

Combating air pollution resulting from energy use in Asia

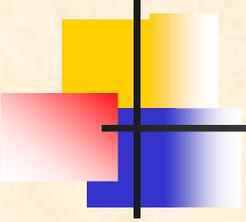
SYMPOSIUM ON SPACE TOOLS FOR MONITORING AP
AND ENERGY USE FOR SUSTAINABLE DEVELOPMENT

12-15 Sept. 2006
Graz, Austria

By Kim Oanh N. T.

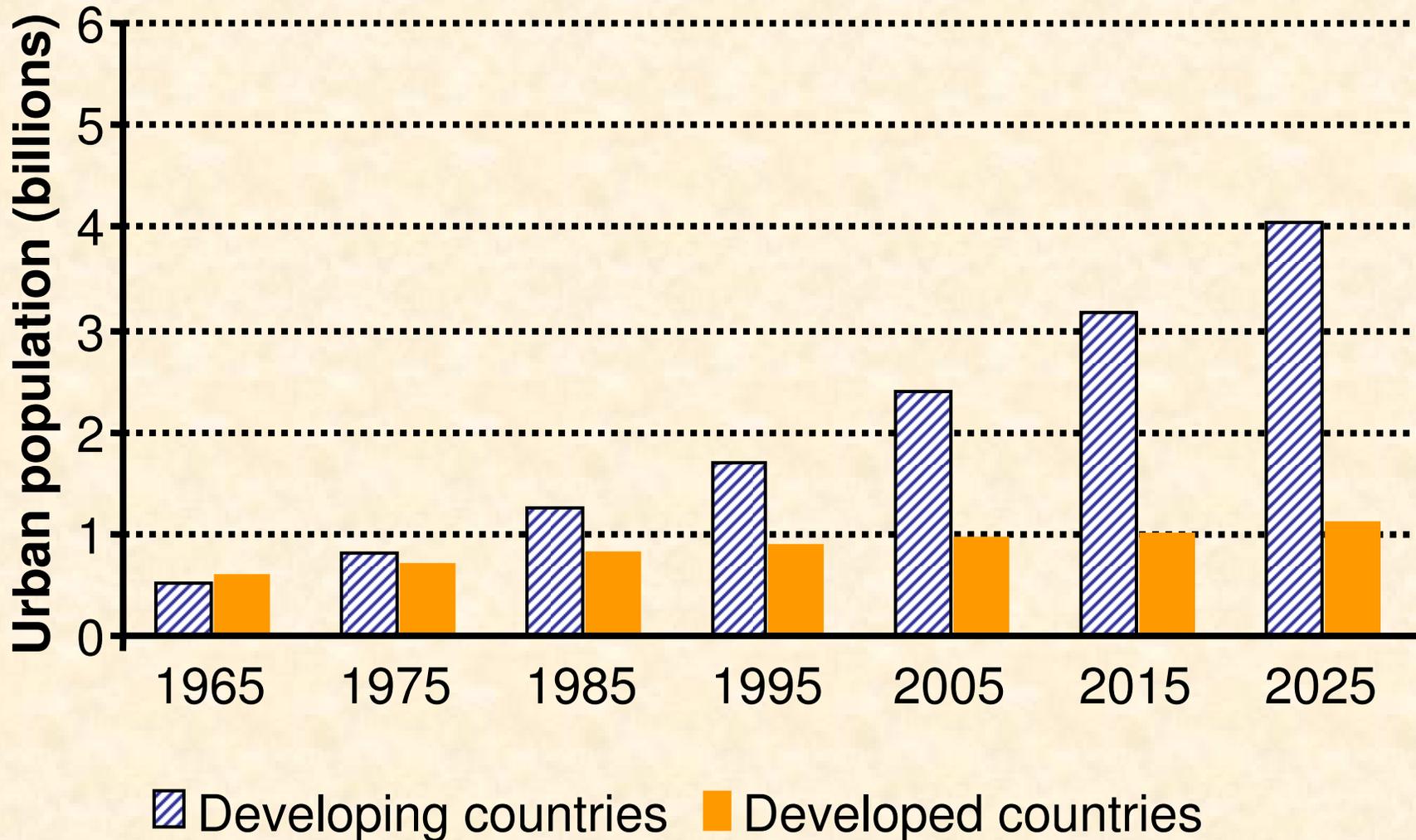
EEM, SERD, Asian Institute of Technology, Thailand

Highlights



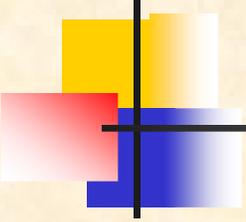
- Some Features of Energy Use in Asia and Air Pollution Emission Sources
- Air pollution status in Asia
- Examples of air quality management efforts in Asia
- Regional/international cooperation for improving air quality in Asia
- Need for large scale monitoring tools

Urban Population Growth



Source: UAQM course, WB (2003)

Baseline scenarios in Asia by WB (2003)

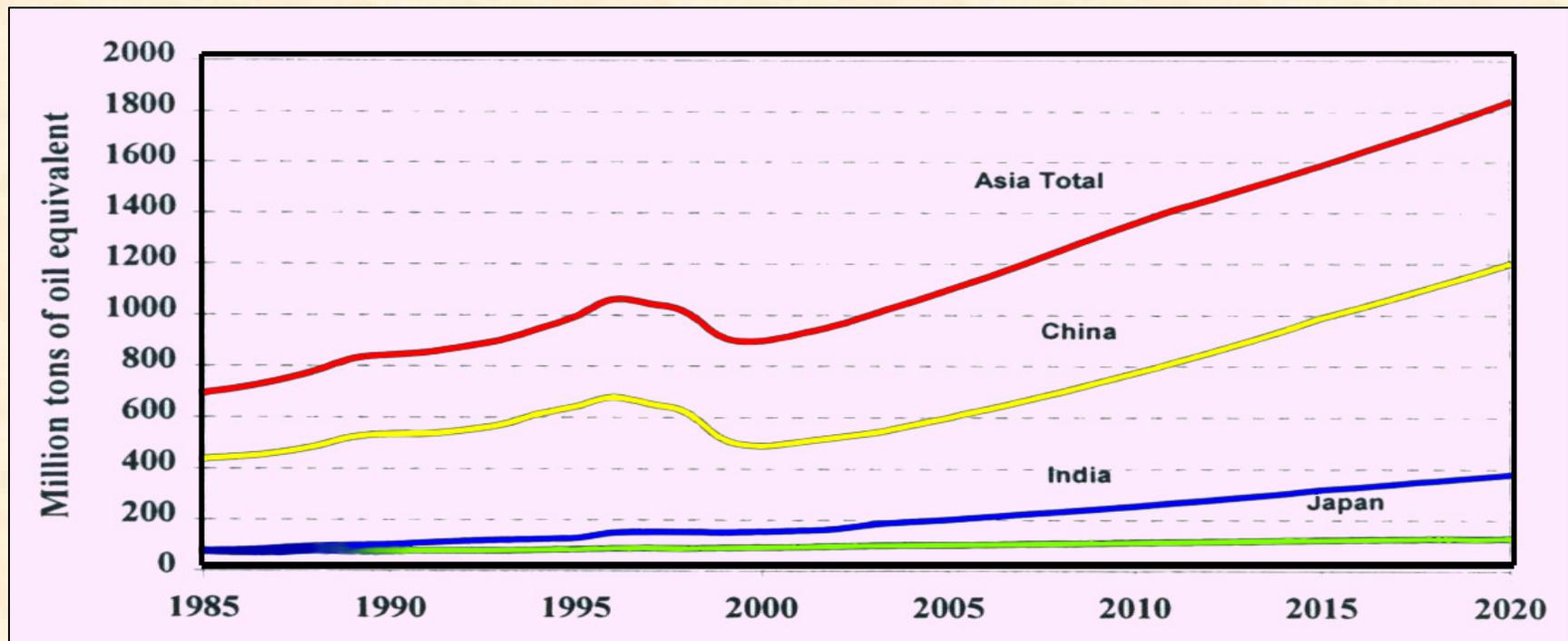


- Urbanization: Urban population will increase from 30% of total population now to 60% by 2025 → increase number of megacities in Asia
- Motorization & Industrialization: Transport and Industrial sectors to grow >10%/ year

