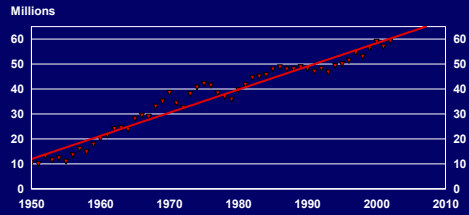


Mitigating The Environmental and Health Effects of Motor Vehicles and Fuels

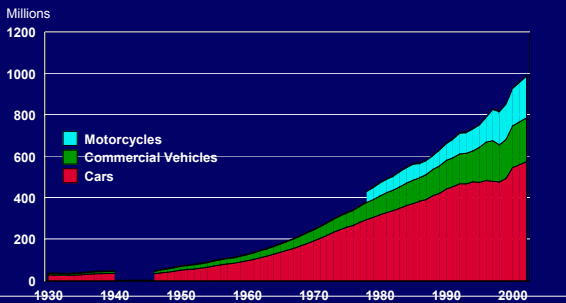


Michael P. Walsh
 October 1, 2004
 Moscow, Russia

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

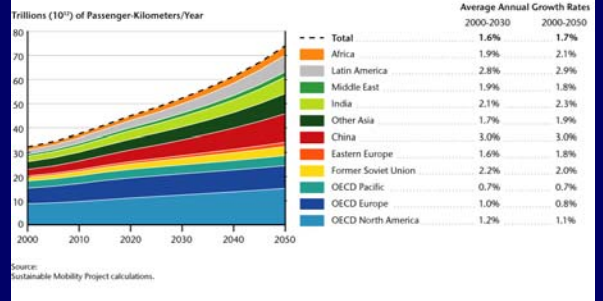


World Motor Vehicle Population

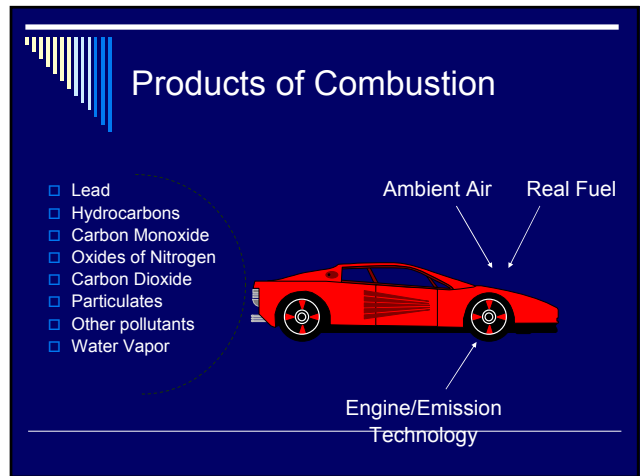
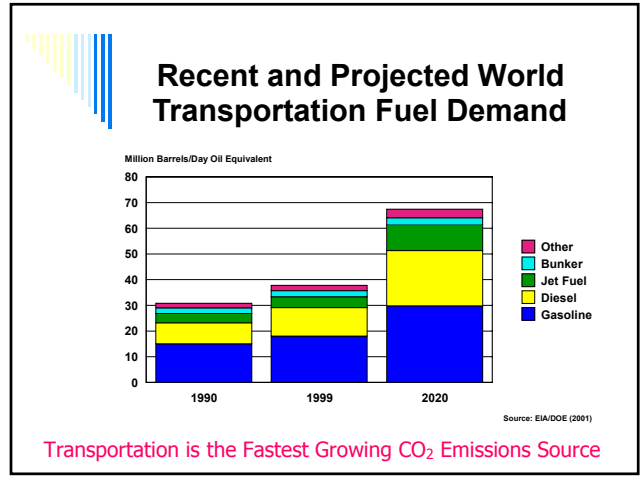
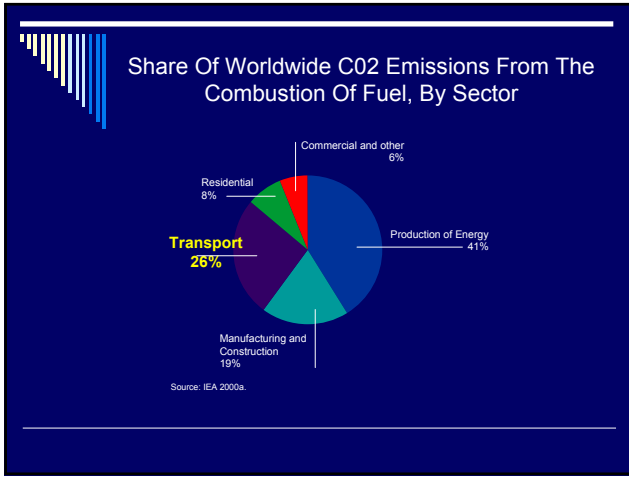


