



# Experience of others in reducing sulphur in Vehicles emissions & Next Challenge for Cleaner Fuels and Vehicles,



Partnership for  
Clean Fuels and Vehicles





# Outline

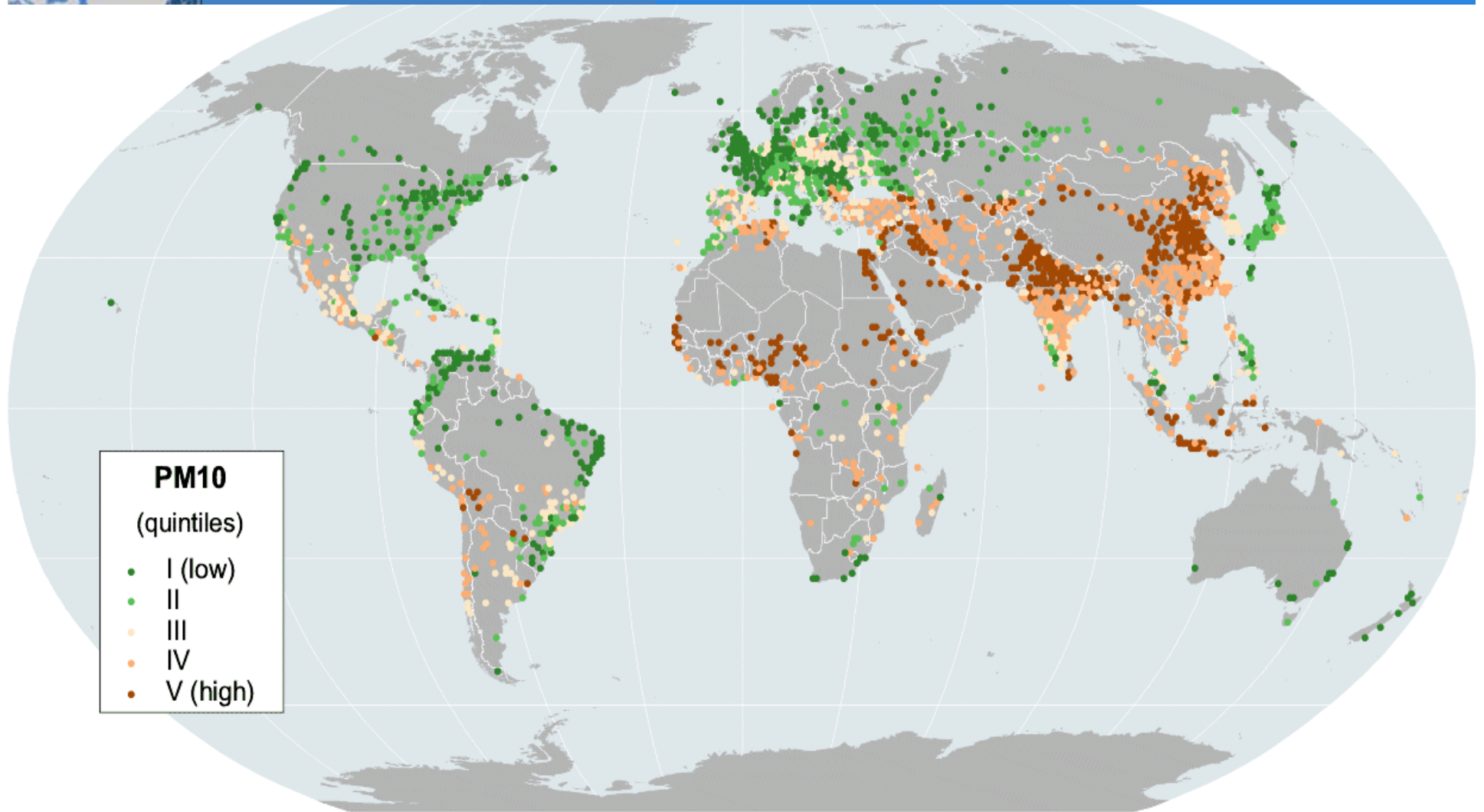
Climate, Fuel Consumption, Urban Air Pollution Closely Linked

Vehicles Are Important for Each

Must Select Policies/Measures that Provide Co-Benefits or Ancillary Benefits; Not Trading One Problem for the Other

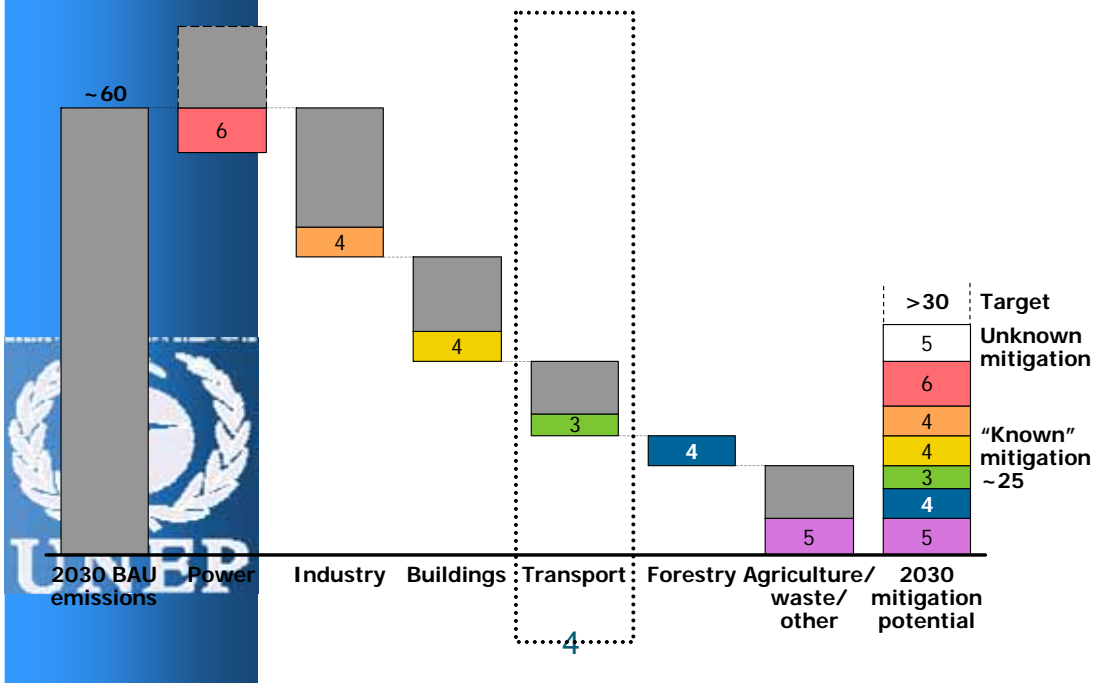
Clean Fuels/Clean Vehicles Must Play Important Role in Solving Urban Air Pollution AND Climate Problems

# PM<sub>10</sub> in Major cities



### 3 key interventions

- Low Emissions, Fuel-efficient cars
- Low-carbon fuels
- Reduced vehicle-miles traveled through congestion pricing, Bus Rapid Transit, etc.





# Promoting clean Fuel & Vehicles

- Cleaner fuels for intro cleaner vehicles  
Promoting need for clean fuel for intro cleaner vehicles (unleaded & sulphur)
- Standards  
Import standards/ regulations (age, catalytic converters)
- Cleaner fleet management  
Motor bicycles  
Support clean vehicles fleets
  - Clean fleet management (toolkit)
  - Busfleets



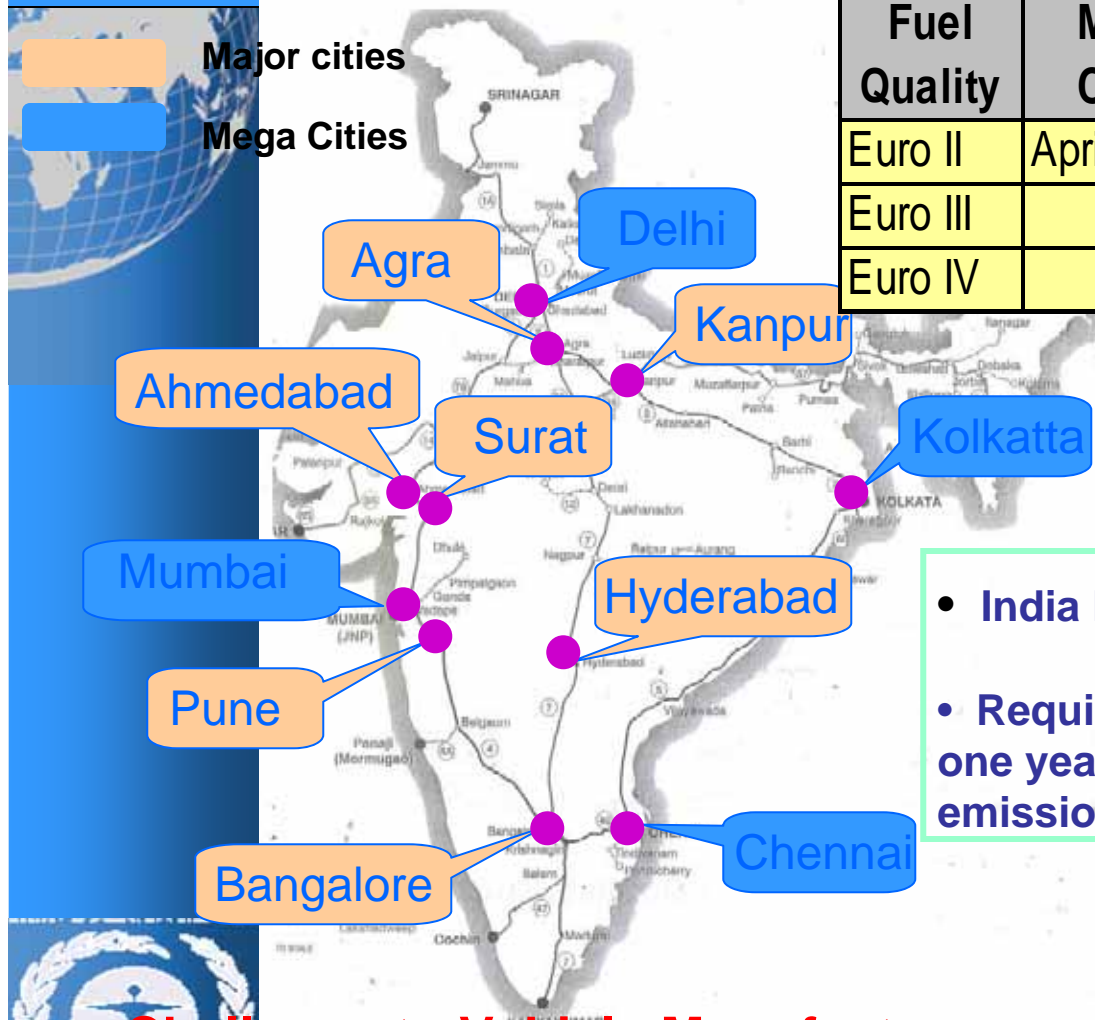


# Indian Industry Perspective on Key fuel and vehicle issues



# Outcome of Auto Fuel Policy

| Fuel Quality | Mega Cities | Major Cities | Rest Of India |
|--------------|-------------|--------------|---------------|
| Euro II      | April 2001. | April 2003.  | April 2005.   |
| Euro III     |             | April 2005.  | April 2010.   |
| Euro IV      |             | April 2010.  | Not decided   |



- India Emission Regulations  $\equiv$  EU Regulation
- Required Fuel = Matching Euro fuel at least one year before date of implementation of the emission norms

## Challenge to Vehicle Manufacturers:

- Different Fuel Quality in different parts of the Country
- Same vehicles plying in various areas – Effects after-treatment devices/ OBD/ other engine components.





