



**International Experts Workshop  
on International Framework and  
Cobenefit Approach to Promote  
Air Pollution Control  
Countermeasures in East Asia  
2010**

*Proceedings*

**23-24 January 2010  
Hayama, Japan**

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## Preface

Research on the “Policy Development for Regional Framework and Cobenefit Approach to Promote Air Pollution Control in East Asia” started in Fiscal Year 2009 as one of the themes of the research on the “Comprehensive Research on Improved Regional Air Quality Management through Analyses of Regional Air Pollution and Cobenefits Approach”.

The objectives of this theme are:

- To develop an environmental regime for comprehensive atmospheric management in East Asia and identify major issues for consensus building on such a regime
- To identify major factors towards comprehensive atmospheric management strategy with emission targets: triggers for negotiations and possible negotiation processes for consensus
- To analyze costs of major damages by air pollution and prevention measures for better understanding of policy makers on this topic

The major research items of this theme in FY 2009 are:

- (i) Consideration of consensus building processes for a cooperative regional regime on air pollution control in East Asia;
- (ii) Comparative analyses of restrictive factors and barriers to the promotion of negotiation in major related countries;
- (iii) Consideration of reduction target for air pollutants;
- (iv) Consideration of effective environmental governance in East Asia;
- (v) Economic analyses of cobenefit environment policy for global climate change and local air pollution.

The International Experts Workshop was held on 23-24 January, 2010 at IGES Headquarters in Hayama, Japan with the participation of experts and resource persons from China, Japan, Korea, Thailand, UNEP, and research team members. Intensive discussions were held on issues concerning regional cooperation on air quality in East Asia, atmospheric management policies in China, Japan, Korea, and Thailand, and issues concerning data availability.

I hope the results of this workshop are informative and fruitful for the future research.

**Katsunori Suzuki**

Professor, Kanazawa University

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## International Experts Workshop on International Framework and Cobenefit Approach to Promote Air Pollution Control Countermeasures in East Asia 2010

### Report of the Workshop

1. The International Experts Workshop on International Framework and Cobenefit Approach to Promote Air Pollution Control Countermeasures in East Asia was held on 23-24 January, 2010, at Institute of Global Environmental Strategies (IGES), Hayama, Japan.
2. The participants of the workshop included experts from China, Korea, Thailand, United Nations Environment Programme (UNEP), Japanese resource persons, and the team members of the research project titled "Policy development for regional framework and co-benefit approach to promote air pollution control in East Asia (Global Environment Research Fund (S-7-3), Ministry of the Environment, Japan)".
3. Mr. Hideyuki Mori, Vice President, IGES opened the workshop. The opening remarks were made by Prof. Katsunori Suzuki, Kanazawa University.
4. Prof. Suzuki made an introductory presentation, introducing the background, framework, and objectives of the research project. Major points of discussion were:
  - It is desirable to clarify the range of options for a new framework, e.g. soft vs. hard law, legally binding vs. voluntary, and who the main actors should be.
  - Based on the current impression from the EANET negotiation, a regime based on soft law seems more appropriate in the East Asia situation.
  - Actors involved will vary based on the type of agreement, as actors would be limited in an intergovernmental agreement, but a regional agreement would involve a wider range of actors.
  - The original aim of MOEJ was to establish emission reduction targets for SO<sub>x</sub> and NO<sub>x</sub>, and this project is promoting the addition of O<sub>3</sub>.
5. Prof. Suzuki made a presentation on the research result from Sub-theme 1, on consensus building process for a cooperative regional regime on air pollution control in East Asia based on existing regional networks for air pollution. Major points of discussion were:
  - Critical load approach was effective in Europe, but its effectiveness has not been proven in Asia.

- Since some of the bureaucrats in charge of the air quality issue are too busy with the domestic air pollution issues, a more top-level approach may be needed to prompt bureaucrats to take action. Relative strengths and weaknesses of top-down vs. bottom up approaches should be considered.
  - There is a need to consider pollutants that are most relevant to a cobenefit approach. Although SO<sub>x</sub> and NO<sub>x</sub> are still important pollutants, short-lived climate forcers such as O<sub>3</sub> and Black Carbon (BC) are becoming priorities in relation to the cobenefit approach.
6. Dr. Mark Elder, IGES, made a presentation on the results from case study of Europe and Convention on Long-range Transboundary Air Pollutants (LRTAP), and how the result compares with and implies for East Asia. Major points of discussion were:
- LRTAP could be considered to be an example of a cobenefit approach, but its applicability to Asia should be considered. Incentives could be considered as a possible approach.
  - The principle of common but differentiated responsibilities could be considered as part of a new regional cooperation mechanism.
  - It is important to distinguish between the LRTAP and the subsequent protocols.
  - It is not clear how much LRTAP has changed national policies.
  - Cooperation in the Baltic is interesting. It is not legally binding, but there is a significant amount of cooperation.
  - As a domestic factor, “policy process” more accurately explains the behaviour than “regime type”.
  - Incentives from NAMAs should be considered for Asian countries.
7. Assoc. Prof. Noppaporn Panich, Chulalongkorn University, made a presentation on the air quality management policy of Thailand. Major points of discussion were:
- Inter-departmental coordination is done relatively well in Thailand, as representatives from ONEP, PCD, UNEP, and UNDP meet regularly for coordination.
  - Local governments lack manpower and need assistance from the central government for implementation, but now it is getting better with more budget and more manpower.
8. Assoc. Prof. Esook Yoon, Kwangwoon University, made a presentation on the politics of air quality management in Korea, and Asst. Prof. Dong-Young Kim, KDI School of Public Policy and Management, made a presentation on the urban air pollution policies in Korea from 1991 to 2009. Major points of discussion were:

- Decentralization occurred mostly for implementation aspects.
  - The President is highly influential in the process of the air quality management policy-making.
  - Overall, the role of ENGOs is complex.
  - In the case of automobile emission regulation, decision-making leadership was taken on an ad hoc basis, with stakeholders taking advantage of given situation.
  - MOE supplemented its influence over more established ministries (MOF, MCIE) by incorporating the ENGOs' influence through their study groups.
  - MOE's media strategy is now fairly highly developed.
  - Clarification of how emissions trading works.
  - Extent of connection between air pollution policies and to recent "green growth" policies should be considered.
9. Assoc. Prof. Mingyuan Wang, Tsinghua University, made a presentation on the case study of China, on the administrative policies concerning air quality in China; and Prof. Zifa Wang, Institute of Atmospheric Physics, Chinese Academy of Science, made a presentation on recent trends towards regional air quality management in China. Major points of discussion were:
- The Beijing Municipal Government makes significant financial contributions to monitoring stations and CAS helps operate them. In some cases, monitoring stations are located on CAS property in cases where local governments object to locating them on city property.
  - NDRC and MEP should improve coordination regarding acid rain and energy intensity targets for the 12<sup>th</sup> Five Year Plan.
  - In the 12<sup>th</sup> Five Year Plan, installing nitrate removal equipment will be mandated for the point sources.
  - For emission inventory, many of those inventories are not open to the public because they are controlled by the local governments.
  - Social pressure is more likely to be effective at local level, but there is persisting conflict between the central government and local governments over prioritizing economic growth or environmental regulation.
  - Beijing pushed the polluting factories outside the cities, but other cities will welcome the factories because they will contribute to the GDP growth.
  - Emissions trading may not be an effective option within control zones since factories are likely to simply relocate to other zones or areas.
  - MEP's research budget has grown significantly in recent years, and is now 200 million yuan per year.

10. Dr. Naoko Matusmoto, IGES, made a presentation on Japan's domestic policy process towards regional cooperation on air quality management. Major points of discussion were:
- The Rio Conference and the resulting Agenda 21 was the fundamental basis for establishing EANET.
  - In the development of EANET, bureaucrats intentionally avoided contacts with media so as not to provoke emotional responses by the public.
  - One reason why Japan's Environment Agency focused on acid rain was that it was considered to be an issue which Japan had the capability to take up and contribute to, and could have high visibility among East Asian countries.
  - EANET is still meaningful even though its scope is limited.
  - Japan's foreign policy regarding environmental issues is not just related to EANET, but has a broader scope.
11. Dr. Ken Yamashita and Dr. Amin Nawahda, Acid Deposition and Oxidant Research Center (ADORC), made presentations regarding the effective/efficient policies based on science of the atmospheric management in East Asia, and the target of reduction for air pollutants. Major points of discussion were:
- Clear message is as important as accuracy of data, and there is a need to keep in mind that intermediate outcome needs to be produced by the summer of 2011.
  - Air pollution itself is a high priority in Asia, but transboundary air pollution is less of a priority.
  - Health impacts are often considered to be a higher priority in developing countries compared to other impacts.
  - Use of scenarios would help to address the problem of data availability and accuracy.
  - It may be desirable to use a multistakeholder process to develop scenarios and assumptions.
12. Prof. Jusen Asuka, Tohoku University, made a presentation on the economic analyses of cobenefit environment policy for global climate change and local air pollution using Asian MERGE model. Major points of discussion were:
- When MERGE model and AIM model are compared, MERGE model includes more target pollutants than AIM.
  - From cobenefit perspective, O<sub>3</sub> and BC are attracting more attention.
  - Extent of using scenarios to address data problems.
13. Assoc. Prof. Norichika Kanie, submitted his presentation on air pollution institutional

architecture in East Asia, because he was not able to attend the meeting due to his obligation in Paris. Major points of discussion were:

- There are other regimes besides climate change which could be analyzed; including trade related ones, ASEAN+3, etc. Subtheme 1 will focus in existing environmental initiatives while Subtheme 4 will focus on non-environmental initiatives such as those relating to security and trade.
- Climate change is a global issue but air pollution is not. Also, the climate change area is dominated by diplomats while the air pollution area practitioners and bureaucrats are heavily involved.
- It is important to consider how to create a forum to talk. Cobenefits is a keyword to bring stakeholders together.
- Lack of negotiating capacity, especially language barriers, is not a problem only in East Asia. However, other regions managed to establish agreements, which suggest further consideration regarding the situation in East Asia.
- The concept of an Asian Community may be acceptable, but there is a need to consider how fast and how far we go with the integration. Trust is needed to commence a discussion on this, where results regarding cobenefit approach from this research may contribute in nurturing the needed trust.

14. Mr. Iyngararasan Mylvakanam, UNEP, made a presentation on integrated policy response towards atmospheric environment issues in the world. Major points of discussion were:

- It is important to consider how to further develop joint meetings between the various air pollution related agreements.
- The importance of capacity building was emphasized.
- The future framework needs to address multiple pollutants, as reducing SO<sub>x</sub> without addressing BC will double the warming effect.
- For Malé Declaration, it only took one month from Policy Dialogue between environmental ministers and scientists to the Adoption of the Declaration by the heads of state.
- For the future framework to be successful, emphasis should be given to local initiatives, ground-up approach, and capacity-building, as in the case of Malé Declaration.

15. Major points of the general discussion and wrap up were:

- In order to promote consensus building, simulation exercises such as mock negotiations based on modelling hypothesis and domestic factors may be useful. The simulations could include modellers, government officials, political scientists,

and NGOs.

- EANET expansion failed after three years of negotiation because of two basic reasons. One reason is the insufficient communication between scientists and policy makers. The other reason is that bureaucrats are already busy with domestic issues, and expansion means they need to negotiate with other stakeholders within the respective countries, as expansion to modelling and mitigation measures increases stakeholders.
  - One good outcome of EANET is that after 10 years of activity, friendship has been nurtured.
  - Original thinking behind this research project is that more strategies and science is needed to overcome the high barriers to expanding EANET. Cobenefit approach was considered to facilitate the negotiation by integrating air pollution issues with the climate change issue. The resulting regional framework should implement regulations or control measures.
  - The basic assumption about the process of developing a regional framework, starting from scientific research, and then gradually developing into convention, monitoring, and protocols, may be too biased from the experience of LRTAP. There is a need to focus more on local concerns and aspects.
  - Regarding the overall conduct of the study, emphasis should be placed on enhanced collaboration between subthemes, promoting understanding between natural and social scientists, and translating technical language into language that is more accessible to policymakers. Consensus building should be a main goal.
16. The workshop was closed by Mr. Nobuhiro Kino, Ministry of the Environment, Japan, who expressed appreciation to the active participation of the participants and expectations towards the future outcome from the research project.

## Introductory Presentation

Research on Regional Framework and Co-benefit Approach to Promote Air Pollution Control in East Asia

Katsunori Suzuki  
Kanazawa University

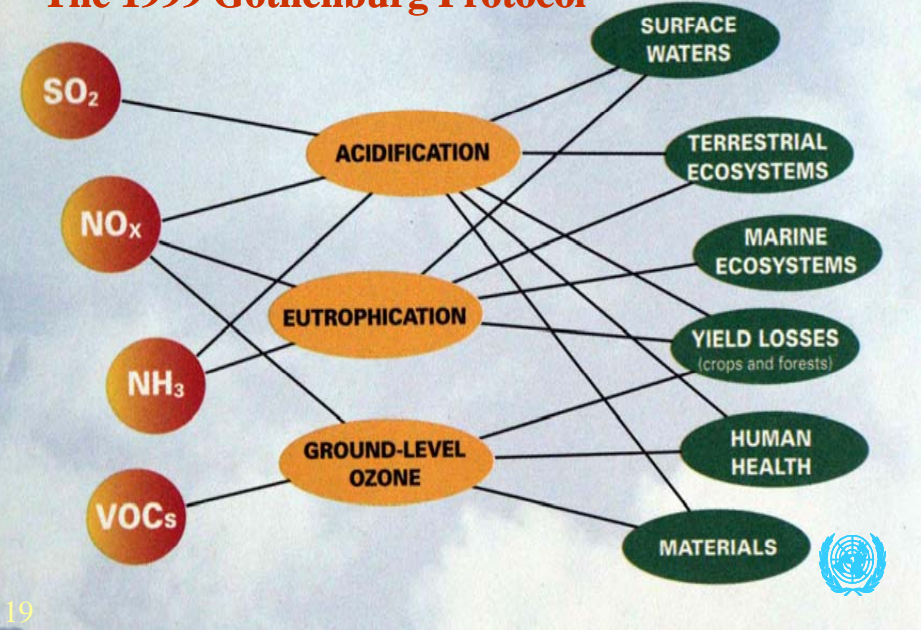
## S-7 Project Framework Comprehensive Research on Improved Regional Air Quality Management through Analysis of Regional Air Pollution and Co-benefits Approach

- Theme 1: Research on East Asian/hemispheric level ozone/aerosol pollution by integration of mathematical model and observation
- Theme 2: Improvement of emission inventories and development of emission scenarios for air pollutants in East Asia
- **Theme 3: Policy development for regional framework and co-benefit approach to promote air pollution control in East Asia**

## Background

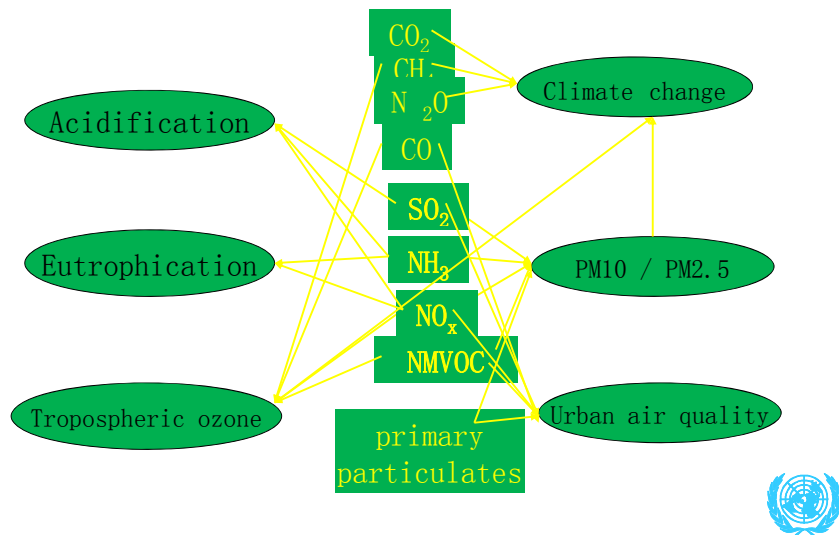
- **Simultaneous occurrence of various air pollution problems**
  - Traditional local air pollution, acid deposition and other transboundary air pollution, climate change etc.
- **Lack of inter-linkages between different air pollution problems**
  - Separate approaches for different air pollution problems and no regional framework for inter-linkage

## The 1999 Gothenburg Protocol

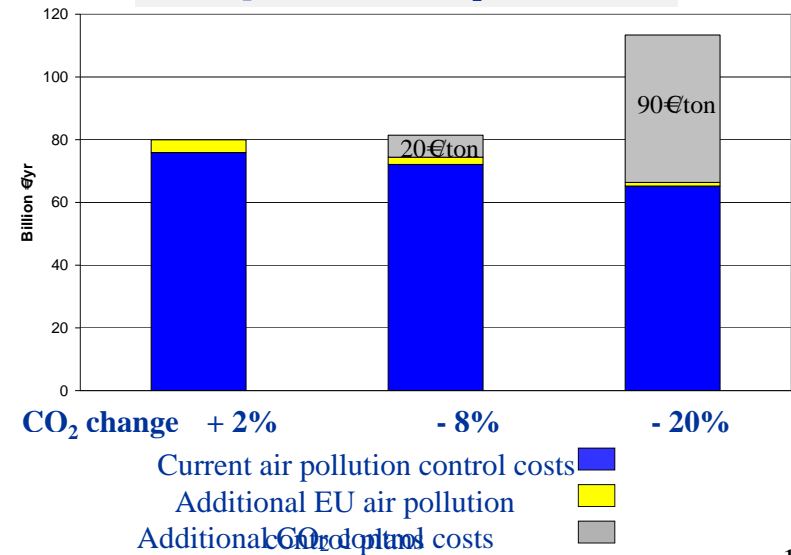




## Multi-pollutant / multi-effects approach: an extended version for a future protocol ?



## European costs for controlling air pollution and CO<sub>2</sub> emissions



11b

## Previous Project

### Research on long-range transport of ozone and aerosols in East Asia (C-081) : 2008

- Research on the Cooperative Framework for Comprehensive Management of Atmospheric Environment in East
- Other components include:
  - Analysis of pollution by using area-wide model for East Asia
  - Source-receptor analysis air pollutants and sensitivity analysis of reduction
- Originally three-years research project from FY 2008

## Objectives of the Project

- To develop an environmental regime for comprehensive atmospheric management in East Asia and identify major issues for consensus building on such a regime
- To identify major factors towards comprehensive atmospheric management strategy with emission targets: triggers for negotiations and possible negotiation processes for consensus
- To analyze costs of major damages by air pollution and prevention measures for better understanding of policy makers on this topic



## 5 sub-themes

- ① Research on consensus building processes for a **cooperative regional regime on air pollution control in East Asia** on the basis of existing regional networks on air pollution
  - ② Research on major domestic factors (constraints and problems) to build consensus for a cooperative regional regime on air pollution control in East Asia
  - ③ Research on science-policy implications for regional air pollution control in East Asia
  - ④ Research on external factors to influence development of regional regime on air pollution control in East Asia
  - ⑤ Research on institutional arrangements for co-benefit approach to contribute to international negotiations for air pollution control
- Possibility of establishing sub-theme 6 on scientific/technological aspects of co-benefit approach

## Objectives of this workshop

- To share information on the progress of each sub-theme; and
- To provide contribution/suggestions to other sub-themes

## Sub-theme 1

Research on consensus building processes for a cooperative regional regime on air pollution control in East Asia on the basis of existing regional networks on air pollution

Katsunori Suzuki  
Kanazawa University

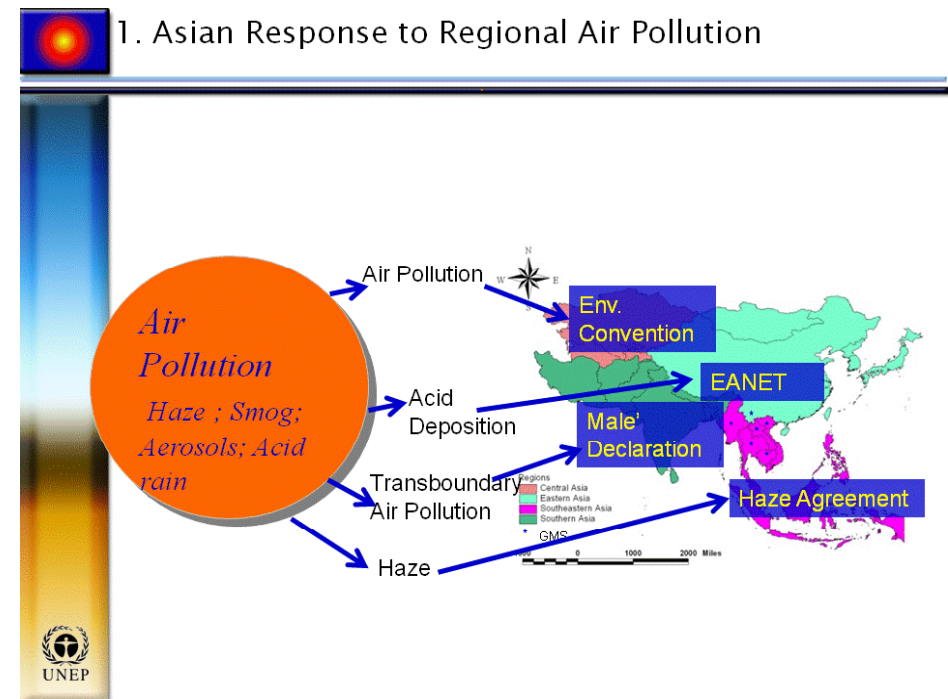
## Goals of this Sub-theme

- To consider a cooperative environmental regime for comprehensive atmospheric management in East Asia
- To develop a proposal on a comprehensive atmospheric management strategy in East Asia possibly with emission targets, and possible negotiation processes for consensus building for such a strategy

## Cooperative environmental regime for comprehensive atmospheric management in EA

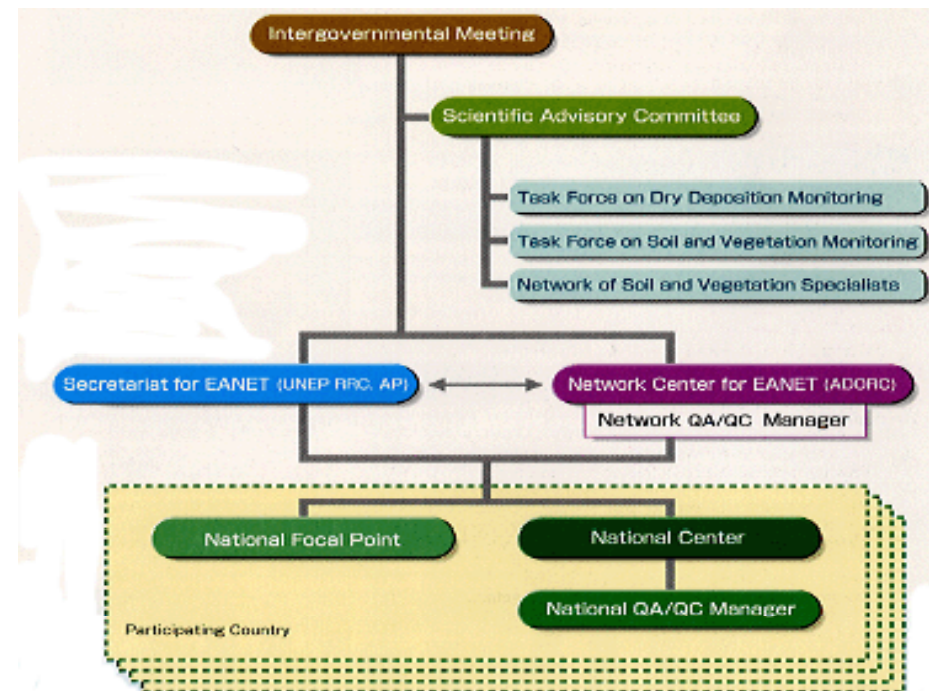
- Existing regional/sub-regional initiatives
  - Convention on Long-range Transport of Air Pollution (LRTAP Convention)
  - Acid Deposition Monitoring Network in East Asia (EANET)
  - ASEAN Agreement on Transboundary Haze Pollution
  - Male Declaration
  - Framework Convention for Sustainable Environment in East Asia
  - Other relevant initiatives such as ABC

## 1. Asian Response to Regional Air Pollution

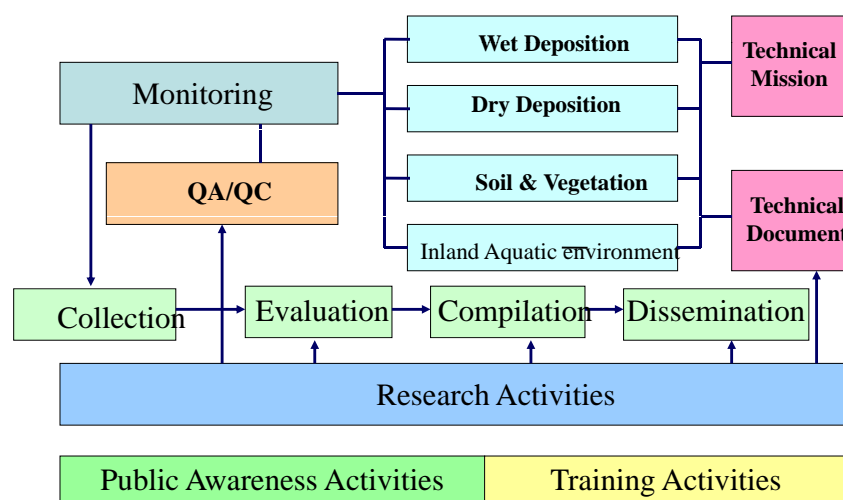


# Acid Deposition Monitoring Network in East Asia (EANET)

- Thirteen (13) countries in East Asia established EANET to detect acid deposition problems and help policy makers to tackle the problem.
- After five years of discussions by experts in East Asia, EANET started in 1998 as a trial basis and formally started from 2001.
- UNEP assumes the role of the Secretariat and the Acid Deposition and the Oxidant Research Center in Niigata functions as a technical center.