Growth Will Likely Continue

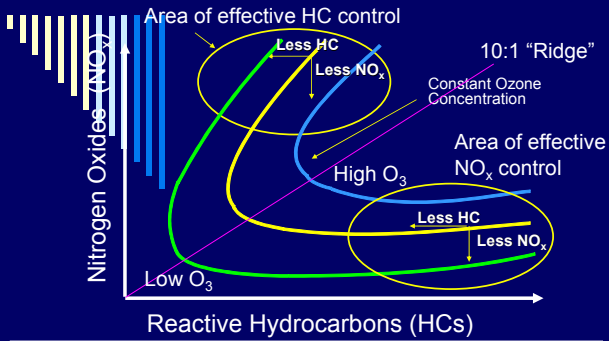
Personal transport activity by region



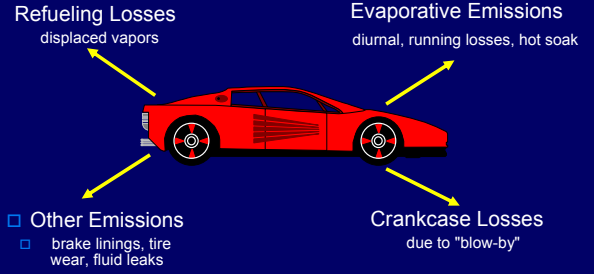
...and even more significant freight transport growth: 2.4 % /year



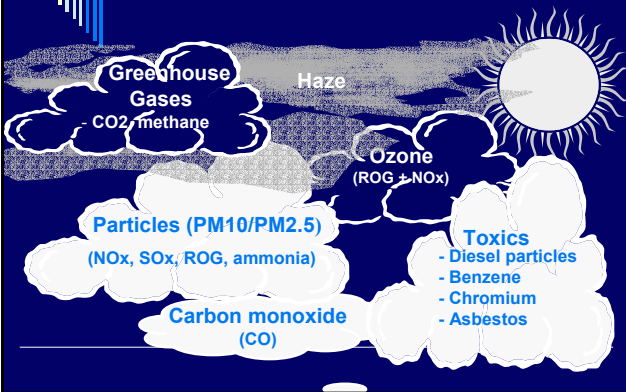
Ozone Isopleth Plot (EKMA Diagram)



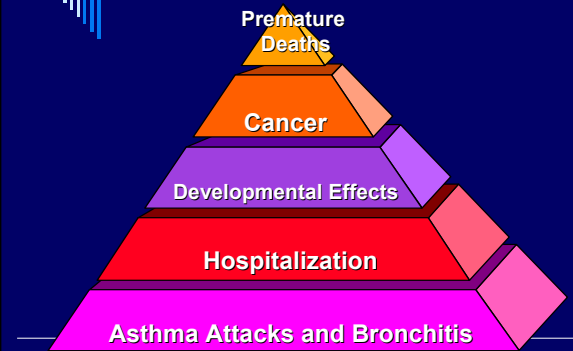
Other Emissions From Vehicles



What pollutants are of concern?