# ISSUES / CONCERNS

Fuel Specifications

Fuel Quality at retail outlet

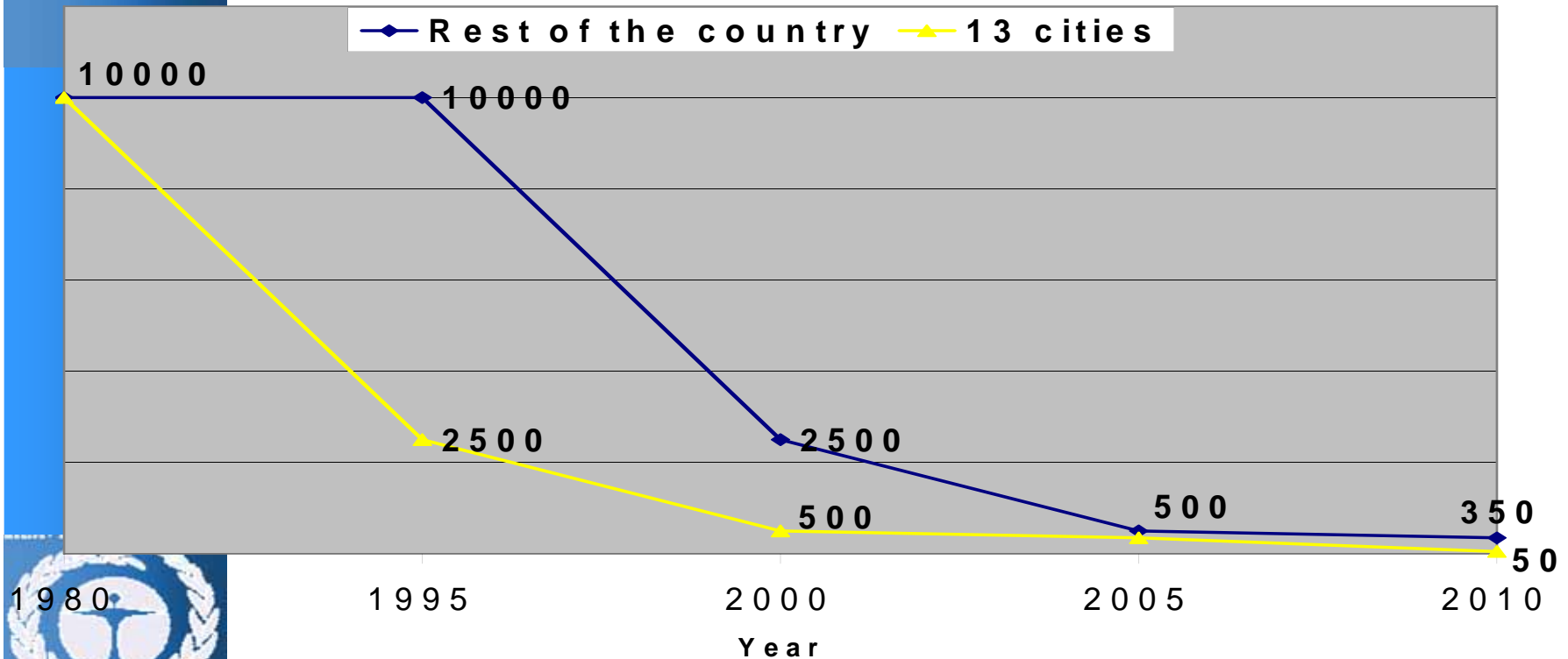
Fuel Adulteration

Court Orders

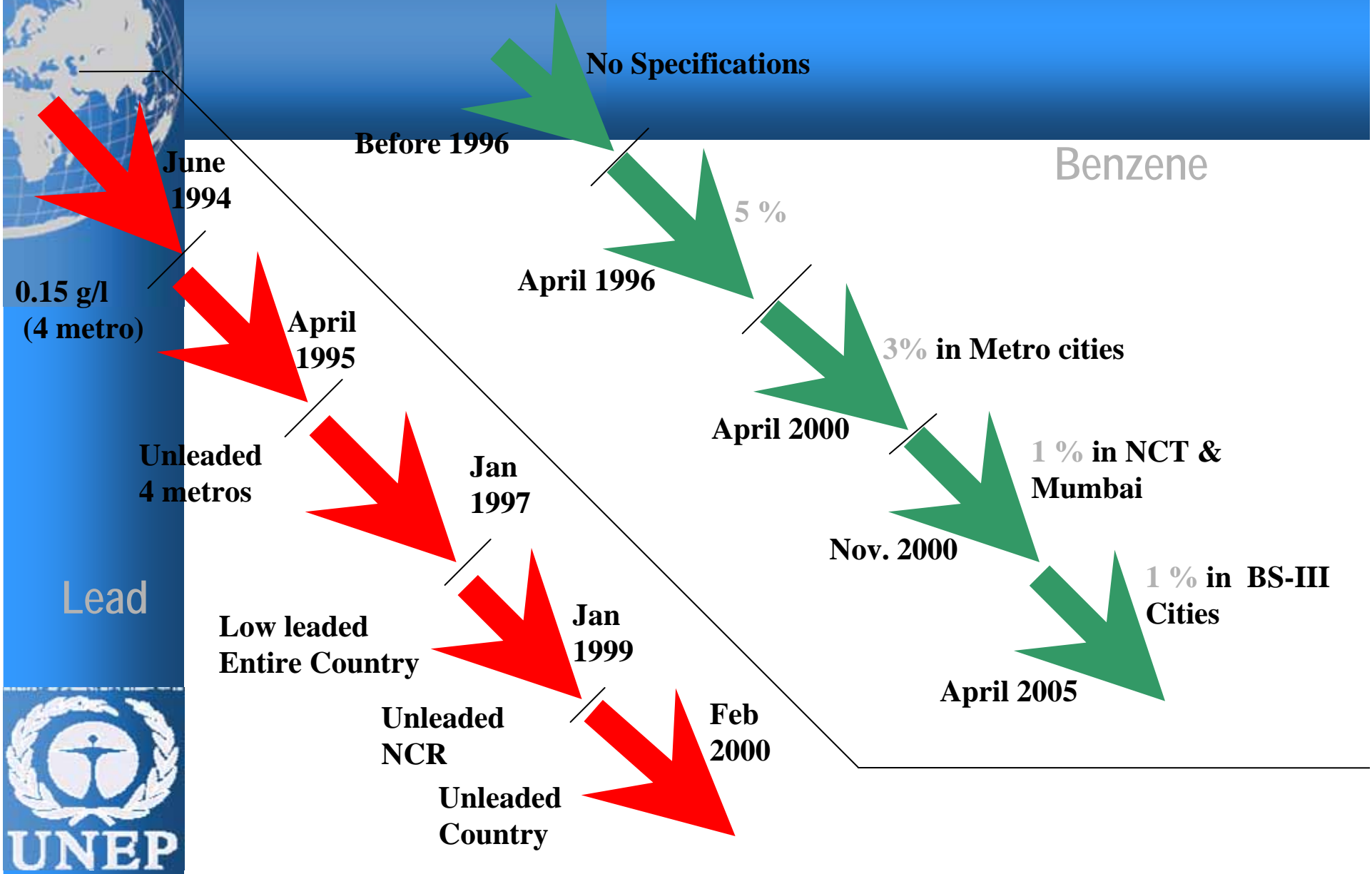
No clear roadmap on

- Ethanol gasoline blends
- Bio Diesel
- LPG
- CNG
- Hydrogen & CNG Blends

# Diesel Quality Change - India



# GASOLINE QUALITY IMPROVEMENT IN INDIA



GASOLINE LEAD PHASE-OUT PROGRAMME IN INDIA



# Fuel Quality at Retail Outlet : Industry Concerns

## Fuel Adulteration

- Adversely effects vehicle performance and calls for major engine repairs.

## Quality

- Gum content in some samples found to be too high
- Specification of Gum content met only at refinery level and not at retail level.
- Members reported problems even with fuel being supplied to them directly by refineries where no intermediary is involved.

Variation in fuel quality and specifications make it difficult for manufacturers to design and tune engine appropriately

Consequences of fuel adulteration being absorbed by automobile manufactures only

Going forward, with sophistication in vehicle technology, adulteration will worsen the gains sought to be achieved through technological routes





## FUEL QUALITY RELATED DECISIONS BY COURTS AND GOI

Mashelkar Committee submitted auto fuel policy report  
– Approved by Government

EPCA submitted a report on Clean Fuels to the Hon'ble Supreme Court.

As per orders of the Hon'ble Courts

- All buses in Delhi to be converted to CNG mode.
- Autos allowed option of CNG and Petrol.
- Taxis complying to Bharat Stage II allowed with CNG / Petrol / Diesel.

LPG allowed by Government as an automotive fuel.

MoP&NG decided to introduce 5% ethanol blending in gasoline.

Cabinet decides to increase ethanol content to 10 % while bio fuel policy has recommended 20 %





## *To Sum up.....*

Alignment of petrol / diesel standards with EU regulations in all respects and supply at RO to enable industry meet sustained emission performance

Need to evolve standards for CNG, LPG, Bio Fuels & Hydrogen CNG blends

Prepare roadmap for sustained availability in consultation with all stake holders



# Improving Fuel Quality in Asia

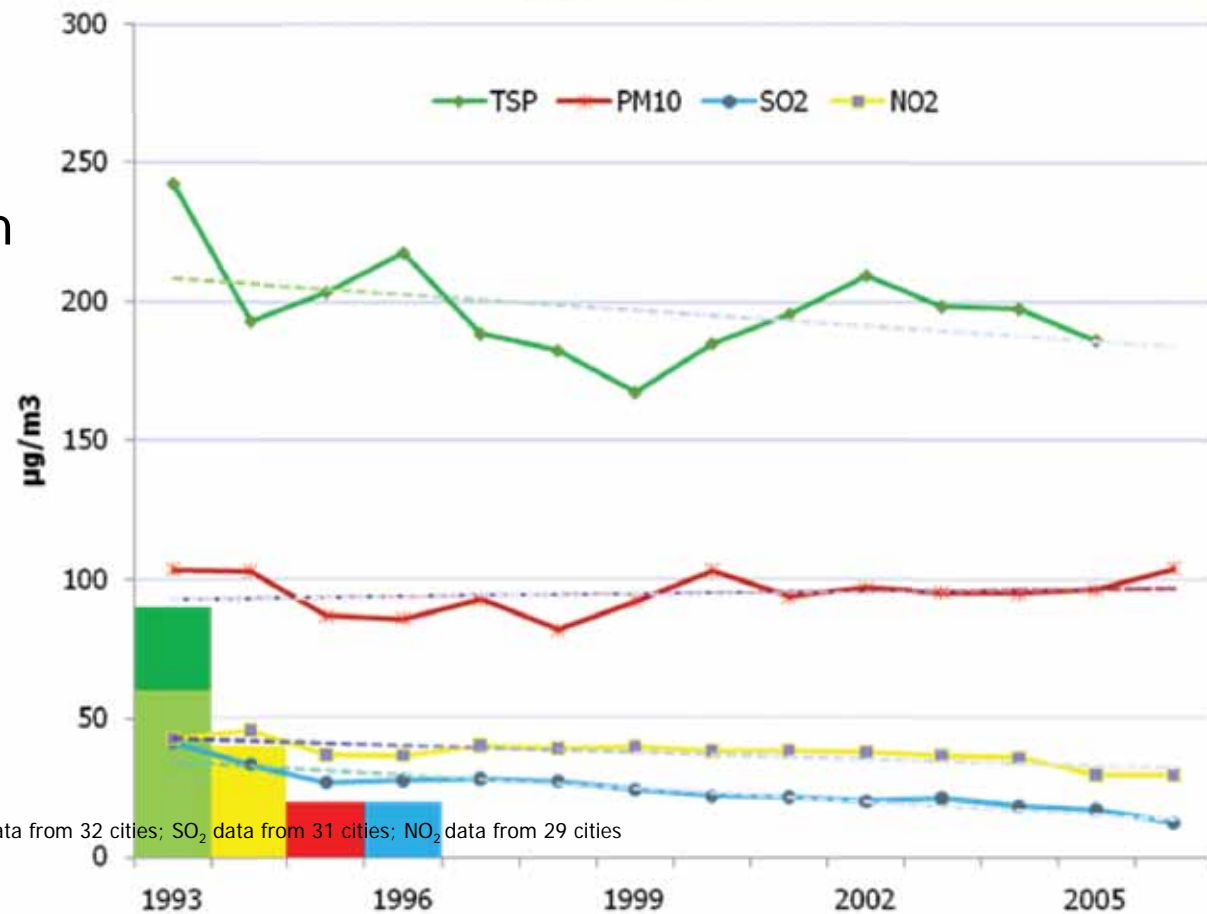


# Trends Air Pollution 2003-2006

- Air quality in Asia is improving but still far above WHO limits
- PM is main pollutant of concern