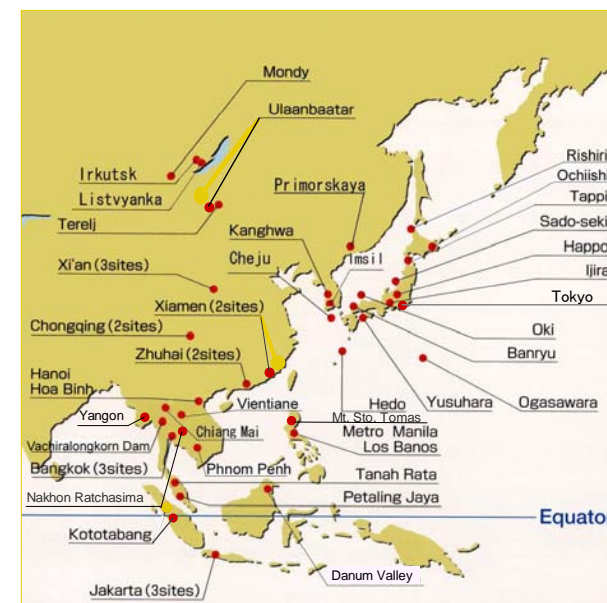
## EANET ACTIVITIES



**Wet/Dry**  
**Total 51/40**

- Russia:4/4
- Mongolia:2/2
- China:9/4
- R. of Korea:3/3
- Japan:12/12
- Philippines:3/3
- Viet Nam:2/2
- Thailand:6/6
- Cambodia:1
- Lao PDR:1
- Malaysia:3/3
- Indonesia:4/1
- Myanmar:1

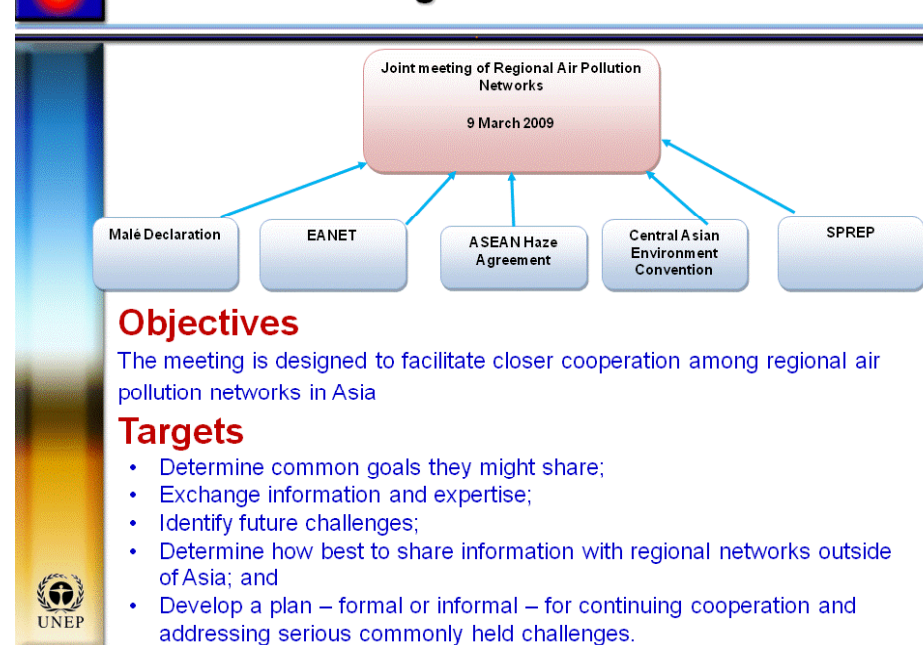
Acid Deposition monitoring sites in 2007



## Observations

- Three years' negotiations resulted in a new instrument to strengthen the basis for EANET
- Insufficient achievement regarding expansion of scope for species and activities due to some reasons (bureaucratic barriers etc.)
- New approach with more top down approach may be required for further development

## 2. Joint Meeting



### Comprehensive atmospheric management strategy in East Asia with emission targets

- Two possible options for such a strategy
  - Regulatory framework e.g., by a legally binding instrument
  - Incentive framework e.g., with economic incentives
- Recently there are significant attention for short-lived climate forcers such as ozone and black carbon
- Co-benefit may be a promising tool to develop a regional strategy

### Proposal on Co-benefit Forum in Asia

- Presently Co-benefit approach is not well known in Asian air pollution community.
- Co-benefit Forum to share information and experiences might be a useful tool to promote this approach in Asia.
- Possible design of the Forum is under consideration.

## S7 Theme 3 Subtheme 2

### Research Results

#### International Experts Workshop on International Framework and Cobenefit Approach to Promote Air Pollution Control Countermeasures in East Asia

23-24 January, 2010, Hayama, Japan

IGES

Hideyuki Mori  
Mark Elder  
Hiromitsu Miyajiri

1

Theme 3: Research on an international framework and cobenefit approach to promote air pollution control countermeasures in East Asia

(東アジアの大気汚染対策促進に向けた国際枠組とコベネフィットアプローチに関する研究)

- Subtheme 2: Research on restrictive factors and barriers to the promotion of negotiations in major related countries based on the countries' environmental policy trends and their underlying determining factors  
(主要関係国の環境政策の変遷とその要因を踏まえた交渉推進の制約要因と課題の研究)

2

## Research to be presented at this meeting (from Subtheme 2)

- Overview of Subtheme 2
  - Comparisons with Europe (LRTAP)
  - Implications/ lessons for East Asia
- East Asian case studies presented by international experts:
  - Thailand (1)
  - South Korea (2)
  - China (2)
- ❖ [Note: Technically, these case studies are linked to subtheme 2 due to the focus on domestic factors, but the results will be relevant for all subthemes.]
- Japan case study (IGES)
  - What were the factors leading Japan to promote international cooperation on air quality management, specifically EANET?

3

## Relationship between agreement to increase cooperation and domestic policy

International agreement for increased cooperation on air quality management

➤ Needs national (domestic) decision  
➤ Implemented through domestic policy change

Examples:

- Increased budget for monitoring
- Stricter regulations

Other domestic obstacles related to international negotiation

Examples:

- Language barriers
- Perceptions of negotiators
- Priority of issue areas

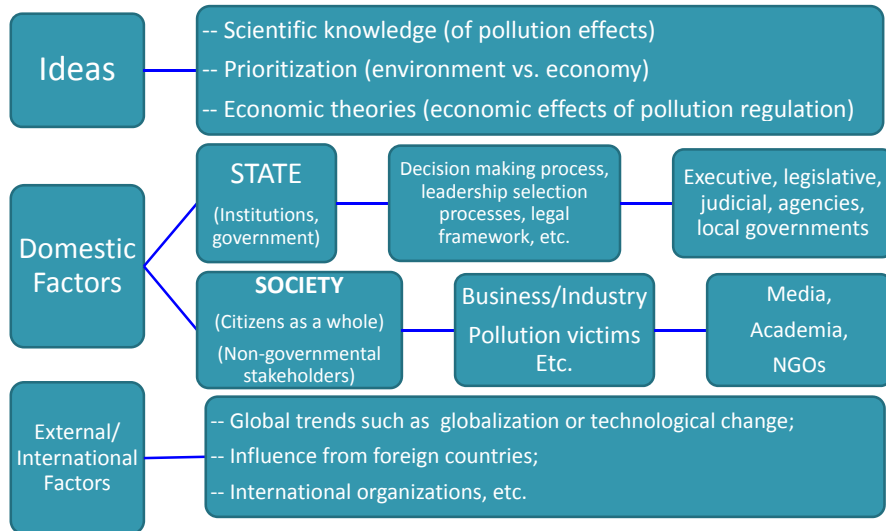
Similar domestic obstacles & promoting factors

Examples: business opposition, citizen pressure

4



## Classification framework of factors potentially explaining policy decisions



5

## Results from case study of Europe / LRTAP

(LRTAP: Convention on Long-range Transboundary Air Pollution)

6

## European Case: LRTAP

- Research question: What were the major factors influencing European countries' negotiating positions and decisions to agree to LRTAP and related protocols (with a special emphasis on analyzing the role of domestic factors)?
  - Scope: mainly up to early 1990s
- Conventional explanation focuses on:
  - Role of science, environmental damage
  - Epistemic communities (agreed understanding among scientists of the countries)
  - Cold war détente (LRTAP as confidence building measure to reduce tensions)

7

## Main argument for Europe/LRTAP case

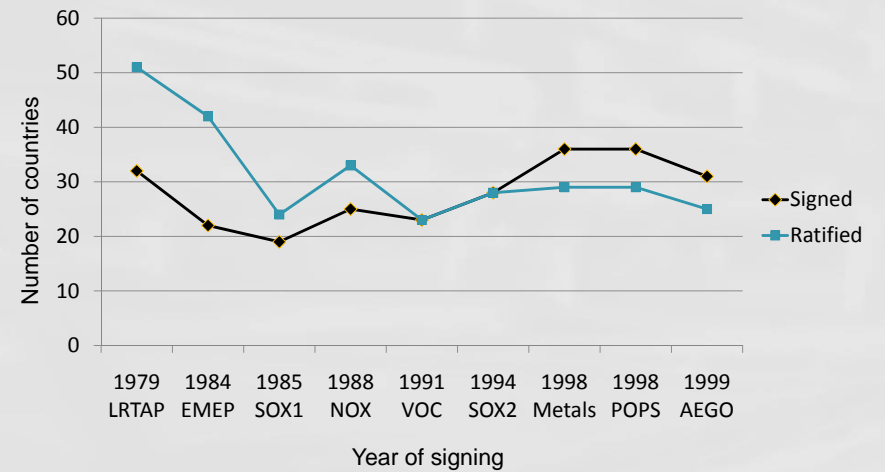
- Science/environmental damage, cold war détente are important as
  - Foundation and initial driving force
  - Provided basic information (some countries weren't aware of environmental damage – didn't understand their own interests).
- But this does not explain
  - Differences in countries' negotiating positions
  - Countries' decision making process to accept/reject agreements
- Domestic factors need to be considered, especially
  - Economic considerations (economic growth, industrial competitiveness)
  - Also institutional factors: capacity of environmental regulators

8

# LRTAP Protocols

Protocol	Date signed	No. Parties	Date in effect	No. Parties
LRTAP	1979	32	1983	51
<a href="#">Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)</a>	1984	22	1988	42
<a href="#">Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent</a>	1985	19	1987	24
<a href="#">Control of Nitrogen Oxides or their Transboundary Fluxes</a>	1988	25	1991	33
<a href="#">Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes</a>	1991	23	1997	23
<a href="#">Further Reduction of Sulphur Emissions</a>	1994	28	1998	28
<a href="#">Heavy Metals</a>	1998	36	2003	29
<a href="#">Persistent Organic Pollutants (POPs)</a>	1998	36	2003	29
<a href="#">Abate Acidification, Eutrophication and Ground-level Ozone</a>	1999	31	2005	25

## Trend in signing & ratification of LRTAP protocols



### Gothenburg Protocol (1999): Ratification/ Signing Status

Ratified			Did not ratify				
Country	EU	Joined EU	Country	At negotiations	Signed	EU	Joined EU
Belgium	X		Albania	*		O	
Bulgaria		X	Armenia	*	X	O	
Croatia	O		Austria	*	X	X	
Cyprus		X	Belarus	*		O	
Czech Republic		X	Canada	*	X	O	
Denmark	X		Greece	*	X	X	
Finland	X		Ireland	*	X	X	
France	X		Italy	*	X	X	
Germany	X		Liechtenstein	*	X	O	
Hungary		X	Malta	*			X
Latvia		X	Monaco	*		O	
Lithuania		X	Montenegro	*		O	
Luxembourg	X		Poland	*	X		X
Netherlands	X		Moldova	*	X	O	
Norway	O		Russia	*		O	
Portugal	X		Serbia	*		O	
Romania		X	Ukraine	*		O	
Slovakia		X	Azerbaijan			O	
Slovenia		X	Kyrgyzstan			O	
Spain	X		Kazakhstan			O	
Sweden	X		Bosnia-Herzegovina			O	
Switzerland	O		Estonia				X
United Kingdom	X		Georgia			O	
United States	O		Iceland			O	
European Community	X		FYROM			O	
			Turkey			O	
25	12	9	26	17	9	4	3

## Observations on overall trends of LRTAP Protocols

- First one, 1979, is general, with no specific requirements, so it is easy for countries to agree
- Later ones have specific requirements, so fewer countries agree.
- Importance of EU membership
  - EU ratified 1999 Multi Effect Protocol in 2003
  - Earlier, 2001, EU National Emissions Ceiling Directive required even more stringent limits
  - Therefore, all EU members need to observe it, regardless of whether or not they signed/ratified

## Key economic considerations

	Pusher countries	Dragger countries
•Effects of environmental damage & abatement costs on economic competitiveness, macro economy	•Nordic countries suffered forest damage •Poland (black triangle), USSR, other E. Europe were pushers before econ crisis	•Didn't recognise domestic damage (UK) •Economic crisis (after end of communism) creates resistance (esp. E. Eur)
•Relationship between economic structure to pollution types (electricity fuel type, auto industry)	•Less dependent on coal •Strong auto emissions technology (West Germany)	•More dependent on coal (UK, Ireland, E. Europe) •Weak auto emissions technology (UK)
•Availability of cost effective technological solutions	•Catalytic converters (West Germany)	•Transition may be financed by pusher countries •Britain shifted to natural gas electric power
•Importance of EU membership	•Pusher countries use EU membership as an incentive for them to join LRTAP protocols.	•Member candidates ready to accept stricter standards as condition to join EU

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## Other important domestic factors

- Role of media in spreading environmental information
  - Particularly important for pusher countries in West Europe, especially Nordic countries, W. Germany
- Degree of administrative capability of environmental authorities affected how strongly countries pushed/dragged
  - Britain / dragger: fragmented
  - Nordic, some East European communist countries /pushers: higher capacity, coherent
- Note: effect of regime type (e.g. democratic or communist system) is not clear
  - Democracies included both pushers (Sweden) & draggers (UK)
  - Solid support in communist countries for stronger environmental measures until economic conditions worsened (USSR/Russia, Poland, East Germany)

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## Comparisons and implications for East Asia

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## Important differences in structural conditions between Europe and East Asia

- Environmental damage (especially transboundary) may be more unevenly distributed in Asia than in Europe
- E. Asia has lower degree of formal regional institutions (political, security, economic), regional economic integration
  - But still a significant amount of cooperation at lower levels, and informally
- Income disparity between countries (fewer developed countries in E. Asia)

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## Main non-economic domestic factors: Overview of conditions in Asian case study countries

Factor	Trend	Implications (cautiously positive?)
Environmental damage	<ul style="list-style-type: none"> <li>•Can increase with economic growth</li> <li>•But national policies are steadily strengthening in many Asian countries</li> </ul>	<ul style="list-style-type: none"> <li>•Some progress already made</li> <li>•But can be offset by economic growth</li> <li>•Continue economic &amp; health damage</li> <li>•Will public pressure increase ?</li> </ul>
Science	<ul style="list-style-type: none"> <li>•Increased clarity of actual pollution</li> <li>•General role in policymaking seems strengthening steadily, if gradually.</li> <li>•Steady increase in cooperation between countries</li> </ul>	Positive?
Media	Gradual increase in coverage of environmental issues	Positive?
Environment ministries & administration	Gradual but steady strengthening	Positive?
Regime type	Many democratic countries, a few communist, a few authoritarian	Unclear

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## Main economic factors: Overview of conditions in Asian case study countries

Factor	Trend	Implications (cautiously positive?)
Electricity fuel type	Extensive reliance on (relatively cheap) coal in Asia	<ul style="list-style-type: none"> <li>•Tech measures available;</li> <li>•Potential fuel switching, energy conservation</li> </ul>
Motorisation	Rapidly increasing in Asia	<ul style="list-style-type: none"> <li>•Desire to develop globally competitive auto industries with high tech capability</li> <li>•Shift costs to motorists</li> </ul>
Overall energy shortage	Common interest in energy conservation, renewable energy	Positive
Economic conditions	Many Asian countries successfully avoid major prolonged recessions	<ul style="list-style-type: none"> <li>•Growth contributes to pollution but</li> <li>•Growth facilitates shift in priorities</li> </ul>
Environment/ economy priority	Is it shifting in Asia?	Positive?
Future economic structural change	Maybe trend to more services, less energy intensive economic structure as growth & incomes progress.	Positive?

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## Implications for Asian case studies

- Which countries could be pushers or draggers? Several countries are already strengthening domestic policies.
- Scientists from different countries should collaborate to reach a common understanding.
- Importance of looking at specific industries. Which industries:
  - are most responsible for air pollution?
  - could be hurt from air pollution?
  - could benefit from abatement?
- Distribution of abatement costs; consider compensation
- Scientific findings are more influential when describing domestic damage.
- Importance of media in raising awareness of scientific results.
- Availability of technical solutions like increased efficiency or renewable energy?
- Explore the potential of a cobenefit approach to persuade dragger countries

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## Questions for discussion

1. What are the main policy trends in domestic atmospheric environment management in the case study countries?
  2. What are the main factors determining these trends?
  3. What are the gaps or weakness in the domestic policies in the case study countries?
  4. What are the main obstacles to addressing these gaps or weaknesses?
- Later(?): What are the implications for future potential increased international cooperation?

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## Study on the effective/efficient policies based on science on the atmospheric management in East Asia

### S7-3-3

International Experts Workshop on International Framework and Cobenefit Approach to Promote Air Pollution Control Countermeasures in East Asia

Ken Yamashita, ADORC

23-24 January, 2010, Hayama, Japan

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## Sub-theme 3 (2009-2013)

(Inter-linkage of Science and policy)

### - A study on target of reduction for air pollutants -

- Review of scientific aspect in terms of the environmental to be considered for scenario setting of air pollutants reduction in East Asia.
- Consideration on appropriate target and estimation of socio-economic effects in case the target is not achieved.
- Case study on the contribution to policies of atmospheric environmental management by science (e.g. amendment of standard of Ozone and PM in U.S. and its scientific basement) in connection with inter-linkage between science and policy.
- Study on the appropriate contribution to the environmental policies in East Asia by science compiling/considering advantages and disadvantages of the process.