Health Impacts of Air Pollution



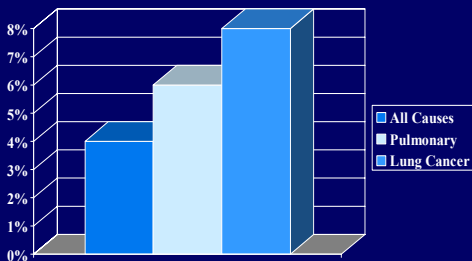
Health Effects

- Different Pollutants have Different Effects
 - Carbon Monoxide - circulatory system, heart
 - Ozone - respiratory system, lung
 - PM - lung, potential effects on heart
 - Diesel, Air Toxics - cancer, respiratory effects
- There are potential effects of the Mixture
- Some Populations more sensitive than others
 - elderly
 - people with heart and lung disease

Health Effects From Emissions Beyond Dispute

- WHO Concludes ~ 800,000 Premature Deaths Each Year From Urban PM; Diesels One Major Source
- Numerous Studies in Europe & US Consistently Link PM With Premature Deaths, Hospital Admissions, Asthma Attacks, Etc.
- No Evidence of a Threshold
- Ozone Also A Serious Health Concern

Increased Risk of Premature Mortality Due To $10\mu\text{g}/\text{m}^3$ $\text{PM}_{2.5}$



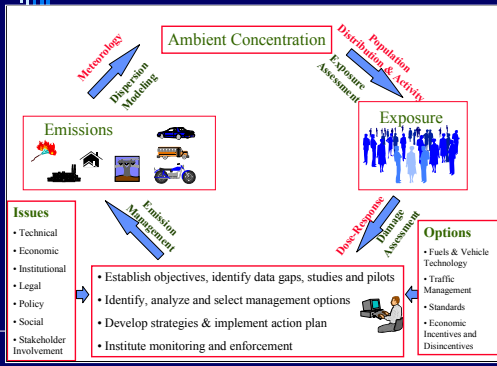
JAMA, March 2002

PM10 Study in Europe

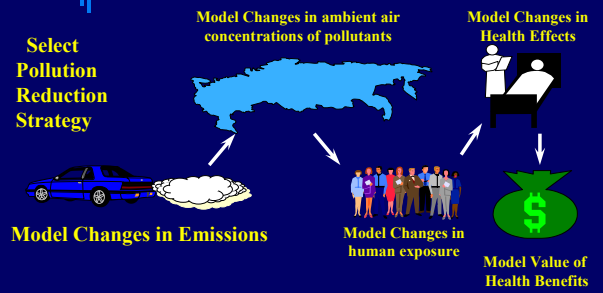
(Lancet Medical Journal – September 2, 2000)

- ~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 ~18Months Earlier Than They Otherwise Would
- Over 300,000 cases of chronic bronchitis; 500,000 asthma attacks; 16 million lost person days of activity
- Health Costs From Traffic Pollution ~1.7% of total GDP

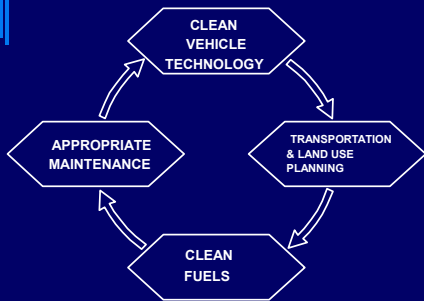
Integrated Air Quality Management Framework



Integrating Science & Policy: How to Evaluate a Emissions Control Strategy?