- WHO (1979) TSP guideline, 60-90 $\mu\text{g}/\text{m}^3$
- WHO (2005) PM10 guideline, 20 $\mu\text{g}/\text{m}^3$
- WHO (2005) SO<sub>2</sub> 24-hour guideline, 20 $\mu\text{g}/\text{m}^3$
- WHO NO<sub>2</sub> guideline, 40 $\mu\text{g}/\text{m}^3$

**Aggregated Annual AQ Trends**  
1993-2006

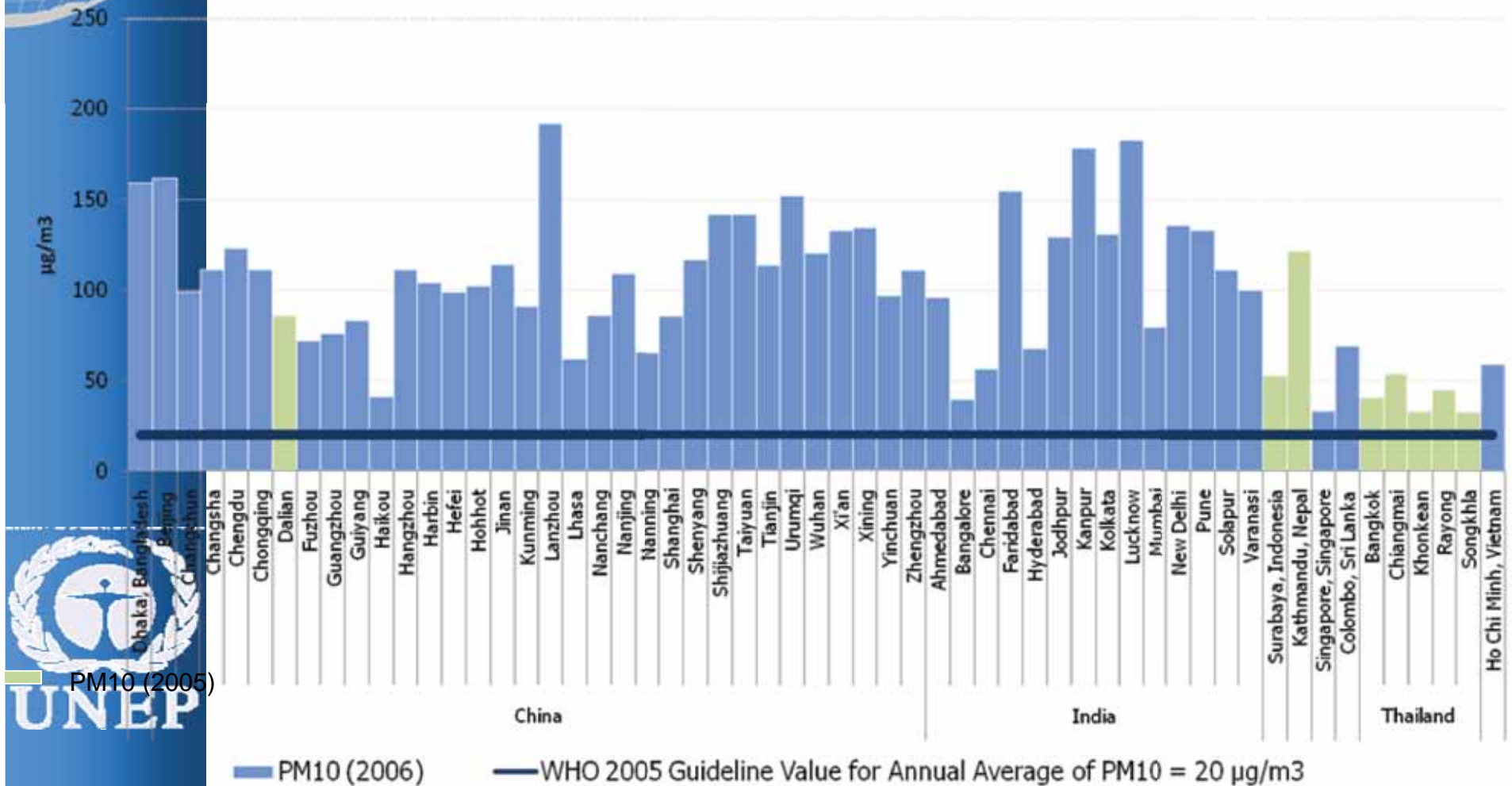


Note: TSP data aggregated from 17 cities; PM10 data from 32 cities; SO<sub>2</sub> data from 31 cities; NO<sub>2</sub> data from 29 cities



# PM levels in Asia – versus WHO guideline values

**PM10 Annual Ambient Concentrations in Asian Cities vs WHO**



# Sulfur levels in Diesel – March 2008

|                                 | 1996  | 1997 | 1998 | 1999 | 2000 | 2001 | 2002              | 2003              | 2004 | 2005                | 2006 | 2007                | 2008 | 2009 | 2010            | 2011 | 2012            |
|---------------------------------|-------|------|------|------|------|------|-------------------|-------------------|------|---------------------|------|---------------------|------|------|-----------------|------|-----------------|
| Bangladesh                      |       |      |      |      |      |      | 5000              |                   |      |                     |      |                     |      |      |                 |      |                 |
| Cambodia                        |       |      |      |      | 2000 |      |                   |                   | 1500 |                     |      |                     |      |      |                 |      |                 |
| Hong Kong,                      |       | 500  |      |      |      |      | 50                |                   |      |                     |      | 10 <sup>a</sup>     |      |      |                 |      |                 |
| India (nationwide)              | 5000  |      |      |      | 2500 |      |                   |                   |      | 500                 |      |                     |      |      | 350             |      |                 |
| India (metros)                  | 5000  |      |      |      | 2500 | 500  |                   |                   |      | 350 <sup>a</sup>    |      |                     |      |      | 50 <sup>a</sup> |      |                 |
| Indonesia                       | 5000  |      |      |      |      |      |                   |                   |      |                     | 2000 |                     |      |      | 350             |      |                 |
| Japan <sup>b</sup>              | 500   |      |      |      |      |      |                   |                   |      | 50                  |      | 10                  |      |      |                 |      |                 |
| Malaysia                        | 5000  |      | 3000 |      |      |      | 500 <sup>c</sup>  |                   |      | 500 <sup>d</sup>    |      |                     |      |      |                 |      | 50 <sup>a</sup> |
| Pakistan                        | 10000 |      |      |      |      |      | 7000 <sup>c</sup> |                   |      |                     |      |                     |      |      |                 |      |                 |
| Philippines                     | 5000  |      |      |      |      | 2000 |                   |                   | 500  |                     |      |                     |      |      |                 |      |                 |
| PRC (nationwide) <sup>e,f</sup> | 5000  |      |      |      |      |      | 2000              |                   |      | 500                 |      |                     |      |      |                 |      |                 |
| PRC -                           | 5000  |      |      |      |      |      | 2000              |                   | 500  | 350                 |      |                     | 50   |      |                 |      |                 |
| Singapore                       | 3000  |      | 500  |      |      |      |                   |                   |      |                     | 50   |                     |      |      |                 |      |                 |
| South Korea                     | 500   |      |      |      |      |      |                   | 430               | 100  |                     | 30   | 15(10) <sup>f</sup> |      |      |                 |      |                 |
| Sri Lanka                       | 10000 |      |      |      |      |      |                   | 5000 <sup>d</sup> |      |                     | 500  |                     |      |      |                 |      |                 |
| Taipei,                         | 3000  |      |      | 500  |      |      | 350               |                   | 100  |                     |      |                     | 50   |      |                 |      |                 |
| Thailand                        | 2500  |      |      | 500  |      |      |                   |                   | 350  |                     | 150  |                     |      |      | 50              |      |                 |
| Viet Nam                        | 10000 |      |      |      |      |      |                   |                   |      |                     |      | 500                 |      |      |                 |      |                 |
| European Union                  |       |      |      |      | 500  |      |                   |                   |      | 50(10) <sup>f</sup> |      |                     | 10   |      |                 |      |                 |
| United States                   | 500   |      |      |      |      |      |                   |                   |      |                     | 15   |                     |      |      |                 |      |                 |

Notes: a - under consideration/ discussion; uncertain; b = nationwide supply of 50 ppm commenced in 2003 and for 10 ppm in 2005 due to voluntary goals set by the oil industry; c = marketed; d = mandatory; e = voluntary standard of 500 ppm, however formal standard remains 2000 ppm, product in the market nationwide varies 500-1000 ppm; f = various fuel quality available; g = gasoline only

Source: CAI-Asia. 2008 March



# Vehicle Standards – Light Duty March 2008

| Country                 | 95                                  | 96     | 97 | 98 | 99     | 00     | 01 | 02     | 03     | 04     | 05        | 06                  | 07     | 08     | 09     | 10 | 11 | 12                           | 13 | 14 |
|-------------------------|-------------------------------------|--------|----|----|--------|--------|----|--------|--------|--------|-----------|---------------------|--------|--------|--------|----|----|------------------------------|----|----|
| European Union          | E1                                  | Euro 2 |    |    |        | Euro 3 |    |        | Euro 4 |        |           | Euro 5              |        |        | Euro 6 |    |    |                              |    |    |
| Bangladesh <sup>a</sup> |                                     |        |    |    |        |        |    |        |        |        | Euro 2    |                     |        |        |        |    |    |                              |    |    |
| Bangladesh <sup>b</sup> |                                     |        |    |    |        |        |    |        |        |        | Euro 1    |                     |        |        |        |    |    |                              |    |    |
| Hong Kong, China        | Euro 1                              | Euro 2 |    |    |        | Euro 3 |    |        | Euro 4 |        |           | Euro 5              |        |        |        |    |    |                              |    |    |
| India <sup>c</sup>      |                                     |        |    |    |        | Euro 1 |    |        | Euro 2 |        |           |                     | Euro 3 |        |        |    |    |                              |    |    |
| India <sup>d</sup>      |                                     |        |    |    | E1     | Euro 2 |    |        |        | Euro 3 |           |                     | Euro 4 |        |        |    |    |                              |    |    |
| Indonesia               |                                     |        |    |    |        |        |    |        |        |        | Euro 2    |                     |        |        |        |    |    |                              |    |    |
| Malaysia                |                                     |        |    |    | Euro 1 |        |    |        |        |        |           | Euro 2              |        | Euro 4 |        |    |    |                              |    |    |
| Nepal                   |                                     |        |    |    |        | Euro 1 |    |        |        |        |           |                     |        |        |        |    |    |                              |    |    |
| Pakistan                | No conclusive information available |        |    |    |        |        |    |        |        |        |           |                     |        |        |        |    |    |                              |    |    |
| Philippines             |                                     |        |    |    |        |        |    |        | Euro 1 |        |           | Euro 2              |        |        |        |    |    |                              |    |    |
| PRC <sup>a</sup>        |                                     |        |    |    |        | Euro 1 |    |        | Euro 2 |        | Euro 3    |                     | Euro 4 |        |        |    |    |                              |    |    |
| PRC <sup>e</sup>        |                                     |        |    |    |        | Euro 1 |    | Euro 2 |        | Euro 3 |           | Euro 4 Beijing only |        |        |        |    |    |                              |    |    |
| Singapore <sup>a</sup>  | Euro 1                              |        |    |    |        | Euro 2 |    |        |        |        |           |                     |        |        |        |    |    |                              |    |    |
| Singapore <sup>b</sup>  | Euro 1                              |        |    |    |        | Euro 2 |    |        |        | Euro 4 |           |                     |        |        |        |    |    |                              |    |    |
| Sri Lanka               |                                     |        |    |    |        |        |    |        | Euro 1 |        |           | Euro 2              |        |        |        |    |    |                              |    |    |
| South Korea             |                                     |        |    |    |        |        |    |        |        |        | Euro 4    |                     |        | Euro 5 |        |    |    |                              |    |    |
| Taipei, China           |                                     |        |    |    |        |        |    |        |        |        | US Tier 1 |                     |        |        |        |    |    | US Tier 2 Bin 7 <sup>g</sup> |    |    |
| Thailand                | Euro 1                              |        |    |    |        | Euro 2 |    |        | Euro 3 |        |           |                     | Euro 4 |        |        |    |    |                              |    |    |
| Viet Nam                |                                     |        |    |    |        |        |    |        |        |        | Euro 2    |                     |        |        |        |    |    |                              |    |    |

Notes: Italics – under discussion; a – gasoline; b – Diesel; c – Entire country; d – Delhi, Chennai, Mumbai, Kolkata, Bangalore, Hyderabad, Agra, Surat, Pune, Kanpur, Ahmedabad, Sholapur, Lucknow; Other cities in India are in Euro 2; e – Beijing and Guangzhou (as of 01 September 2006) have adopted Euro 3 standards; Shanghai has requested the approval of the State Council for implementation of Euro 3; f – Euro 4 for gasoline vehicles and California ULEV standards for diesel vehicles; g – Equivalent to Euro 4 emissions standards  
CAI-Asia. 2008, March.