2

## Members

Sub-theme leader: Dr. Ken Yamashita, ADORC

Dr. Amin Nawahda, ADORC

Cooperative researcher:

Emeritus Prof. Iwao Uchiyama

Kyoto University, Japan

Prof. Kazuhiko Kobayashi,

Tokyo University, Japan

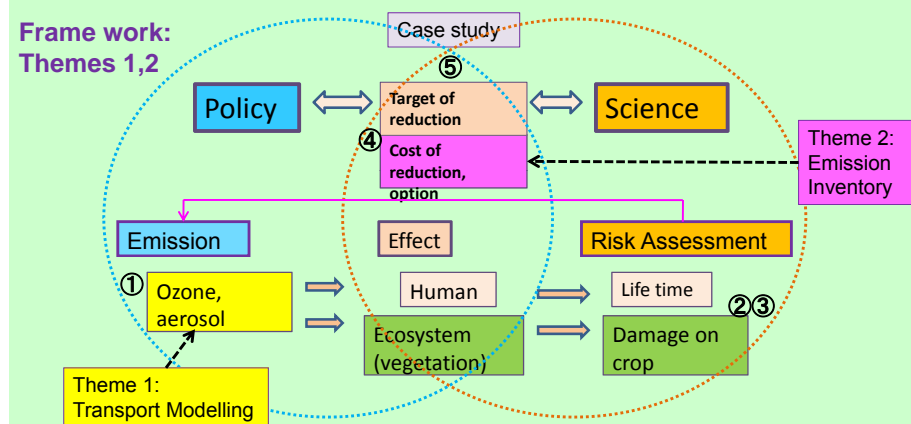
Dr. Otto Hänninen,

National Institute for Health and Welfare,  
Finland

Ass. Prof. Denise Mauzerall,

Princeton University, USA

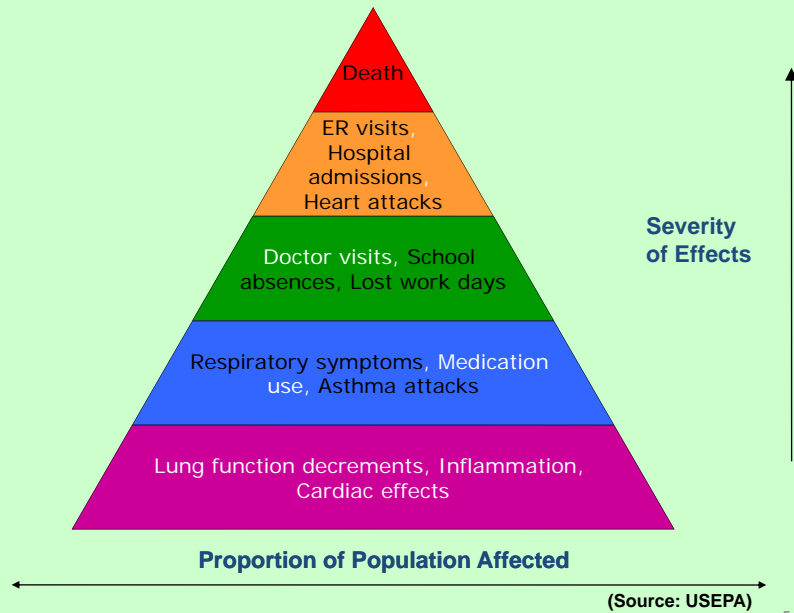
Frame work:  
Themes 1,2



- ① Identification/confirmation of the priority issue based on present atmospheric management and perspective in Asia (O3 & PM)
- ② Review/evaluation of adverse effects on human health and ecosystem (crop) by ozone
- ③ Review/evaluation of adverse effects on human health (ecosystem) by aerosol
- ④ Estimation of socio-economic effects with achievement of target of reduction of air pollutants, and consideration on the target from the view point of requirement of science
- ⑤ Case study on the contribution to policies of atmospheric environment management by science

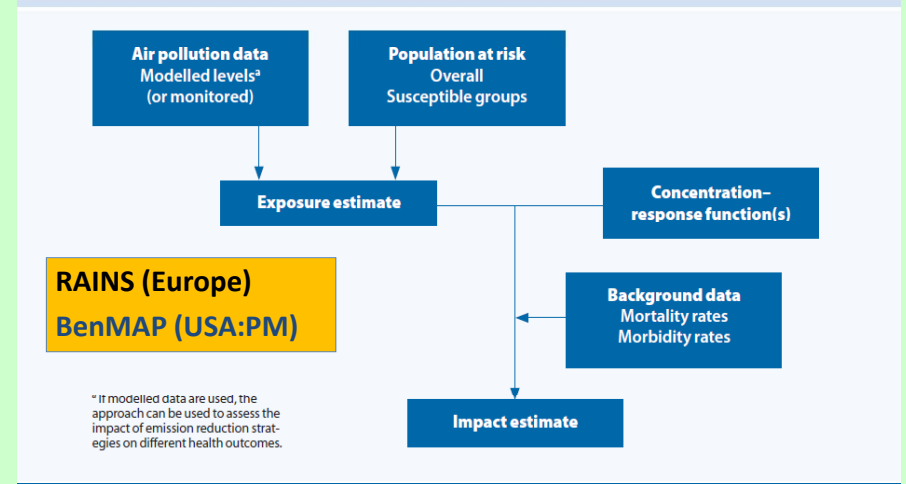
4

# Health Impacts: "Pyramid of Effects"



# The approach to estimate risk

Fig. 7.1. Schematic presentation of the main steps of a health impact assessment

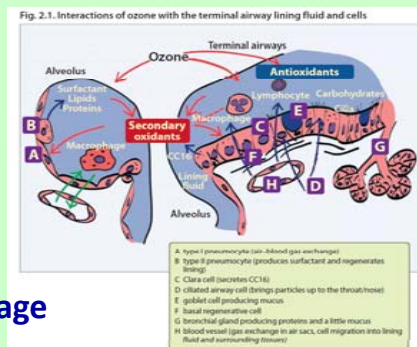


(Source: Health risks of particulate matter from long-range transboundary air pollution (WHO))

# I. Health Risk of Ozone

- In short-term studies, O<sub>3</sub> appears to have effects independent of other air pollutants on a number of health aspects:

- pulmonary function
- lung inflammation
- lung permeability
- respiratory symptoms
- increased medication usage
- morbidity and mortality



# Hazard assessment of ozone

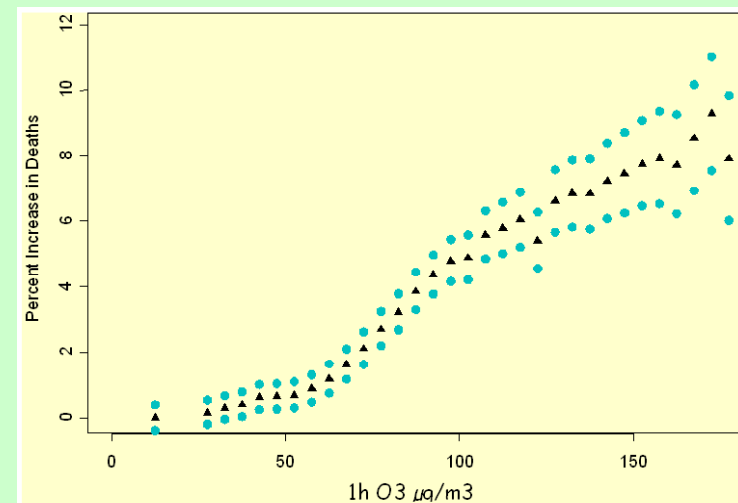


Figure 2.2. Dose-response of ozone (1-hour maximum daily mean) and daily number of deaths (average of lags 0 and 1) during the summer season. Data from 23 European cities of APHEA2 study. (Gyparis et al. 2004)  
(The blue dots show 95% CI limit)

(Source: Health risks of ozone from long-range transboundary air pollution (WHO))

## WHO Guidelines for Air Quality:O3

	Daily maximum 8-hour mean	Effects at the selected ozone level
High level	240 µg/m <sup>3</sup>	Significant health effects, substantial proportion of vulnerable population affected.
Interim target-1 (IT-1)	160 µg/m <sup>3</sup>	Important health effects, an intermediate target for populations with ozone concentrations above this level. Does not provide adequate protection of public health.
<b>Air quality guideline (AQG)</b>	<b>100 µg/m<sup>3</sup></b>	<b>This concentration will provide adequate protection of public health, though some health effects may occur below this level.</b>

AQG 2000: 120 µg/m<sup>3</sup>

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## Guidelines and limit values for Ozone: WHO, EU

### Box 2.1. WHO Air Quality Guidelines and EU ozone standards for protection of health

#### WHO Air Quality Guidelines for ozone (WHO, 2006)

- Guideline: daily maximum 8-hour mean: 100 µg/m<sup>3</sup>
- Interim target (IT-1): daily maximum 8-hour mean: 160 µg/m<sup>3</sup>
- High level: daily maximum 8-hour mean: 240 µg/m<sup>3</sup>

#### EU Air quality directive – EC Directive 2008/50/EC (EU, 2008)

- Target value: maximum daily 8-hour mean: 120 µg/m<sup>3</sup> not to be exceeded on more than 25 days per calendar year – to be met by 1.1. 2010
- Long-term objective: maximum daily 8-hour mean within a calendar year: 120 µg/m<sup>3</sup>
- Information threshold (1-hour average): 180 µg/m<sup>3</sup>
- Alert threshold (1-hour average): 240 µg/m<sup>3</sup>

(Source: Health risks of ozone from long-range transboundary air pollution (WHO))

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## National Ambient Air Quality Standards for Ground-level Ozone (USEPA)

	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Time
Ozone	0.075 ppm (2008 std)	8-hour <sup>1</sup>	Same as Primary	
	0.08 ppm (1997 std)	8-hour <sup>2</sup>	Same as Primary	
	0.12 ppm	1-hour <sup>3</sup> (Applies only in limited areas)	Same as Primary	

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## II. Health Risk Assessment of PM

### I. Effects related to short-term exposure

- Lung inflammatory reactions
- Respiratory symptoms like coughing and difficult or painful breathing
- Adverse effect on the cardiovascular system
- Increase in medication usage
- Increase in hospital admissions
- Increase in mortality

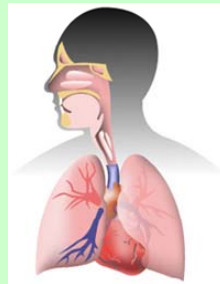
### II. Effects related to long-term exposure

- Increase in lower respiratory symptoms
- Reduction in lung function in children and adults
- Increase in chronic obstructive pulmonary disease
- Reduction in life expectancy mortality and probably to lung cancer

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## Particulate Matter

- Larger particles ( $> PM_{10}$ ) deposit in the upper respiratory tract
- Smaller, inhalable particles ( $\leq PM_{10}$ ) penetrate deep into the lungs

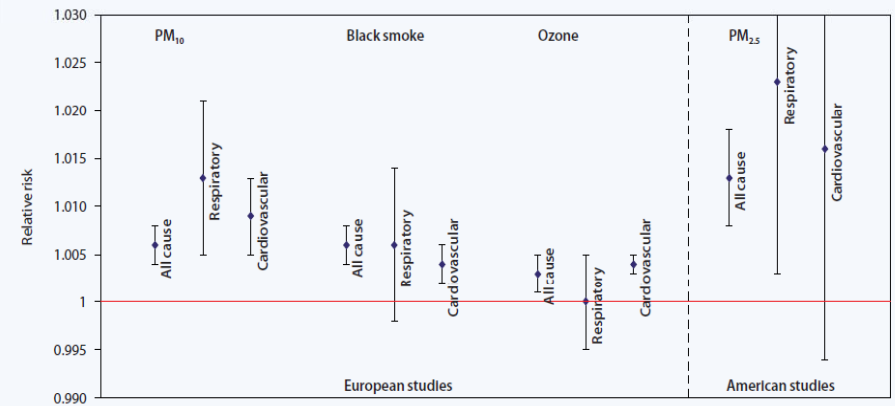


- Both coarse particulate matter and fine particulate matter can penetrate to lower regions of the lung
- Deposited particles may accumulate, react, be cleared or absorbed

(Source: USEPA) 13

## Studies on the effects of short-term exposure to PM

Fig. 3.2. Summary estimates for relative risks for mortality and different air pollutants



Note: There were not enough European results for a meta-analysis of effects of  $PM_{2.5}$ . The relative risk for this pollutant is from North American studies and is shown for illustrative purposes only.  
Source: WHO (18).

(Source: Health risks of particulate matter from long-range transboundary air pollution (WHO)) 14

## EPA's PM Standards: Old and New

	Previous Standards		2006 Standards	
	Annual	24-hour	Annual	24-hour
<b>PM<sub>2.5</sub> (Fine Particles)</b>	15 $\mu\text{g}/\text{m}^3$ Annual average	65 $\mu\text{g}/\text{m}^3$ 98 <sup>th</sup> percentile	15 $\mu\text{g}/\text{m}^3$ Annual average	35 $\mu\text{g}/\text{m}^3$ 98 <sup>th</sup> percentile
<b>PM<sub>10</sub> (Coarse Particles)</b>	50 $\mu\text{g}/\text{m}^3$ Annual average	150 $\mu\text{g}/\text{m}^3$ 1 expected exceedance	<b>Revoked</b>	150 $\mu\text{g}/\text{m}^3$ 1 expected exceedance

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## PM<sub>2.5</sub> – Primary 24-hour Standard

- EPA has strengthened the level of the 24-hour  $PM_{2.5}$  standard from the 1997 level of  $65 \mu\text{g}/\text{m}^3$  to  $35 \mu\text{g}/\text{m}^3$ , as proposed.
- - EPA's assessment concluded that the standard should be strengthened to better protect the public from short-term fine particle exposures.
  - Significantly expanded body of scientific information.
  - Epidemiologic studies show health effects at and below the level of the 1997 24-hour standard including premature death, increased emergency room visits and increased hospitalizations.
  - Consensus among CASAC PM panelists to place more emphasis on lowering the 24-hour  $PM_{2.5}$  standard.
- EPA has retained the form of the 24-hour standard - the average of the 98th percentile of 24-hour  $PM_{2.5}$  concentrations averaged over three years.

(Source: USEPA) 16

## Air Quality Guidelines: (WHO,2005)

PM <sub>2.5</sub>	PM <sub>10</sub>
10 $\mu\text{g}/\text{m}^3$ annual mean	20 $\mu\text{g}/\text{m}^3$ annual mean
25 $\mu\text{g}/\text{m}^3$ 24-hour mean	50 $\mu\text{g}/\text{m}^3$ 24-hour mean

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## III. Risk Assessment of Ozone on Ecosystem

- Effect on vegetation  
e.g.; crop yield
- Effect on animals (less documents)

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## Agricultural production losses caused by ozone

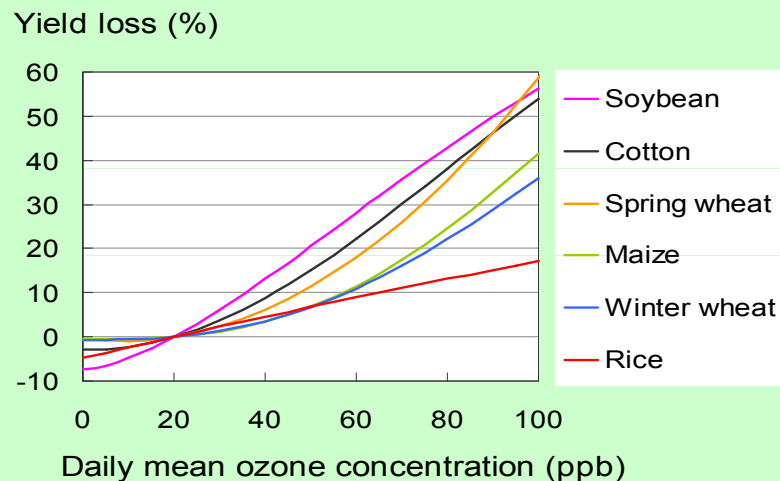


Figure Relationships between ozone concentrations and yield losses in major agricultural crops. (Lesser et al., 1990; Skarby et al., 1993; Kobayashi et al., 1995)

(Source: Tropospheric Ozone A Growing Threat by ADORC)

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## Research Plan

### 2009 (JFY)

- Identification of the priority issue of air pollutants based on present atmospheric management and perspective in Asia (ozone & PM).
- Consideration on the applicable method of risk assessment of ozone and PM using the latest scientific knowledge by reference retrieval and interview to the relevant organization (USEPA, IIASA).
- Obtaining information on the GIS data of population (vital statistics), crop and mortality/morbidity for analysis of risk.
- **Holding the meeting of cooperative experts to discuss the risk assessment (12 February, 2010, ADORC).**

### 2010

- To quantify exposures of ozone and PM in East Asia referring to international indices (e.g. AOT40 and SOMO35).

## Research Plan

### 2011

- Based on the results of exposure estimation in the previous year, evaluating adverse effects on human health and ecosystem (crop) by ozone and PM in terms of economic values of health damage and crop yield loss.
- Consideration on the socio-economic effect comparing to the damages and cost for reduction of emission.

### 2012

- Case study on the contribution to policies of atmospheric environment management by science.

## Research Plan

### 2013

- Based on the risk assessment and its economic and social effects, consideration on the determination of the appropriate environmental target and reduction of emissions.
- And consideration of functional element of framework to implement effective policy in East Asia from the case study of scientific knowledge and implementation of policy.



S7-3-3: Study on the effective /efficient policies based on science on the **atmospheric management** in East Asia (**Inter-linkage of science and policy**): A study on target of reduction for air pollutants

by: *Amin NAWAHDA*

Planning and Training Dept. Acid Deposition and Oxidant Research Center (ADORC), e-mail: [nawahda@adorc.gr.jp](mailto:nawahda@adorc.gr.jp)

IGES-2010/01/23-24

## Objectives: Risk quantification

For PM2.5 and O3:

- 1- To estimate recognized environmental exposures
- 2- To estimate possible environmental impacts
- 3- To quantify the economic costs of those impacts

2

## PM2.5: population exposure

-Study region:

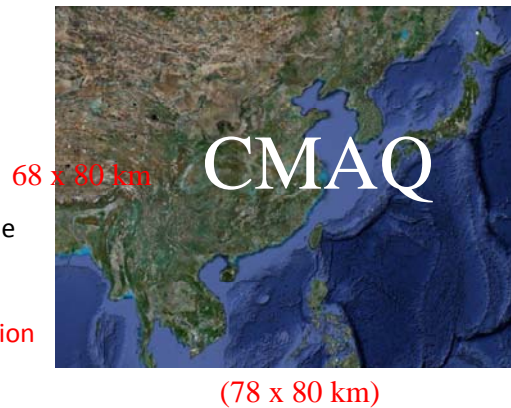
-grid box: 80 x 80 km x 150 m

-population data: 5 x 5 km (GPWv3,2000)

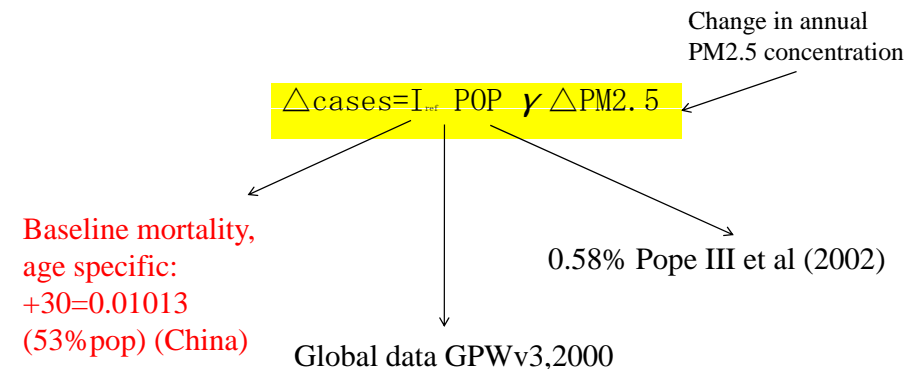
-age distribution based on available data

-total exposures will be calculated using both **population distribution and change in PM2.5 concentrations.**

-Mortality: those **age 30+** and infants will be considered



## PM2.5: total health impacts



Ref.: (Wang, et..al,2004)



## PM 2.5: screening of cells

A screening based on WHO/EPA-PM2.5 guidelines:

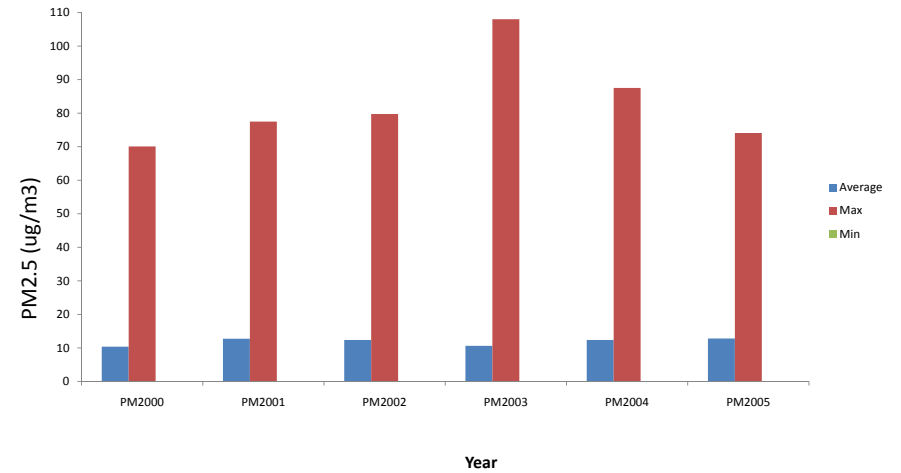
- 24 h average: 25/35 ug/m3

- annual average: 10/15 ug/m3

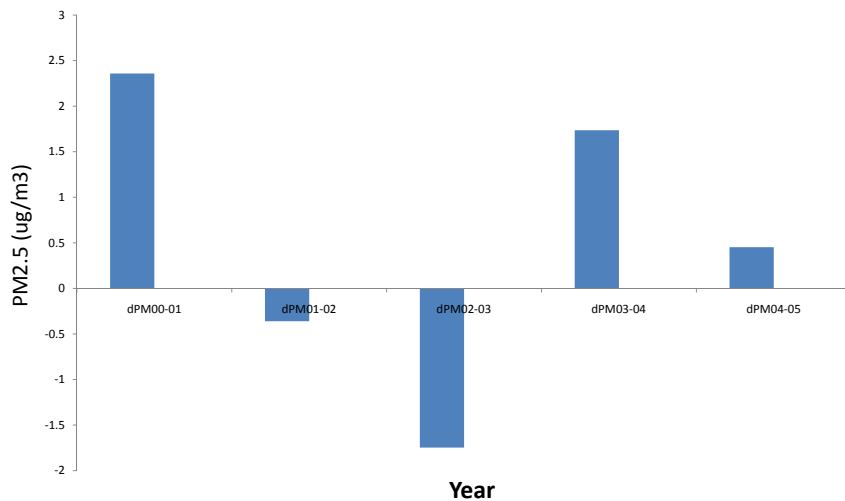


Collection of mortality and morbidity related data

## PM2.5: Annual average 2000-2005, Cell(49,36)



## PM2.5: Annual change in average concentrations, 2000-2005, cell(49,36)



## Approach for PM 2.5-Risk assessment

- Endpoint:
  - Loss in statistical life expectancy
  - Related to long-term PM2.5 exposure, based on cohort studies
- Life tables provide baseline mortality for each cohort in each Cell (country)

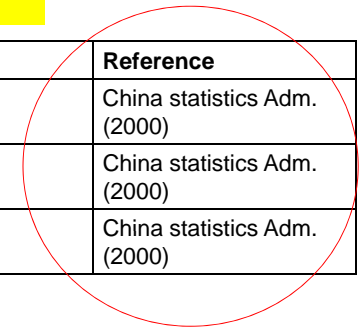
# Assumptions

- Mortality related to PM2.5
  - PM2.5 includes effects from; EC, NH4, NO3, OC, SO4
- Considering WHO/EPA guidelines and data availability for further risk assessment
- No effects for younger than 30 years!
- infant mortality ex/included?