Source: UAQM DL course, WB (2003)

Asia total energy consumption: ~ 5.6 billion tce
(37% of world cons. in 2005)

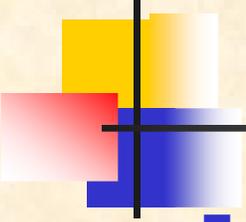
Main share of fuel in Asia: coal (43%), oil (35%)



Asia's coal consumption: 1985-1999 and projected to 2020

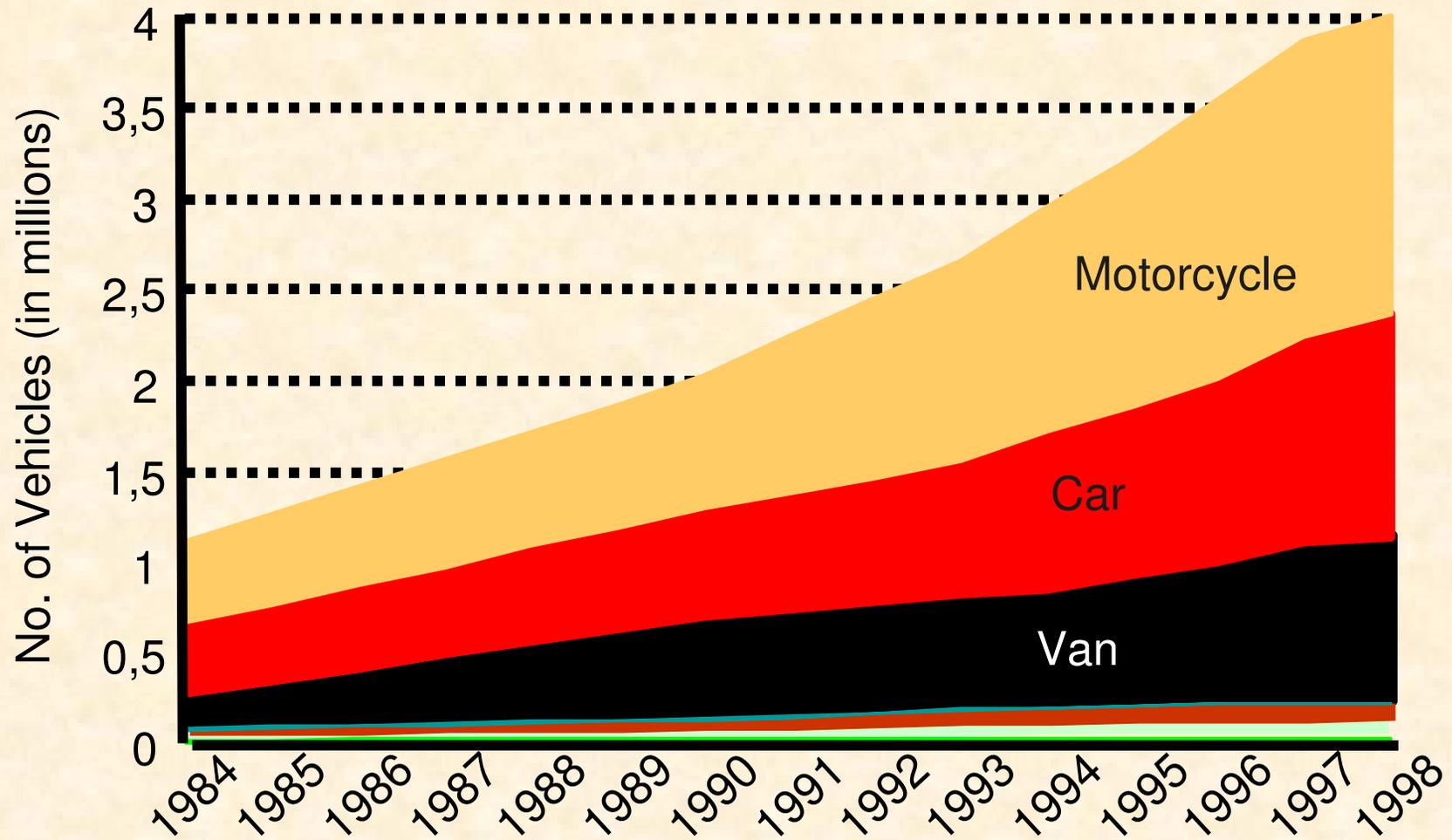
Source: Coal Energy (2000)

Sources of Air Pollution in Asian Developing Countries



- Transport: 60-80% air pollution in urban area
- Power plants, industry: coal-based, limited emission control technology, polluting SMI
- Domestic and commercial fuel burning: solid fuels → indoor air pollution
- Bio-mass and refuse open burning
- Other significant sources:
 - Outdoor cooking, incense burning
 - Open markets, unpaved roads, etc.

Vehicle Growth in Bangkok





Problems: Traffic congestion
Fuel quality
Old and second hand vehicles, etc.
Exhaust control devices (?)

Coal burning industry
Source: WHO (2003)



Brick kiln in Pakistan
CAI-Asia website (2005)