Indonesia

# Fuels, Vehicle Status



# Outline

## Background

- Environmental Disaster
- Air Pollution Disaster
- Indonesian Today: Air Pollution
- Worsening Air Quality
- Health Effect
- Achieving Result on AQM

## Vehicle Standard

- Vehicle Statistic

## Fuels Quality

## Conclusion

## The Next Step



# Air Pollution Disaster



Rapid urbanization, industrialization and land clearing palm oil plantation (forest fire) in Indonesia tend to cause chronic air pollution problems

# Indonesia Today: Air Pollution

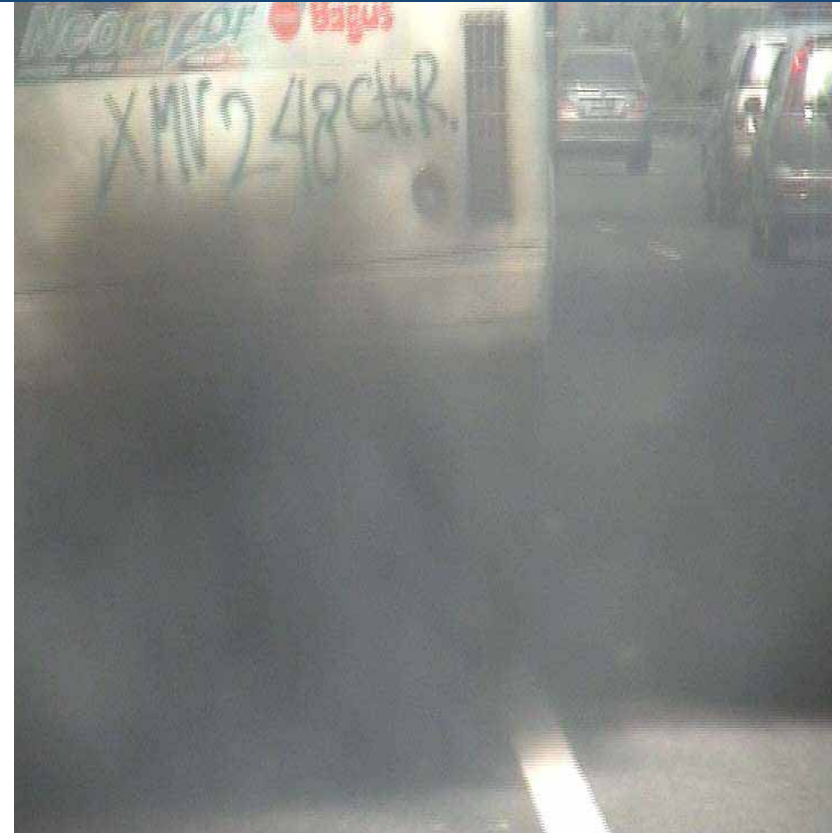
## Case of Jakarta

### Worsening ambient air quality

- In 5 years since 2001: Jakarta have never breathe more than 27 days “good air”. *Source: Jakarta Environmental Management Agency*
- Nearly all pollutants exceed AAQS regularly (NO<sub>x</sub>, SO<sub>2</sub>, (PM<sub>10</sub>), and O<sub>3</sub>)
- 70% from vehicular emissions: 25% stationary sources/industry, 5% domestic sources.

### Social and Financial Impact

- Increased respiratory diseases
- Health costs from air pollution.



**Challenge:** high level of public awareness about air pollution, but low commitment to improve air quality (especially among policymakers).





# Worsening Ambient Air Quality

## AAQS Report 2007

| City         | “Good” Category | Parameter Dominant |
|--------------|-----------------|--------------------|
| Jakarta      | 55              | PM <sub>10</sub>   |
| Bandung      | 66              | PM <sub>10</sub>   |
| Semarang     | 76              | PM <sub>10</sub>   |
| Surabaya     | 57              | SO <sub>2</sub>    |
| Medan        | 64              | CO                 |
| Palangkaraya | 230             | O <sub>3</sub>     |

Source: Ministry of Environment 2008





# Health Effect (2)

- In this 2 decades, respiratory infection and respiratory disease is no 1 of the most 10 diseases that affected people in the Greater Jakarta.
- Health Profile 2004 in the Greater Jakarta:
  - 46% respiratory disease have correlation with air pollution (respiratory infection, asthmatic, eyes irritation).
  - 32% mortality (predicted) was related to air pollution (cardiovascular disease, pneumonia).





# Achieving Results in AQM

## Fuels

- Unleaded gasoline
  - Lowered blood lead levels in children in the monitored cities
  - Reducing of lead exposure in ambient air
- Increased interest in CNG, bio-fuels (ethanol and bio-diesel)

## Vehicle Technology and Emission

- Revised emission standards for new-type and in-use vehicles

## Traffic Management

- Bus rapid transit system in Jakarta
- Monthly car-free day in Jakarta

## Policy Formulation

- Local Clean Air Act in Jakarta (2005)
- Draft policy paper on vehicular emission reduction strategy
- Draft of national act on clean air.

## Public Involvement:

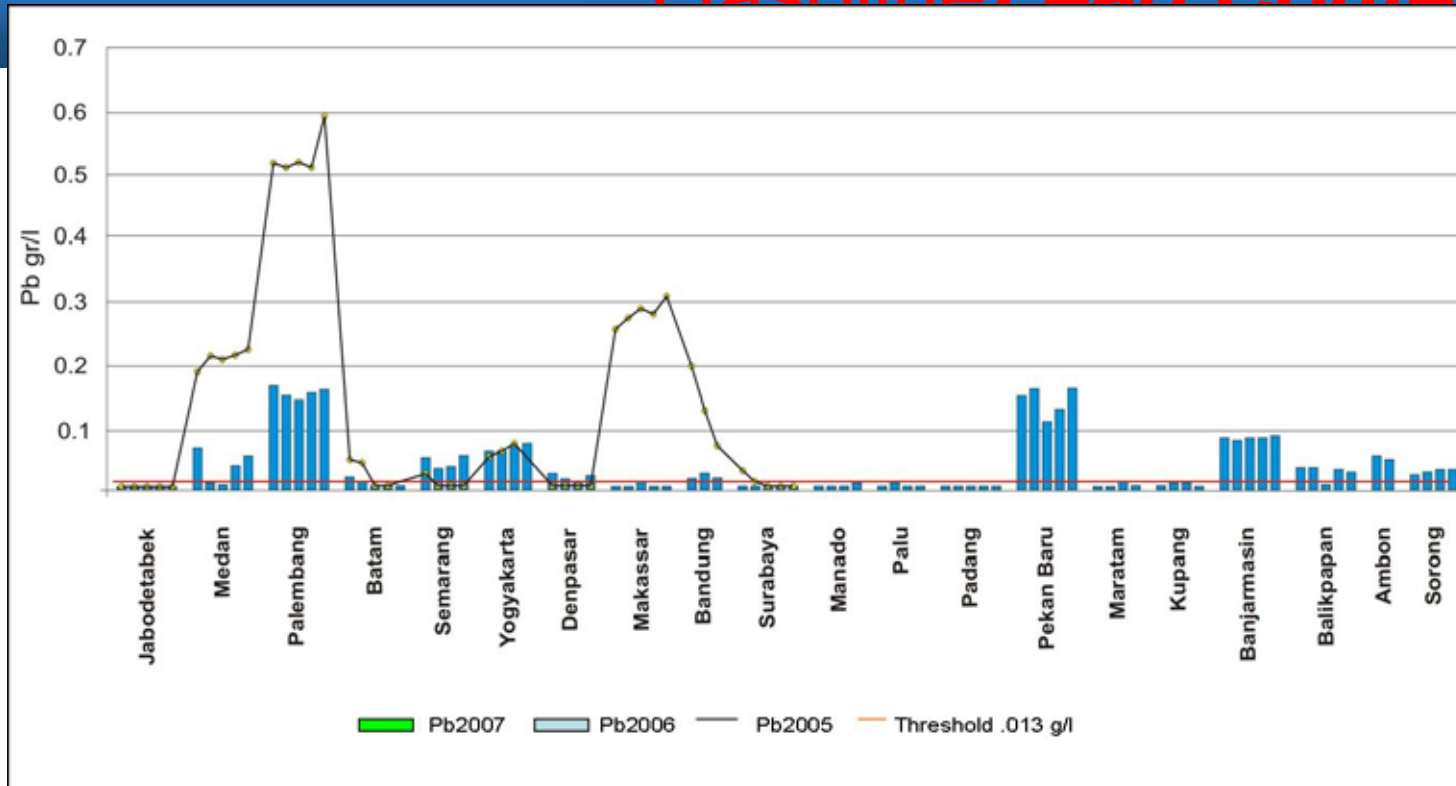
- I/M
- Support to gain better air quality.

**Creating Partnerships at All Levels,  
Ensuring Public Awareness for Support**



# Fuels Quality

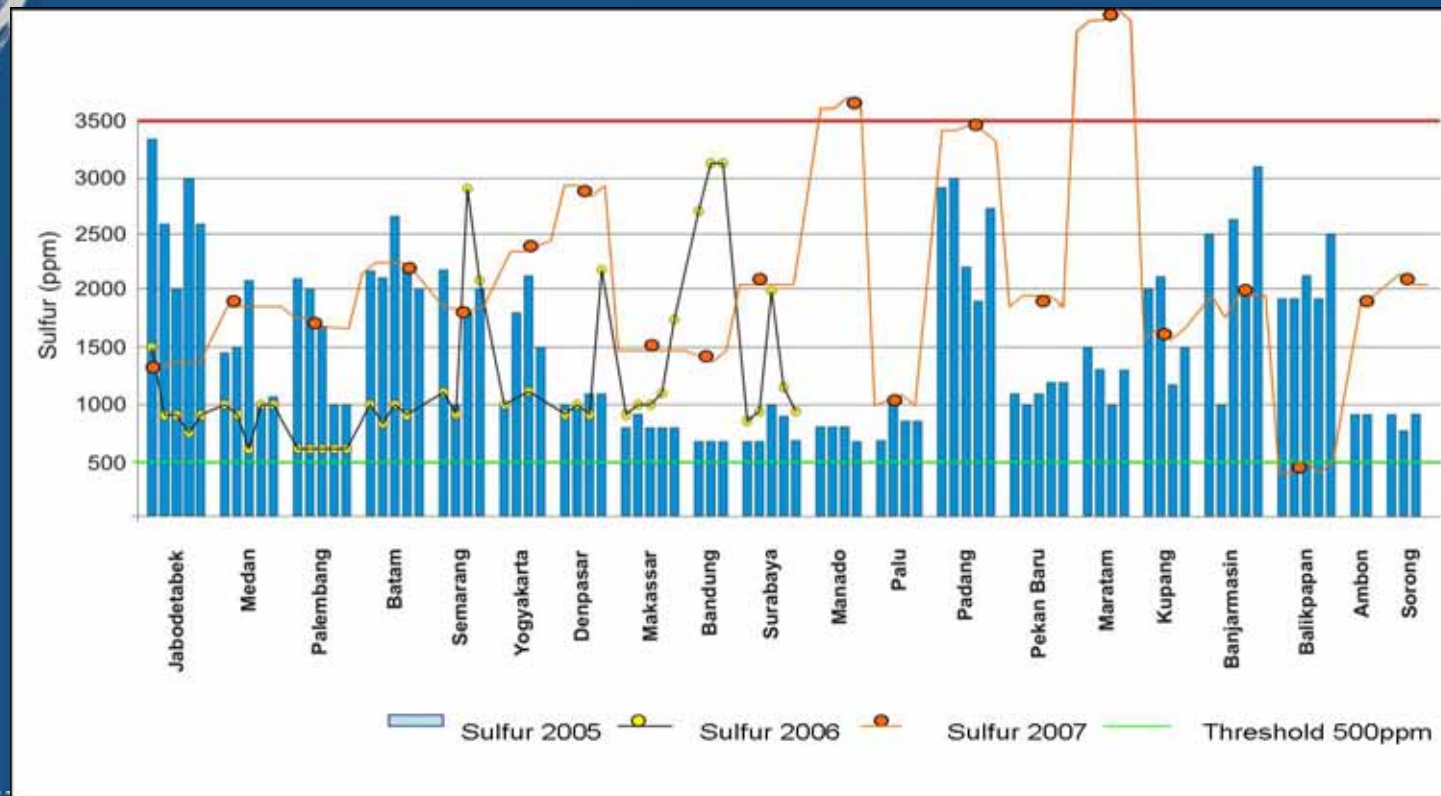
## Gasoline Lead Content



Fuel Quality Monitoring in 20 cities shows the lead content in 2006 had an average .038 g/l, while in 2007 revealed dropped to .00387 g/l. Thus, ten cities monitored revealed undetectable lead content, meanwhile, for other 10 cities revealed lead content equals to or below the standard required for ULG.