# PM2.5: Baseline mortality in 2000- China (Wang et..al,2006)

$$\Delta \text{cases} = I_{ref} \cdot POP \cdot \gamma \cdot \Delta PM2.5$$

Health endpoint	Rate	Reference
Total mortality	0.00645	China statistics Adm. (2000)
Mortality among 30+ yr old	0.01013	China statistics Adm. (2000)
Infant mortality	0.0247	China statistics Adm. (2000)



# Health impacts from ozone

# Approach for ozone

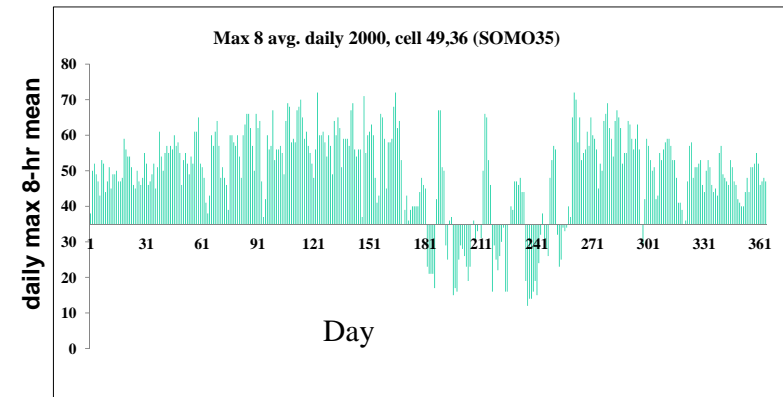
- Endpoint: Cases of premature deaths
- Related to daily 8-hour mean ozone levels
- With a cut-off (35 ppb 8-hour mean) – SOMO35
- Accumulated over the full year
- **Baseline mortality data for each country**
- Exposures are calculated for; urban, subrural, and rural population in each 80\*80 km grid cell

## Why SOMO35 ?

- WHO recommends use of the SOMO35 index (ppb days)
- In contrast to other air quality indices it considered O3 to have a lower threshold
- 80 x 80 km grid size

## O3: SOMO35, 2000

related to excess of daily max. 8 hour means > 35 ppb (SOMO35)



## Mortality and morbidity due to exposure to O3 (EPA, US,1999)

- M: number of mortalities (or morbidities) during 24 h period relative to number of deaths for respiratory diseases.

$$\Delta M = Y_0 (1 - e^{-\beta \Delta O_3}) * \text{population}$$

- Y<sub>0</sub>: baseline incidence of daily non-accidental deaths per person of any age

$$\beta = \frac{\ln(RR)}{\Delta O_3}$$

- β : CR coefficient

## O3: Yield Loss (Wang, et..al,2004) based on M7 & M12

$$Y = A \exp[-(M7/B)C]$$

Y: mean yield

A: theoretical yield at 0-O3

B: scale parameter for O3 (dose to get 0.37A)

C: Shape parameter

Relative yield loss:

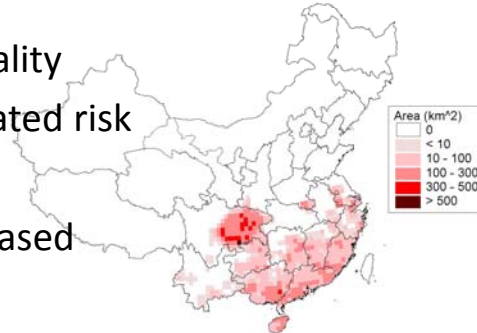
$$RYL = 1 - Y/Y_{base}$$

Y<sub>base</sub>: mean yield at 25ppb (EPA)

# LULC in East Asia

- LULC data (rice, wheat, corn, soybeans)
- Crop Calendar
- Considering seasonality
- and months of elevated risk
- Endpoint: Yield loss
- Risk index: M7,12-based

Rice / Rice (per 0.5 degree grid cell)



Ref.: [http://www.dndc.sr.unh.edu/boles/d\\_jpeg/doublerice.jpg](http://www.dndc.sr.unh.edu/boles/d_jpeg/doublerice.jpg)

# O3: Exposure-Yield relations based M7 & M12

X. Wang, D.L. Mauzerall / Atmospheric Environment 38 (2004) 4383–4402

4389

Table 3  
O<sub>3</sub> exposure-yield response equations for rice, wheat, corn and soybeans based on 7-h and 12-h means, SUM06 and W126 indices

Crop	Exposure-relative yield (RY) relationship	Reference
Rice	$RY = \exp[-(M7/202)^{2.47}] \exp[-(25/202)^{2.47}]$	Adams et al. (1989)
Wheat	$RY = \exp[-(M7/137)^{2.34}] \exp[-(25/137)^{2.34}]$ (Winter wheat)	Lesser et al. (1990)
	$RY = \exp[-(M7/186)^{3.2}] \exp[-(25/186)^{3.2}]$ (Spring wheat)	Adams et al. (1989)
	$RY = \exp[-(SUM06/52.32)^{3.176}]$	Adapted from EPA (1996) <sup>a</sup>
	$RY = \exp[-(W126/51.2)^{1.747}]$	Adapted from EPA (1996) <sup>a</sup>
Corn	$RY = \exp[-(M12/124)^{2.83}] \exp[-(20/124)^{2.83}]$	Lesser et al. (1990)
	$RY = \exp[-(SUM06/93.485)^{3.5695}]$	Adapted from EPA (1996) <sup>a</sup>
	$RY = \exp[-(W126/93.7)^{3.392}]$	Adapted from EPA (1996) <sup>a</sup>
Soybean	$RY = \exp[-(M12/107)^{1.58}] \exp[-(20/107)^{1.58}]$	Lesser et al. (1990)
	$RY = \exp[-(SUM06/101.505)^{1.452}]$	Adapted from EPA (1996) <sup>a</sup>
	$RY = \exp[-(W126/109.75)^{1.2315}]$	Adapted from EPA (1996) <sup>a</sup>

<sup>a</sup>Weibull parameters are given for each studied cultivars of a particular crop under NCLAN. We construct a single exposure-response function for a crop by using the median Weibull parameters of all studied cultivars.

## Next step

- How far can we advance in environmental risk assessment based on large scale models?
- What level of uncertainties can be justified and enable us to quantify effects?

## Air Pollution Institutional Architecture in East Asia should be Diffused and Start with High-level Political Agreement

Hayama, 24 January 2010



Norichika Kanie, Ph.D.  
Visiting Professor  
*SciencesPo./IDDRI*  
and  
Associate Professor  
Graduate School of Decision Science and Technology  
Tokyo Institute of Technology



## Higher stakes in Climate Change over Air Pollution

- UNFCCC-KP
    - More than 110 head of states gathered in Copenhagen 2009
  - LRTAP in Europe and US
  - Male declaration
  - Haze Agreement
  - EANET in Asia
- Do exist, but less political stake as the scope and issue frame is limited



## Why Climate Change?

From around 2005 climate change has become to an issue which is more than "just one environmental issue". Increasingly more politically important forum start to deal with the issue.

- One of main issues since 2005 Gleneagles G8.
- Security Council discussed climate change on 17 April 2007.
- UNGA Special Session in 2007 and 2009
- IPCC and Al Gore won Nobel PEACE prize in 2007
- More than 110 head of states at COP15 (equivalent to Rio)



## Two reasons for the change

1. Climate-related events that are (seemingly) impacts of climate change
  - ← heat wave in Europe, more frequent and heavier flooding, Hurricane, Typhoon
  - ← Progress on impact research (2005 Feb. Avoiding Dangerous Climate Change, AR4)
  - ← Media interpretations (IPCC publications, "Inconvenient Truth")
2. Political recognition on political importance of the issue
  - ← potential impact on contemporary life styles and basic needs (carbon constraints)
  - ← Recognition of the real issue / for DCs economically attractive opportunities



# Climate Security: two reasons why climate change is considered as a security issue

## 1. Direct threat

【caused by results (impact)】

Changing climate pattern (rain, draught, flood, etc), immigrant/refugee caused by the sea level rise



Cause of conflict (esp. Africa, Small Island States)



2. Policies against climate change are DEEPLY linked with national security issues – resource and energy security 【strategically central issue】

Climate Policy



Shifting Energy Source

From Fossil Fuels to Renewable Source of Energy (decentralized)



Competing over new energy resources (e.g. biomass, natural gas) require new strategy

Strategies and Competition over new energy(-related) TECHNOLOGY (to make use of wind, solar, biomass as energy resources / developing, deploying, and transferring low-carbon technology)



## Asian Mitigation Targets

	Mid-term(2020)	Long-term (2050)
Japan	-25% (from 90)	-60 ~ -80% (from current level)
China	-40~45% (Intensity, from 2005)	
India	-20% ~ 25%(Intensity, from 2005 in 2020) -37%(Intensity, from 2005 in 2030)	
Indonesia	-26% (from BAU) -41% (with int'l support)	
Singapore	-16%(from BAU)	
Maldives	Carbon Neutral in 2019	

7



## How to realize Co-benefits?

- Pollution is more serious (and well-acknowledged problems in East Asia)
  - many substances that cause environmental pollution overlap with ones causing climate change
- However, more funding opportunities for climate change measures



## Problems on co-benefit approach

- Currently, traditional overseas development assistance (ODA) can be used for projects targeting air pollution abatement
- The clean development mechanism (CDM) under the Kyoto Protocol can assist on the climate change side.
- However, technically complicated problems exist between the two financial mechanisms.
  - One is that a CDM project has to be an add-on to ODA, because conventional ODA is decreased if ODA funding is used for CDM.
  - Another technical difficulty with CDM is that the amount of emissions reduced by a given project has to be "reasonable" and proven, a process widely recognized as both time and cost consuming, even though it is important.



## Create an institutional approach that fits the pollution issue into a regional framework?

- Trans-boundary air pollution is a regional problem
- Recent study on institutions suggests that decentralization works better in solving problems, especially in developing countries

Vinod K. Aggarwal, *Institutional Designs for a Complex World* (Cornell University Press, 1998); Elinor Ostrom, "Decentralization and Development: The New Panacea." In Keith Dowding, James Hughes and Helen Margetts, *Challenges to Democracy: Ideas, Involvement and Institution* (Palgrave Publishers, 2001): 237-256; Christopher K. Ansell and Steven Weber "Organizing International Politics." *International Political Science Review*, January (1999); and Peter M. Haas, Norichika Kanie and Craig N. Murphy, "Conclusion: Institutional design and institutional reform for sustainable development." In Norichika Kanie and Peter M. Haas eds. *Emerging Forces in Environmental Governance* (UNU Press, 2004)



## Hypothesis to be test

- Lack of negotiating capacity is a serious problem for regional multilateral talks.
  - Solving problems starts with finding a common language, as only a couple of countries are native to English.
  - Professional diplomats, especially from smaller countries, may be too busy to be engaged in technical talks.
  - Changing delegates with lower capacity makes it difficult for sustainable consensus-making
- Decentralization could make a positive difference.
  - starting with top-level political agreement to create a decentralized mechanism involving multiple actors may be more effective in Asia to realize a low-carbon future than time-consuming incremental expansion of various kinds of centralized technical agreements.



From the view point of East Asia

Economic analyses of Co-benefit environment policy for global climate change and local air pollution: Asian MERGE model

24 January 2010

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## Economics characteristics of Co-benefit environment policy analyses

1. Introducing global climate change (GCC) and local air pollution (LAP) in a model simultaneously. For the explicit relation of GCC and LAP and using data correctly, cooperation with science researchers is necessary.
2. Global model with multiple regions.
3. Long-term analyses (dynamic)

## Some Models including GCC and LAP

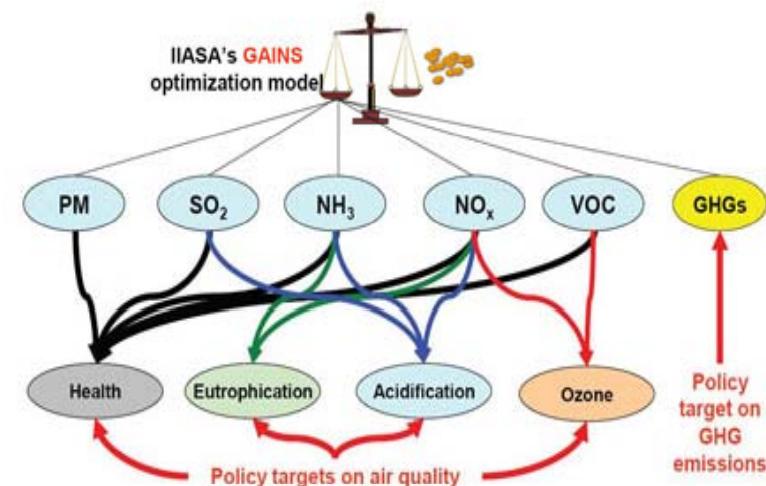
1. GAINS (Greenhouse gas – Air pollution Interactions and Synergies) —IIASA
2. Expanded MERGE (Model for Evaluating the Regional and Global Effects of GHG Reduction Policies) —NEAA (Netherlands Environmental Assessment Agency)
3. E3ME (An Energy-Environment-Economy Model of Europe)—Cambridge Econometrics

## About GAINS



1. It is developed from RAINS which is strong on LAP.
2. Focus on synergy and trade-off between GHG Emission and Particulate pollution, Acidification, Eutrophication, Tropospheric ozone but co-benefit analyses is not carried on.
3. Long-term analyses with 5 years step (until 2030).
4. Their analysis is from bottom to up.
5. Policy, cost and technology.
6. Can be applied with selected country.

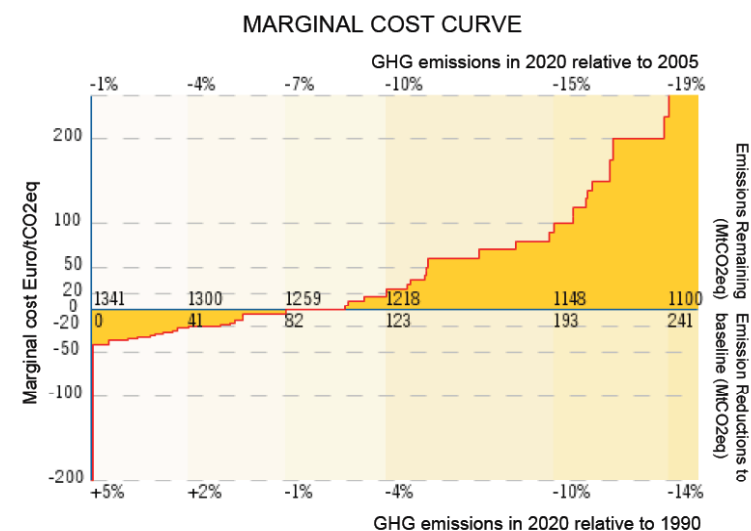
## Framework of GAINS



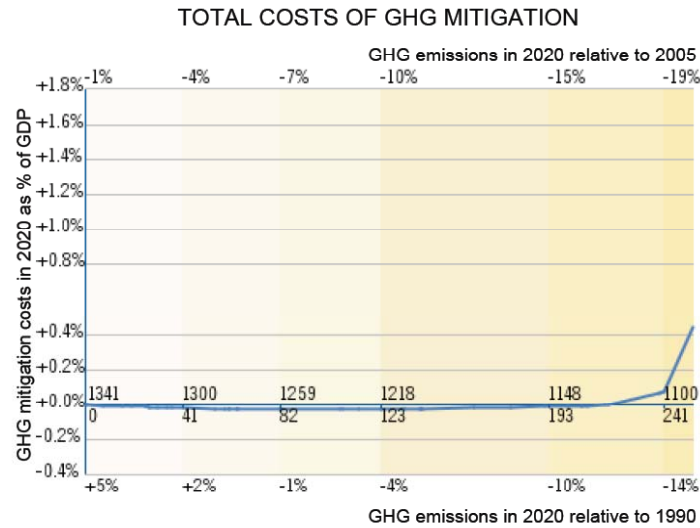
SO<sub>2</sub> Emission and Control Cost of Japan and China (GAINS, 2009)



Marginal cost curve of Japan (GAINS, 2009)



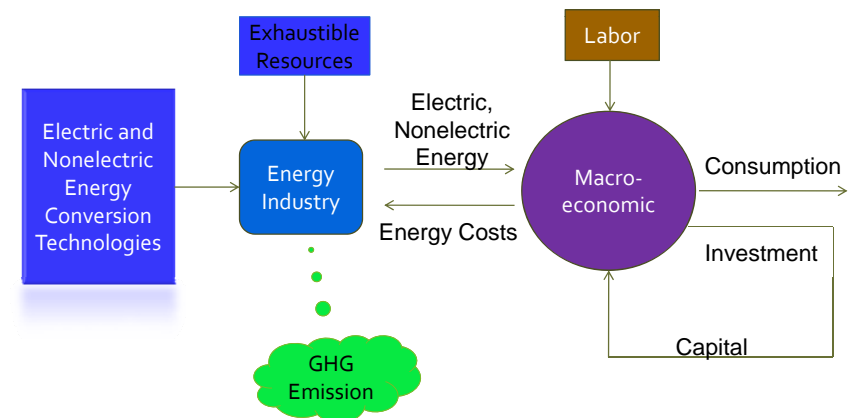
## GHG mitigation total costs of Japan (GAINS, 2009)



## About MERGE

1. MERGE is set up by Manne and Richels of Harvard University in early 90s.
2. Macroeconomic model considered with GHG policy only (without LAP).
3. Top-down model including only one industry: energy industry.
4. Long-term model (until 2100, by 10 years step), therefore, MERGE is dynamic and multi-regional macro-economic model
5. Policy analyzing was based on multiple scenarios.

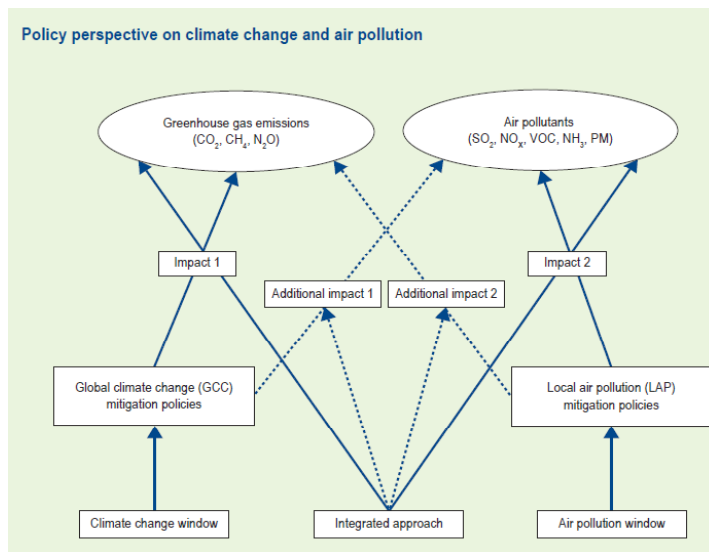
## Framework of MERGE



## From MERGE to Expanded MERGE

1. Added LAP to the model.
2. Emphasizing cost-benefit mode rather than cost-effectiveness.
3. New mathematical expressions are included in the model, such as, emissions of PM from energy use in electricity and non-electricity sectors, monetary estimates for the damages resulting from premature PM deaths.
4. Meriting advantage of GAINS model in LAP analyses and introducing GAINS results directly.

## Expanded MERGE model



## Result of Expanded MERGE

(% change compared with BAU)

		World	OECD	China	India
Climate change window	CO2eq mitigation(%)	73	74	81	77
climate policy	PM-death reduction(%)	42	34	45	40
	GDP (%)	-2.2	-0.8	-6.4	-3.6
	GCC benefits (% GDP)	0.1	0.2	0	0
	LAP benefits(% GDP)	1.8	1.4	4.6	3.5
	benefits-GDP loss (% GDP)	-0.2	0.8	-1.8	-0.2
alternative air policy	benefits-GDP loss (% GDP)	1.1	1	2.8	1.8
incentive power	Climate policy – alternative air policy (% GDP)	-1.3	-0.2	-4.5	-2
Air pollution window	CO2eq mitigation (%)	40	38	42	61
air policy	PM-death reduction (%)	71	65	70	74
	GDP (%)	-2.3	-1	-6.9	-7.5
	GCC benefits (% GDP)	-0.1	-0.1	-0.1	0
	LAP benefits (% GDP)	3.2	2.5	7.3	6.8
	benefits – GDP loss (% GDP)	0.9	1.6	0.3	-0.8
alternative climate policy	benefits – GDP loss (% GDP)	-0.1	0.2	-0.7	-0.3
incentive power	air policy - alternative climate policy (% GDP)	1.1	1.4	1	-0.5
Integrated approach	CO2eq mitigation (%)	59	70	56	58
	PM-death reduction (%)	67	74	65	62
	GDP loss (%)	2.9	1.5	7.4	5.8
	LAP benefits (%GDP)	3.3	2.9	6.7	5.6
	benefits – GDP loss (% GDP)	0.5	1.4	-0.6	-0.2

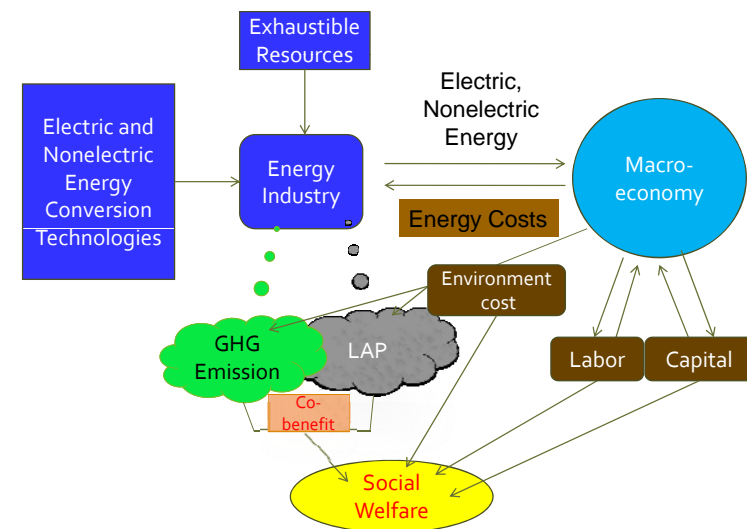
## Air pollutants included in GAINS and Expanded MERGE

	GAINS	Expanded MERGE
1	CO <sub>2</sub>	CO <sub>2</sub>
2	CH <sub>4</sub>	CH <sub>4</sub>
3	N <sub>2</sub> O	N <sub>2</sub> O
4	NO <sub>x</sub>	NO <sub>x</sub>
5	TSP, PM <sub>10</sub> , PM <sub>2.5</sub> and PM <sub>1</sub>	TSP, PM <sub>10</sub> , PM <sub>2.5</sub>
6	SO <sub>2</sub>	SO <sub>2</sub>
7	VOC	
8	NH <sub>3</sub>	
9	CO	
10	F-Gases	

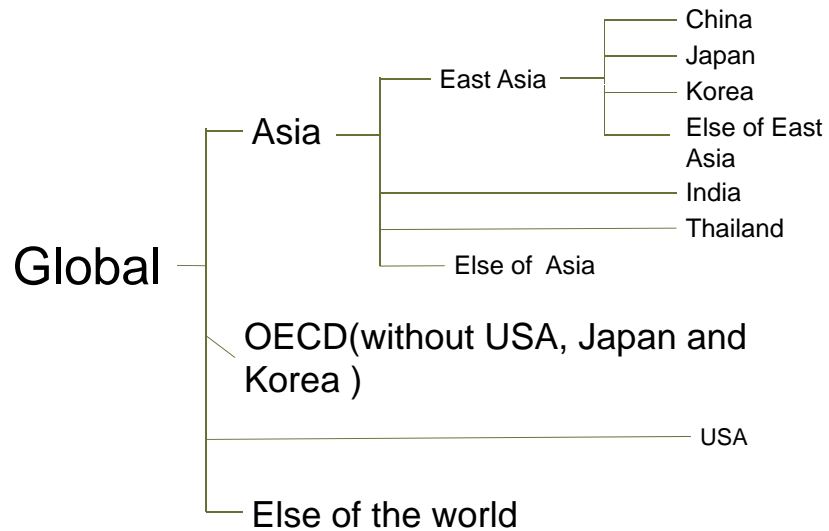
## From Expanded MERGE to Asian MERAGE Model

1. To format Asian version LAP functions by cooperating with other themes group of S-7 project (for example, which pollutants should be included in Asian model).
2. To add new GHG factors, such as black carbon, in GCC functions (under consideration).
3. To estimate both Asian and some Asian countries' (like Japan, China, Korea and etc.) social economic value of premature PM deaths.
4. Promote air pollutions will be included in model by adding trans-boundary air pollution index into some specific country like Japan. The function which will decide this index should be based on the achievement of other S-7 groups.