Indoor air pollution from cooking

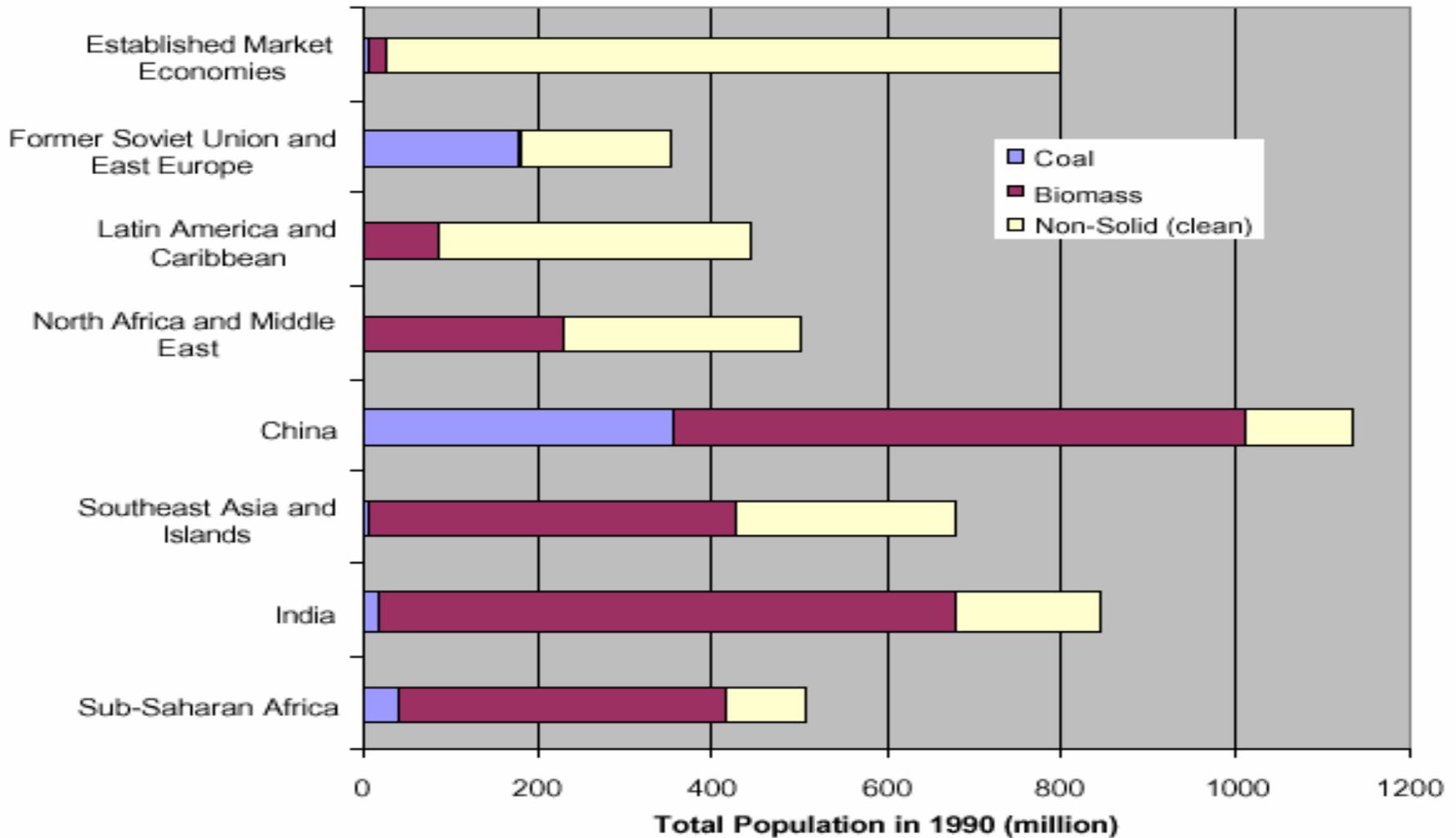


Low quality solid fuel and poor ventilation

→ High indoor air pollution

→ High exposure, especially for women, infants,...

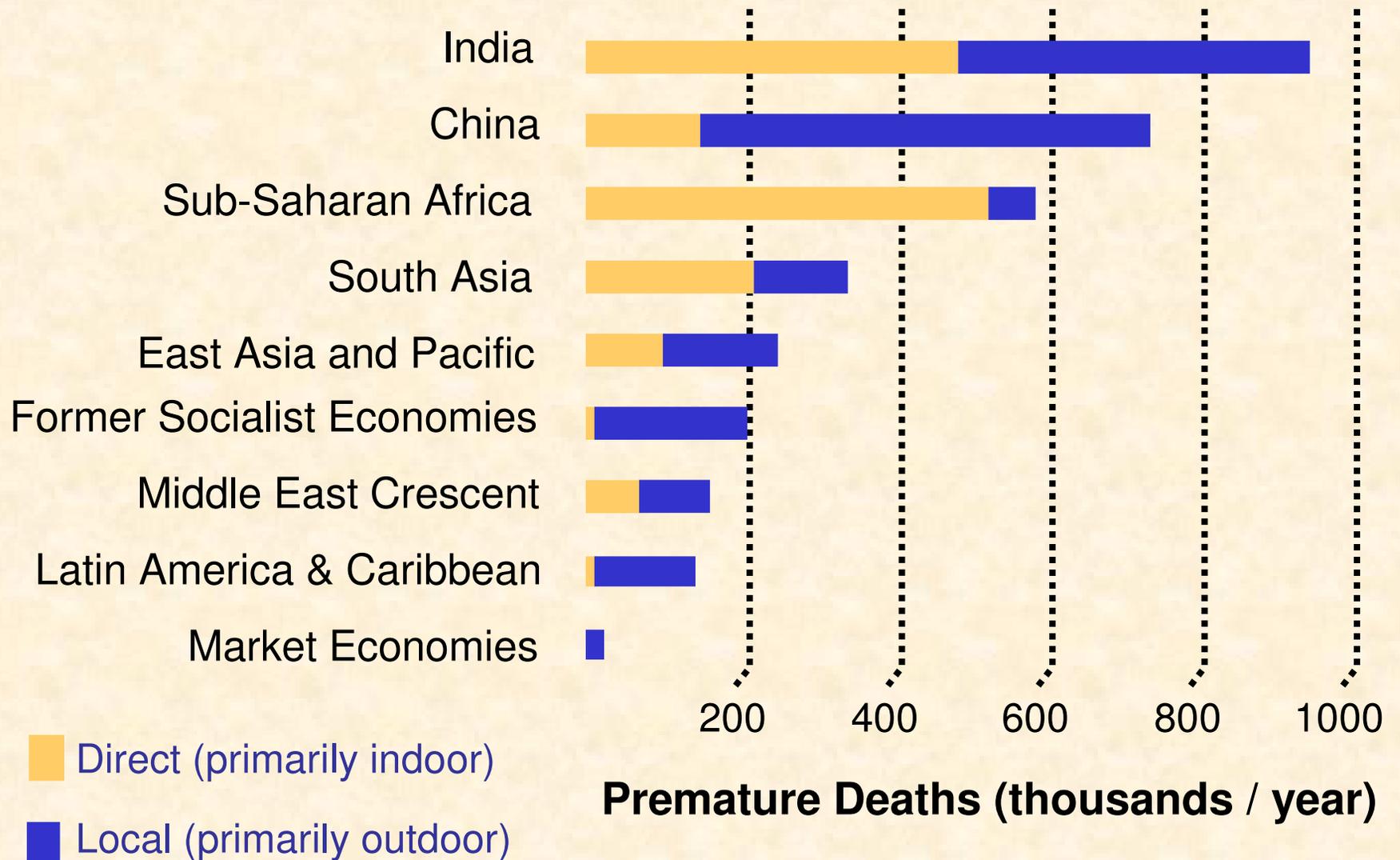
World population using clean and potentially dirty (solid) fuels for household



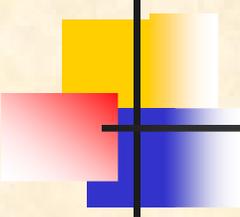
DL UAQM, WB(2003)

Note: Most use of solid fuels in the first two regions is in vented heating stoves.

Premature Deaths Estimated due to Air Pollution



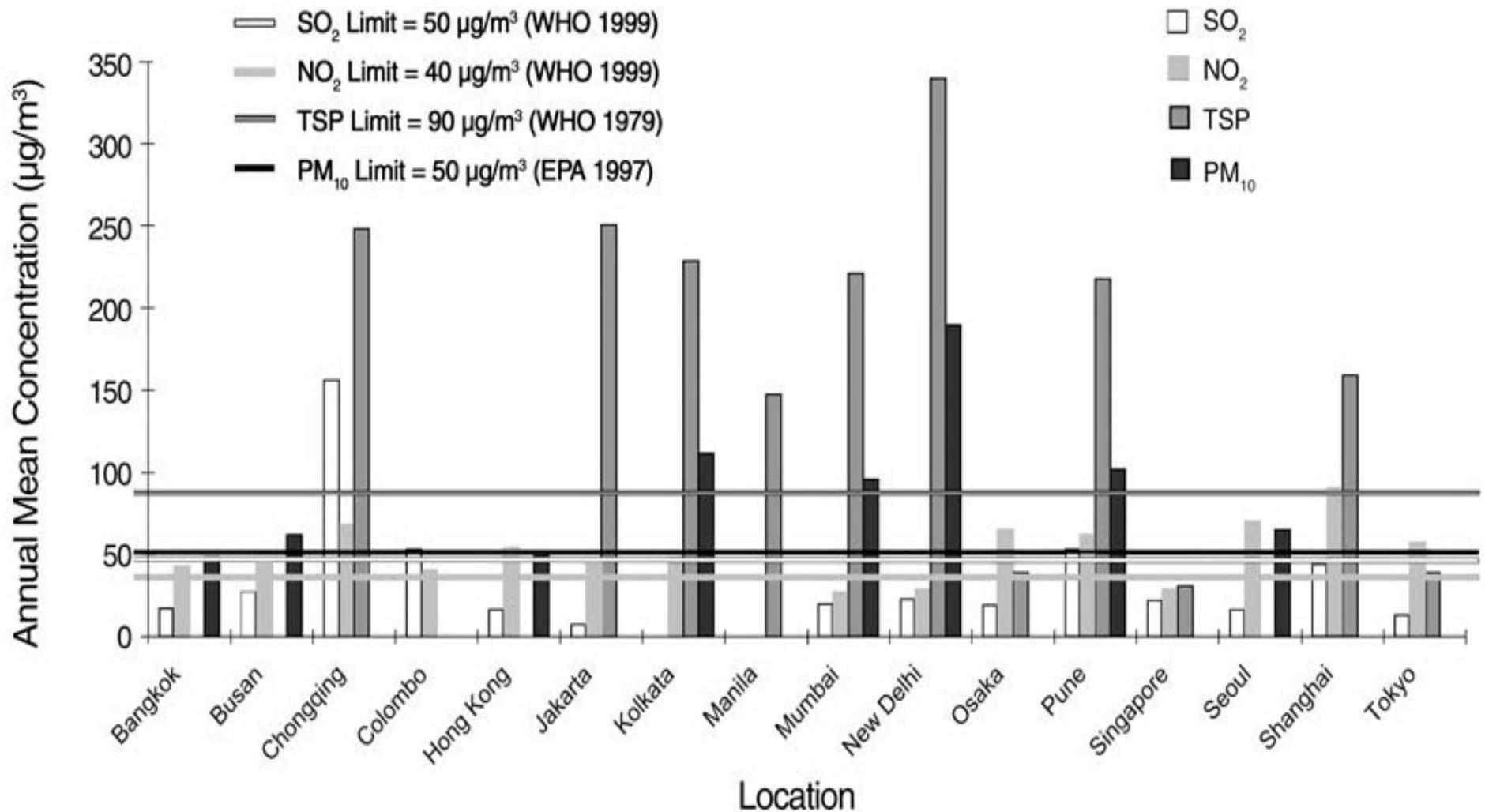
DL UAQM, WB(2003)