# Fuels Quality (2)

## ADO Sulfur Content



The sulfur content in diesel fuel in many cities (2007) are still high exceeded 3,500 ppm, and the average 2,150 ppm with range 400 ppm - 4,600 ppm, a significant increase compared to the average number in 2006 which was 1510 ppm.

# Conclusion

The air pollution at this present time is still being a threat for most regions in Indonesia, especially the major city like as the Greater Jakarta

Fuels quality are correlated to worsening air quality

- Leaded gasoline phase-out and sulfur content reduction in ADO is a trigger point to implement lower emission vehicle technology:
  - Catalytic Converter (lead poisoning itself and its capability to reduce HC, CO and NO<sub>x</sub>)
  - Diesel Particulate Trap (to reduce PM and SO<sub>x</sub> emission).

Fuels Quality Monitoring (2007) in 20 cities in Indonesia:

- ULG for nationwide
- Most regions are still supplied ADO with high sulfur content exceeding 1900 ppm with minimum range found 400 ppm maximum 4,400 ppm. There is increasing of sulfur content compare to previous year (2005 and 2006).

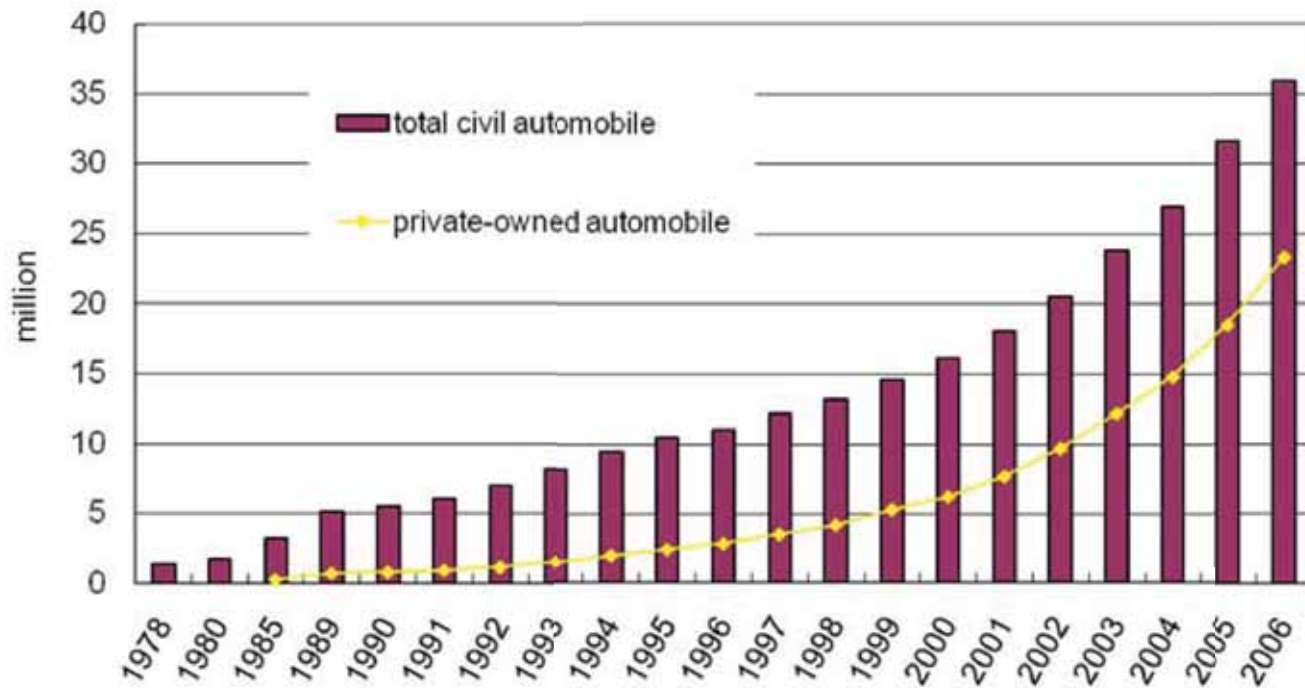




# Vehicle Emission Control in China

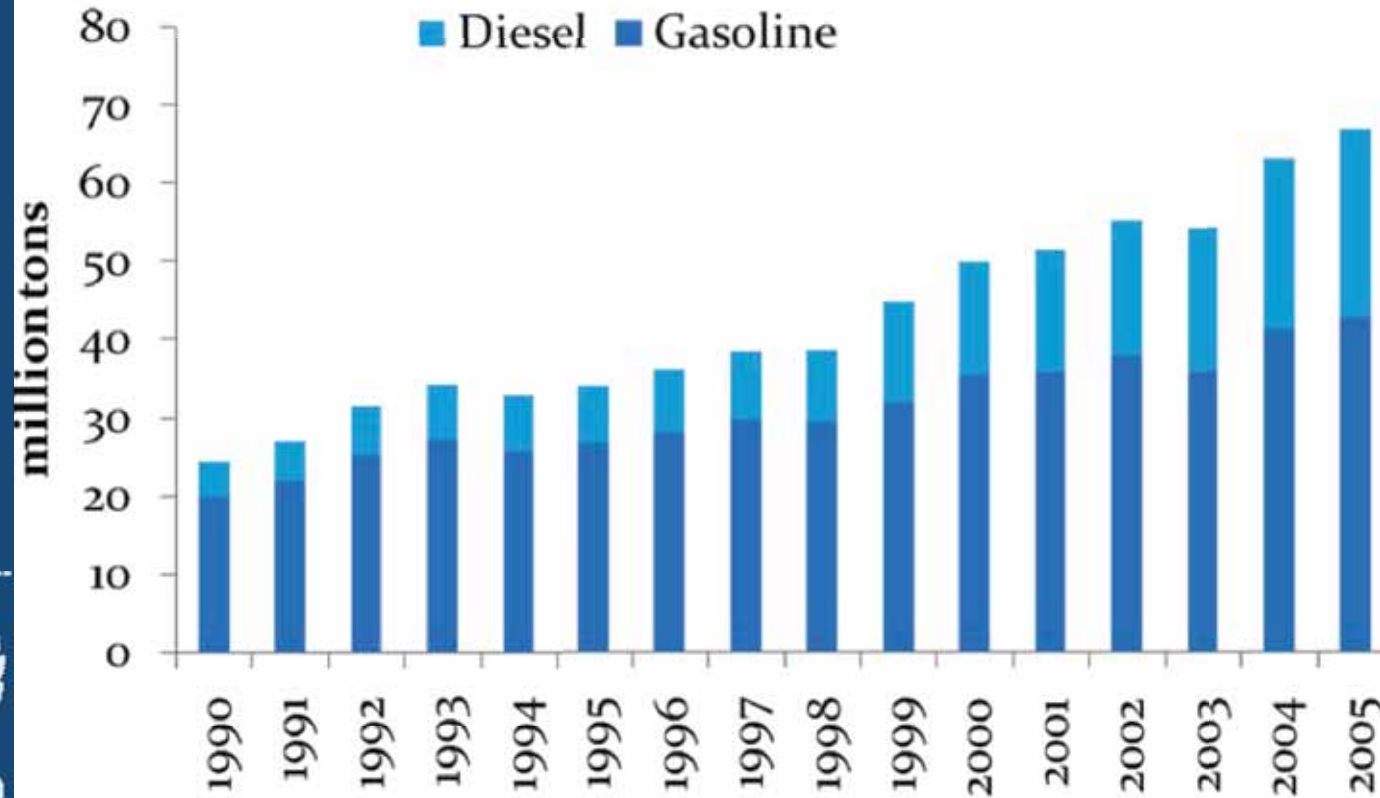


# Growth of Automobile Population in China



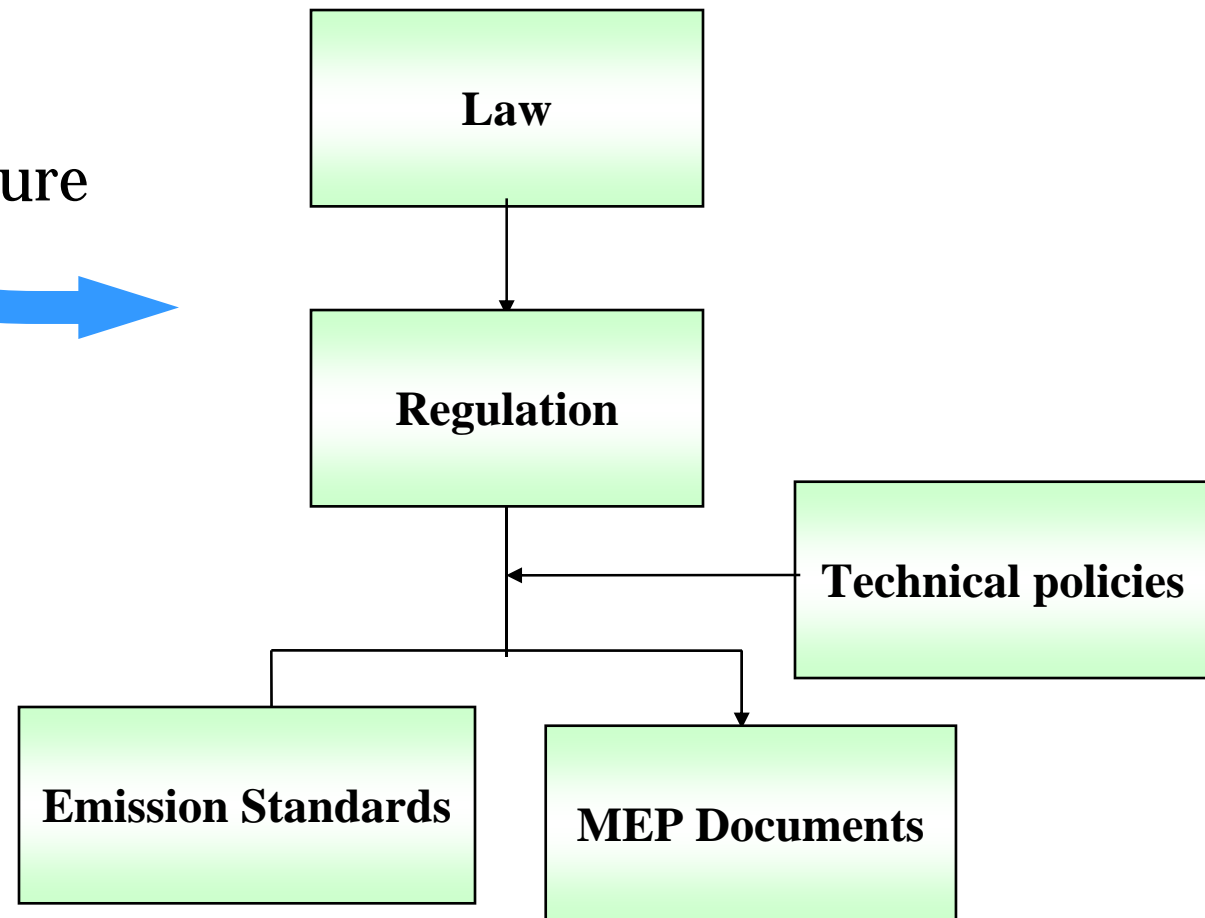


## Annual Consumption of Motor Gasoline and Diesel



# Vehicle Emission Management Framework

Basic Structure





## Laws, Regulations & Standards

Since 1983, SEPA has published and revised 34 standards of vehicle-emitted pollutants control, covering light-duty vehicle, heavy-duty vehicle, heavy-duty engine, motorcycles, mopeds and tri-wheel & low speed vehicles (agriculture transport vehicles), etc.