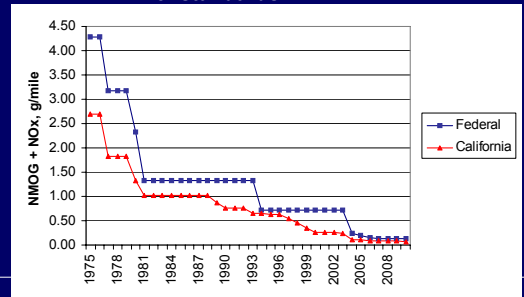


ELEMENTS OF A COMPREHENSIVE VEHICLE POLLUTION CONTROL STRATEGY

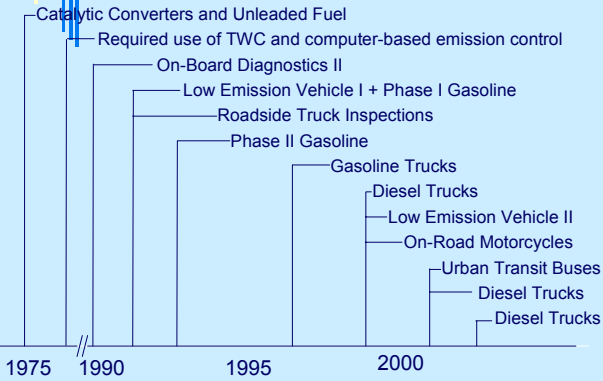


Tremendous Success With Technology-based Air Pollution Standards

Over 95% reduction over the past 40 decades of standards



Key Motor Vehicle Milestone



Key US Air Regulatory Schedules

8-hr Ozone Standards (smog)

2003	States recommend nonattainment designations
2004	EPA makes nonattainment designations
2005-09	New NO _x Rule/NAAQS review*
2004-07	States develop/submit SIPs
2007-08	EPA approves SIPs
2007-19	Attainment deadlines vary

PM_{2.5} Standards (fine particles)

2003	States recommend nonattainment designations
2004-05	EPA makes nonattainment designations complete NAAQS review*
2005	EPA issues SO ₂ /NO _x transport rule
2004-07	States develop/submit SIPs
2008-09	EPA approves SIPs
2009-14+	Attainment deadlines

Mobile Source Program

2003	Non-road diesel proposed
2003---	Other non-road categories
2004	Tier 2 becomes effective
2004*	Mobile air toxics rule
2007	HD diesel rules effective

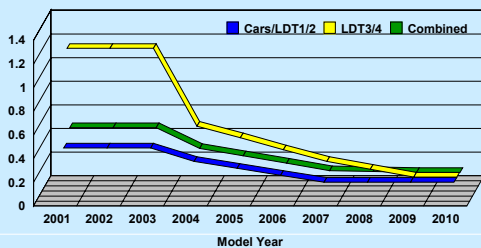
Air toxics/Stationary Source Program

2004	Complete all MACT standards
2003-12	Residual risk standards
2004-10	Area source standards
2004---	Community assessment-based risk reduction programs

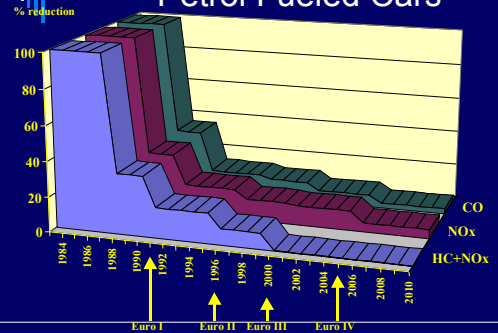
*Dates subject to ongoing legal discussions

US Tier 2 Standards

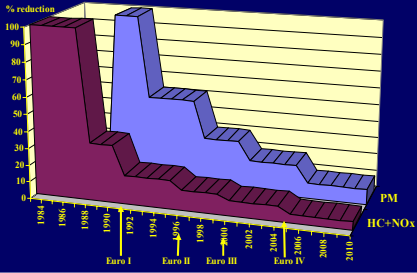
NO_x Standards (grams/mile)



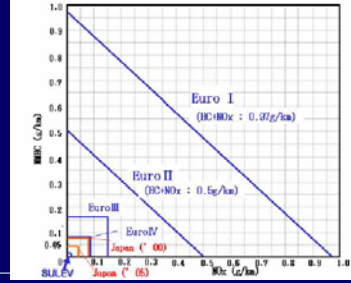
EU Emissions Standards For Petrol Fueled Cars