Air quality in Asia

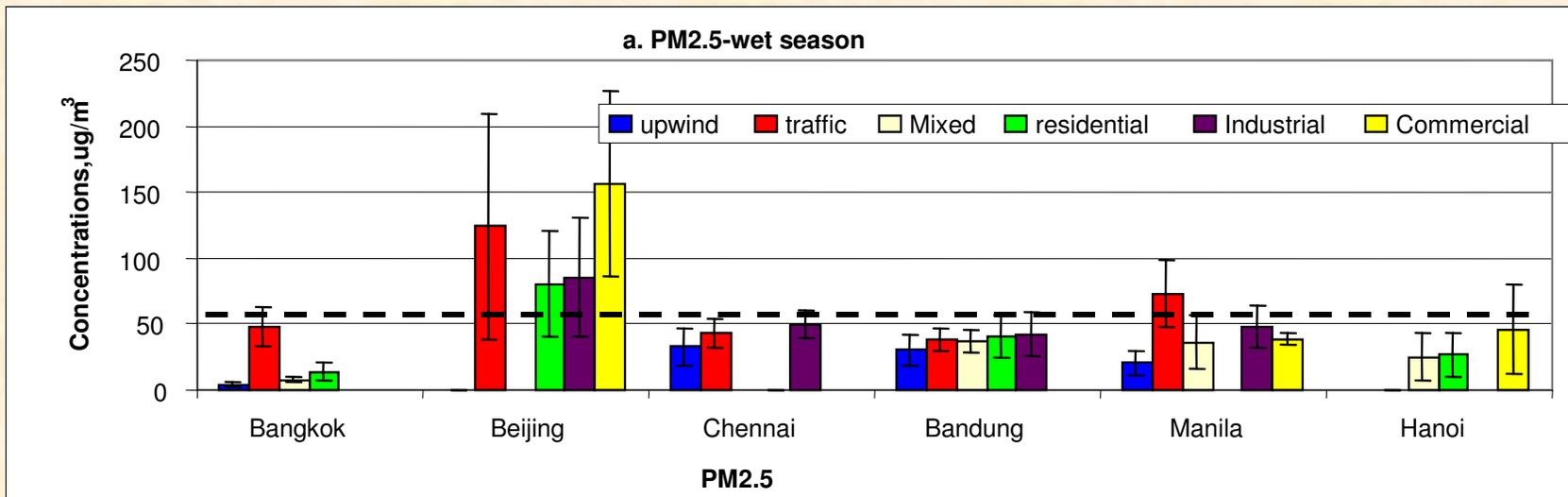
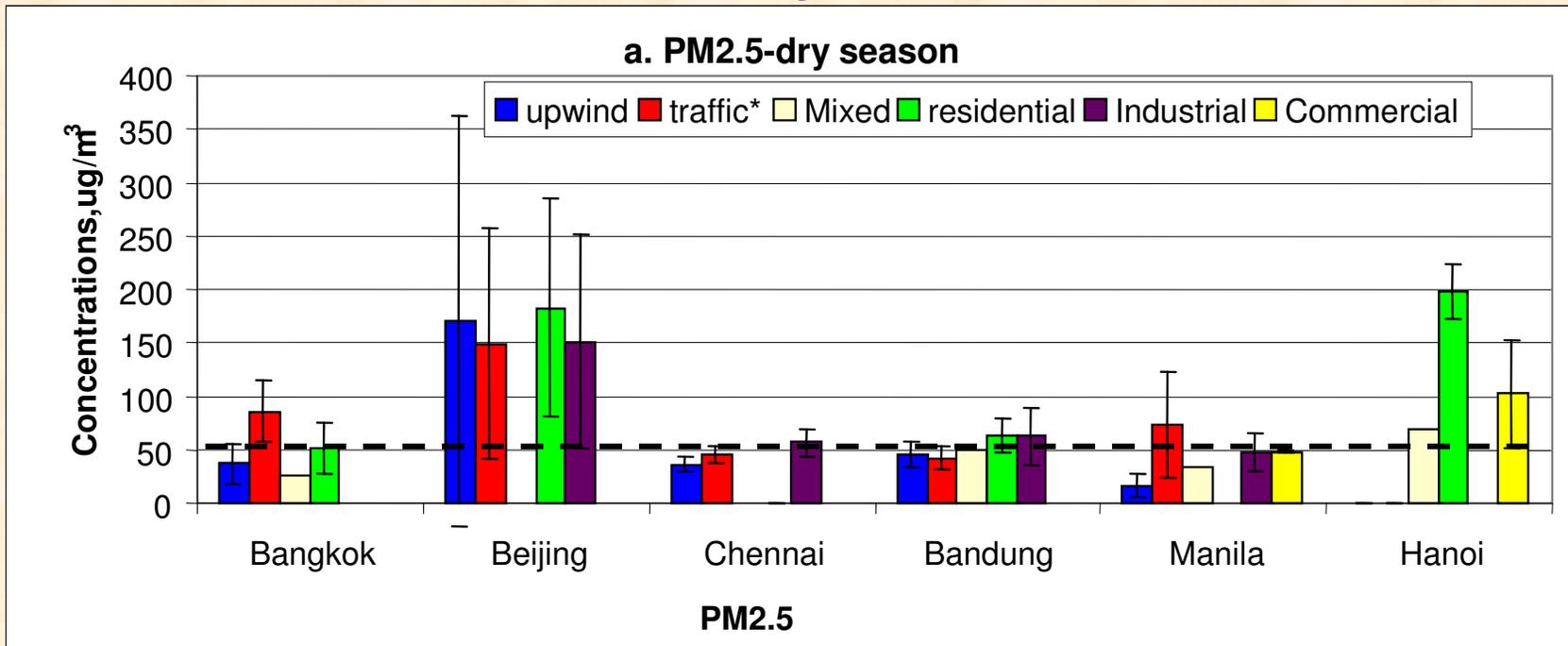
- Air quality is worsening in urban areas
- Particulate matter is most significant
- Ground level ozone is emerging issue in many urban areas
- Pb is reduced thanks to unleaded gasoline
- Indoor air pollution is significant
- ➔ Impact of air pollution on human health and economics is serious but not well studied