These standards cover new vehicles and in-use vehicles.

Comprehensive vehicle emission control standard system has been gradually established.

# Fuel Quality Improvement Gasoline

| Country | Year              | 90    | 91 | 92    | 93    | 94 | 95    | 96 | 97    | 98    | 99 | 2000 | 01  | 02    | 03                 | 04    | 05               | 06   | 07 | 08 | 09 | 10 | 11 |
|---------|-------------------|-------|----|-------|-------|----|-------|----|-------|-------|----|------|-----|-------|--------------------|-------|------------------|------|----|----|----|----|----|
|         | Standard          |       |    |       |       |    |       |    |       |       |    |      |     |       |                    |       |                  |      |    |    |    |    |    |
| US      | Emission Standard | Tier0 |    |       | Tier1 |    |       |    |       |       |    |      |     |       | Tier2              |       |                  |      |    |    |    |    |    |
|         | S content         | 338   |    |       |       |    |       |    | 0~500 |       |    |      |     |       | Avg.120<br>Max.300 |       | Avg.30<br>Max.80 |      |    |    |    |    |    |
| EU      | Emission Standard |       |    | EURO1 |       |    | EURO2 |    |       | EURO3 |    |      |     | EURO4 |                    | EURO5 |                  |      |    |    |    |    |    |
|         | S content         |       |    | 1000  |       |    | 500   |    |       | 150   |    |      |     | 50    |                    | 10    |                  |      |    |    |    |    |    |
| CHINA   | Emission Standard |       |    |       |       |    |       |    |       |       |    | CHN1 |     |       | CHN2               |       | CHN3             | CHN4 |    |    |    |    |    |
|         | S content         |       |    |       |       |    |       |    |       | 1000  |    |      | 800 | 500   |                    |       |                  | 150  |    |    |    |    |    |
| BEIJING | Emission Standard |       |    |       |       |    |       |    |       | CHN1  |    | CHN2 |     |       | CHN3               | CHN4  |                  |      |    |    |    |    |    |
|         | S content         |       |    |       |       |    |       |    |       |       |    |      | 500 |       | 150                | 50    |                  |      |    |    |    |    |    |

# Fuel Quality Improvement Diesel

| Country | Year<br>Standard  | 90   | 91                | 92    | 93    | 94    | 95    | 96  | 97    | 98   | 99   | 2000 | 01    | 02   | 03    | 04   | 05    | 06 | 07 | 08 | 09 | 10 | 11 |
|---------|-------------------|------|-------------------|-------|-------|-------|-------|-----|-------|------|------|------|-------|------|-------|------|-------|----|----|----|----|----|----|
|         |                   | US   | Emission Standard | Tier0 |       |       | Tier1 |     |       |      |      |      |       |      |       |      | Tier2 |    |    |    |    |    |    |
| US      | S content         | 2000 |                   | 500   |       |       |       |     |       |      |      |      |       | 30   | 15    |      |       |    |    |    |    |    |    |
| EU      | Emission Standard |      | EURO1             |       |       | EURO2 |       |     | EURO3 |      |      |      | EURO4 |      | EURO5 |      |       |    |    |    |    |    |    |
|         | S content         | 3000 |                   | 2000  | 500   |       |       | 350 |       |      |      | 50   |       | 10   |       |      |       |    |    |    |    |    |    |
| CHINA   | Emission Standard |      |                   |       |       |       |       |     |       | CHN1 |      |      |       | CHN2 |       | CHN3 | CHN4  |    |    |    |    |    |    |
|         | S content         |      |                   |       | 10000 |       |       |     |       |      | 2000 |      | 500   |      |       |      |       |    |    |    |    |    |    |
| BEIJING | Emission Standard |      |                   |       |       |       |       |     |       | CHN1 |      | CHN2 |       | CHN3 |       | CHN4 | CHN5  |    |    |    |    |    |    |
|         | S content         |      |                   |       |       |       |       |     |       |      |      |      |       | 500  | 350   |      | 50    |    |    |    |    |    |    |



# Fuels and Vehicles Environmental Performance in Russia & CIS States



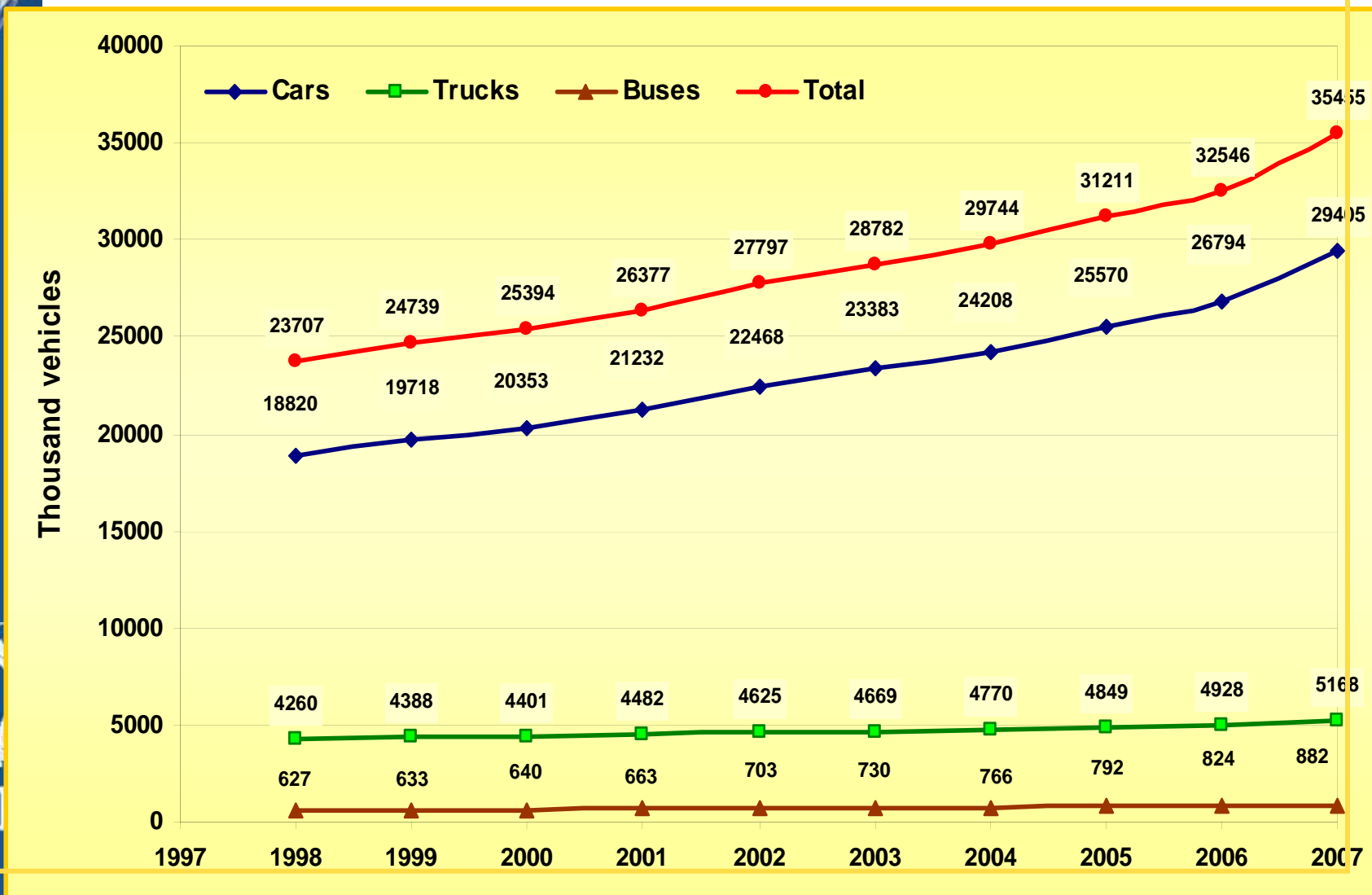
# Commonwealth of Independent States (CIS)

## COMMONWEALTH OF INDEPENDENT STATES - EUROPEAN STATES



UNEP

# Russian vehicle fleet dynamics



## Motor fleet structure by age in CIS countries (cars), %

| Country                            | 0-5  | 6-10 | 11-15 | 16-20 | > 20 |
|------------------------------------|------|------|-------|-------|------|
| Uzbekistan                         | 11.0 | 13.0 | 22.0  | 26.0  | 28.0 |
| Russia                             | 21.6 | 27.7 | 50.7  |       |      |
| Turkmenistan                       | n/d  | n/d  | n/d   | n/d   | n/d  |
| Moldova                            | 8.9  | 10.8 | 25.8  | 27.5  | 27.0 |
| Kazakhstan                         | n/d  | n/d  | n/d   | n/d   | n/d  |
| Kyrgyzstan<br>(all motor vehicles) | 1.6  | 6.3  | 21.4  | 70.7  |      |
| Georgia                            | 4.4  | 12.2 | 26.3  | 24.6  | 32.5 |
| Azerbaijan                         | 15.8 | 26.2 | 58.0  |       |      |
| Armenia                            | n/d  | n/d  | n/d   | n/d   | n/d  |

n/d - no data



## Motor fleet structure by age in CIS countries (buses), %

| Age                                | 0-5  | 6-10 | 11-15 | 16-20 | > 20 |
|------------------------------------|------|------|-------|-------|------|
| Country                            |      |      |       |       |      |
| Uzbekistan                         | 11.0 | 13.0 | 22.0  | 26.0  | 28.0 |
| Russia                             | 26.2 | 26.8 | 47.0  |       |      |
| Turkmenistan                       | n/d  | n/d  | n/d   | n/d   | n/d  |
| Moldova                            | 2.8  | 9.0  | 25.9  | 37.1  | 25.2 |
| Kazakhstan                         | n/d  | n/d  | n/d   | n/d   | n/d  |
| Kyrgyzstan<br>(all motor vehicles) | 1.6  | 6.3  | 21.4  | 70.7  |      |
| Georgia                            | 2.3  | 1.2  | 38.4  | 36.0  | 22.1 |
| Azerbaijan                         | 11.8 | 20.0 | 68.2  |       |      |
|                                    |      |      |       |       |      |



n/d - no data



## Motor fleet structure by age in CIS countries (trucks and light duty), %

Age

Country

|                                    | 0-5  | 6-10 | 11-15 | 16-20 | > 20 |
|------------------------------------|------|------|-------|-------|------|
| Uzbekistan                         | 2.1  | 7.6  | 26.3  | 64.0  |      |
| Russia                             | 14.0 | 23.5 | 62.5  |       |      |
| Turkmenistan                       | n/d  | n/d  | n/d   | n/d   | n/d  |
| Moldova                            | 3.8  | 18.1 | 22.1  | 29.7  | 26.3 |
| Kazakhstan                         | n/d  | n/d  | n/d   | n/d   | n/d  |
| Kyrgyzstan<br>(all motor vehicles) | 1.6  | 6.3  | 21.4  | 70.7  |      |
| Georgia                            | 2.2  | 9.2  | 18.1  | 43.3  | 27.2 |
| Azerbaijan                         | 7.7  | 15.3 | 77.0  |       |      |
| Armenia                            | n/d  | n/d  | n/d   | n/d   | n/d  |