## Framework of Asian MERGE model



## Regions and Countries in Asian MERGE model



Object function (global welfare function) and its economic constraints

Welfare function (r-region, t-year)

$$\sum_r n_r \sum_t e_{t,r} \log \left[ E_{t,r} (C_{t,r} - F_{t,r}) \right]$$

Negishi Weight  $\uparrow$   $n_r$     Time discounter of utility  $\uparrow$   $e_{t,r}$     GCC index function  $\uparrow$   $E_{t,r}$     Consumption  $\uparrow$   $C_{t,r}$     LAP function  $\uparrow$   $F_{t,r}$

Budget constrains

$$Y_{t,r} = C_{t,r} + I_{t,r} + J_{t,r} + K_{t,r} + D_{t,r} + X_{t,r}$$

$\uparrow$  GDP (2005 \$)     $\uparrow$  Saving for investment     $\uparrow$  Energy Cost     $\uparrow$  LAP cost     $\uparrow$  GCC cost     $\uparrow$  Net export

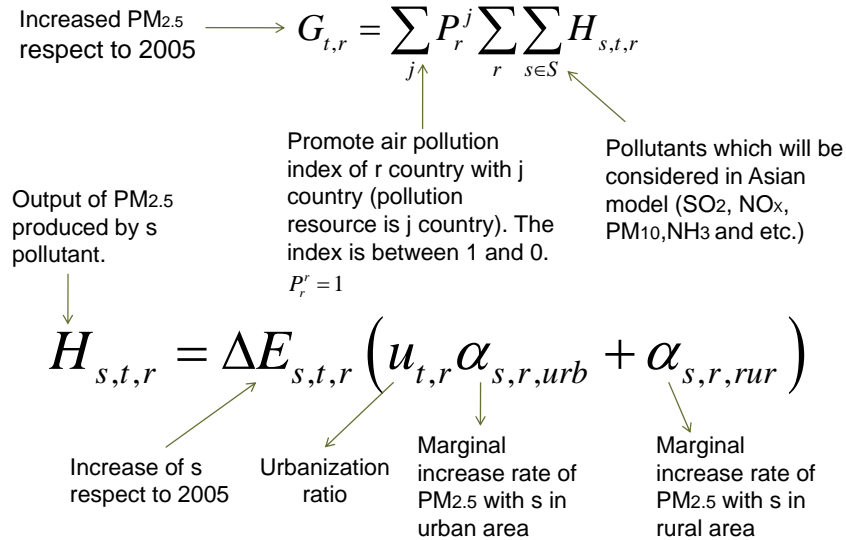
To evaluate the damage for world warming (GCC index function)

$$E_r(\Delta T) = \left( 1 - \left( \frac{\Delta T}{\Delta T_{cat}} \right)^2 \right)^{h_r}$$

Temperature rises respect 2005  $\swarrow$   $\Delta T$      $\searrow$   $\Delta T_{cat}$     Development index (the highest is the country with high income, and it is set as 1)  $\swarrow$   $h_r$

Damage index  $\swarrow$   $E_r(\Delta T)$     Catastrophic temperature change limit  $\swarrow$   $\Delta T_{cat}$

### LAP function considering with promote air pollution



We need advise from science theme groups of S-7 project

### Analysis flow of Asian MERGE model

Step 1. Optimize global welfare function and get optimal policy of GCC and LAP, therefore GCC and LAP level of each region and country will be clear.

Step 2. Based on the result of step 1, to optimize Asian welfare function and get optimal policy of GCC and LAP of Asian. Optimal solution will show value of each variable.

Step 3. Based on step 1 or step 2, to optimize welfare function of each and get optimal policy of GCC and LAP of these countries. Other optimal solution of variables in this model could also be found, for example, government of Japan will reduce CO<sub>2</sub> emission by 25%, Chinese government suggested their aim about decrease CO<sub>2</sub> intensity by 40%-45% till 2020 from 2005 level.

Step 4. Co-benefit analyses for each optimal solution.

Step 5. Based on above steps, give policy suggestions for Asian Environment Cooperation.

Can we get a ozone target value function of Japan, like this

$$O_{jp}^{75} = f(x_s^r, x_s^{jp})$$

Quantity of pollutant

and countermeasure function like below

$$x_s^r = g(p_s^r)$$

Countermeasure of Japan for s in country r

Therefore, we can estimate cost function of countermeasure function, analyze welfare change of Japan and give our policy suggestion for promote air pollution in Asia

# Research on the Policies of Administration of Air Quality in China

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## Part 1 Overview of challenges faced by air quality in China and its developing tendency

- 1.1 Analysis of basic background
- With a sustained and rapid development of China's national economy and the constant and sharp increase in energy consumption, the air pollution problem is increasingly severe in China, the air pollution which occurred in advanced countries in the industrialization for hundreds of years arises intensively; there is a deep trouble of severe air pollution accidents with a grim situation of air environment.
- Total Suspended Particulates (TSP) concentration is universally out of limits; sulfur dioxide pollution keeps on the higher level; total emission of motor vehicles exhausts rapidly rises; nitrogen oxide pollution shows an aggravating tendency; there are various acid rain areas such as Middle China, Southwest, East China, South China in the whole country.

### 1.1.1 Overview of challenges faced by air quality in China

- 1. The pollution due to coal combustion is so serious to impose influence on the economic and social sustainable development. Air pollution in China is mainly a kind of pollution due to coal combustion: smoke dust, sulfur dioxide and nitrogen oxide .
- 2. The air pollution is grim in cities, the haze weather in cities still frequently occurs and does harm to the health of human.
- 3. The increasingly highlighted acid rain pollution doing a grave harm.
- 4. The traffic pollution gradually worsens as an important factor affecting the air pollution in cities. With the constant increase in vehicles quantity in cities, the air pollution is transforming from the pollution due to coal combustion to the compound pollution of coal combustion and transportation.

### 1.1.2 Analysis of reasons for the above-mentioned challenges:

- 1. The process of urbanization in China is accelerating;
- 2. The technological level of air pollution control is weak, particularly in such fields as clean coal technology, industrial stoves in the industry of metallurgy, chemistry, building materials etc., and the control and prevention technology of emission pollution for manufacture facilities;
- 3. Industrial structure is unreasonable, the increase of the industries with high energy consumption is quick;
- 4. The energy mix gives priority to coal. The proportion of coal in the energy mix will not be changed fundamentally in a long period.

### 1.1.3 New development of national strategies for environment and development

- China puts forward a series of national strategies and policies in conformity with the concept of sustainable development. Under the direction of the scientific outlook on development and awareness of conservation, Chinese government accelerates the development of modern energy industry, and gives prominence to building a resource-conserving, environment-friendly society, actively promoting energy conservation and emission reduction and developing circular economy, to endeavor to strengthen the ability of sustainable development.

### 1.1.3 New development of national strategies for environmental and development

- Such strategies of environment and development are as follows:
  1. the concept of “ecological civilization”
    - In 2007, Hu Jintao pointed out that ecological civilization should be constructed.
  2. “resource-conserving and environmental-friendly society”
    - “building a resource-conserving and environmental-friendly society” is a strategic task in the medium-long period planning of national economy and social development”.

- 3. “energy conservation and emission reduction”
  - The “eleventh five-year” plan requires the energy consumption per GDP in 2010 will be reduced by 20% and the main pollutants will be reduced by 10% on the basis of 2005.
  - Energy conservation and emission reduction have become an important instrument and breakthrough to improve economic structure and transform the development ways, so as to push technological renovation, develop green economy.

- 4. Economic transformation and industrial structure adjustment
  - At present, China is promoting technological transformation and independent innovation, speeding up adjustment of structure and transition of development mode; boosting the reconstruction and upgrading of traditional industry.
- 5. “Three transitions”

Wen Jiabao, pointed out at the 6<sup>th</sup> National Environmental Protection Conference in 2006

  - from emphasizing economic growth and underestimating environmental protection to paying equal attention to environmental protection and economic growth;
  - from environmental protection falling behind economic growth to keeping environmental protection and economic growth in the same step;
  - from protecting environment by administrative measures to solving the environmental problems by comprehensive utilization of legal, economic, technological and necessary administrative measures.



## 1.2 The latest developing tendency of administration of air quality in China (since 2006)

### 1.2.1 Legislations, systems, policies and strategies concerning administration of air quality

At present, China has set up a systematic mechanism of air quality supervision and control which consists of laws, systems, policies and strategies.

- 1. Legislations:
  - The Standing Committee of the National People's Congress has accelerated the drafting or revision of such laws in relation to the prevention and control of air pollution as the *Law on the Prevention and Control of Air Pollution*, the *Law on Promotion of Cleaner Production*, the *Renewable Energy Law*, the *Energy Conservation Law*, and the *Law on Promotion of Circular Economy*. Furthermore, a lot of related regulations and standards were formulated.
- 2. Systems:
  - Main systems for supervision and control of air in China including total quantity control of main air pollutants, air environmental standards, air pollutant discharge fees, gazette of air environmental quality.

- 3. Policies
  - The development of energy is closely related to the target of air environmental protection, the policies concerning energy conservation and emission reduction have become an important point in the administration of air quality;
  - Due to increasingly severe regional air pollution in China, it is in urgent need to establish regional and combined mechanism for prevention and control of air. China is making effort to improve such mechanism.

### 1.2.2 Target for administration of air quality and analysis of key fields

- Targets:
  - Chinese government put forward the following target on Nov. 25, 2009: CO<sub>2</sub> emission per GDP will be reduced by 40% to 45% in 2020 than that in 2005. Such target as the restrictive index will be brought into medium-long period planning for national economy and social development.
- Key fields:
  - 1 Industry
    - China's industry is the most dominant consumption field of coal, petrol and natural gas, thus the practice of energy conservation, control of energy consumption and enhancement of energy utilization efficiency in the industrial field are in favor of reducing the emission of pollutant from the sources.

- 2. Transportation
  - China will continue to enhance the standard of emission for motor vehicles and fuel economy standards; keep developing the public transportation system and promoting the use of clean energy vehicles.
- 3. Urban
  - In addition to the above control measures for vehicles emission, central heating, using clean energy, and increasing the urban green areas are adopted in urban areas in order to relieve the air pollution.
- 4. Construction
  - China's standards and supervision of energy conservation for construction are tending to be rigorous.

### 1.2.3 Methods of administration of air quality

- 1. Administrative organ
  - The former State Environmental Protection Administration was upgraded to be the Ministry of Environmental Protection.
  - Furthermore, the Leading Group for Energy Conservation and Emission Reduction of the State Council was established.
- 2. Planning
  - The most important environmental plan is the national eleventh five-year plan for environmental protection.

### 3. Administration

- (1) monitoring
  - The national air quality monitoring network has been formed and the air quality daily report or even forecast system is carried out in key cities.
- (2) License
  - The local people's government in the control regions of total air pollutant quantity, in accordance with the conditions and procedures provided by the State Council, checks and determines the total quantity of main air pollutants discharge of enterprises and institutions to approve and issue the license for main air pollutants.

- (3) Administrative guidance and contract
  - For example, the responsible system for environmental target and letter for emission reduction responsibility are adopted on a larger scale.
- (4) Economic incentive system
  - Tax, charges and governmental subsidy are applied in the environmental protection; green credit, green insurance and the pilot program for emission trading are becoming important economic instruments.
- (5) information disclosure and public participation
  - Enterprises are required to disclose their environmental information according to law;
  - The procedures of public participation has been introduced in the making of laws, regulations and rules, approval of licenses, environmental impact assessment and other decision-making

## Part 2 Research on administration of air quality for Beijing Olympic Games

### 2.1 Necessity for administration of air quality

- Commitment of air quality when bidding for the Games
- Air quality challenge in Beijing

### 2.2 Administrative mechanism of air quality for Beijing Olympic Games

- Beijing Municipality set up the "2008 Environmental Construction Direction Department" and its office, in charge of uniform direction, organization and coordination of the environmental construction;
- Other relevant provinces and regions such as Inner Mongolia Autonomous Region, Hebei Province, Shandong Province respectively set up special authorities to control the air quality in their regions.
- At the national level: the Ministry of Environmental Protection (the former State Environmental Protection Administration) and local governments of Beijing, Tianjin, Hebei, Inner Mongolia, Shanxi and Shandong set up the Coordination Group to Guarantee Air Quality for the Olympic Games.

## 2.3 Legal system and characteristics of air quality administration for the Olympics

### 2.3.1 Legal system of air quality administration for the Olympics

#### 1. National normative documents

- The *Guarantee Measures for Beijing Air Quality for the 29<sup>th</sup> Olympic Games* and the *Guarantee Measures of the Neighboring Provinces, Autonomous Regions and Municipalities of Beijing for Beijing Air Quality for the 29<sup>th</sup> Olympic Games* made jointly by the former State Environmental Protection Administration and governments of Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Shandong;
- The *Emergent Measures for Air Pollution Control under the Extreme Unfavorable Weather during the Beijing Olympic Games and Paralympic Games* made jointly by the former State Environmental Protection Administration and governments of Beijing, Tianjin and Hebei.

#### 2. Local normative documents

- (1) Beijing Municipal Government and its departments, Governments of Districts and Counties in Beijing made a serial of normative documents, focusing on the prevention and control of coal smoke, administration and control of motor vehicles and polluting enterprises.
- (2) Governments of Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong also made local normative documents to carry out the guarantee measures for air quality

### 2.3.2 Legal systems for air quality administration for the Olympics

#### 1. Planning system

##### (1) *Green Olympic Activities Plan*

- On August 25, 2000, the Committee of Bidding for Beijing 2008 Olympic Games, Beijing Environmental Protection Bureau, and environmental NGOs jointly signed the *Green Olympic Activities Plan*, putting forward the target and 30 specific measures for environmental quality in Beijing.

##### (2) *Special Plan for Energy Construction and Structure Adjustment of Beijing*

- Involving the scheme of adjustment of energy structure; the main projects of clean energy construction; reduction of coal burning projects and reasonable utilization of coal resources etc.

#### 2. Environmental standards

- Beijing Municipality made or revised and implemented 23 compulsory local standards of air pollutant discharge for coal burning facilities, motor vehicles, VOCs emission sources (oil refining and petrol chemical industry, equipments using organic solvent, and storage and transportation of oil products), incineration of dangerous wastes etc.

#### 3. Administrative orders

- In order to ensure the air quality before, during, and after the Olympic Games, the nation, provinces and municipalities, districts and counties issued a serial of administrative orders, such as the temporary traffic control measures.

#### 4. Economic incentive system

- Preferential policies such as investment subsidy, tax reduction or exemption, price discount and bonus to encourage the use of clean energy; strengthening the elimination and transformation of polluting vehicles that fail to meet the European No.1 standard for exhaust emissions

## 5. Information disclosure and public participation

- Beijing Environmental Protection Bureau issued periodically the “Gazette of Environmental Situation in Beijing”, making the environmental quality of the whole city public; and disclosed the relevant policies and information to the public.

### 2.3.3 Characteristics of laws and regulations for administration of air quality for the Olympics

- 1. Promulgation authorities
  - Beijing Municipal Government or its departments(43);
  - Central Coordination Authority and local governments of related provinces, autonomous regions and municipalities(14).

## 2. Promulgation time

- Promulgated intensively during several months before the opening of 2008 Olympic Games;

## 3. Legal status

- the administrative regulations promulgated by the State Council;
- the local regulations promulgated by the local people’s congress, and the administrative rules issued by the provincial level governments;
- the administrative rules are the main part.

## 4. Relying heavily on command and control measures

- the command and control measures are dominant;
- most of the normative documents include the temporary legal measures for the Olympic Games, as well as, the long-term measures for the post-Olympics period.

## 2.4 Achievements in the administration of air quality for the Olympics and the problems thereof

### 2.4.1. Achievements of emission reduction in the key fields

#### 1. key fields

##### (1) vehicles exhausts:

- controlling the pollution of vehicles with high emission;
- implementing the environmental label system for the vehicles entering Beijing;
- the temporary traffic control measures for the vehicles;
- the measures for compensation and punishment

##### (2) emission reduction of key enterprises:

- the industrial enterprises in Beijing should adopt effective measures to make the discharge of pollutant meet the standards; otherwise, they should stop operation to treat pollution.

## 2. Achievement of emission reduction

- The implementation of the limited travel measures for vehicles made the total pollutants emission reduce by 63%, about 118 thousand tons;
- The implementation of the measures for enterprise emission reduction made about 130 enterprises with high pollution in Beijing stop operation or limit production during the Olympic Games.

### 2.4.2. Improvement of air quality in Beijing

- During 17 days from August 8 to 24, the air quality in Beijing met the required standards every day, the concentration of pollutants fell by 50%, far exceeded the commitment.

### 2.4.3. Problems in the administration of air quality for the Olympics

- 1. Lack of sustainability
  - Considering technological, social and economic factors for counter-measure application, there are barriers on the continuous feasibility.
- 2. The temporary measures are dominant at the absence of long-term consideration
  - Most of the measures will be void automatically after the end of the Olympic Games, only a small part of regulations and rules provide long-term administrative measures.

## 2.5 Basic measures for air administration after the Olympics

- 1. Make the plans with technological and economic feasibility
  - Beijing is no longer faced with environmental pressure from the outside world and the pressure brought by its own commitments, the technological and economic feasibility should be analyzed to make the plans for emission reduction and air quality targets.
- 2. Deregulate properly
  - The guarantee of the Olympics is replaced by common environmental protection, and the relationship between the public interests and private interests should be reevaluated, strict command and control measures should be changed according to laws, regulations and rules.
- 3. Strengthen economic incentive measures
  - Except for the command-control measures, the economic incentive measures should be strengthened further.

## Part 3 Research on the mechanism for cross-region administration of air quality

### 3.1 General

- 1. The cross-region feature of air pollution
  - Air pollutant can flow and flee, which causes cross-region pollution damage, i.e. the air pollutant knows no administrative borders.
- 2. The necessity of cross-region administration of air quality
  - (1) to deal with the problem of cross-region pollution
    - Air quality administration by single administrative area can not have full effect to deal with cross-region pollution and it's necessary to have a cross-region administration mechanism to coordinate and integrate related areas.
  - (2) To overcome local protectionism and strengthen central supervision
    - The establishment of cross-region administration mechanism will help to overcome local protectionism and strengthen administration and coordination at the national level.

- 3. Related experiences on the cross-region administration of water resources
  - (1) Legislative
    - The state administers water resource in terms of valley and administrative area. The water administrative authority of the central government determines valley administrative institution for important rivers and lakes.
  - (2) The administrative authority
    - The administrative authority for the valley administration, which exercises the water administrative function over the valley it is in charge of is set up by the state;
    - The valley administrative authorities are subject to the administration of the water administrative authority of the central government;
    - The State council may establish institution for coordination and decision-making for valley administration, which may be composed of by persons from related department of the State Council, valley administrative authorities and local governments.

- (3) function
  - The valley administrative authority is in charge of the administration of the valley, such as
  - The implementation of the laws and regulations and the supervision and inspection thereof;
  - The draft of water policies and regulations for the valley;
  - Organization of the drafting of the comprehensive plan for the valley and related special plans and supervision the implementation thereof;
  - Organization of the preliminary work of valley-scale water projects and the important project cross provinces (autonomous regions and municipally directly under central government);
  - uniform administration of the water resources.
- Although the air pollutant flows unlike water in a specified way, the concept of regional administration of air is convincible in China. That's because the most intractable air pollution problems of china occur in separated territory, which leads to pollution cross provinces. The valley administration of water resources in China is a good example for cross-region air quality administration.

## 3.2 Relevant laws and policies for the cross-region administration of air quality

### 1. Policy

•The *Decision of the State Council on Fulfilling the Scientific Outlook for Development and Strengthening Environmental Protection* in 2005 pointed out that “In the way of regional ecological system administration, the nation will straighten out the functions and division of labor of the departments step by step, strengthen the harmony and integrity of environmental administration; establish and perfect the administrative mechanism of the national supervision, local administration and unit responsibility. The nation will strengthen the direction, support and supervision of the local environmental protection, perfect the detached offices of regional environmental supervision, harmonize the cross-province environmental protection, and urge to inspect the outstanding environmental problems”

### 2.Relevant legislations

•The law of the PRChina on the Prevention and Control of Air Pollution provides: “The administrative department of environmental protection under the State Council together with relevant departments under the State Council may, in light of the meteorological, topographical, soil and other natural conditions, delimit the areas where acid rain has occurred or will probably occur and areas that are seriously polluted by sulfur dioxide as acid rain control areas and sulfur dioxide pollution control areas with the approval of the State Council. ”

## 3.3 Construction of cross-region administrative mechanism for air quality

### 3.3.1 Authorities establishment

1. Limitations of work in the environmental protection bureau system
  - Local governments should be responsible for environmental quality in their respective administrative jurisdictions, but the work of local environmental protection bureaus is often out of the line with the work of the Central Government.
2. Establishment of six regional supervisory centers
  - Till the end of 2008, under the former SEPA, six regional supervisory centers were established in the East China, South China, Southwest, Northeast, Northwest and North China, whose main work is environmental law enforcement at local level. As is an important effort to strengthen the national supervisory system through regional mechanism.