Annual mean pollutants concentrations in Asian cities, 2001-2003



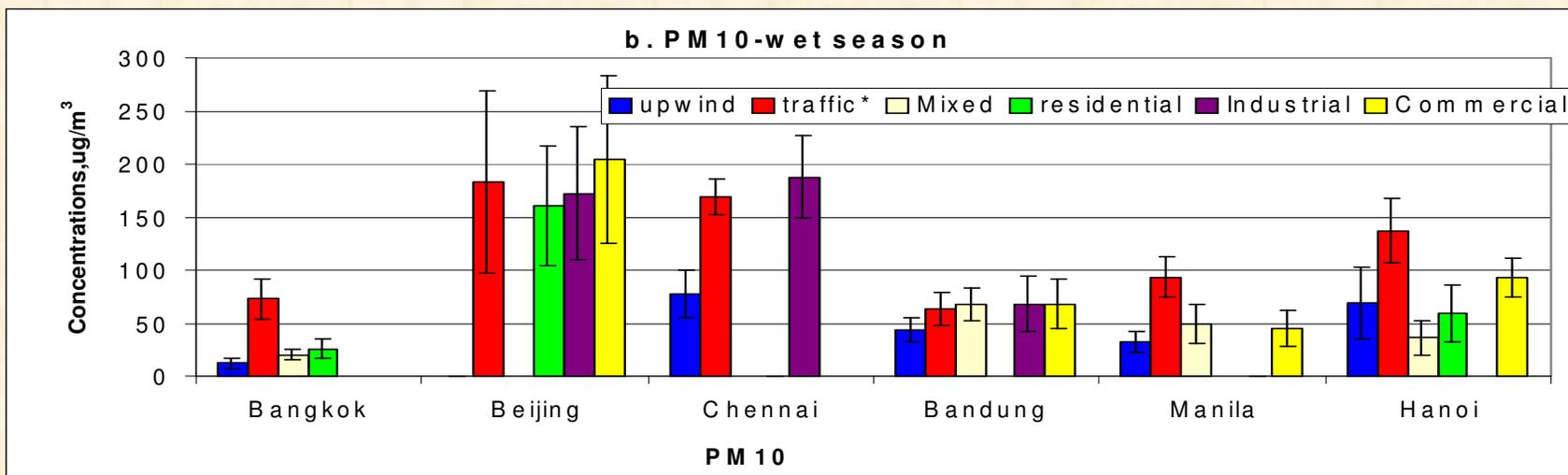
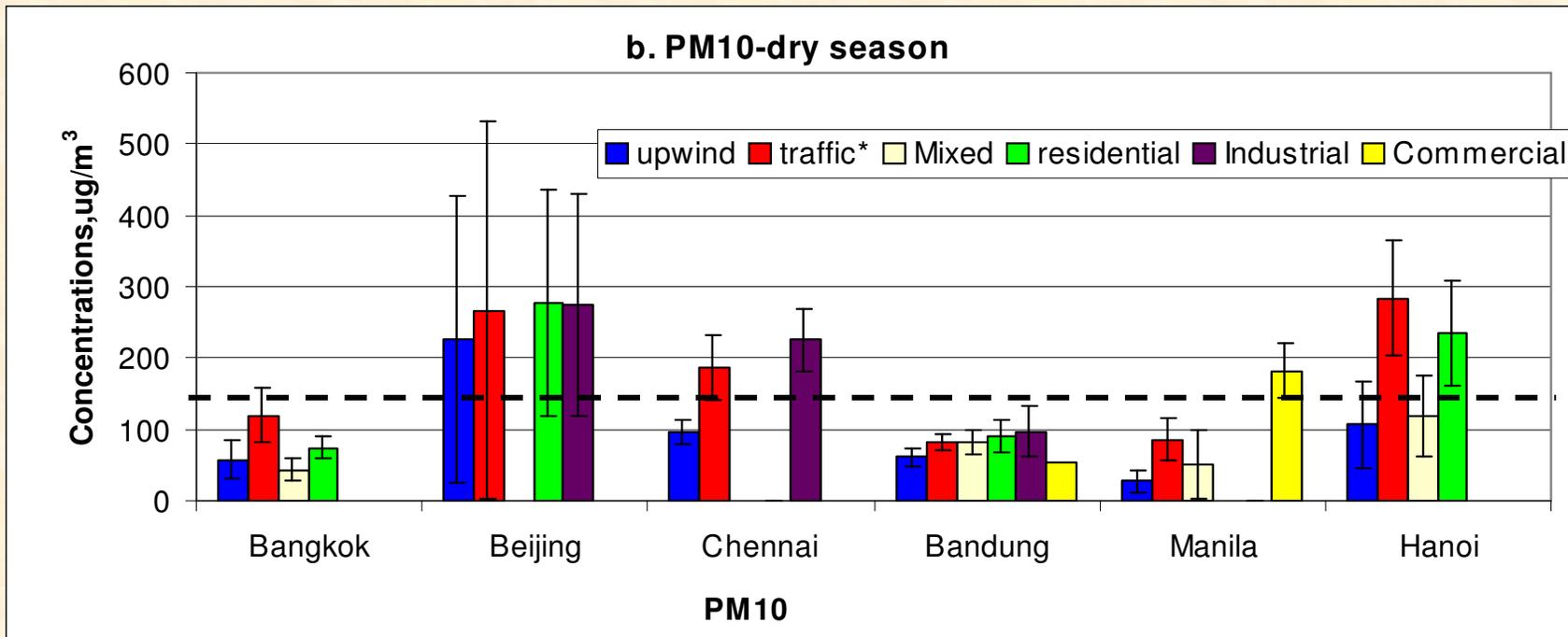
Source: Air Pollution in Mega cities of Asia (KEI, 2004)

AIRPET: Seasonal average PM2.5 in 6 Asian cities



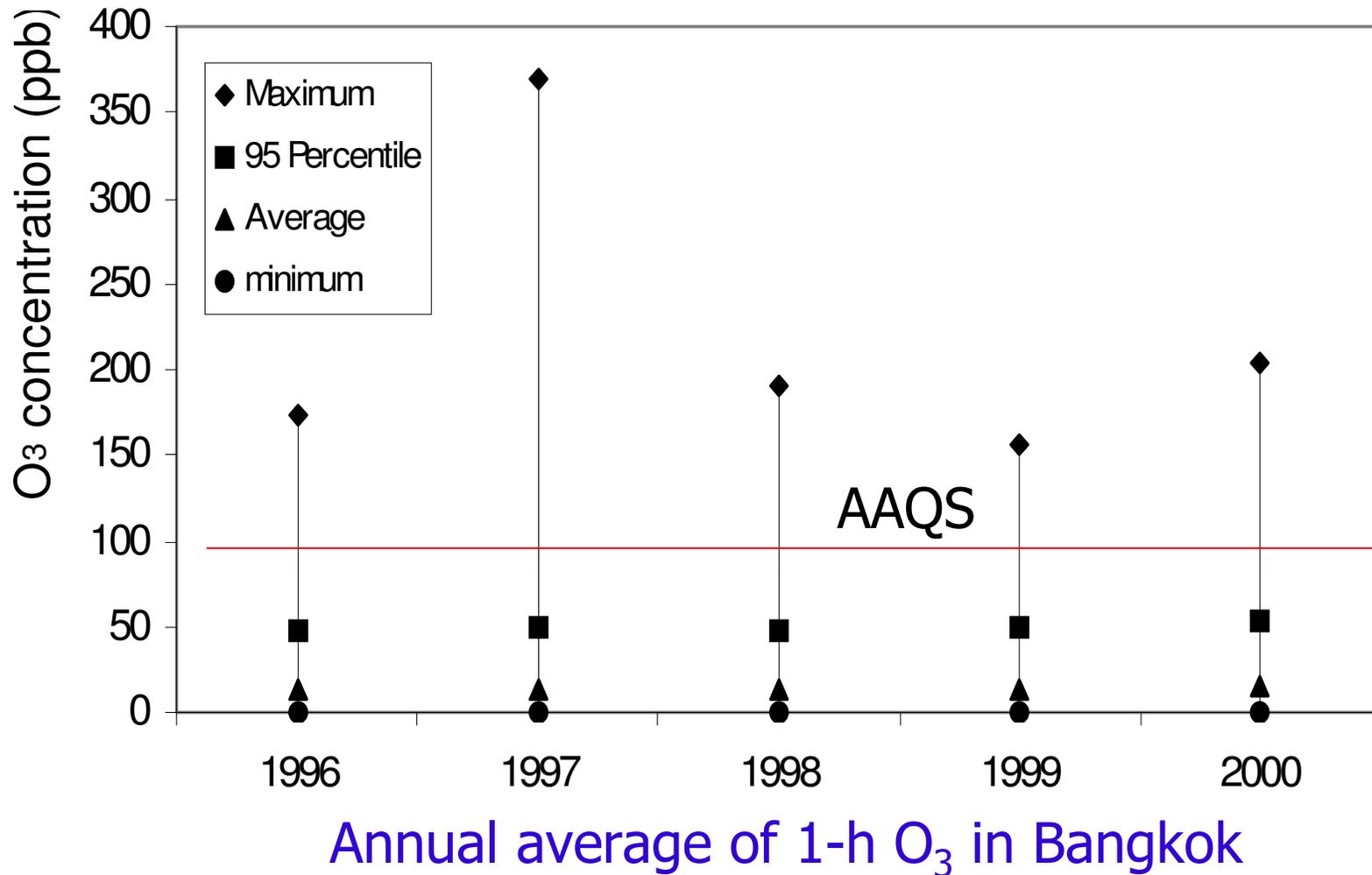
Kim Oanh et al. (2006)