Emissions From Diesel Cars In Europe

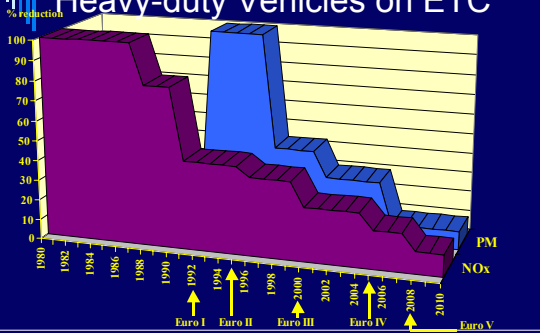


Gasoline Car Regulations



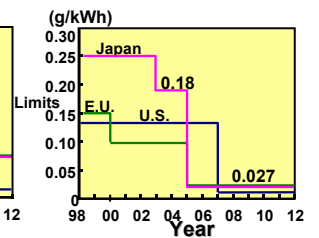
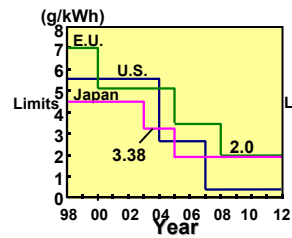
Euro I	500 ppm
Euro II	500 ppm
Euro III	150 ppm
Euro IV	50 ppm
Japan '00	100 ppm
Japan '05	10 ppm
CA SULEV	30 ppm

EU Emissions Standards For Heavy-duty Vehicles on ETC

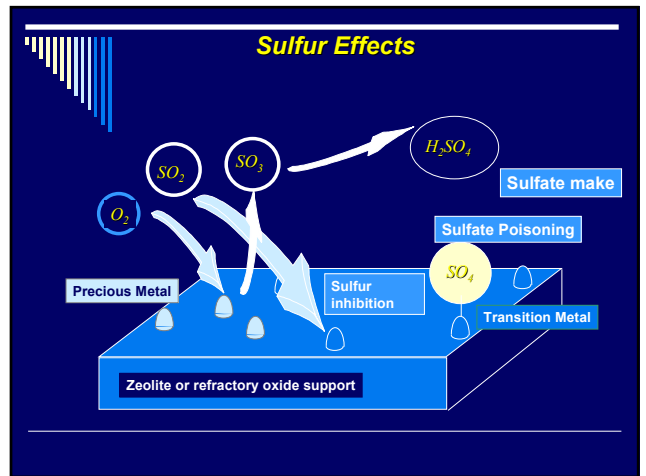
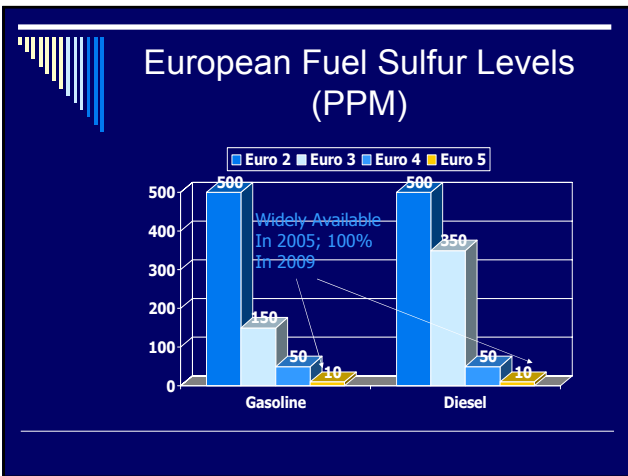
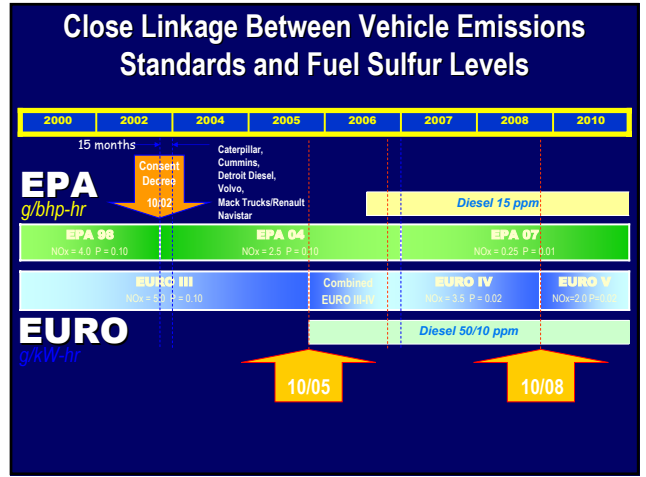
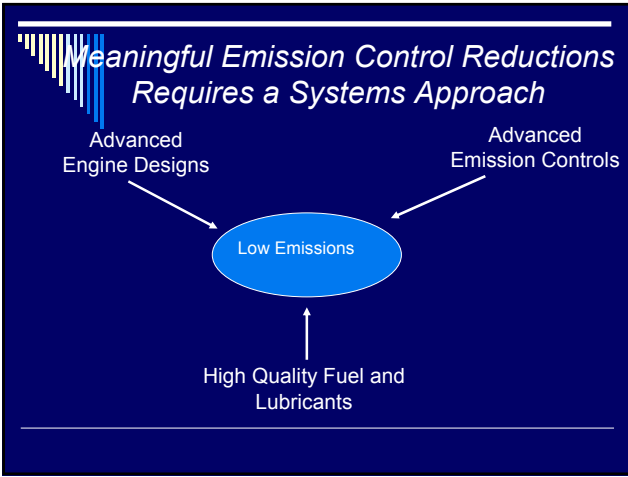


