# Clean Air Initiative for Asian Cities and the Cobenefits Approach in Asia

Cornie Huizenga and May Ajero
Clean Air Initiative for Asian Cities

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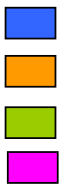
# Status of Air Quality in Asia

- Ambient air quality in Asia is generally improving despite increase in motorization and energy use
- Average ambient TSP, PM10 and $SO_2$ trends are improving
- Average ambient TSP and PM10, however, continue to exceed WHO and USEPA guidelines
- Average ambient $SO_2$ is in compliance with WHO guideline
- $NO_2$ close to guidelines
- Insufficient information on $O_3$ for reliable trend analysis
- It is uncertain whether the observed improvements in air quality will be sustained



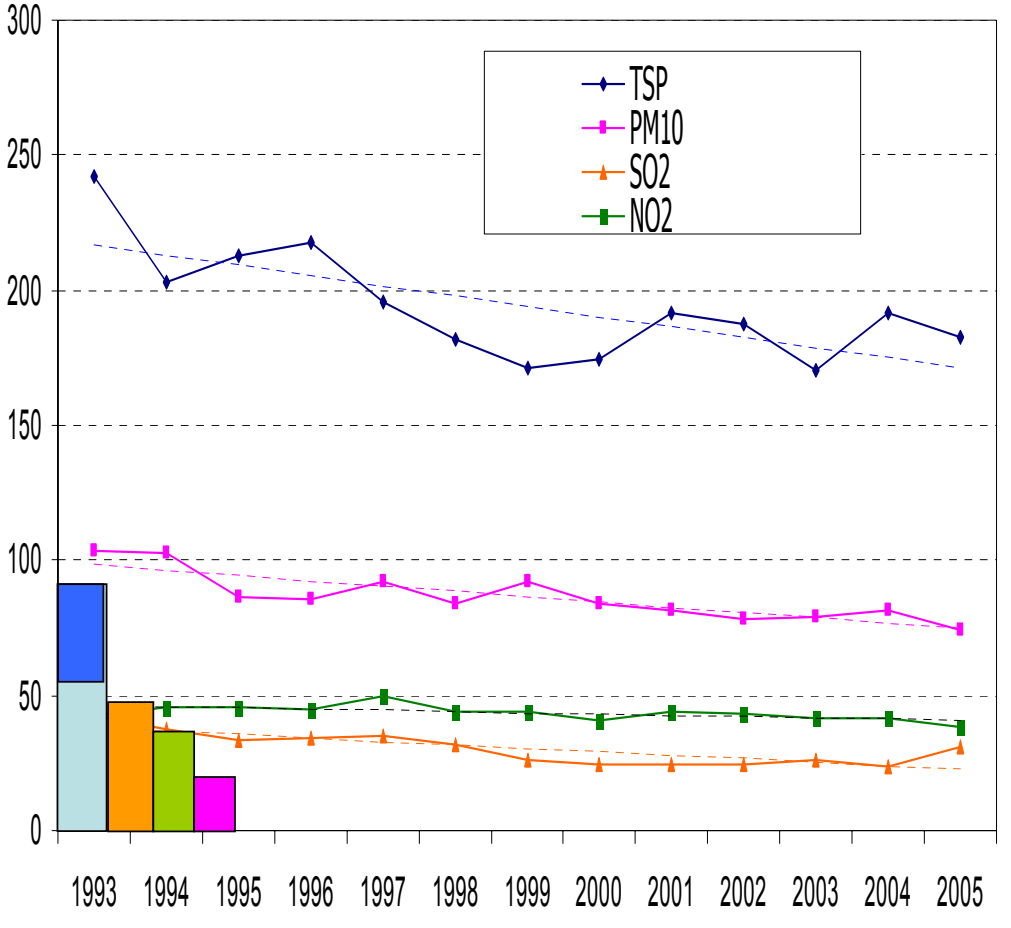
WHO (1979) TSP guideline, 60-90μg/m³

WHO $SO_2$ guideline, 50μg/m³

WHO $NO_2$ guideline, 40μg/m³

WHO (2005) PM10 guideline, 20μg/m³

Aggregated Annual Ambient AQ Trends, μg/m³ (1993 to 2005)