n/d = no data

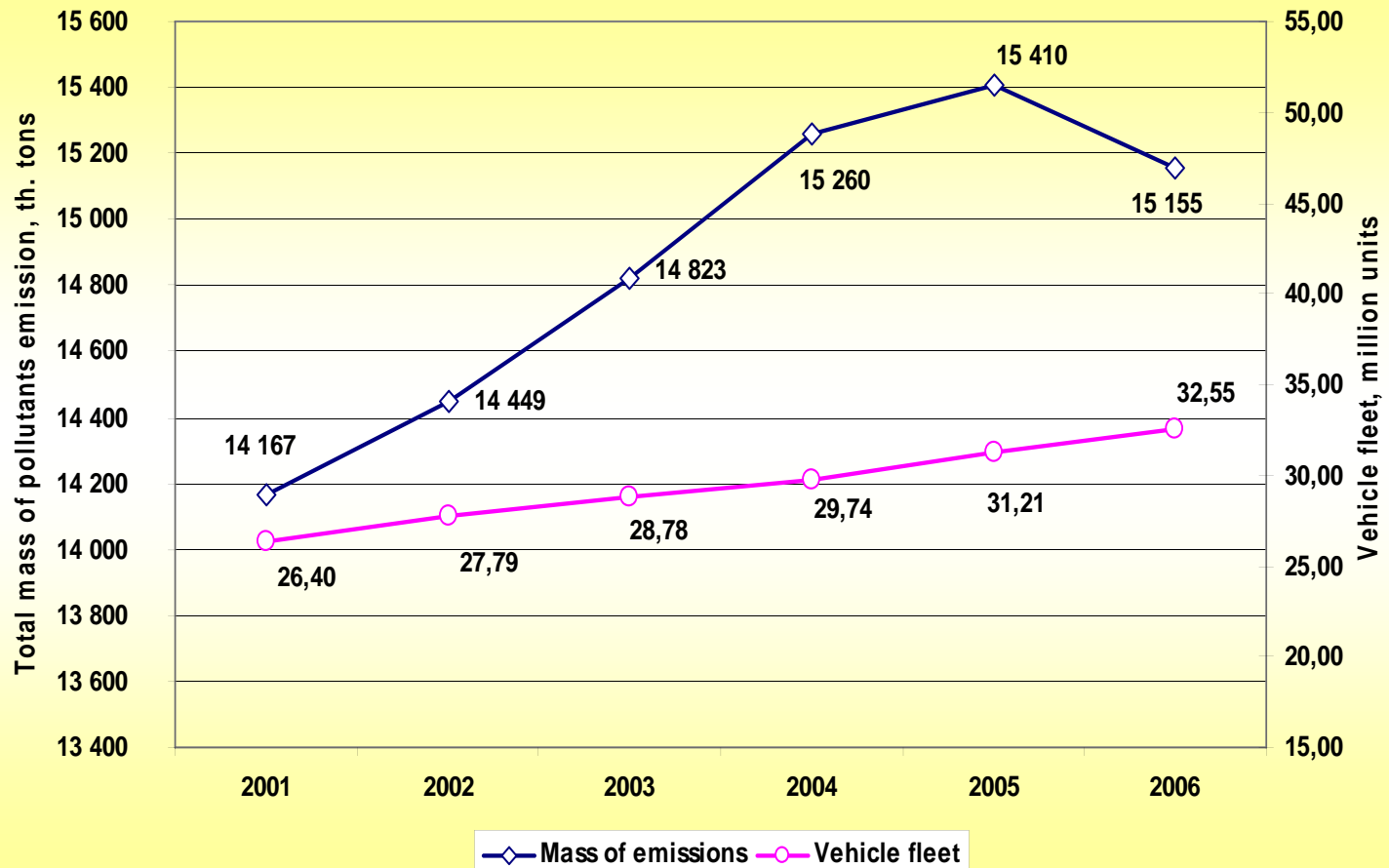




## **Some problems which define negative environmental and health impacts of motor transport in CIS countries**

- Inconsistence between motor fleet growth and development of road infrastructure, resulting in traffic congestion;
- Shortcomings in traffic engineering and control, lack of parking policy in cities;
- Lack of public transport financing, insufficient quality of its services;
- Insufficient rate of vehicle fleet renewal and suboptimal structure of the fleet (mainly concerns truck and bus fleet);
- Insufficient quality of produced and retailed motor fuels, lack of system of "assured provision" of consumers with the appropriate fuel;
- Insufficient use of alternative fuels.

# Dynamics of pollutant emissions by the Russian motor vehicle fleet



# Improvement of vehicle fleets' environmental performance across CIS

| Measures   | Russia  | Uzbekistan  | Turkmenistan                         |
|--|---|---|--------------------------------------|
| Ban on production and import of vehicles not complying with EURO requirements        | from 01.01.06 ≥ EURO-2<br>from 01.01.08 ≥ EURO-3<br>from 01.01.10 ≥ EURO-4<br>from 2014 ≥ EURO-5 (cars) | from 01.03.07 ≥ EURO-2<br>from 01.01.10 ≥ EURO-3<br>(import only) | -                                    |
| Ban on sale of the new cars without catalytic converters                             | from 01.01.06   | -   | -                                    |
| Availability of emission standards for:  |   |   |                                      |
| • new motor vehicles (produced and imported)   | UN ECE Requirements   | UN ECE Requirements   |                                      |
| • vehicles in operation  | New national standards harmonized with EU Directive   | Russian standards (previous version)                              | Russian standards (previous version) |
| Mandatory environmental technical inspection   | +   | +   | +                                    |
| Tax differentiation  | -   | -   | -                                    |
| Subsidies  | -   | -   | -                                    |
| Programmes for vehicle fleet modification  | +   | +   | planned                              |
| Ban on access of motor vehicles not complying with EURO requirements to city centres | +   | -   | -                                    |
| Renewal of bus fleet with EURO-2+ vehicles   | +   | +   | +                                    |
| Programmes for transfer to CNG and other alternative fuels                           | +   | no data   | planned                              |



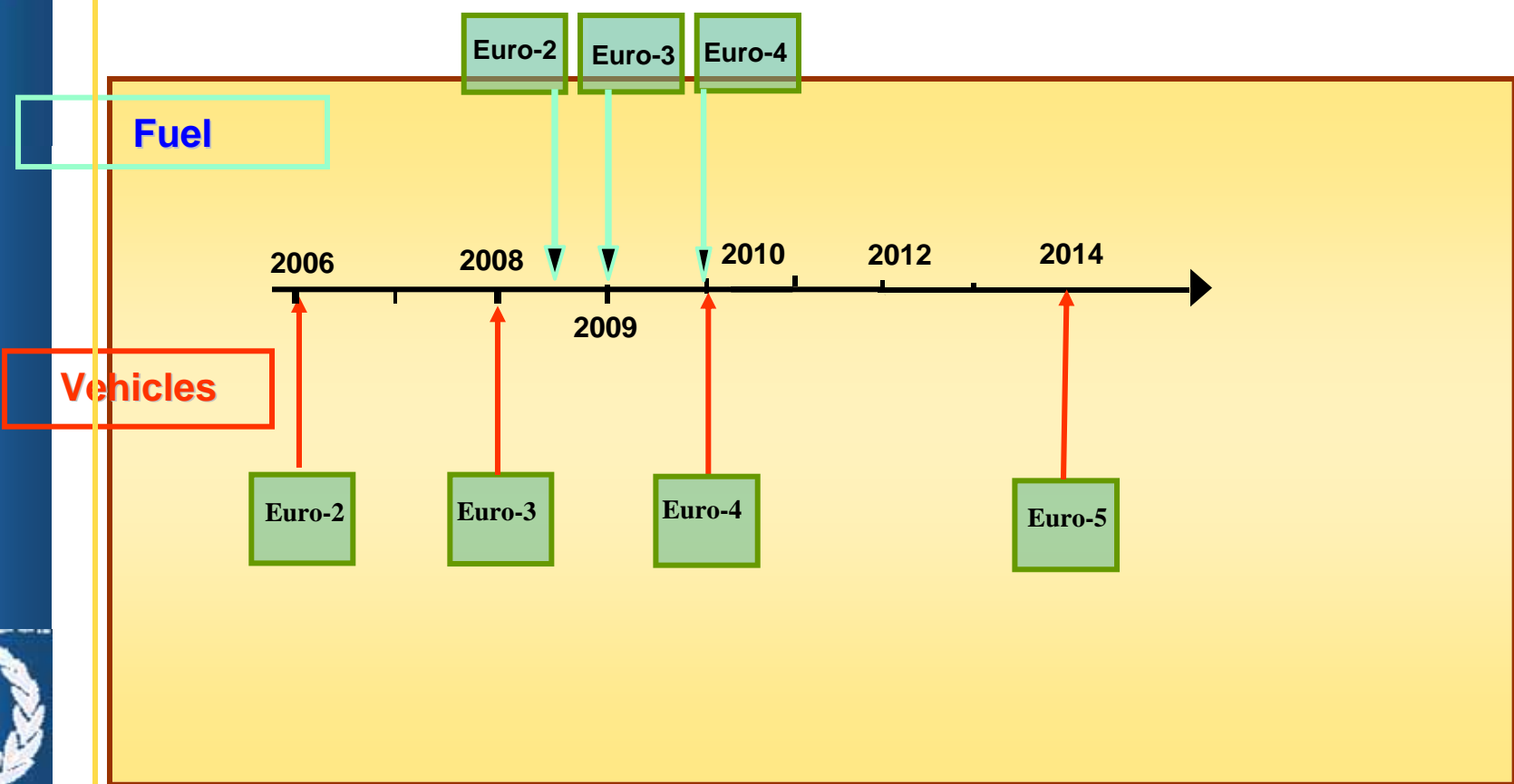
# Improvement of vehicle fleets' environmental performance across CIS

| Measures   | Moldova  | Kazakhstan  | Kyrgyzstan   |
|--|--|---|--|
| Ban on production and import of vehicles not complying with EURO requirements        | Age restrictions for imported vehicles:<br><ul style="list-style-type: none"> <li>• cars <math>\leq 7</math> years</li> <li>• trucks <math>\leq 10</math> years</li> </ul> | from 01.01.09 $\geq$ EURO-2<br>from 01.01.11 $\geq$ EURO-3<br>from 01.01.14 $\geq$ EURO-4 | Age restrictions for imported vehicles under consideration |
| Ban on sale of the new cars without catalytic converters                             | -  | -   | -  |
| Availability of emission standards for:  |  |   |  |
| • new motor vehicles (produced and imported)   | -  | -   | -  |
| • vehicles in operation  | Russian standards (previous version)   | Russian standards (previous version)  | Russian standards (previous version)                       |
| Mandatory environmental technical inspection   | +  | +   | +  |
| Tax differentiation  | -  | -   | -  |
| Subsidies  | -  | -   | -  |
| Programmes for vehicle fleet modification  | -  | no data   | -  |
| Ban on access of motor vehicles not complying with EURO requirements to city centres | -  | -   | -  |
| Renewal of bus fleet with EURO-2+ vehicles   | -  | no data   | -  |
| Programmes for transfer to CNG and other alternative fuels                           | +  | no data   | -  |