International Emission Regulations: - Heavy-duty vehicles (GVW>3.5t) -

- Nitrogen oxides (NOx)
- Particulate matter (PM)



Low-sulfur diesel needed to meet 2005 regulations



Fuel Parameters Important For Emissions

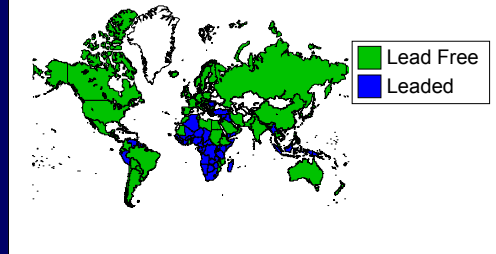
Gasoline

- Sulfur
- Vapor Pressure
- Benzene
- Oxygenates
- Additives
- Other

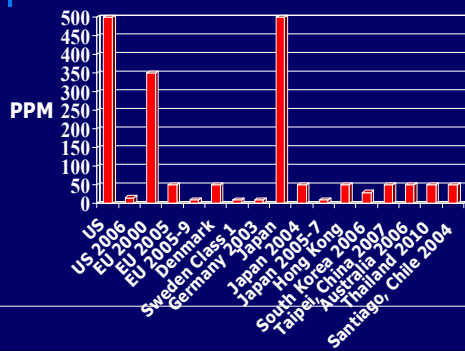
Diesel

- Sulfur
- Volatility
- Aromatic Hydrocarbons
- Additives
- Other

Lead Free Gasoline Worldwide 2004



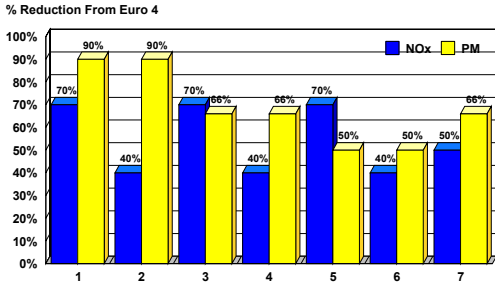
Ultra Low Sulfur Diesel Fuel Is Spreading