# Benchmarking Air Quality Management in Asia

- The Benchmarking study involved 20 cities in Asia representing various economic levels and geographic coverage.
- The cities were categorized according to four AQM capability indices – 1) AQ measurement; 2) data availability and assessment; 3) emission estimates; and 4) AQ management enabling capacity.
- Cities with high levels of economic development tend to have well-developed AQM systems
- Benchmarking of AQM capability can assist cities in setting priorities and developing strategies for strengthening their AQM capability

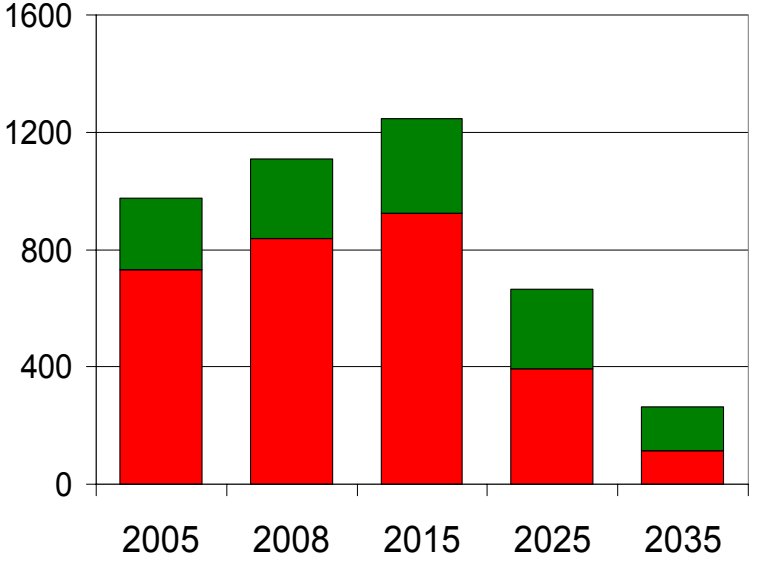
| AQM Capability | AQM Capability Scoring | Cities | Level of Economic Development/ Trends of Air Pollution |
|---|---|---|---|
| Excellent I | 91-100 | Hong Kong, Singapore, Taipei, Tokyo | • High technology applied<br>• Low air pollution |
| Excellent II | 81-90 | Bangkok, Seoul, Shanghai | |
| Good I | 71-80 | Beijing, Busan | • Maturing of cleaner processes, use of cleaner fuels and mature emission controls.<br>• Further improvement of air quality |
| Good II | 61-70 | New Delhi | |
| Moderate I | 51-60 | Ho Chi Minh, Jakarta, Kolkata, Manila, Mumbai | • Cleaner processes developed. Systematic AQM procedures developed<br>• Air pollution decreasing from high levels |
| Moderate II | 41-50 | Colombo | |
| Limited I | 31-40 | Hanoi, Surabaya | • Urbanisation, industrialisation and mobilisation continued. Initial systematic AQM procedures applied<br>• High but stabilising levels of air pollution. Serious health and environmental impacts |
| Limited II | 21-30 | Dhaka, Kathmandu | |
| Minimal | 0-20 | - | • Increased urbanisation, mobilization and industrialisation. Only ad hoc AQM.<br>• Deterioration of air quality through rising levels of air pollution |