### 3.3.2 Function of the administrative authorities

Six regional supervisory centers are the supervision offices dispatched by the Ministry of Environmental Protection

- supervise the enforcement of national environmental policies, plans, laws, regulations, rules and standards;
- undertake the coordination and resolution of important environmental disputes in the region, valley, and cross-province sea area;
- undertake the technological work for examination of emission reduction for main pollutants;
- put forward suggestions on limitation of approval of regions, valleys and sector industries etc.

### 3.3.3 A typical case concerning the cooperation between regions: Pan Pearl River Delta region “9+2” plan

- In 2005, the environmental protection bureaus in nine provinces (autonomous regions) such as Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Hainan, Sichuan, Guizhou, Yunnan and two special administrative areas of Hong Kong and Macao began to develop the regional cooperation in the Pan Pearl River Delta region.

- Target
  - Carry out the Central Government's strategic arrangements on regional harmonious development;
  - Jointly research and deal with the regional environmental problems, and jointly strengthen the regional prevention and control of pollution and ecological protection.
- Main contents
  - Including the cooperation on ecologic environmental protection, water environmental protection, and prevention and control of air pollution etc.
  - The cooperation for air pollution includes jointly discuss the ways to prevent and control acid rain and sulfur dioxide, adopt measures to reduce the emission of air pollutants such as sulfur dioxide.
- Cooperative mechanism
  - The joint meetings for cooperation on environmental protection in Pan Pearl River Delta region will be held to research and determine the important matters on regional environmental protection;
  - Set up special working groups in accordance with the cooperative need to develop specific cooperation;
  - All parties periodically report and exchange environmental protection work;
  - Periodically organize all kinds of regional forums and seminars on environmental protection to carry out the exchanges and communications on administration of environment, prevention and control of pollution, ecological environmental protection and environmental science and technology.

### **3.4 Existing problems in the construction of cross-region administrative mechanism for air quality and their perfection**

#### **3.4.1 Existing problems**

- 1. Limited functions of the supervisory centers
  - The functions of six regional supervisory centers are limited to entrusted and authorized supervision, investigation, disposal and related suggestion, they have no independent status and authority to carry out effective prevention and control measures for cross-region air pollution and other environmental challenges.
- 2. The regional cooperative institutions are not standing
  - For example, in the environmental cooperation of Pan Pearl River Delta, the main ways of such cooperative mechanism are joint meetings, and special groups established for sepecific needs.
- 3. Relation between the local environmental protection bureaus and the regional supervisory centers
  - Local environmental protection bureau need not report to the supervisory centers, share information with them, or develop cooperation by other means, as affects the effectiveness of the supervisory centers' work.

#### **3.4.2 Suggestions**

- 1. Strengthen the status and authority of the supervisory centers
- 2. Set up standing institution of regional cooperation for environmental protection
  - Refer to the valley administration model for water resources, the standing institution of regional cooperation should be set up for the purpose of timely and effective protection of air quality.
- 3. Straighten out the relation between the local environmental protection bureaus and the supervisory centers
  - The local environmental protection bureaus should report the information of air quality and pollution to the supervisory centers, share such information with them,
  - cooperate with the supervisory centers on their supervision and administration when it is necessary.



## Recent trends towards regional air quality management in China

Zifa Wang

LAPC/NZC, Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing, 100029, China

23-24 January, 2010, Hayama, Japan

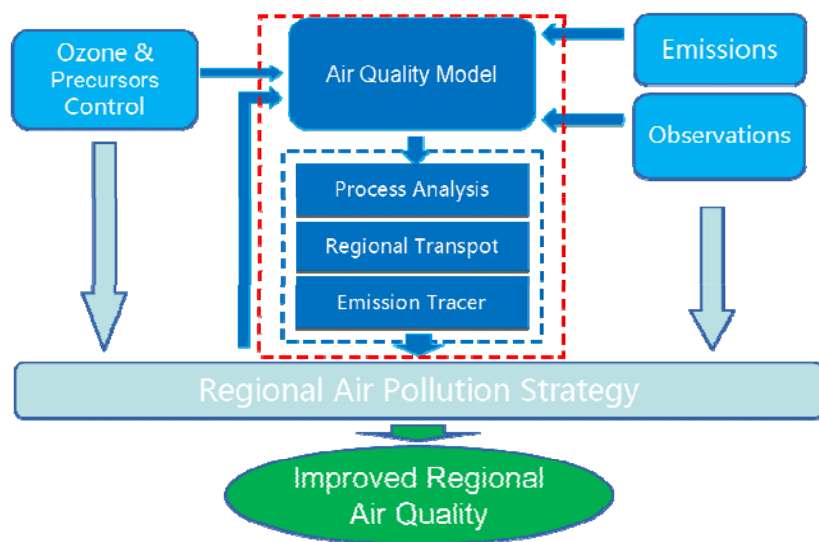


## Recent trends towards regional air quality management in China

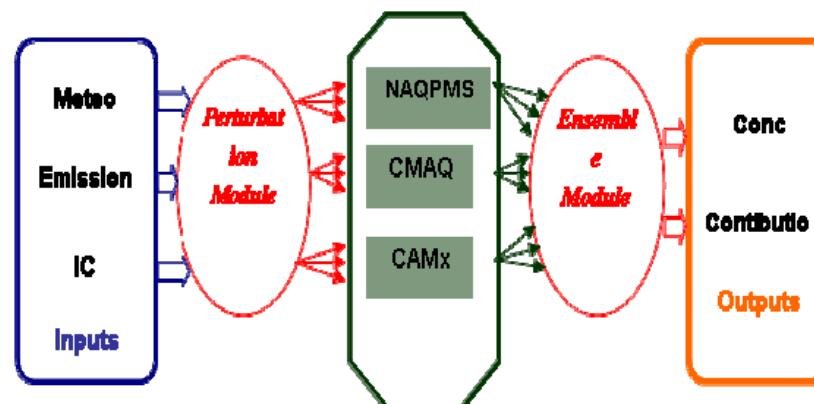
1. The Beijing Municipal Government's efforts to organize regional air quality management after the Olympics
2. Efforts by local governments, especially Shanghai and Guangzhou, to control air pollution for international events, following the example of the Beijing Olympics
3. Towards the regional air quality districts and the establishment of new regional bureaus

### 1.1 New research projects after the Olympics 1

Regional air pollution simulation, forecasting, early warning system



### The multi-model ensemble prediction system





# Field Observations

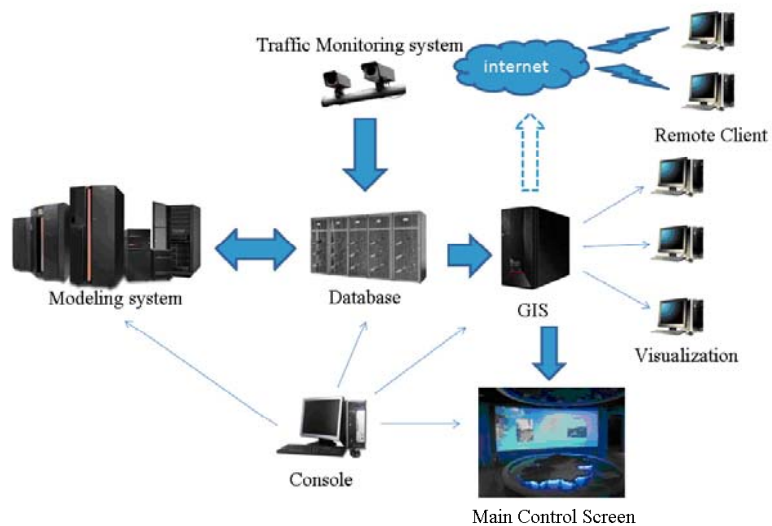


## 1.1 New research projects after the Olympics 2

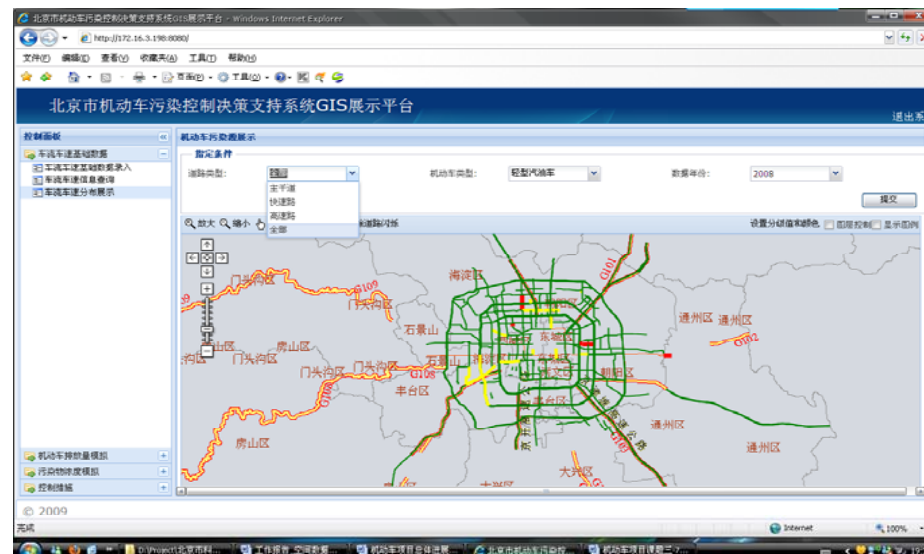
### The Decision and Support System for Automobile Pollution Control (DSSAPC)



## Hardware Framework of the DSSAPC



## Road Network and traffic flow in Beijing



## Snapshot of real-time traffic emission from the system



## 1.2 Post-Olympic counter-measures to control air pollution in Beijing

- Car-ban
- Phasing out “yellow-tag” vehicles
- Strict regulations for factories to resume production
- Green Construction

*Dec. 31th is the last “blue sky” in 2009, Beijing harvested 285 “blue sky” days which are 11 days more than the “Olympic Year”, and the air quality have continued to improve for 11 consecutive years.*

## 1.3 Decision making process

- Assessing current status and problems of air pollution
- Determining the targets and measures of air pollution management
- Assessing the control measures

## 1.4 Difficulties experienced by other regions in China

## 1.5 Future Plans

- Joint control effort on regional air quality
- Long-term air pollution control strategies after the Games
- Strict regulations on vehicle emissions
- Urge the industries to adopt clean technologies
- Promote renewable energy technologies
- Smart design and energy efficient technologies for new buildings

## 2 Efforts by local governments to control air pollution for international events, following the example of the Beijing Olympics

Shanghai

Guangzhou

➤ Following the MEP's guidance and requirement, a regional air quality monitoring network in the Yangtze Delta covering Shanghai, Jiangsu and Zhejiang province is being established so as to monitor local atmospheric environment comprehensively and promote regional data-sharing and cooperation.

➤ Joint consultation and regional emission inventory are also discussed and intercommunicated between different departments and cities, laying the technical foundation for joint prevention and control of regional air pollution.

➤ During the building of regional network, it's required that more advanced monitoring techniques and index system involving fine particulate matter as well as ozone should be introduced and put into practice in Shanghai and other developed cities of this region, considering increasingly severe haze and ozone pollution.

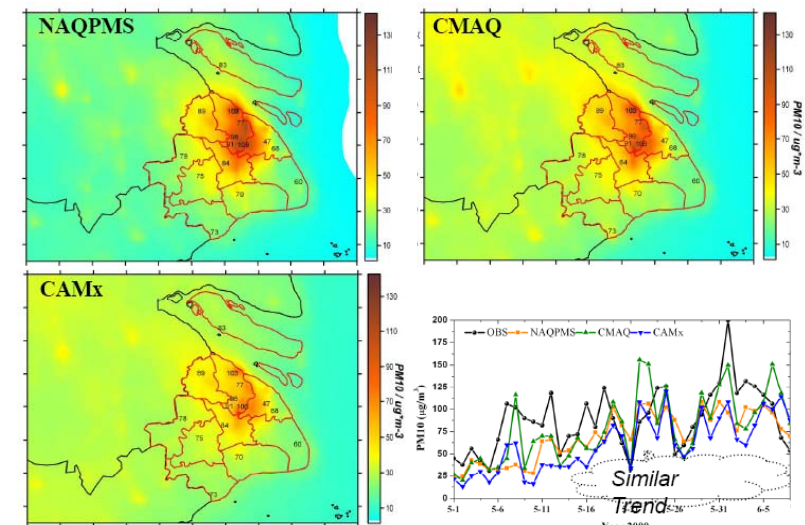
➤ An ensemble modeling system of air quality forecast for Shanghai Expo 2010 (EMS-Shanghai) is also designed and established in Shanghai Environmental Monitoring Center (SEMC) with the help of researchers from Institute of Atmospheric Physics, CAS

## 2.1 Shanghai World Expo 2010

The Shanghai World Expo 2010, as another mega international event after the 28th Beijing Olympic Games in China, has drawn the whole world's attention again

Being a great, if not bigger, challenge for organization and management ability of Shanghai government, especially on environmental issues such as potential air quality problems.

Following the successful example of the Beijing Olympics, air quality security as an important part of local environment management was put onto the agenda of Shanghai government in time and won strong support from Chinese Ministry of Environmental Protection (MEP).



Ensemble modeling system of air quality forecast for Shanghai Expo 2010

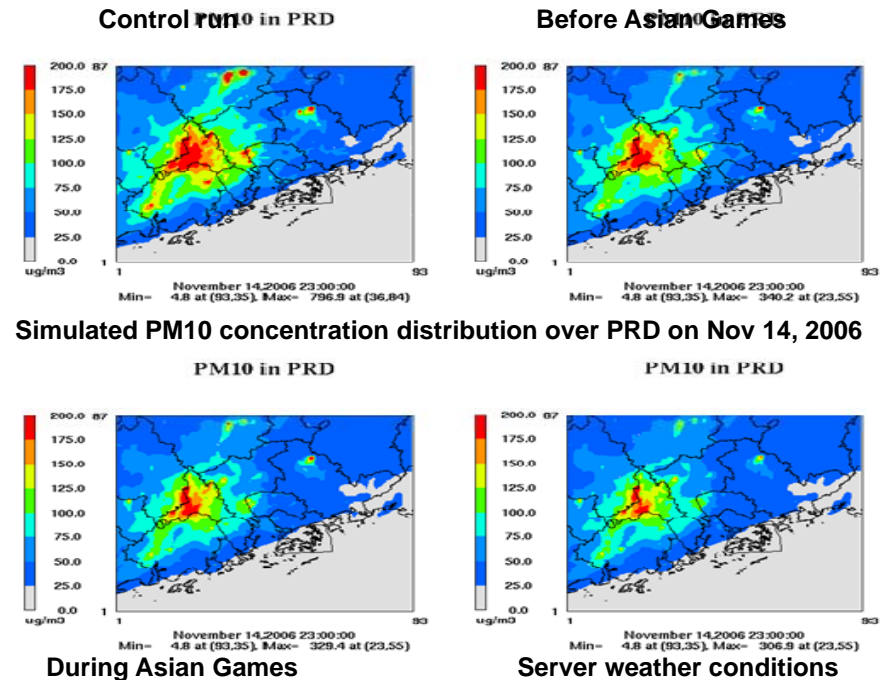
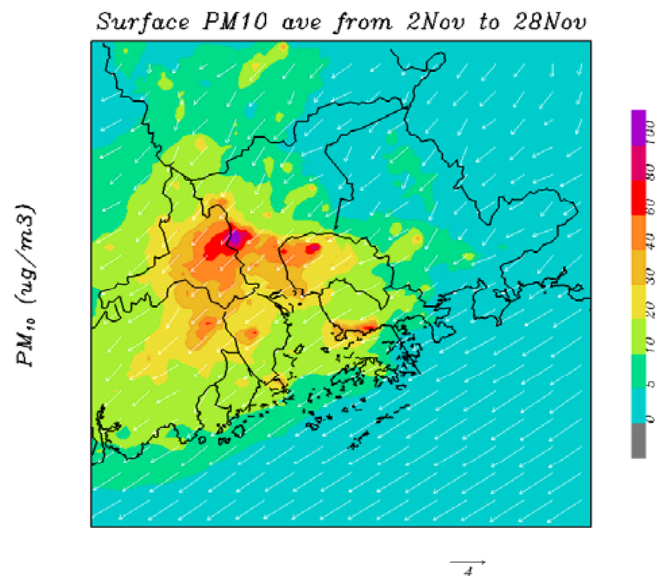
## A systematic and comprehensive control action plan for the regional air pollution

Local pollution control-oriented and regional joint prevention

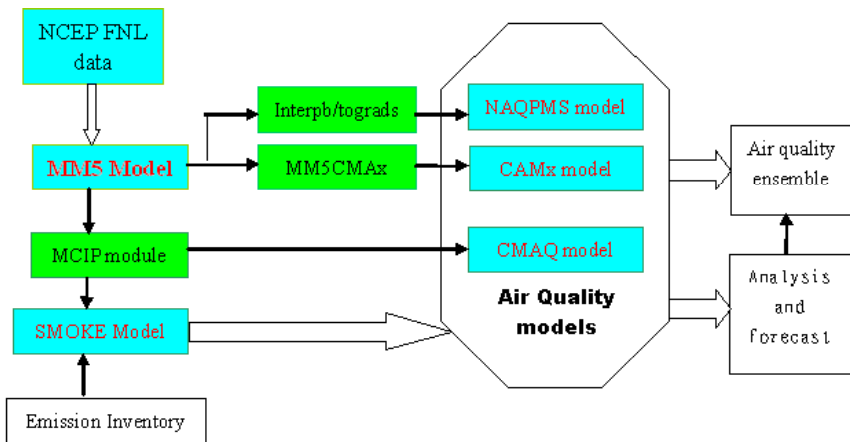
- **Pollution control for power plant emission, including SO<sub>2</sub> and NO<sub>x</sub> reduction and closing down small thermal power generation units;**
- **Emission control for industrial exhaust, especially for high pollution enterprises such as coking and cement industries;**
- **Intensifying vehicle pollution supervision by updating vehicle emission standards, developing public transport services vigorously, and executing emission inspection more strictly, etc;**
- **Strengthening control of VOCs pollution by proceeding oil vapor recovery;**
- **Launching joint control action of blown dust to reduce negative environmental influence due to mass construction**

## 2.2 The Asian Games 2010 in Guangzhou

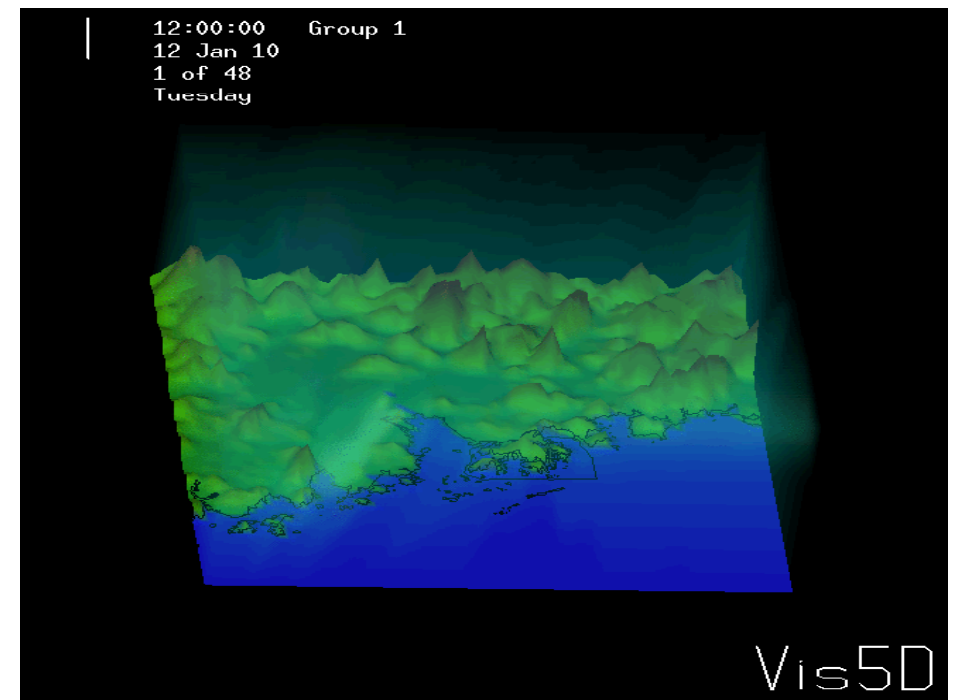
In November 2010, the 16th Asian Games will be held in Guangzhou, China. In order to provide a good air quality for athletes and participants, the Guangzhou municipal government has promised "green Asian Games", reiterating their commitment to ensure air quality during the Asian Games. Learning from the experience and measures of the Beijing Olympics in full protection of air quality work, Guangzhou in-depth has studied on the characteristics of air pollution in the Pearl River Delta, mainly through large-scale comprehensive observation, model simulation, the Asian Games earlier analysis of historical data. The Guangzhou municipal government has proposed a phased and sub-scene security programs, and has made a full demonstration of environmental and economic benefits on the various control programs and measures. Through the early part of the implementation of emission reduction measures, as of the end of 2009, Guangzhou's air quality has improved significantly.