Euro 5/6 Developments

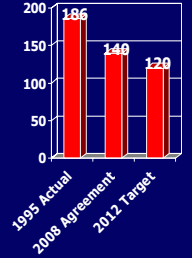
- Germany, France, Denmark & Sweden Pushing Hard For Traps
- Standards Process Could Be Very Slow
 - DG XI Wants Part of CAFE Process – 2005 Proposals
 - 10 Accession Countries
 - New Constitution
 - New Parliament
 - New Commission
 - Likely 2-3 Years
- There Will Very Likely Be Tight Euro 5/6
- Looking For Incentives Approach in the Interim
 - German Environment Ministry Pushing Tax Incentives
 - Arguably Illegal But EU in Tough Spot
- UBA Jawboning Effectively

Euro 5 Scenarios Proposed By Commission For Diesel Cars

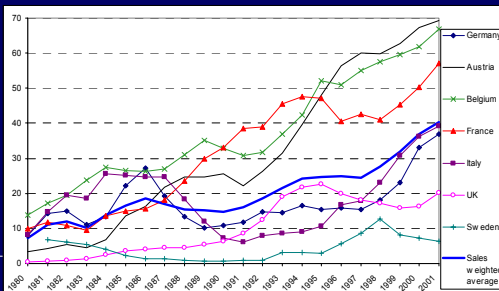


European Agreement (g CO₂/km)

- 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



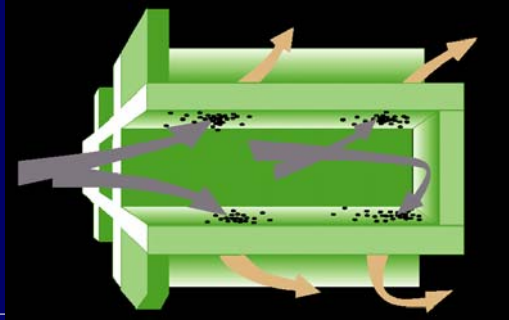
Penetration of Diesel Cars in Europe (% of New Sales)



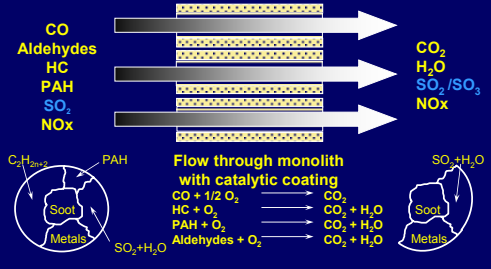
What To Do About Existing Vehicles?



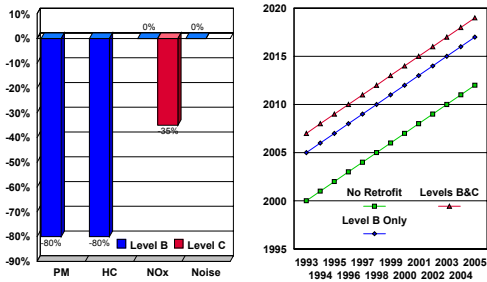
Diesel Particulate Filter



Diesel Oxidation Catalyst

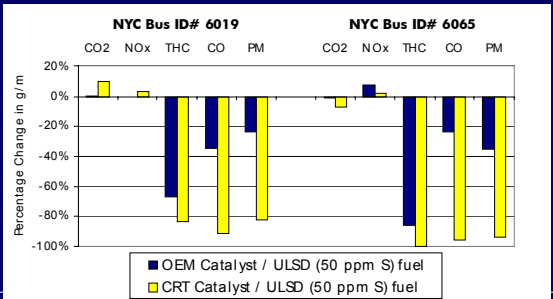


Swedish Retrofit Program All Trucks Above 3.5 Tons

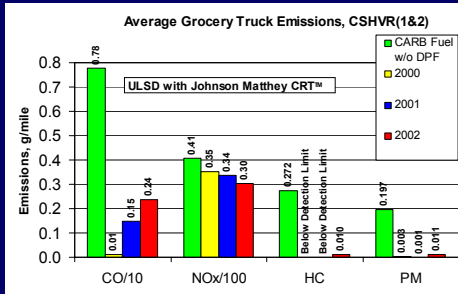


Very Low Sulfur Fuel Dominates The Market

New York City Retrofit Experience



Durability & Reliability



Inspection/Maintenance Considerations

- Program Type
- Effectiveness
 - Enforcement
 - Test types
 - Network design
 - Frequency
 - Quality of repairs
- Cost
 - Economies of scale
 - Sophistication
 - Capital
 - Operations
- Economic Impact
 - Ability to pay for repairs
 - Waivers
 - Scrappage
 - Alternatives
- Institutional Support
 - Audits
 - Oversight
 - Training