# Challenges to Urban Air Quality Management in Asia

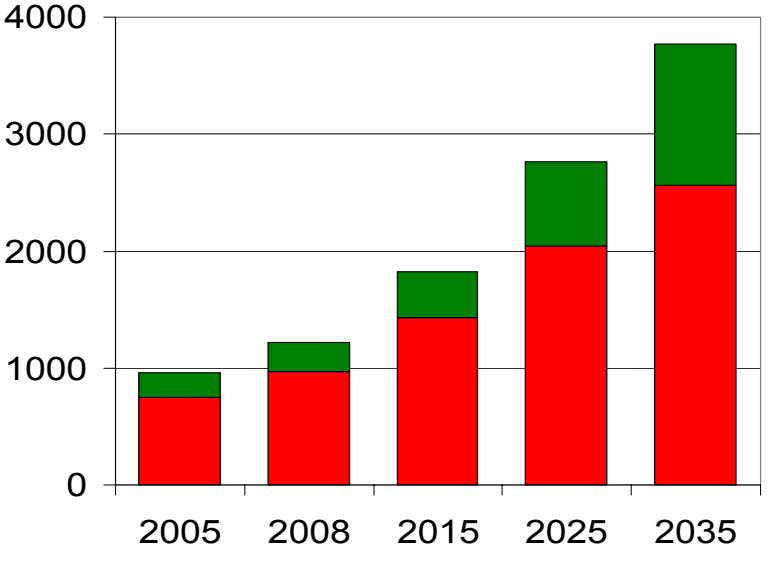
- Uncontrolled increase in energy consumption and rapid motorization will eventually undermine the achievements made in improving vehicle, fuel and energy efficiency.
- Costs of impacts – health, agriculture and environment are still high.
- Air pollution from Asia is affecting air quality of other continents (US and Europe).
- Policies are not integrated with other sectoral issues such as transport, energy and urban planning.
- Poor implementation and enforcement of laws and regulations.
- Air pollution problem in major cities still not fully addressed and growing problem in secondary cities.

# PM and $CO_2$ scenario for China and India

**Thousand Tons of $PM_{10}$**




**Million Tons of $CO_2$**




China, P.R.

India

Source: ADB, 2006

- Projected PM10 and $CO_2$ are based on existing plans for emission (Euro) standards and fuel efficiency targets in China and India

# Climate Change Mitigation in Asia

- Although currently low, contribution to global GHG emissions is expected to increase substantially in the next years.
- Evidences of climate change impacts in Asia already documented – e.g. glacial retreat in the Himalayas, coral bleaching in the Phils.
- Level of awareness on climate change is still low especially in secondary cities and rural areas.
- Most countries in Asia do not have specific commitments to reduce GHG emissions.
- Integration of climate change with other urban sector issues still lacking.
- Governments lack resources to mitigate climate change.
- Large CDM potential but difficulty in methodology approvals probably because of poor baseline information and monitoring capacity.

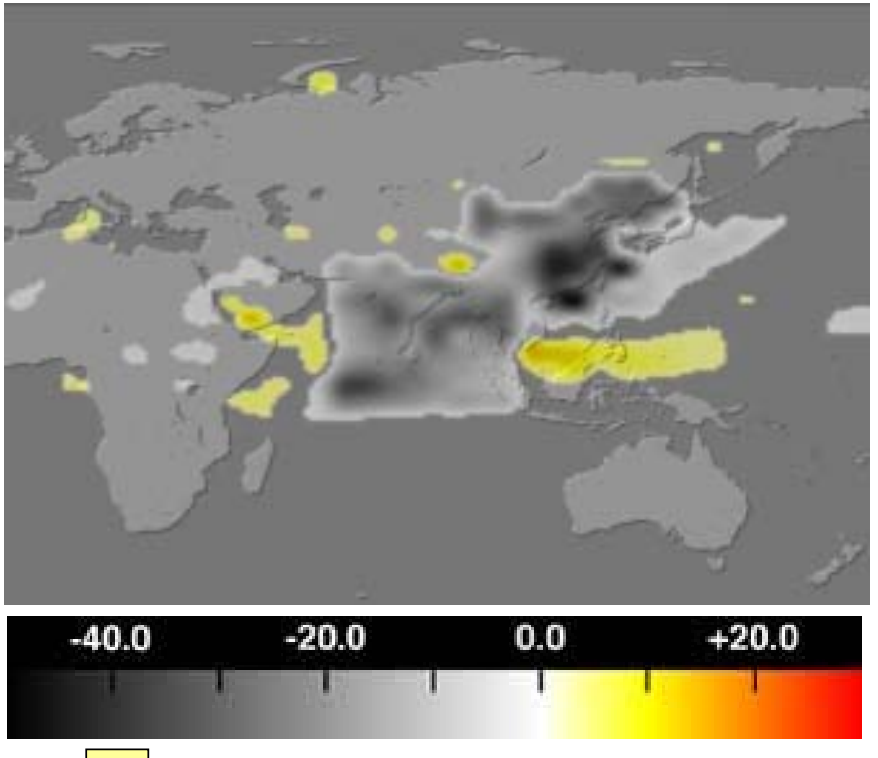
# Links between Air Pollution and Climate Change