AIRPET: Seasonal average PM10 in 6 Asian cities

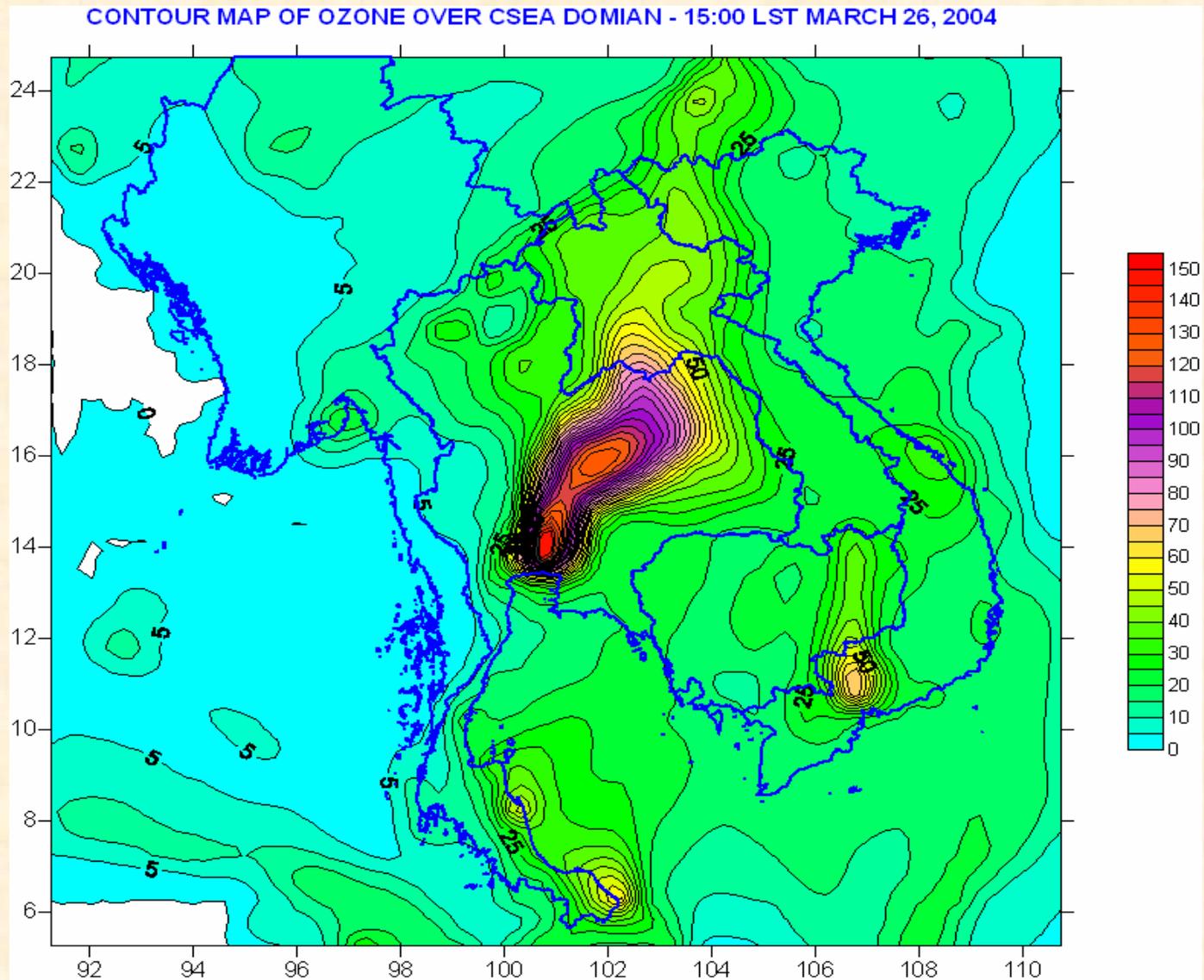


Kim Oanh et al. (2006)

