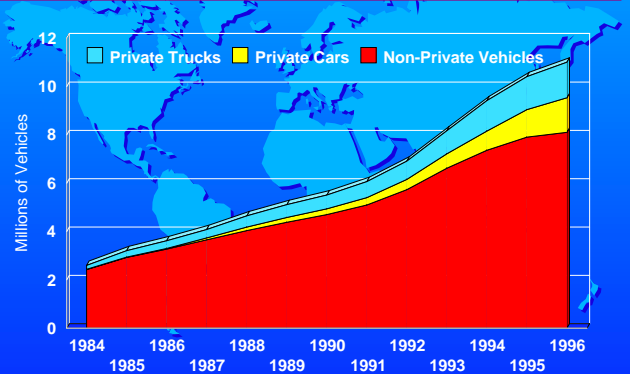
Global Trends in On Road Motor Vehicle Emissions (Normalized to 1990)



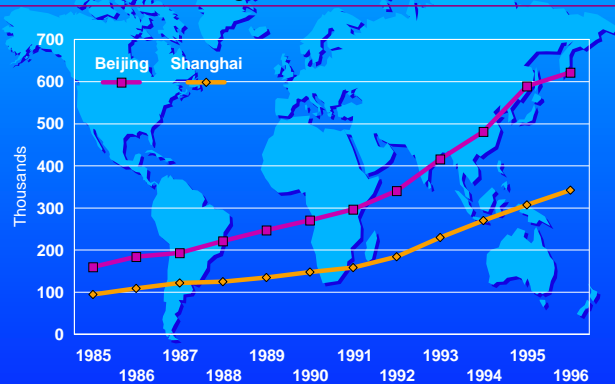
China



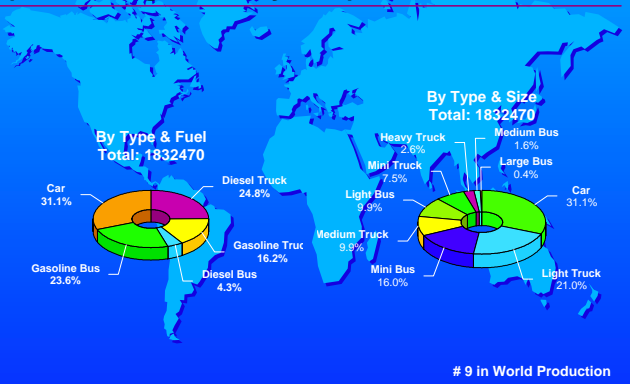
Vehicle Population in China is Growing Rapidly