- Increase in emissions of air pollutants is frequently associated with increase in GHG emissions because of common sources
- The net effect of PM on the climate is expected to become more significant as the load of pollutants in the atmosphere is expected to continually increase.
- Third IPCC Assessment Report recognized that dust, tropospheric ozone, black C, sulphates and other aerosols and PM have impact on climate but level of scientific understanding on this is still limited.
- Fourth IPCC Assessment Report (to be completed in 2007) will devote a specific section on "Air Quality and Climate Change".
- This suggests increasing attention that UNFCCC is giving to air pollution as a contributor to climate change.

# Air pollution is already affecting climate parameters (1)

- Basic science indicate that particulate matter may cause warming or cooling effect depending on size, vertical position and concentration.
- Increasing evidence on contribution of particulate matter to changes in climate.
  - Influence on precipitation and temperature patterns.
  - Decrease in solar radiation reaching ground.
  - Increase albedo of ice causing increased temperatures and ice melting.
- Tropospheric ozone and sulphates are relatively more significant than the other aerosols.

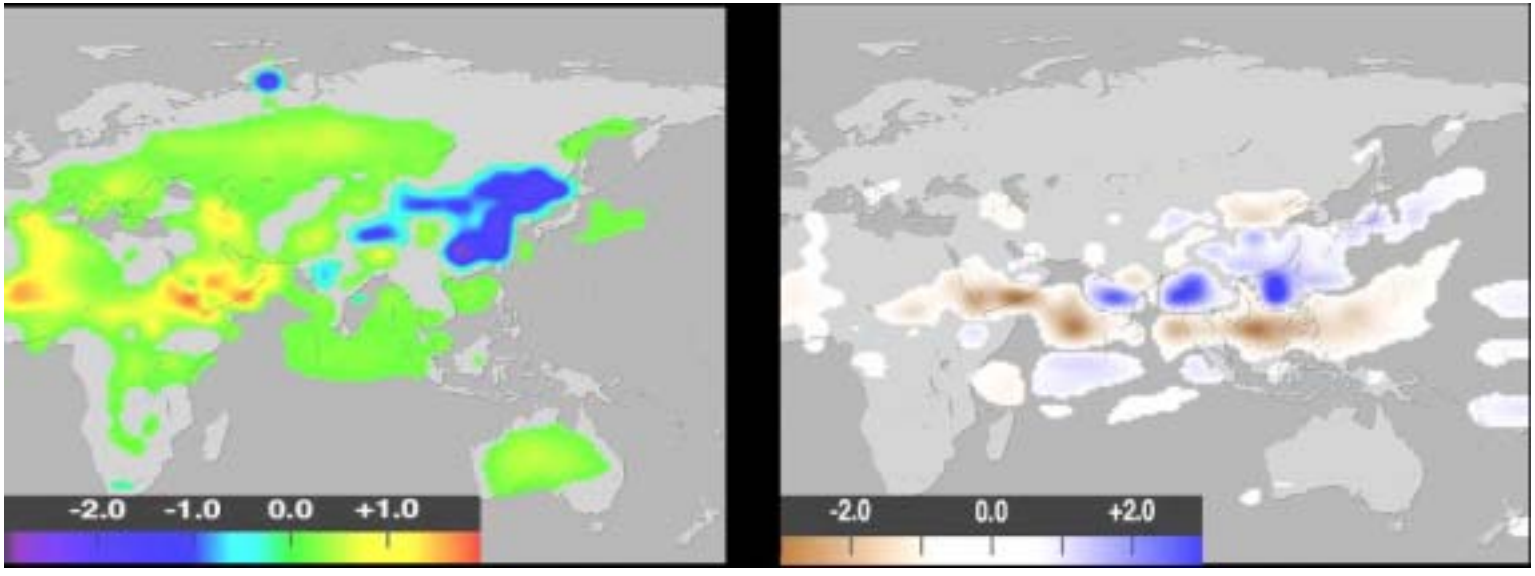
**Particulate matter is affecting crop yields in East Asia by blocking solar radiation.**