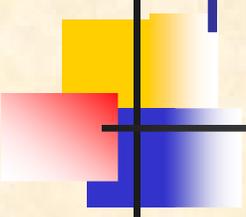
O₃ Pollution Trend in Bangkok



AIT: Simulated O₃ conc. over SEA, CMAQ-MM5



Nghiem and Kim Oanh, 2006

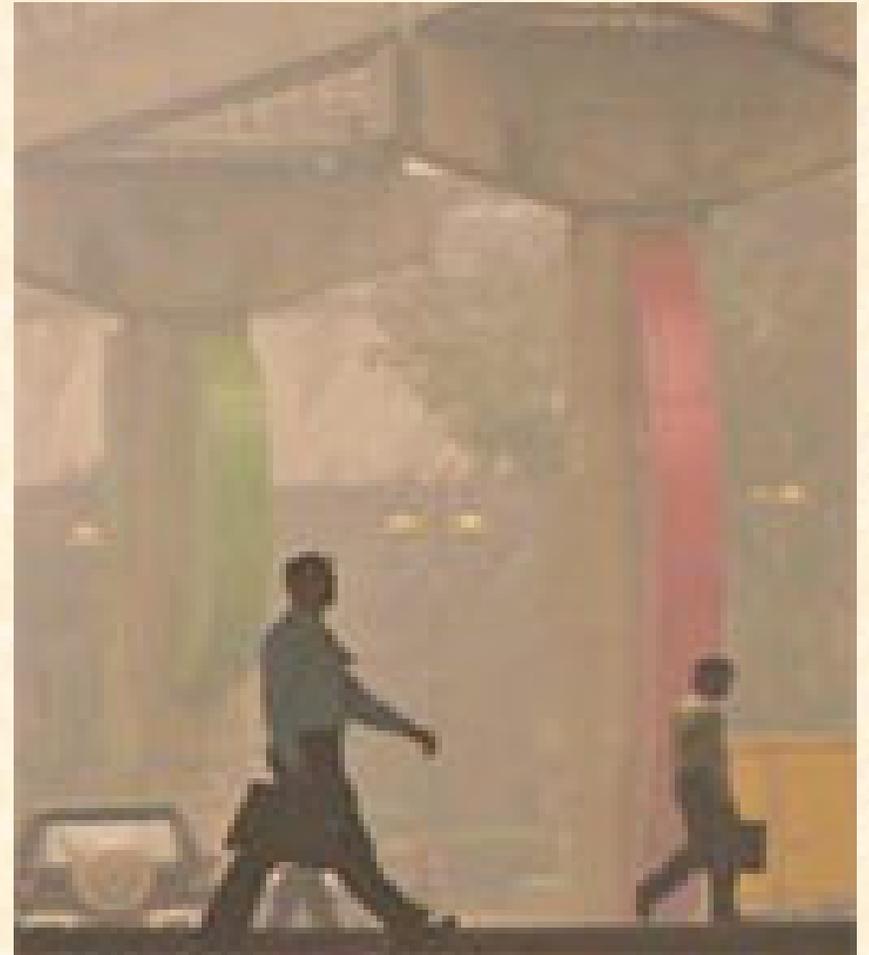


Trans-boundary Air Pollution in Asia

- Acid rain: of increasing concern
- ASEAN Haze from forest fire
- ABC (South Asia Haze): biomass burning and fossil fuel combustion are the main contributors with the man-made sources share $\sim 75\%$ of haze
- Dust storm and effects
- Others of importance: Mercury, POP

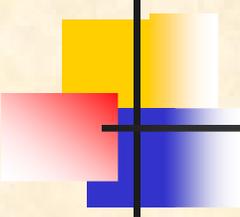


Smoke/haze in Kuching
Malaysia during Indonesia
forest fire in 1997



Yellow haze in Kuala Lumpur,
August 11, 2005
(Forest fires in Sumatra)

Examples of air quality management efforts in Asian developing countries



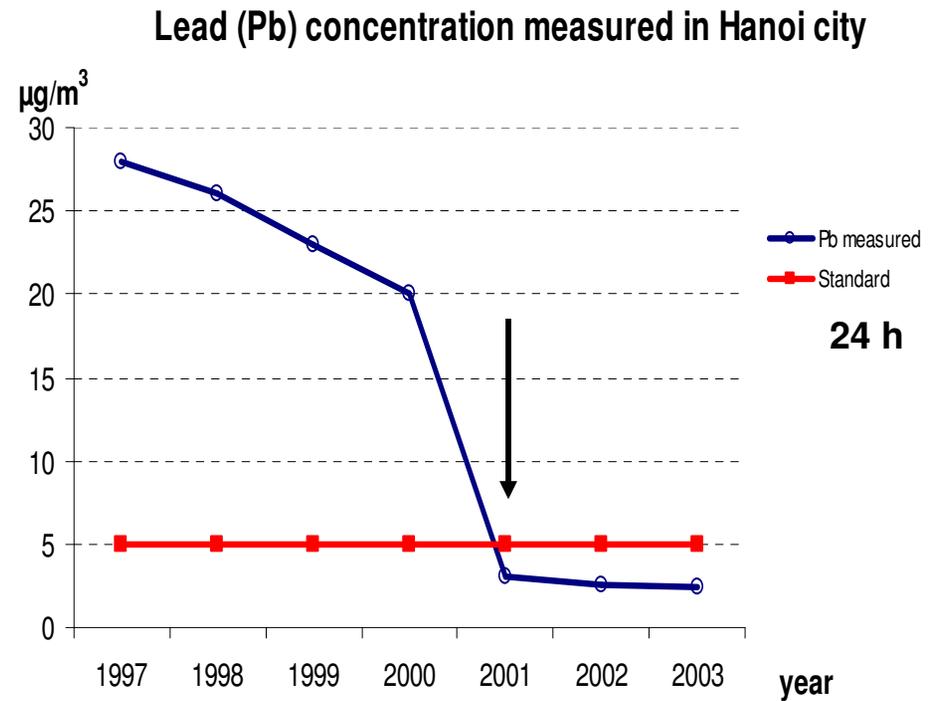
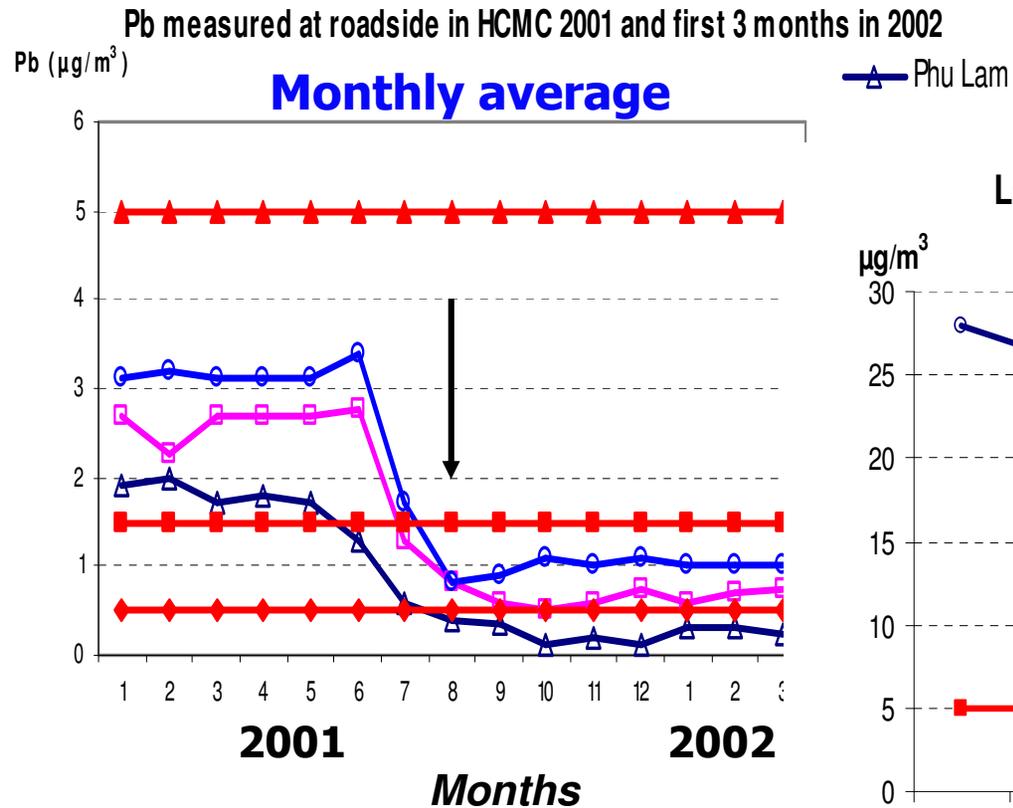
Mobile sources:

- Phasing out leaded gasoline
- Alternative fuels: CNG, biofuels, electric
- Fuel reformulation: S, aromatics content
- Phasing out 2-stroke motorcycles
- 3-W catalyst, PM-trap etc. for new vehicles

Stationary sources:

- Fuel selection
- Flue gas desulfurization, PM control
- Low NO_x burners for new combustion, etc.