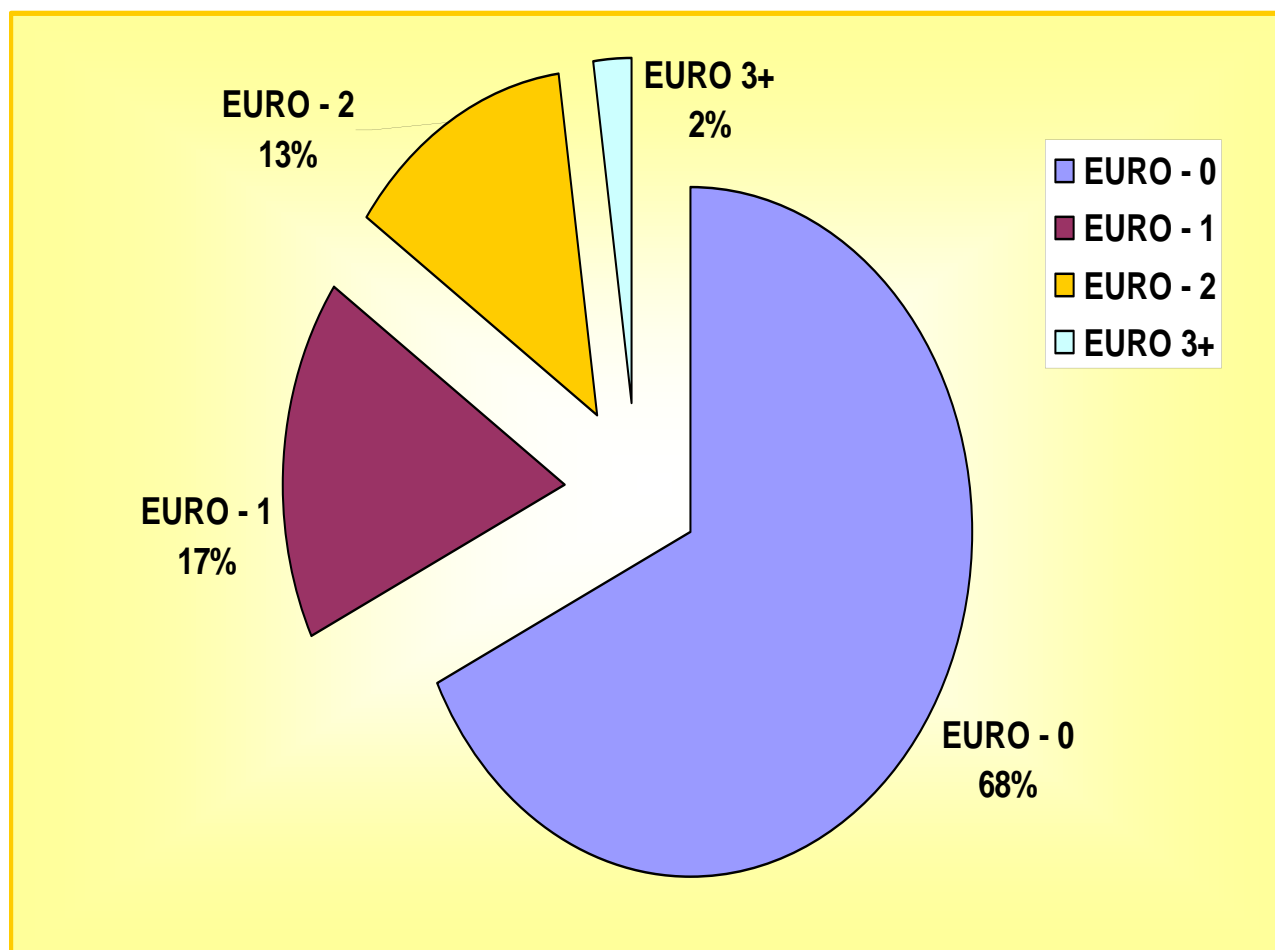
# Improvement of vehicle fleets' environmental performance across CIS

| Measures   | Georgia | Azerbaijan   | Armenia   |
|--|---------|--|---|
| Ban on production and import of vehicles not complying with EURO requirements        | no data | Decree on age restrictions for imported vehicles is being prepared | Ban on import of motor vehicles without catalytic converters since 01.01.07<br>Maximum permitted age of small buses and taxis is 15 years |
| Ban on sale of the new cars without catalytic converters                             | no data | -  | -   |
| Availability of emission standards for:  |         |  |   |
| • new motor vehicles (produced and imported)   | -       | -  | -   |
| • vehicles in operation  | -       | Russian standards (previous version)                               | no data   |
| Mandatory environmental technical inspection   | -       | +  | +   |
| Tax differentiation  | -       | -  | +   |
| Subsidies  | -       | -  | -   |
| Programmes for vehicle fleet modification  | -       | -  | -   |
| Ban on access of motor vehicles not complying with EURO requirements to city centres | -       | -  | -   |
| Renewal of bus fleet with EURO-2+ vehicles   | -       | -  | -   |
| Programmes for transfer to CNG and other alternative fuels                           | -       | no data  | planned   |

# Schedule of introduction of environmental requirements to motor vehicles and fuels in Russia



## Russian bus fleet structure by environmental class (2006)



# Main environmental parameters of motor fuel in Russia

| Parameter   | Unit               | Environmental class and duration of requirements |                              |                              |                              |
|---|--------------------|--|------------------------------|------------------------------|------------------------------|
|   |                    | EURO-2<br>(up to 31.12.2008)                     | EURO-3<br>(up to 31.12.2009) | EURO-4<br>(up to 31.12.2012) | EURO-5<br>(up to 31.12.2017) |
| <b>PETROL</b>                                       |                    |  |                              |                              |                              |
| Maximum sulfur content                              | ppm                | 500  | 150                          | 50                           | 10                           |
| Maximum volume fraction of aromatics                | %                  | -  | 42                           | 35                           | 30                           |
| Maximum volume fraction of unsaturated hydrocarbons | %                  | -  | 18                           | 18                           | 15                           |
| Maximum volume fraction of benzene                  | %                  | 5  | 1,0                          | 1,0                          | 1,0                          |
| Maximum lead concentration                          | mg/dm <sup>3</sup> | < 5  | < 5                          | < 5                          | < 5                          |
| <b>DIESEL FUEL</b>                                  |                    |  |                              |                              |                              |
| Maximum sulfur content                              | ppm                | 500  | 350                          | 50                           | 10                           |
| Minimum cetane number                               |                    | 45   | 51                           | 51                           | 51                           |
| Maximum mass fraction of aromatics                  | %                  | -  | 11                           | 11                           | 10                           |

\* The appropriate Technical Regulation was adopted by the Government in February 2008, and will come into force after six months.





The African Refiners Association is a continent-wide association uniting 40 of the 44 oil refineries operating in Africa as members or associate members. The following are ARA's members:

- CALREF - South Africa
- CORAF - Congo
- Egyptian General Petroleum Corporation - Egypt
- Engen - South Africa
- Fina Petroleos - Angola
- INDEMI Petroleum Company Ltd - Zambia
- Khartoum Refinery Co Ltd - Sudan
- KIPREL - Kenya
- MIDOR - Egypt
- NAFTEC - Algeria
- NARDREF - South Africa
- NNPC - Nigeria
- NOC-Libya - Libya
- PetroSA - South Africa
- Samir Mohammedia Refinery - Morocco
- SAR - Senegal
- SIR - Côte d'Ivoire
- SMB - Côte d'Ivoire
- Société Congo-Italienne de Raffinage (SOCIR) - Democratic Republic of Congo
- SOGARA - Gabon
- SoNaRa - Cameroon
- TOR - Ghana



# First Principles

Public policy to attain air quality objectives should be based on the principles of:

- Sound science
- Cost effectiveness
- A rational approach to air quality planning

Logical steps:

- Remove lead to enable catalytic converters
- Fit catalytic converters
- Start to reduce Sulphur
- Focus on cities to improve air quality





# The benefits of the banded system

The adoption of the banded system provides a clear 'road map' to countries wishing to improve their fuel quality in association with improvements in vehicle technology in their region.....

.....but

It is important to let the individual countries and regions (including JV refiners) decide at what rate they wish to introduce these changes

# The 'AFRI' proposal

A series of steps defining 'core' parameters:

Gasoline

- Octane
- Sulphur
- Benzene

Diesel

- Sulphur
- Cetane
- Density

Colour, Metals, Aromatics, RVP, Oxygenates, etc. to be set by the countries and regions involved

Rate of change must be determined by individual countries



# AFRI specifications

| <b>GASOLINE</b>                      |                |                |               |               |
|--------------------------------------|----------------|----------------|---------------|---------------|
|                                      | <b>AFRI-1</b>  | <b>AFRI-2</b>  | <b>AFRI-3</b> | <b>AFRI-4</b> |
| RON, min*                            | 91             | 91             | 91            | 91            |
| MON, min                             | 81             | 81             | 81            | 81            |
| Lead content**                       | Unleaded       | Unleaded       | Unleaded      | Unleaded      |
| Sulphur content, mass %, max         | 0.1            | 0.05           | 0.03          | 0.015         |
| Benzene content, vol %, max          | to be reported | to be reported | 5             | 1             |
| <b>DIESEL</b>                        |                |                |               |               |
|                                      | <b>AFRI-1</b>  | <b>AFRI-2</b>  | <b>AFRI-3</b> | <b>AFRI-4</b> |
| Sulphur content, mass %, max         | 0.8            | 0.35           | 0.05          | 0.005         |
| Density at 20°C, kg/litre (min/max)  | 800/890        | 800/890        | 800/890       | 820/880       |
| Cetane index (calculated), min       | 42             | 45             | 45            | 45            |
| Lubricity (HFRR @ 60°C), micron, min | to be reported | to be reported | 460           | 460           |

\*A higher grade of gasoline may be marketed if required

\*\* 'Unleaded' means <0.013g of lead per litre





# Specific Recommendations From Break Out Work Group

Once Each Country Shifts To Lead Free  
Petrol

- All Imported Cars Must Have a Functioning Catalyst
- At Least Simple I/M Test To Check

Once 500 PPM Sulfur

- All New Vehicles Meet Euro 2 Equivalent Standards

Once 50 PPM Sulfur

- All New Vehicles Meet Euro 4 Equivalent Emissions Standards



# Recommendations From Work Group (2)

## Mandate I/M Program

- Taxis & High Mileage Vehicles SemiAnnual
- Require Failing Vehicles To Be Fixed
- Gradual Phase In
- Encourage Scrappage of Old/High Polluting Cars

## Encourage Scrappage (**30 Year Old Taxis in Egypt**)

Transportation Controls To Minimize Discretionary Driving (Parking Fees, Congestion Pricing)

Public Awareness Campaigns Critical





# Activities on Pollution & Energy 2

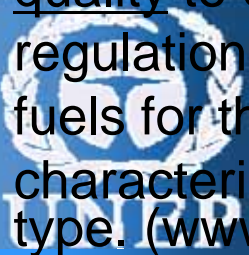
## **The World Forum's Round Table on Fuel Quality (15 November 2007):**

The Round Table clearly showed that there is a close link between the market fuel quality and the emissions of pollutants from motor vehicles.

A further reduction of emissions through more stringent emission regulations requires more advanced emission control technologies, which drives the crucial need for improved fuel quality. The World Forum concluded to set up a new GRPE working group on Fuel Quality.

([www.unece.org/trans/main/wp29/wp29wgs/wp29gen/RoundTable.html](http://www.unece.org/trans/main/wp29/wp29wgs/wp29gen/RoundTable.html))

## **1<sup>st</sup> meeting of the GRPE working group on Fuel Quality (FQ):**



The working group shall develop recommendations on market fuel quality to enable that vehicles, which were tested according to UN regulations or other equivalent regulations and using specific reference fuels for the tests, use in their daily service fuels with specific characteristics relating to the vehicle emission levels and technology type. ([www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/fq01.html](http://www.unece.org/trans/main/wp29/wp29wgs/wp29grpe/fq01.html))



# OICA Proposal

It is therefore recommended (by OICA) that GRPE develop:

a review of the fuel characteristics laid down in the WWFC and international standards (e.g. CEN, ASTM) to justify the setting of the various fuel characteristics;

a simple matrix that would link the level of emission standards (UN-ECE) / emission control technology to fuel quality, and

a recommendation that covers all kinds of road vehicles.

Additionally,

specifications for pure and blended biofuels should be developed.





# "Auto Industry Fuel Quality Needs"

## Gasoline

Eliminate metal additives  
(No Pb, Mn, Fe)  
Eliminate Silicon  
Improve Octane  
Reduce Sulphur  
Control Vapour Pressure  
Control Volatility  
Reduce Benzene  
Improve Detergency  
Control Aromatics and Olefins

## Diesel

Improve Cetane Number and Index  
Control Density, Viscosity, Distillation  
Improve Lubricity  
Reduce Sulphur  
Control Ash  
Improve Cold Flow  
Include Detergency  
Eliminate ethanol in diesel