Source: NASA, 2002 - http://www.gsfc.nasa.gov/topstory/20020822blackcarbon.html

# Air pollution is already affecting climate parameters (2)

## PM affects temperature and weather patterns



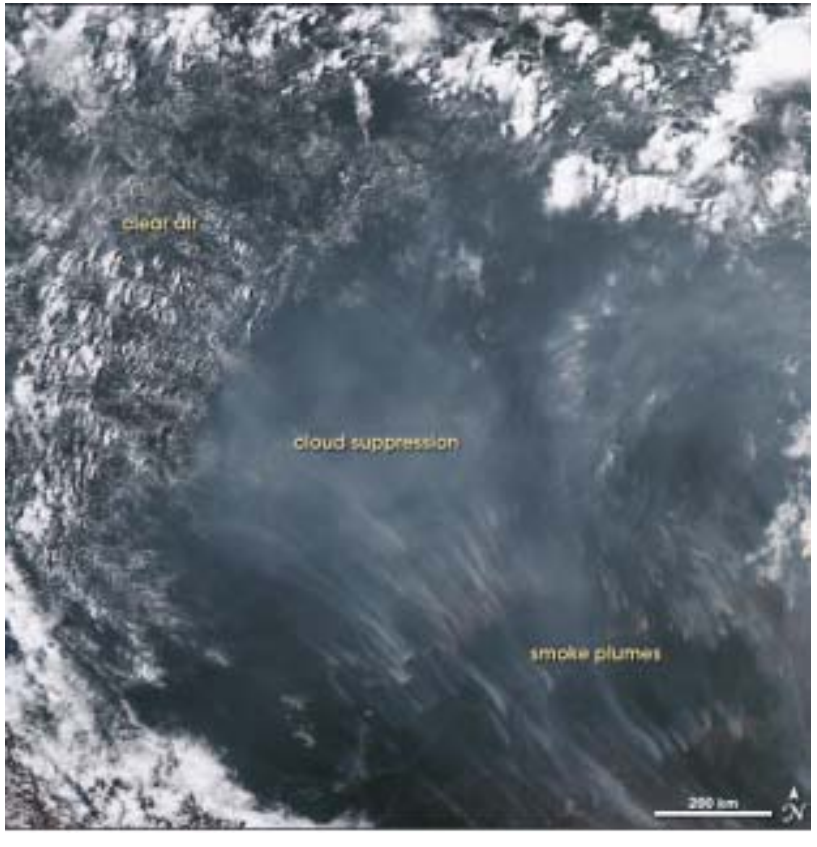

**Soot changes ground temperatures in Asia**
(in degrees Celsius)

**Soot intensifies floods and droughts in Asia**
(in inches rainfall)

- black carbon can affect regional climate by absorbing sunlight, heating the air and thereby altering large scale atmospheric circulation and the hydrologic cycle.
- NASA climate study reveals that large amounts of black carbon (soot) particles and other pollutants are causing changes in precipitation and temperatures over China

Source: NASA, 2002 - http://www.gsfc.nasa.gov/topstory/20020822blackcarbon.html

# Air pollution is already affecting climate parameters (3)




http://www.nasa.gov/vision/earth/environment/pollution_clouds.html

- Recent studies indicate that particulate matter's effect on climate is based mostly on its impact on cloud cover.
- Scientists estimate that pollution will have a net effect 5% increase in cloud cover.This change in cloud cover will greatly impact water availability (e.g.precipitation patterns) locally and globally thereby also affecting agriculture and food security.
- Large plumes of smoke can also act as "cloud killers" because the tiny particles in this form of air pollution absorb a lot of sunlight while some types of air pollution can help clouds to form and storms to grow stronger.
- Extent of the influence of aerosols on rainfall and hurricanes are priority research areas that scientists are looking into.