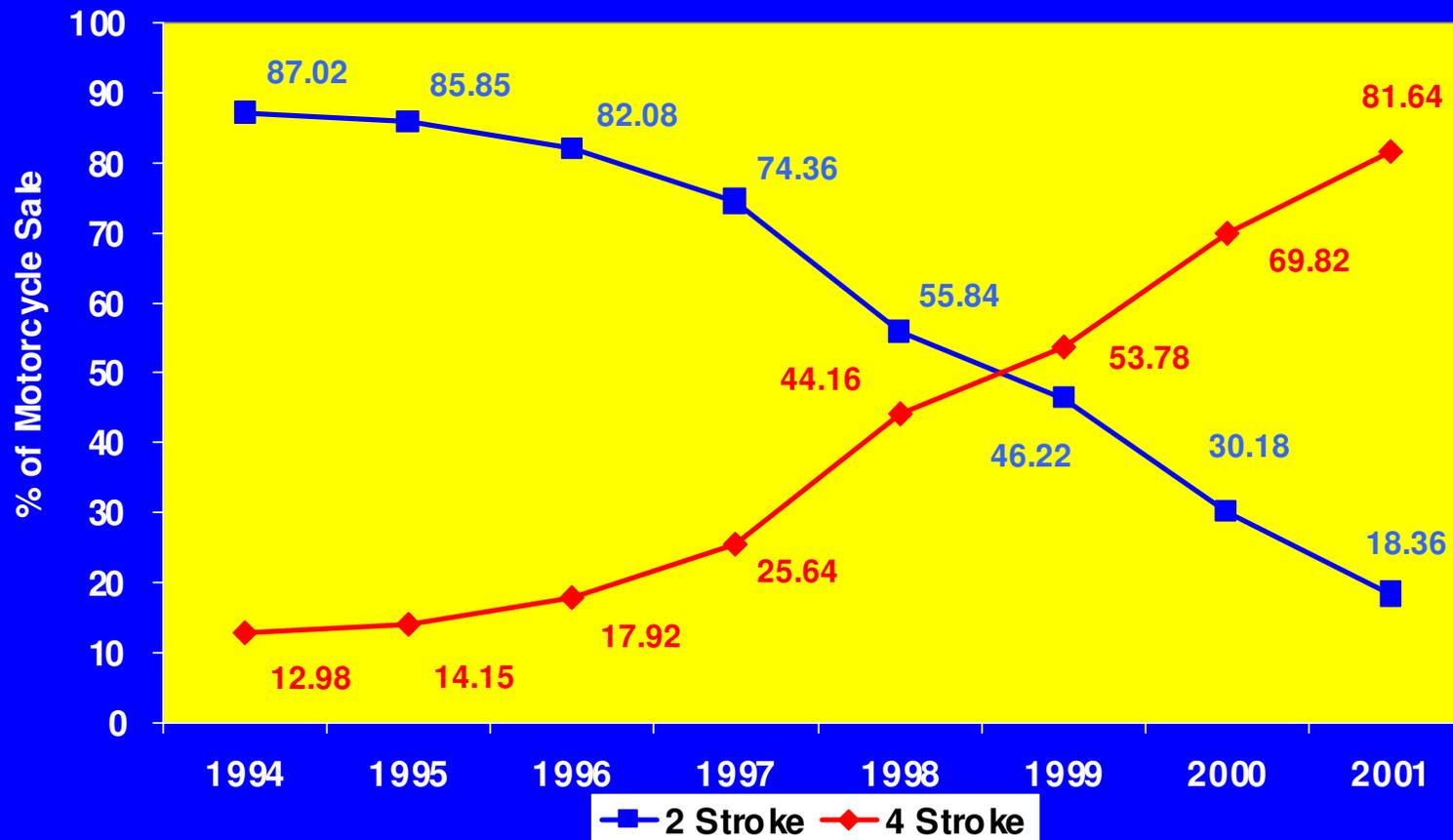
Phase out of leaded gasoline in VN, July 2001



Source: Long, 2005

Phasing out 2-stroke motorcycles in Thailand

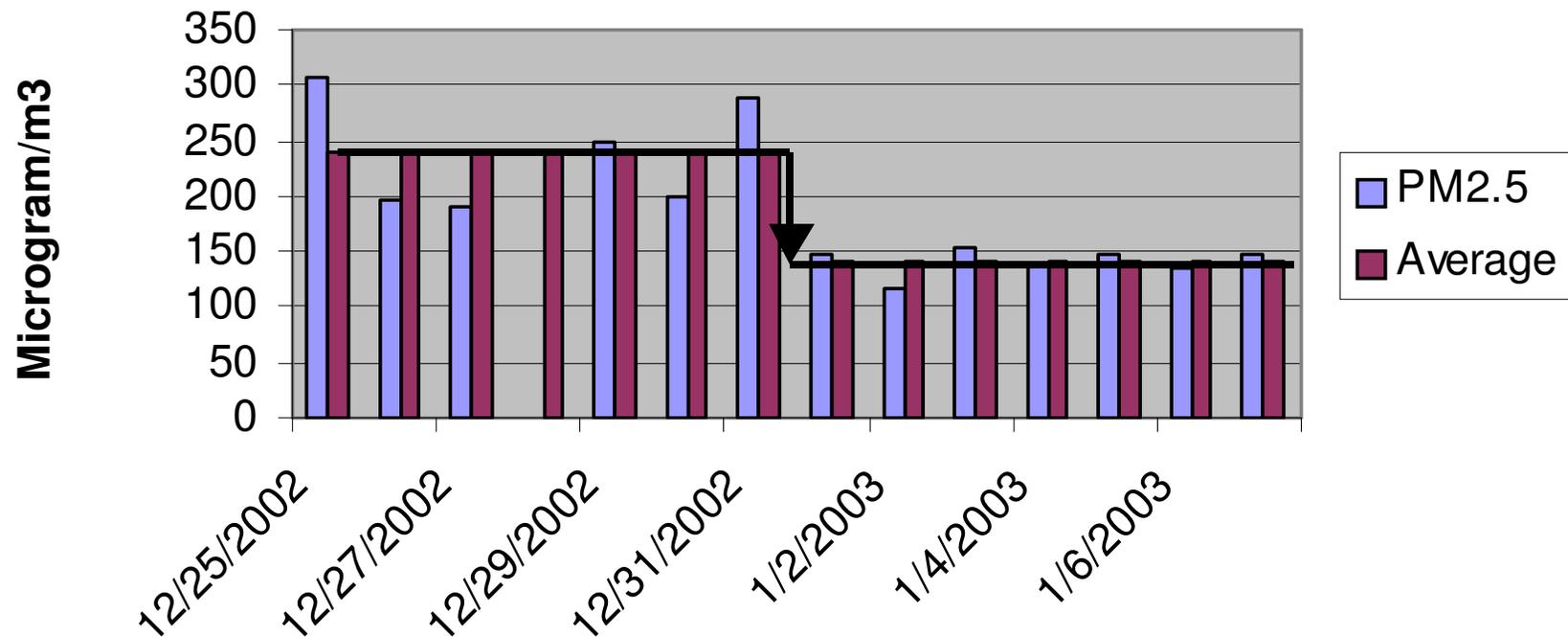
Motorcycle Sale in Thailand from 1994-2001



Source: Supat, 2003

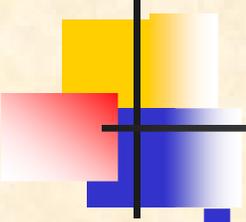
Dhaka Two Stroke Phase-out PM2.5 concentrations decline ~40%

Levels of PM2.5 before and after removal of Baby Taxis (phase-II)



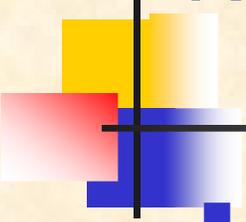
Source: Jha, 2004

Regional/International Efforts



- URBAIR project by WB in 1990s: first coordinated initiatives resulting in suggestion of action plans for Kathmandu, Jakarta, Manila and Mumbai
- Some present important initiatives:
 - Clean Air Initiative for Asia (CAI-Asia) sponsored by ADB → CATNet
 - ABC, EANET, Male's declaration (UNEP)
 - Air Pollution in Megacities of Asia (APMA) project
 - AIRPET (AIT): major activity is PM monitoring with QA/QC for 6 cities

Need for large scale monitoring tools



- Data available on air quality in Asian cities are mostly fragmented with high uncertainty: large scale monitoring tool would provide necessary QA/QC for a better harmonization
- Some sources like biomass burning: large scale monitoring tool to identify and quantify for better emission inventory
- Large scale monitoring data are required for modeling evaluation
- Large scale monitoring for trans-boundary AP

Rice straw open burning in Asia



Kim Oanh et. al, 2005

Thank You