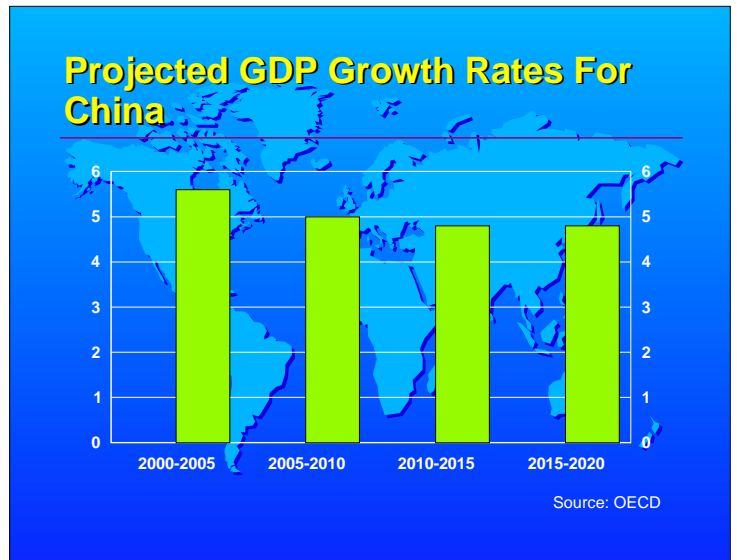
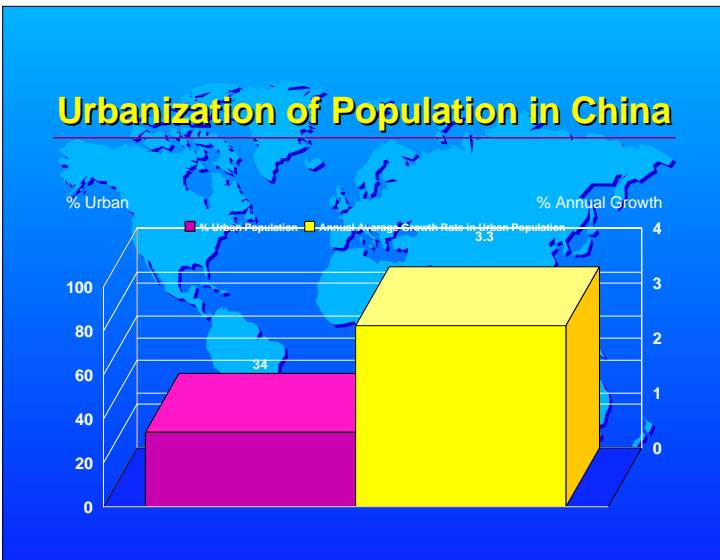
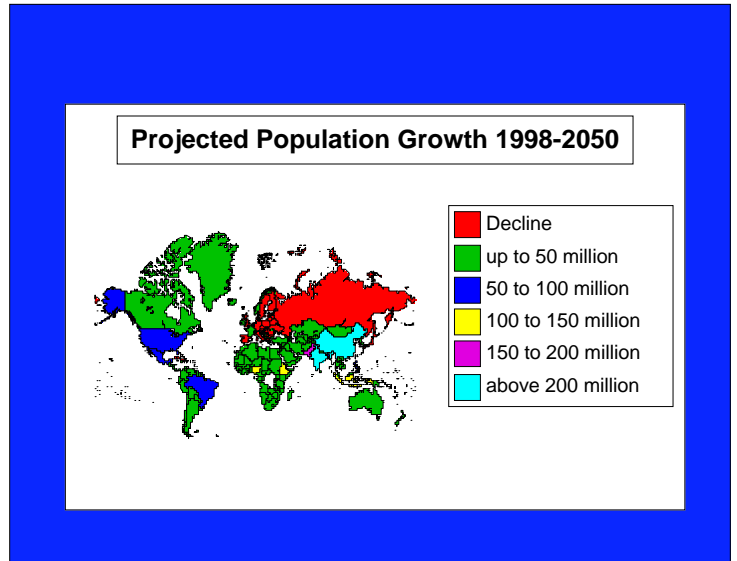
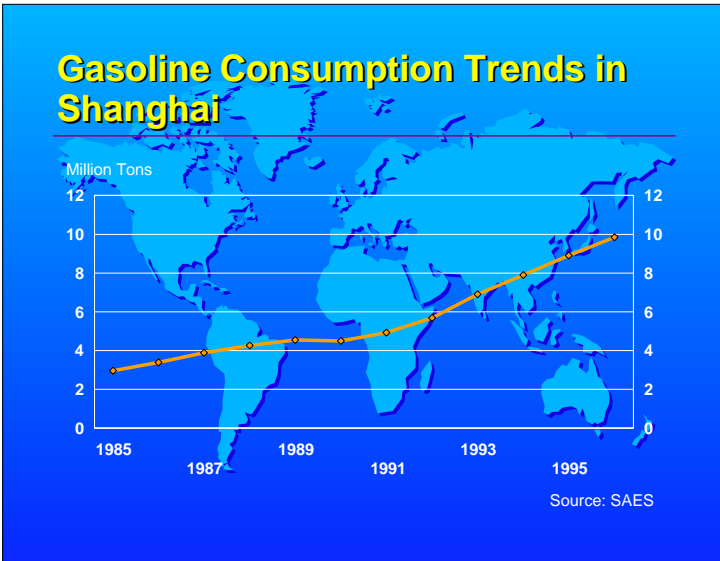
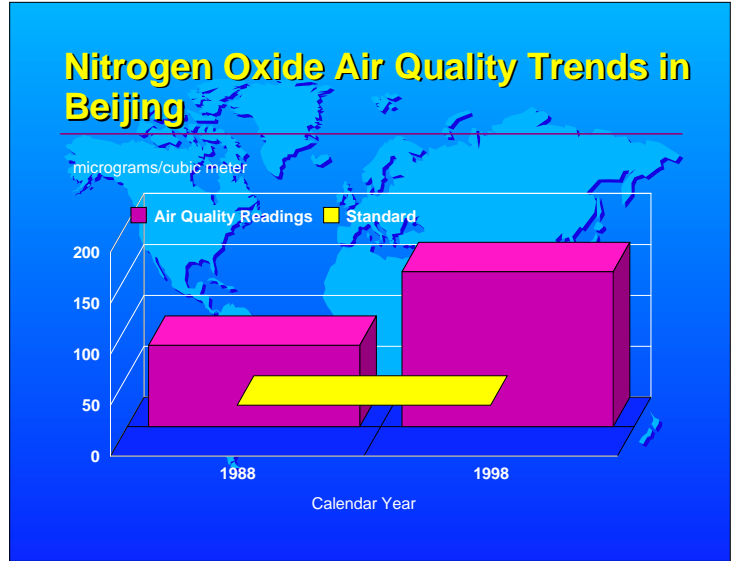


Rate of Growth is Even More Rapid in China's Major Cities



China Vehicle Sales in 1999 (Excluding Motorcycles)





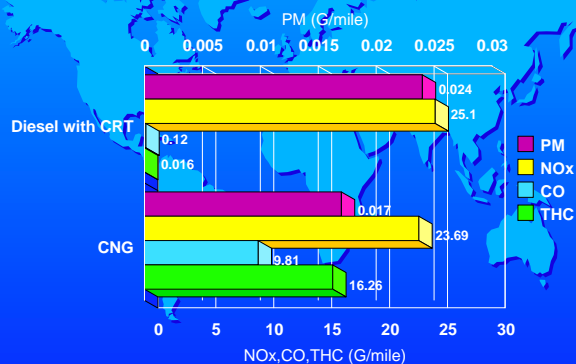
Anticipated Trends in Vehicle Characteristics

- Car fraction will grow rapidly
- Diesel fraction of medium & heavy duty will grow
- Motorcycles will grow rapidly; 2 strokes may gradually be phased out
- Traffic congestion will increase in cities

Developments in China

- Initial Clean Air Strategy Developed
 - Complete Lead Phase Out by 2000
 - Euro 1 Introduced for Cars & Lt. Trucks in 2000 (Beijing, Shanghai 1999)
 - Heavy Truck Standards, Euro 1, also in ~2001 (2000 in Beijing)
 - I/M Pilot Being Developed in Shanghai

Emissions Test Results - New York City Bus - CBD Test Cycle



Conclusions

- Serious Pollution Control Programs Must Adopt A Comprehensive, Holistic Approach
- Fuels Should Be Improved (Incremental Progress)
 - Ban Leaded Gasoline
 - Lower Sulfur in Diesel & Gasoline
 - Maximum Benzene at 1%
 - Fuel Characteristics Should be Posted & Enforced (No Adulteration)

Conclusions (continued)

- Effective Enforcement is Critical
- A Strong Public Awareness Program should be introduced