# Co-Benefits of Climate Change Mitigation Measures

| | International Development Community, NGOs | National, State and Provincial Governments | Local City and Municipal Governments |
|---|---|---|---|
| Climate Change | ◆ | | |
| Energy Security | | ◆ | |
| Air Quality and Health | ◆ | ◆ | ◆ |
| Traffic and Congestion | | | ◆ |
| Economic Development | ◆ | ◆ | ◆ |
| Quality of Life | ◆ | ◆ | ◆ |
| Transport Efficiency | | ◆ | |

# Promising Areas for Application of Cobenefits in Asia

- Power generation
  - –Increased efficiency of thermal plants
  - –Fuel switching: coal -> oil -> gas
  - –Renewable energy: wind, solar…
  - –Hydropower:
- Industrial energy use
  - –Energy efficiency
  - –Methane recovery
  - –Waste incineration
  - –Market incentives
- Sustainable Transport
  - –Inspection and Maintenance
  - –Fuel Efficiency and Alternative Fuels
  - –Public Transport e.g. Bus Rapid Transit
  - –Non-motorized Transport
- Household energy use
  - –Efficient lighting and energy use for appliances
  - –Alternative or renewable energy use
  - –Solid waste to methane capture

# Sample Policy Interventions in Transport Sector (1)

With long term benefits:

- **Adopt integrated urban and transport planning**
  - Improve access to goods and services through integrated urban planning and travel demand management
  - Modal shift that promotes lower fuel consumption per passenger- or freight-kilometer traveled;
- **Provide a substantial part of on-road transport's fuel requirements with clean and GHG efficient biofuels**

With medium term benefits:

- **Reduce the fuel consumed per passenger- or freight-kilometer traveled through traffic demand management**
  - Charge the externalities of private motorized transport
  - Mass-transit improvements
  - Nonmotorized transport
- **Adopt and implement Fuel efficiency standards for new vehicles**

# Sample Policy Interventions in Transport Sector (2)

With short-term benefits:

- **Improving fuel efficiency in existing vehicles**
  - Inspection, certification and maintenance
  - Retrofit
- **Transport demand management**
- **Fiscal measures**

Continuous Action:

- Strengthening continually-updated shared knowledge bases and common tools to assist countries in optimizing their climate change decisions for urban development, transport systems and biofuels
- Implement public awareness programs
- Research and development
- Monitor status and progress

# Opportunities for Co-benefits in Asia

- Co-benefits: if reduced emissions of greenhouse gases (GHGs) are combined with reduction of local air pollutants (e.g., PM10, SOx, NOx).
- Allows energy options, health impacts, and GHG emissions to be linked together and evaluated.
- Cobenefits enables countries to quantify and compare potential benefits in a credible way.
- Helps prioritize options in an environment in which resources are limited.
- Enables sound policy making for management of air quality and GHGs, and sustainable development planning based on quantitative analysis.
- Integrated measures provide substantial local and global benefits in the long and short-term.

# Selected Barriers

## Co-benefits

- Inadequate cobenefit tools and instruments.
- Institutional fragmentation of responsibilities
- Limited access to capital and lack of investment incentives.

## Climate Change Mitigation and Air Quality Management

- Delay in the transfer and adoption of new technologies
- Lack of congruent and consistent knowledge of international best practices on climate change and sustainable transport.
- Weak empowerment and linkages in many metropolitan areas between urban and transport planning, traffic management and enforcement.
- Difficulties in developing an optimum investment framework for more climate friendly transport systems.