**Framework of the ensemble model system in Guangzhou**

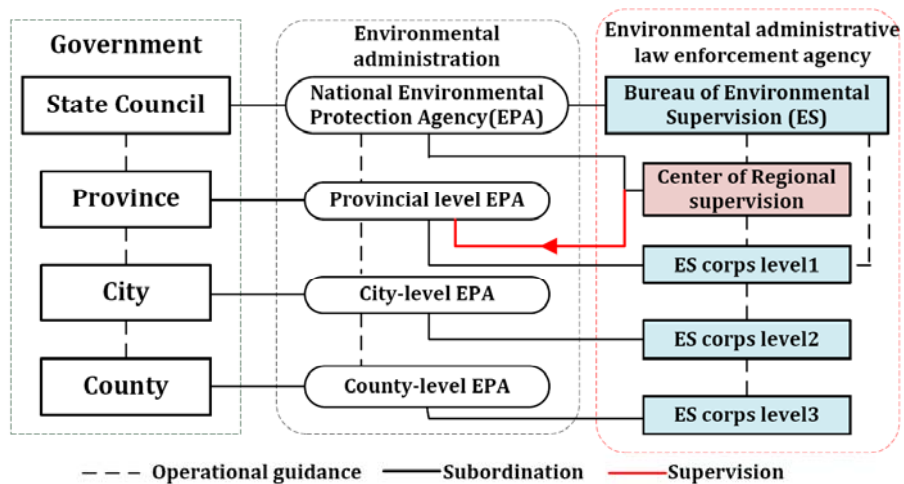


### **3 Towards the regional air quality districts and the establishment of new regional bureaus**

#### **3.1 New projects on the regional air quality districts over China**

- The atmospheric dispersion channel and air quality districts in China
- The classification of management framework and policy of regional atmospheric environment management in China

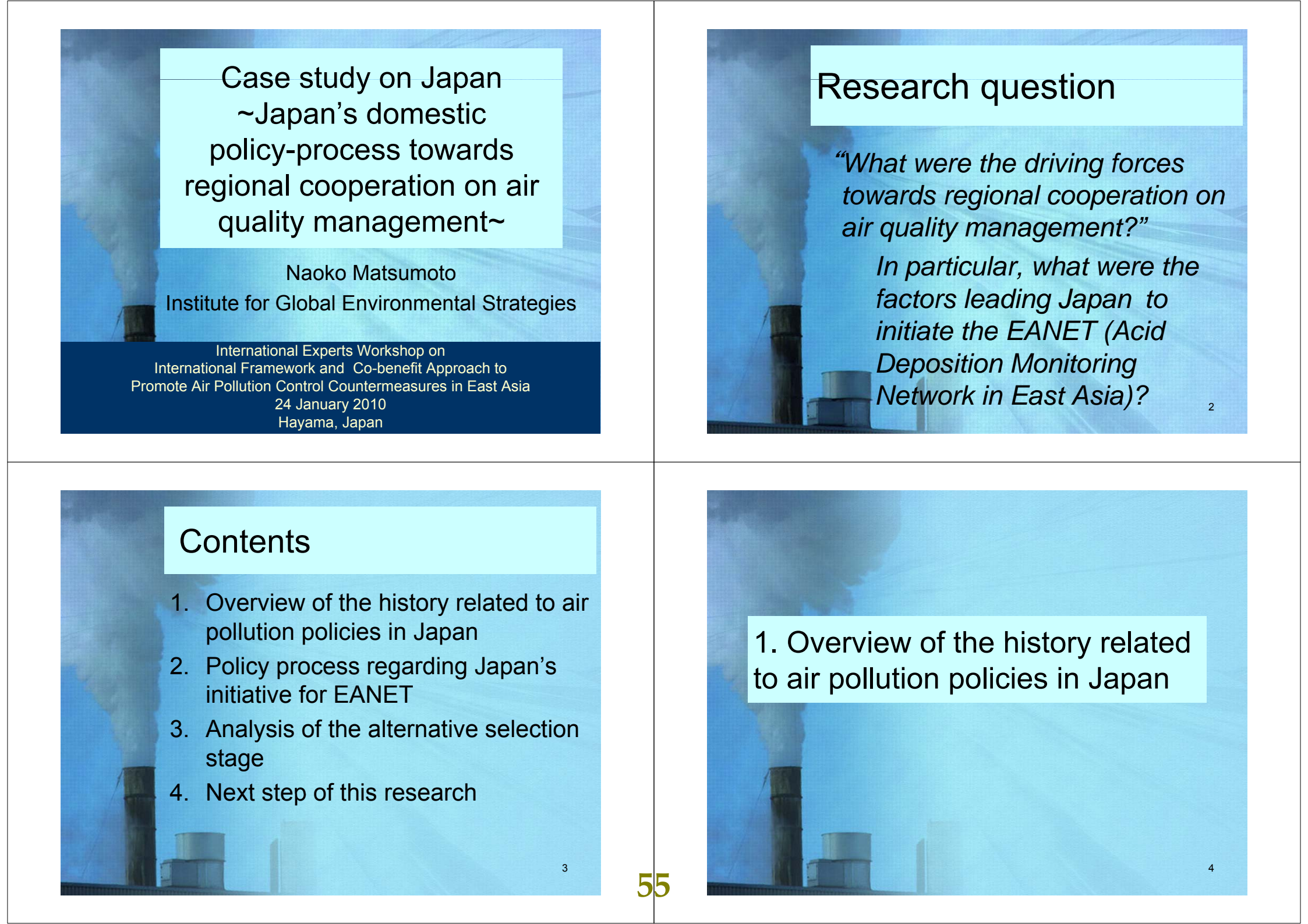
### 3.2 The establishment of new regional bureaus under the MEP



### Six Environmental Protection Regional Supervision Centers



Eastern, Southern, Northwestern, Southwestern, and Northeastern regions of China



## Case study on Japan ~Japan's domestic policy-process towards regional cooperation on air quality management~

Naoko Matsumoto  
Institute for Global Environmental Strategies

International Experts Workshop on  
International Framework and Co-benefit Approach to  
Promote Air Pollution Control Countermeasures in East Asia  
24 January 2010  
Hayama, Japan

## Research question

*“What were the driving forces  
towards regional cooperation on  
air quality management?”*

*In particular, what were the  
factors leading Japan to  
initiate the EANET (Acid  
Deposition Monitoring  
Network in East Asia)?*

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## Contents

1. Overview of the history related to air pollution policies in Japan
2. Policy process regarding Japan's initiative for EANET
3. Analysis of the alternative selection stage
4. Next step of this research

3

1. Overview of the history related to air pollution policies in Japan

4

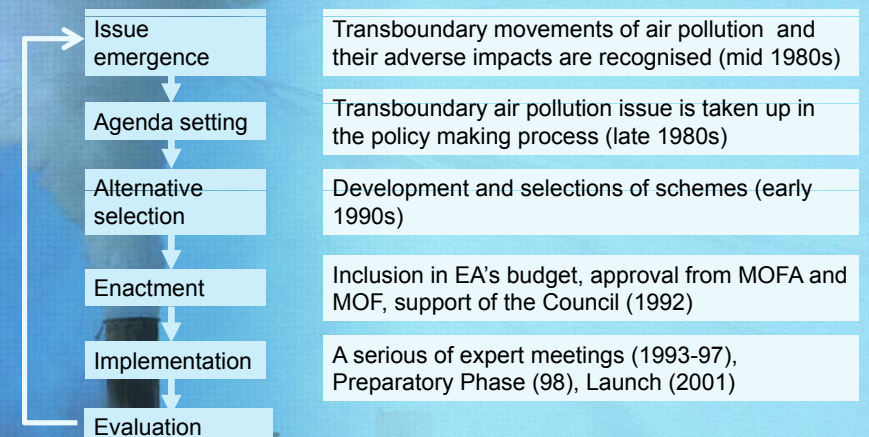


Harashima and Morita (1998)	Broadbent (2005)	Wilkening (2004)	Suzuki (2009)	This study
		1868–1945 Prewar industrialization		
1945–1954 Initial Period		1945–1967 Postwar reconstruction	1945–55 After the War, Poverty	1945–1954 Initial Period
1955–1964 Progressive Period	1955–67 Unbridled Pollution		1955–1965 Insidious air pollution and awareness movement	1955–1964 Progressive Period
1965–1974 Consolidation Period	1967–75 Pollution Reform	1967–1973 Domestic environmental revolution	1965–1975 Emergence/aggravation and control of air pollution	1965–1974 Consolidation Period
1975– Focus-shift Period	1975–88 Transition Era		1973–1990 Transition	1975–1985 Mitigation of air pollution and forecasting
	1988– New Age	1990– Global environment	1985– Global environment and international cooperation	1988– Global Environment Period

	Major environmental issues	Measures taken	Major actors
Initial (1945-54)	Local level issues	Prefectural ordinance	Local governments
Progressive (1955-64)	Gradual recognition as national issue	Law for smoke regulation	Citizens, local governments
Consolidation (1965-1974)	Full recognition as national issue	Basic Law, Env. and emission standards, area-wide control	National gov, local govts, citizens, court,
Focus-shift (1975-1987)	Amenity Urban pollution	Few new legislations, Acid rain survey	Local governments
Global Environment (1988-)	Global environmental issues ( <b>acid rain</b> , ozone layer depletion, global warming, etc)	Vehicle NOx/PM law, control on toxic AP, stringent emission stds, PM standard <b>Initiation of EANET</b>	National gov, local gov. court

## 2. Policy process regarding Japan's initiative for EANET

## Policy process related to international cooperation



Stages Model of the Policy Process based on Birkland (2005)

## Issue emergence

- Acid rain did not get on to the political agenda in the early 1980s –Little severe visible damage-
- 1983: Committee on Acid Rain Countermeasures was established as a precautionary step.
- 1987: Interim report found acid rain throughout Japan (industrialisation in China and Korea determined to be part of the cause).
- 1991: Aircraft measurements begun and showed the existence of huge plumes of sulfur dioxide emanating from the continent during the winter months.

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## Agenda setting

- 1988: A third of the White Paper for the Environment was given to various transboundary and global environmental pollution problems, including acid rain, the extinction of wildlife species, atmospheric pollution problems, and marine pollution.
- 1989: Media coverage of acid rain jumped to 84 articles from 23 in the year before.
- 1991: Japanese policymakers began to proactively pursue regime formation.
- 1992: Press took up the result of the air craft measurement. *"500-km-wide Polluted Winter Air Mass from the Continent Hits Western Japan"*<sup>10</sup> (*Nikkei Keizai Shimbun* 8 Oct. 1992)

## Alternative selection

There were two main alternatives:

1. **Technological** assistance aimed at curbing China's air pollutant emissions  
**Green Aid Plan** (announced in 1991) by the Ministry of International Trade & Industry (MITI)
  - Suffered severe problems in China due to high cost of Japan's technology and lack of capacity for operation and maintenance
  - ⇒ dropped out of the picture as a driving force in acid deposition foreign policy mid 1990s.
2. **Scientific** cooperation with East Asian countries in monitoring  
**EANET** (announced in 1992) by the Environment Agency (EA)
  - Became the centerpiece of Japan's acid deposition foreign policy

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## Enactment

- The Asian monitoring network idea was accepted by the top EA leadership as a central policy objective and included in the EA's budget request for 1992.
- EA gained approval from MOFA to operate internationally and from MOF for funds.
- EA succeeded in convincing the Council of Ministers for Global Environmental Conservation\* (and Prime Minister who headed it) to support EANET.

\**Chikyu Kankyo Hozen ni kansuru Kankei Kakuryo Kaigi*

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# Implementation

1993-1997

**Four expert meetings** coordinated by Japan: state, effects, and future steps

1998 **EANET preparatory phase activities** started (April)

Participants: China, Indonesia, Japan, Malaysia, Mongolia, Philippines, Republic of Korea, Russia, Thailand and Viet Nam

Interim Secretariat: Japan's Environment Agency

Interim network centre: Acid Deposition and Oxidant Research Centre (ADORC) of Japan

2001 **Regular Phase Activities** started

Secretariat: UNEP RRCAP

Network centre: ADORC

EA picked up all expenses to launch the network.

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(<http://www.eanet.cc/eanet/brief.html>)

## 3. Analysis of the alternative selection stage

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## Existing studies on Japan's policy-making related to initiative in EANET

- Wong: *bureaucratic politics model*, supplemented by *complex interdependence* and *two-level games theory*
- Wilkening: *science-policy interface (problem-framework, expert community, and bridging object)*
- Schreurs: *comparative study* (Germany, US, and Japan)
- Kim: *interest-based* and *epistemic community* approaches (Northeast Asia)

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## 1. Major actors

- Central government bureaucracies dominated acid deposition foreign policymaking (both Wong and Wilkening)
  - Leading roles: EA and MITI
  - Lesser roles: MAAFF, MA and MoFA
- Nonbureaucratic actors
  - Scientists
  - Other nonbureaucratic actors remain in the background

*"Bureaucrats have made the key decisions but within the context of a cognitive structure developed by scientists (Wilkening)"*

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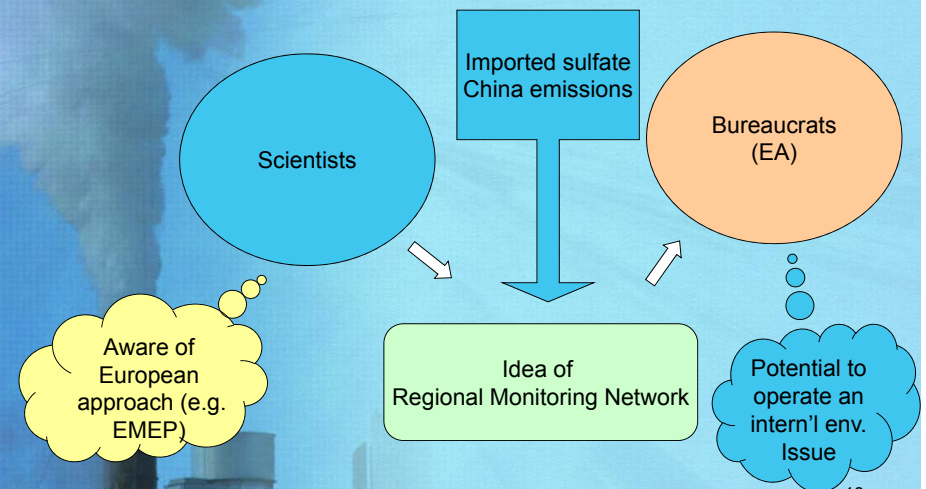
## Why could EA take the lead?

Background: relatively new issue → open to bureaucratic competition

- Creative approach to the problem itself
  - Acid Deposition Monitoring Network
- Endeavored to define its role in the policy process
  - Asserted its leadership on the basis of its official mandate and history
  - Effectively separated the issue from global warming (which was under MITI's control)
  - Alliance with MAFF, MHW, and Meteorological Agency
  - Obtained public support through involving school children across the country in its precipitation surveys

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## How scientists set the context



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(Figure developed by author based on Wilkening)

## 2. Influences of the experiences of other countries

- European experience
  - Usefulness of a science-based approach (particularly EMEP program)
- North American experience
  - The fact that even scientific evidence and public demand are insufficient to persuade a large emitter (US in this case) to accept unilateral changes or multilateral cooperation and a strategy that engages the country to act can be more constructive

Japan learned *“not only scientific aspects but also necessary political conditions”* (Wong)<sup>9</sup>

## Summary of findings

- In the alternative selection stage in the area of the international acid deposition, **central government, especially EA, played the key role, employing the idea of a regional monitoring network put forth by scientists.**
- In the process, **lessons were drawn from the experiences of Europe and North America.**

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## 4. Next step of this research

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*Why did international cooperation in the area of transboundary acid rain gain **agenda status** with such little visible serious damage?*

### *Hypotheses*

- *Did science drive based on the precautionary approach?*
- *Did severe ecological damage in Europe and North America promote awareness?*
- *Did media coverage play a role?*
- *Did bureaucratic interest in obtaining resources for a new policy area put the issue on the agenda?*
- *Was that due to a more general change in the stance of policy makers in Japan towards global environmental issues (Schreurs)?*
- *Did the growing global demands for environmental responsibilities push Japan (Kim)?*



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- (8) Suzuki S. (2009) Watashi no aruita kogai jidai kara kankyo jidai heno hensen no rekishi [history of transition from pollution era to environmental era that I walked through]. *J. Jpn. Soc. Atmos. Environ.*, 44(6) 23

# Politics of Air Quality Management: Korea

Esook Yoon  
Kwangwoon University

## Contents

1. Air quality management policies of Korea: Overview
  - Ideology and Policy changes overtime
  - Current situation of air pollution: sources of air pollution
  - Policy tools and effectiveness
2. Air Quality Management Policy Making and Implementation Process: Policy formulation, enactment, and implementation

Institutional perspective:

- Business and industry
- Central and local governments
- Social environmental groups
- International trade and environmental regimes

## Ideology and Policy Changes Overtime

**1960s-1970s:** Rapid Industrialization

"Dark smoke arising from factories is the symbol of our nation's growth and prosperity." (President Park, Chung Hee's address at Ulsan industrial complex in 1962)

- **The Public Nuisance Prevention Law (PNPL) in 1963:** (pollution abatement facilities in all new factories)
- **Environmental Preservation Act (EPA) in 1977** (replace PNPL) (SO<sub>2</sub> emission standard and water quality)
- **The environmental impact assessment system** in 1979

Both PNPL and EPA were virtually toothless, with lacking monitoring and enforcement mechanisms

- No challenge to the governmental industrial policy
  - No organized public protests
  - Lack of public environmental awareness
- Pollution diseases: *Onsan* Illness, mercury poisoning

## Ideology and Policy Changes

**1980s:** Political change

New Constitution in 1980 (the right to live in a clean and healthy environment)  
SO<sub>2</sub>, concentrations of CO, Nox, airborne particulates rose due to an increase in the number of automobiles

Environmental Administration in 1980  
Lower sulfur oil in 1981  
Amendment of The EPA in 1986, six regional environmental agencies were established to monitor pollution  
Vehicle emission standards  
Clean fuels such as LNG in large cities in 1988.

The philosophy of "grow now, clean up later" still dominant

1987 political democratization and mushrooming of ENGOs  
1988 Olympic Games

## Ideology and Policy Changes

### Since 1990s:

Basic Environmental Law in 1990  
Revision of Basic Environmental Law in 2002

Strengthening of environmental impact assessment, environmental standards, total emission control, emission standards, emission trading, imposition and collection of pollution charges, environmental improvement charges, and recycling dues

Three principles: Sustainable Development  
Polluter Pay Principle  
Preventive Action

Comprehensive and integrative approach to environment and economy

Long-term plan for systemic environmental preservation

Decentralization of environmental implementation

Special Act on Metropolitan Air Quality Management

## Developmental Stages of Environmental Regulations

	1960-70s	1980s – early 1990s	Mid-1990s -present
EDC environmental regulations			
Developmental Stages of Environmental Regulations	1 <sup>st</sup> Stage: Commend & Control (pollution control)  -post pollution control	2 <sup>nd</sup> Stage: Market Incentives (Environmental Impact Assessment)  -plan rational, post pollution control	3 <sup>rd</sup> Stage: Voluntary Pollution Prevention/Collaborative decision making (Integrative, sustainable development)  -preventive, future oriented
Environmental Regulations of Korea			
	1980s	1990s	(2000s)

## Air Quality in Korea

▪SO<sub>2</sub> (a half of OECD average): clean fuels (LNG, low sulfur petroleum)  
Desulfurization facilities  
Low emission production system

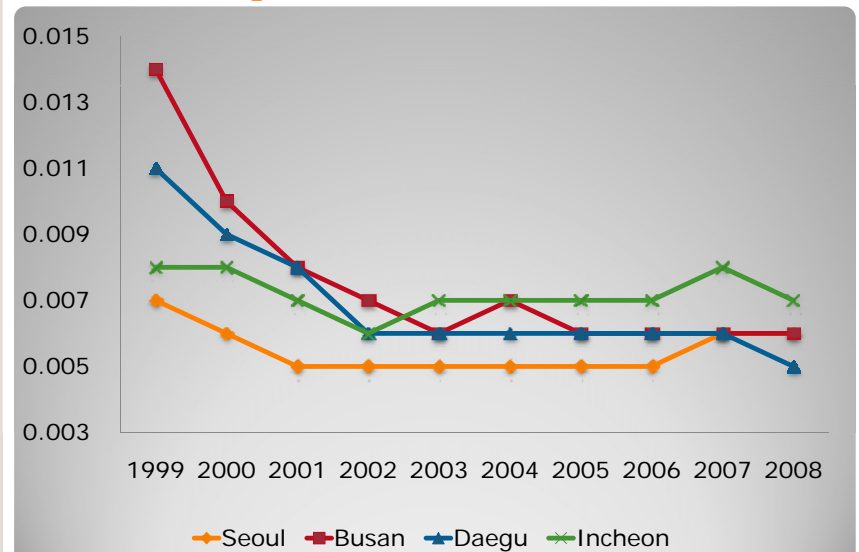
▪CO, NO<sub>x</sub>, PM<sub>10</sub>, Pb: emission standards, gradual improvement of fuel quality, clean energy, strict control of exhaust emissions, imposition and collection of pollution charges & environmental improvement charges

### Problems:

▪PM<sub>10</sub>, VOC, O<sub>3</sub>, NO<sub>2</sub> concentration, CO<sub>2</sub> emissions: high population density, rapid economic growth, energy intensive industrial structure, energy supply structure (new and renewable energy sources)

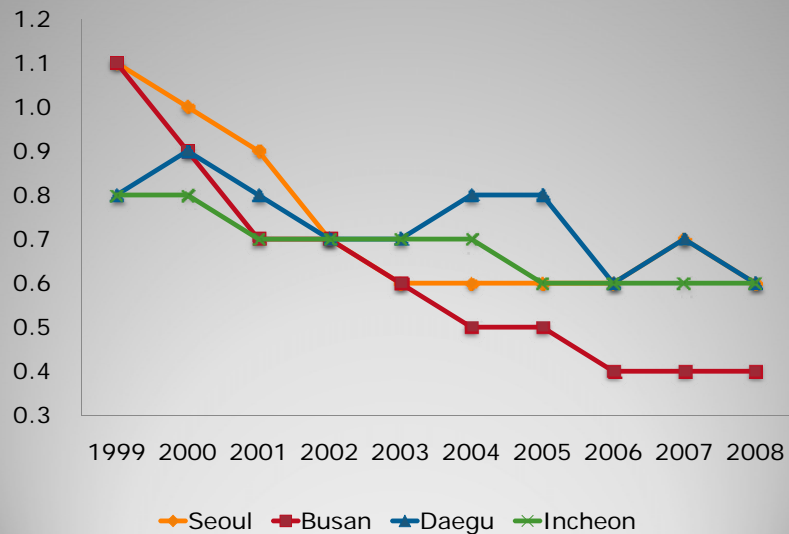
▪trans-boundary sources of pollution: SO<sub>2</sub> emissions, dust and sand storms (*hwang-sa*)

## Sulfur Dioxide(SO<sub>2</sub>) Concentrations in Major Cities (unit : ppm)

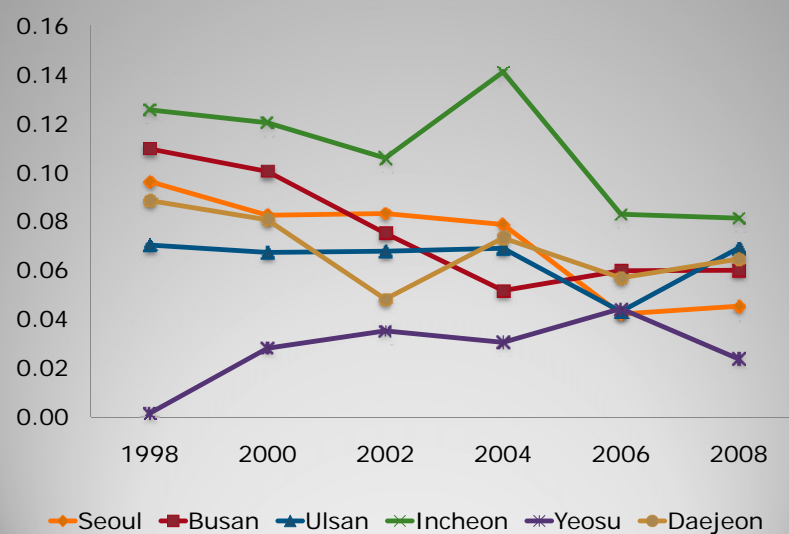




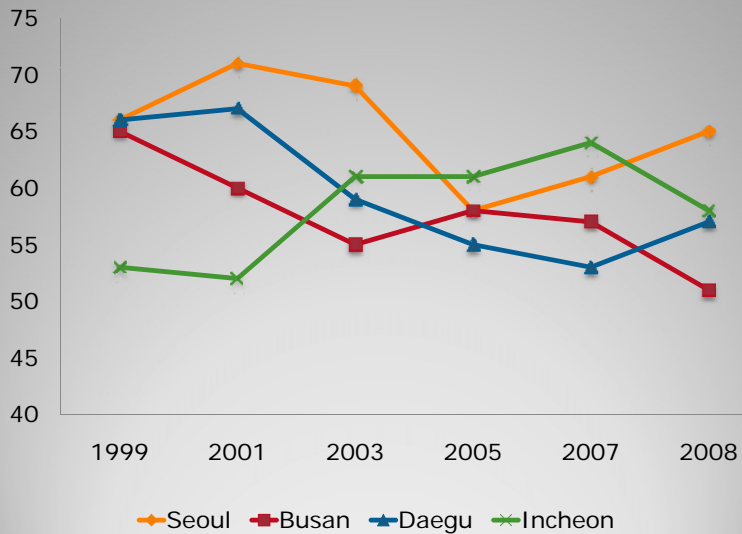
Carbon Monoxide(CO) Concentration in Major Cities