Enforcement

- Most critical factor to the success of I/M
 - Without good enforcement, program inherently weak!
 - Critical to getting emission reduction benefits
- Enforcement mechanisms are required to:
 - Insure all subject vehicles get tested
 - Insure tests are honest and fair
 - Insure failed vehicles are properly repaired
 - Insure failed vehicles are honestly retested
 - Prevent adjustment after retest

Enforcement Features

- Getting cars tested:
 - Registration denial
 - Windshield sticker
 - Computer list checking
 - Penalties
- Ensuring honest tests:
 - Automated systems
 - No money exchange
 - Covert audits
 - Penalties
- Insure repairs work:
 - Technician training
 - Transient testing
 - Standards for HC, CO and NOx
- Prevent readjustment:
 - Remote sensing
 - Penalties

Network Type

- Centralized
 - High through-put test only lanes run by government or contractor
- Decentralized
 - Repair shops licensed to conduct test and perform repairs
- Features
 - Best approach
 - Most cost effective
 - Cheapest to manage
 - Lowest fraud problems
 - Best quality control
- Features
 - Requires extensive quality assurance
 - Big fraud problem
 - Low quality control
 - Expensive due to loss of economies of scale

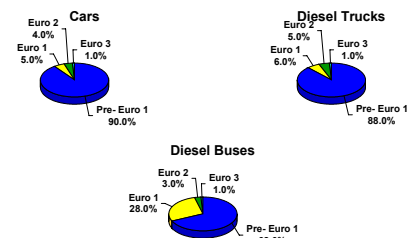
Institutional Support

- Government agencies must:
 - Set standards and establish procedures
 - Manage program and collect data
 - Conduct audits and enforce requirements
 - Insure vehicle owners participate in program
 - Train or certify training of inspectors and auditors
 - Train or certify training of repair technicians

The Current Situation In Russia

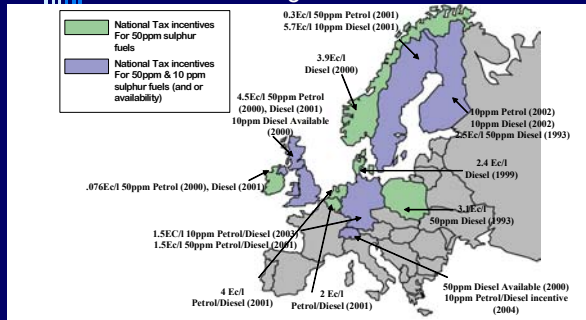
- High Vehicle Population Growth, especially in Cities
- Poor Vehicle Maintenance
- Insufficient Development of Road Network
- Poor Road Conditions
- Ineffective Traffic Engineering

Emissions Technology Structure of Russian Motor Vehicle Fleet



Source: Donchenko

European Tax Incentives Schemes To Encourage Low Sulfur Fuels



Strategy For Progress in Russia

- Institutional Arrangements
 - Responsibility
 - Resources
 - Authority
- Action Plan
 - Well Defined Goals
 - Short, Longer Term Measures
 - Input From All Stakeholders
 - Task Assignments

Strategy For Progress in Russia (Cont'd)

- Enforcement
 - Realistic Penalties
 - Sufficient Resources
- Variety of Policy Instruments
 - Command & Control Regulations
 - Economic Instruments
 - Other Incentives
- Public Awareness
 - Multiple Voices
 - Highlight Benefits