# CAI-Asia activities on Cobenefits (1)

Tracking, documenting and consolidating discussions related to the co-benefits of climate change mitigation and air quality, particularly in the following aspects:

- Research on the development of air quality indicators, climate change parameters, and feasible means by which the two may be correlated and modeled, such as the emerging research on the relationship between particulate matter and climate change.
- Modeling of benefit-cost analyses of co-benefits projects on a local, national and regional scale.
- Clean Development Mechanism (CDM) methodologies (approved and being developed) of projects involving emissions of the transport sector, stationary sources, and other sources of air pollution.
- Current and emerging policies regarding the integration of climate change considerations into air quality concerns, and vice versa.

Discuss and Brainstorm with key groups such as OECC, IGES, CARB, US-EPA, etc. to develop joint programs and activities to further develop and apply the co-benefits framework in Asia

# CAI-Asia activities on Cobenefits (2)

## BAQ 2006 with the following co-benefit sessions:

http://www.baq2006.org/

BAQ Better Air Quality 2006 13 - 15 December Yogyakarta Indonesia

- **Sub-plenary 1: Cobenefits of Climate Change Mitigation and Urban Air Quality Management**

Sub-Workshop 27: Linkage GHGs and criteria pollutants

- **Sub- plenary 2: Trade-offs and synergies of integrating carbon management to air pollution and transportation in city and regions**
  - Sub-Workshop 28: Quantifying transport related cobenefits of emission reduction
  - Sub-Workshop 28: Travel demand management as a co-benefits policy tool
  - Sub-Workshop 31: Trade-offs and synergies of integrating carbon management to air pollution and power generation and industry

# CAI-Asia activities on Cobenefits (3)

With Murdoch University, CAI-Asia is developing a proposed pilot project on "Strengthening capacities to adapt to the effects of climate change and regional air pollution on crops, forests and water availability" under the Greater Mekong Subregion – Core Environment Programme (GMS-CEP) to build capacity on:

- Estimation of emissions, modeling and monitoring ground level $O_3$ and acid deposition;
- Modeling of regional climate change scenarios;
- Estimating physical, social and economic impacts of regional air pollution and climate-induced change on crops, forests, water resources and water availability;
- Development and assessment of options for mitigation and adaptation to impacts on crops, forests and water availability;
- Policy assessments and communication of policy-relevant options to decision-makers

# Co-benefits Approach in the Global Climate Framework

| Kyoto Protocol<br>2008 to 2012 | Kyoto 2 (?)<br>2012 to 2016 | Kyoto 3 (?)<br>2016 to 2020 |
|---|---|---|
| **NO** integration between AQM and Climate Change | **PARTIAL** integration between AQM and Climate Change | **FULL** integration between AQM and Climate Change |

# Co-benefits approach requires integration of approaches

- Climate Change Mitigation (CCM) – emphasis on market based approaches- (e.g CDM), so far only China has clear command and control approach to CCM: overall energy efficiency target of 20% and fuel economy standards in the transport sector.
- Urban Air Quality Management (UAQM) – emphasis very much on command and control approach and only selective use of market based approach, limited to SO2 and NOx
- For co-benefits to prosper you will need to have common thinking on the use of command and control and market based approaches.
- Amongst others this will require new thinking on CDM

# A new approach to CDM – so far the most visible Climate Change tool in Asia

- Current CDM is externally oriented – meeting the requirements of Annex 1 countries and not the developing countries themselves
- Current CDM is supportive of projects that focus on SO2, industrial NOx and to a far smaller extent PM10 which is the main pollutant of concern
- CDM is about optimizing the benefits of the individual and only indirectly of society at large
- CDM has so far not sparked of a mandatory mainstreaming of technologies through policy and supportive incentives – disincentives
- Future CDM: low(er) threshold modality with specific aim to develop and introduce new technologies which reduce GHG's and which have a premium for ancillary air pollutant reduction. This to be accompanied by a policy oriented facility which rewards the mainstreaming by developing countries of pilot approaches and technologies developed under project modality

# - Contact CAI-Asia -

Cornie Huizenga, chuizenga@adb.org

May Ajero, majero@adb.org

http://www.cleanairnet.org/caiasia