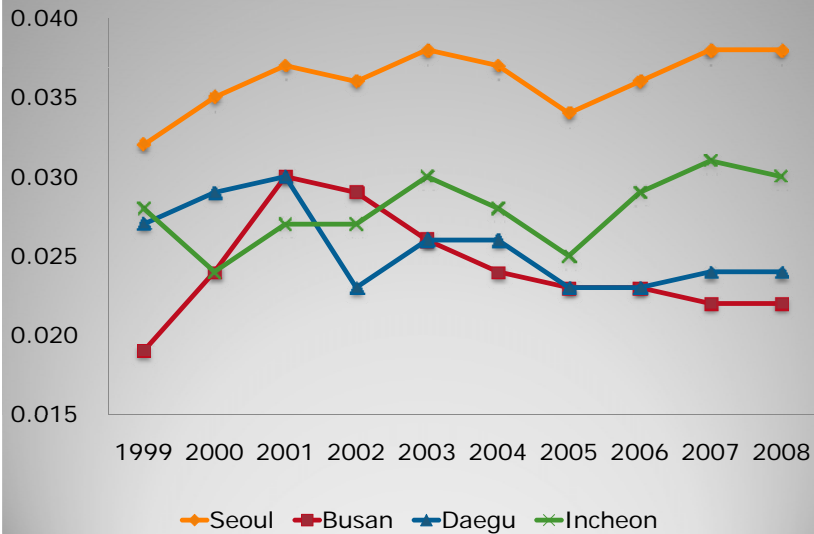
Lead(Pb) Concentration in Major Cities



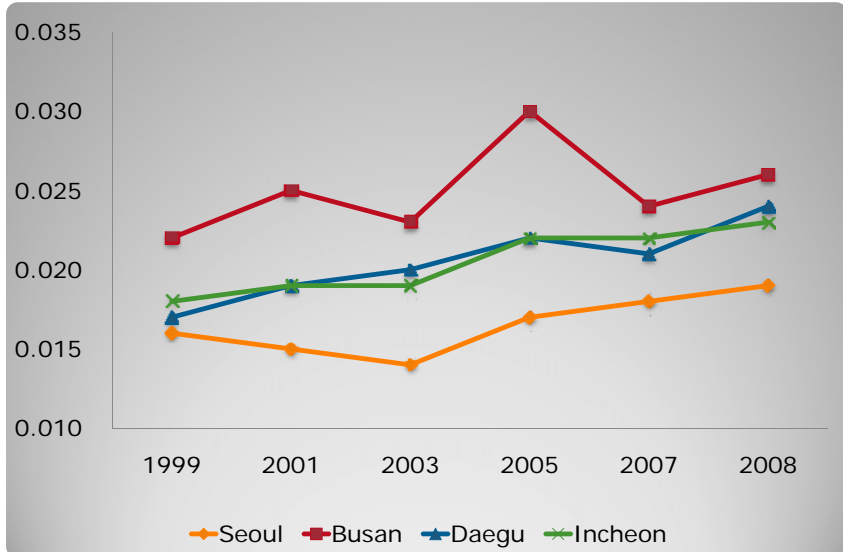
Particulate Matter(PM<sub>10</sub>) Concentration in Major Cities



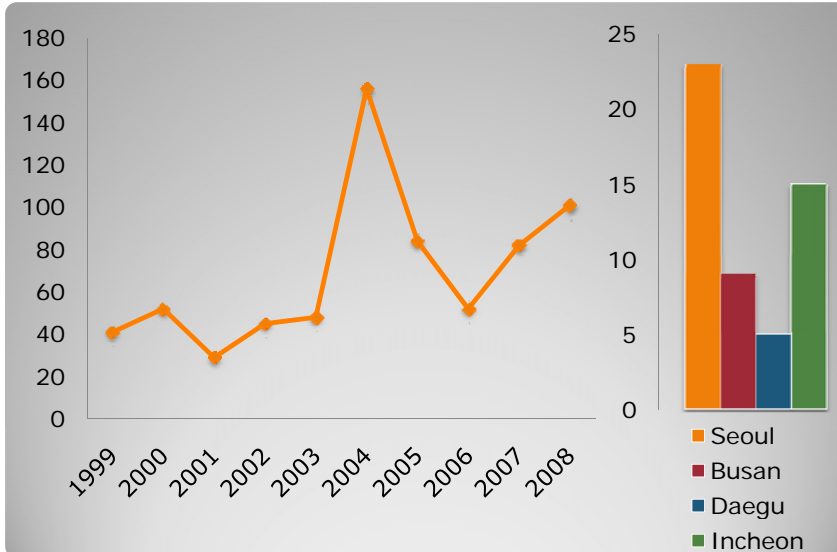
Nitrogen Dioxide(NO<sub>2</sub>) Concentration in Major Cities



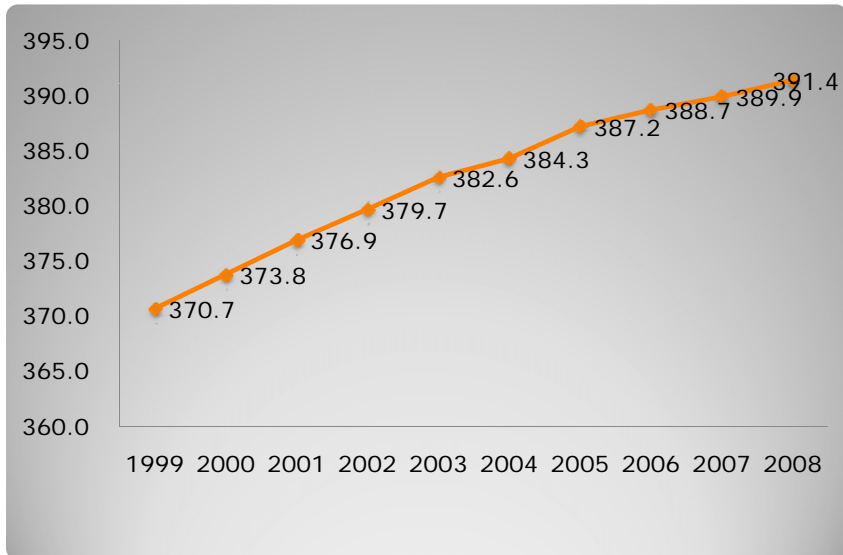
Ozone(O<sub>3</sub>) Concentration in Major Cities: Mean



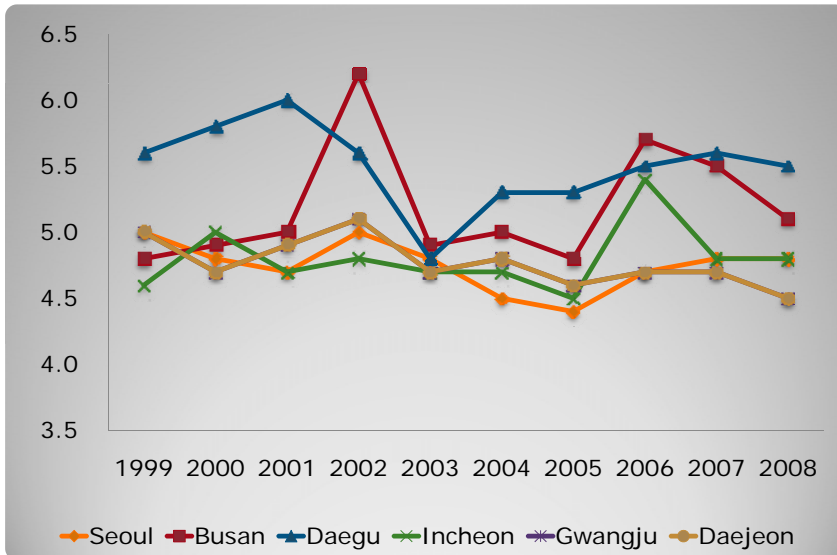
Issuance of Ozone Warning



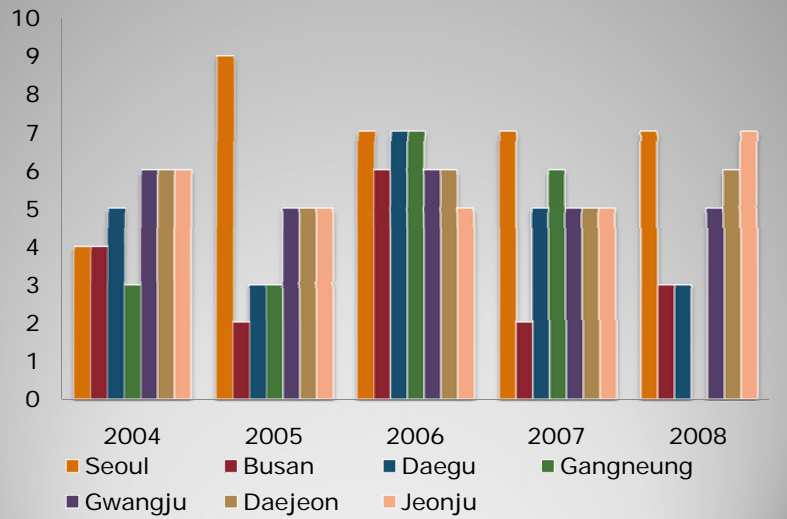
CO<sub>2</sub> Concentrations (ppm)



Acidity(pH) of Rain in Major Cities



## Outbreaks of Dust and Sand Storms



## Politics of Air Quality Management

### Institutional Perspective

- Business and Industry: important determinants of environmental policies and implementation
- Central and local governments: a general movement toward a transfer of environmental policy powers from the national governments to provincial governments "Decentralization mantra"  
Local government system in 1995
- ENGOs and Public opinion
- International regimes

## Business and Industry

Economic interests in air quality management policy of Korea

Close coordination between government and industry

After democratization, public demands for strong environmental regulations

Adopt advanced environmental standards-forcing industry to develop environmental technologies (ex: incinerator)

Large scale public R& D investment for core technology development

## Business and Industry Attitude

**Table 1: Opinions on Domestic Environmental Regulations**

	Less strict	Approp riate	Too strict	Need incentives	Total
#of firms	88	161	82	199	530
(%)	(16.6%)	(30.4%)	(15.5%)	(37.5%)	(100%)

**Table 2: Troubles with strong environmental regulations**

Strongly agree	agree	disagree	Don't know
6.6%	60.4%	25.5%	7.5%

**Table 3: Level of environmental regulations**

Very high	High	Average	Low	Very low
10	42	22	3	1
12.8%	53.8%	28.2%	3.8%	1.3%

## Table

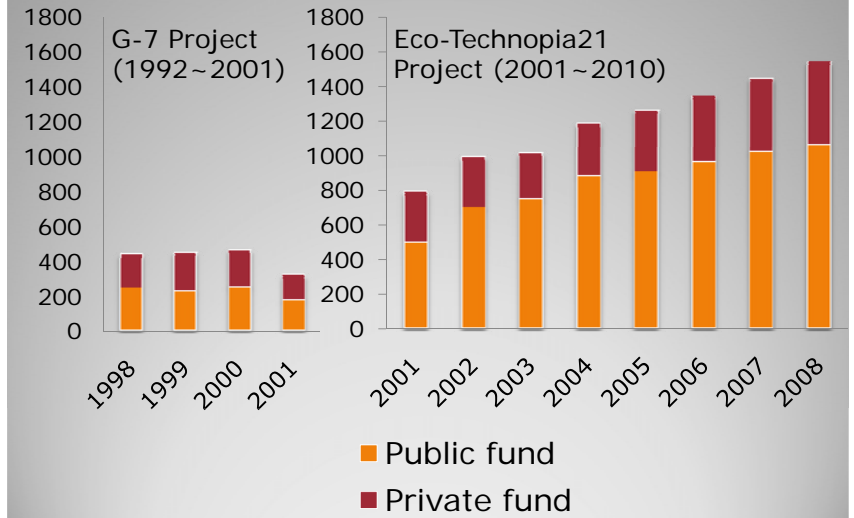
**Table 4: Impacts of Environmental Regulations on Business Competitiveness**

	Positive	No Effect	Negative
# of firms	12	6	31
	24.5%	12.2%	63.3%

**Table 5: Responses to Environmental Regulations**

	Meet standards through investment	Maintain current facility	Fine or penalty	Reduce production capacity	No response (accept)	Total
# of Firms	245	188	43	28	26	530
(%)	(46.2%)	(35.5%)	(8.1%)	(5.3%)	(4.9%)	(100%)

## Investment in Environmental Technology Development Project



## Politics of Air Quality Management

Central and local government:

ENGOS: Action as interest groups, representing general public environmental interests

International Regimes: UNCED, OECD

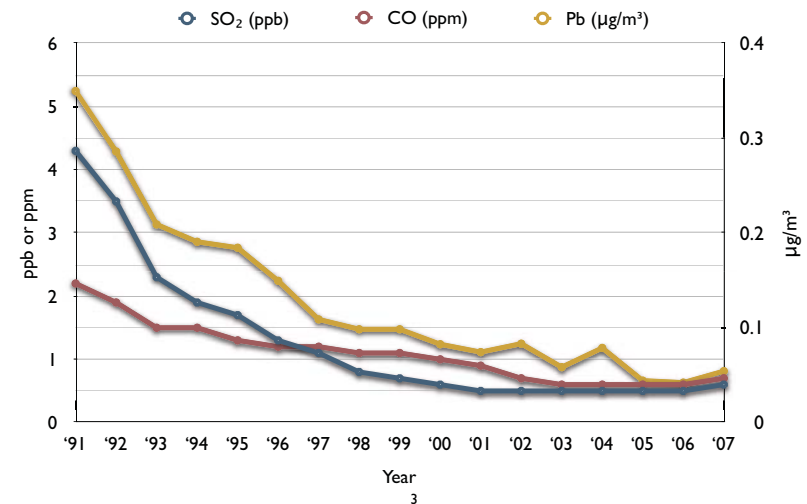
# Explaining urban air pollution policies in Korea (1991-2009)

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International Workshop on International Framework and Cobenefit Approach  
to Promote Air Pollution Control Countermeasures in East Asia  
IGES, Hayama, Japan  
January 23, 2010

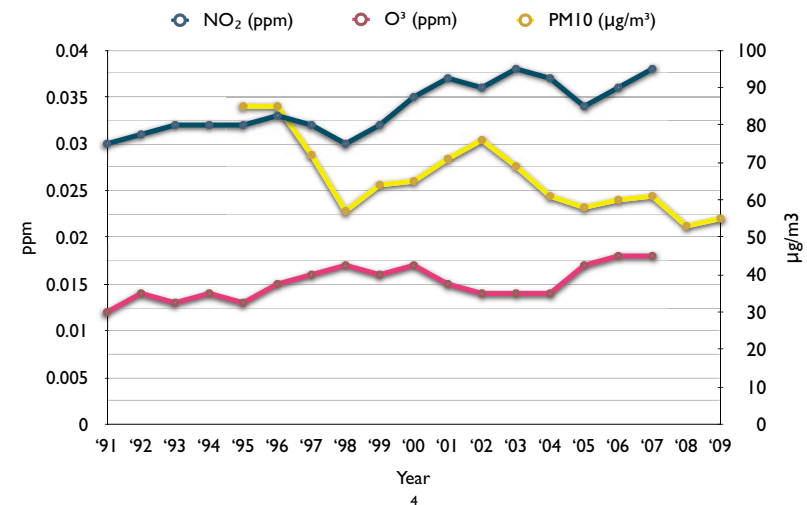
## Air pollutants in Seoul ('99-) I



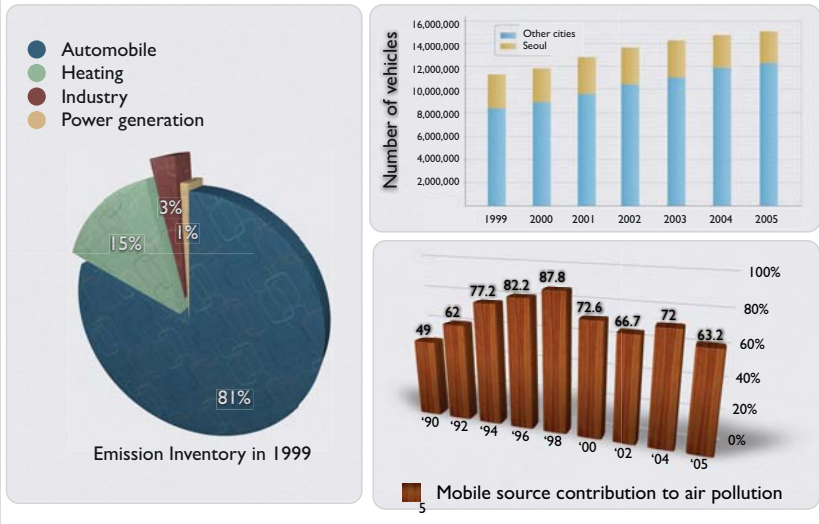
## Content

1. Problems of urban air pollution, especially from mobile sources
2. Major policy initiatives
3. Explanation of policy formulation process
4. Implications

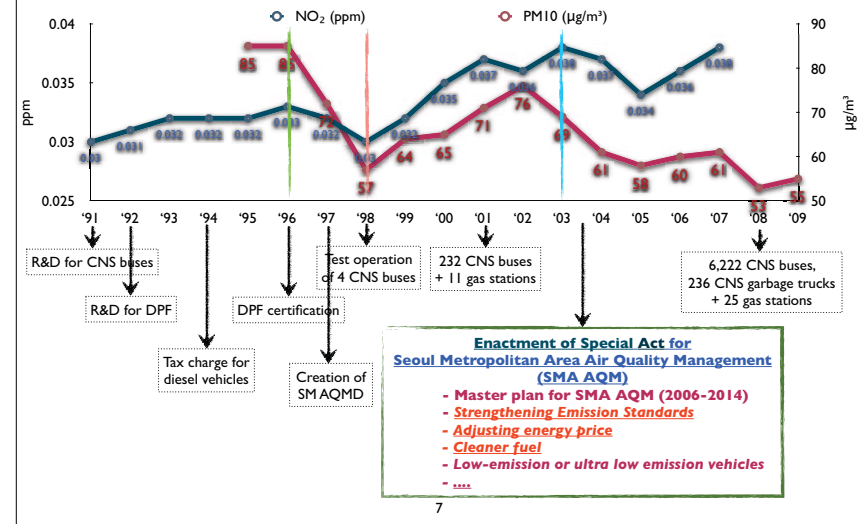
## Air pollutants in Seoul ('99-) II



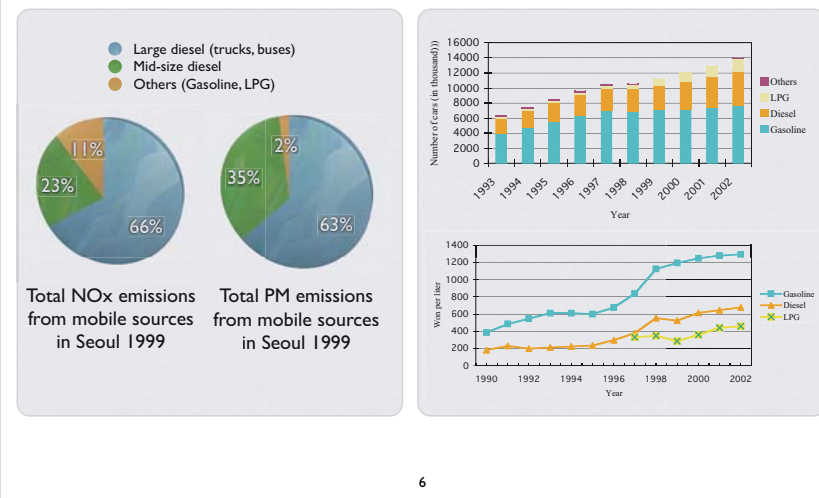
# Auto emissions in Seoul



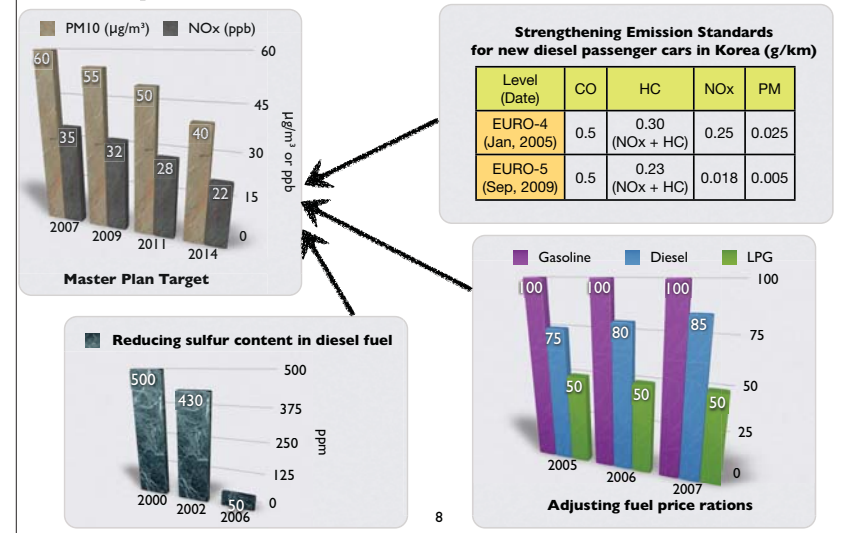
# Major policy initiatives



# Diesel vehicles in Seoul



# Special Act and Master Plan



## Why did the Korean urban air pollution policy take such a particular shape so far?

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## Important context (2)

- MOE who intended to curb PM and NO<sub>x</sub> level in Seoul by tackling diesel vehicles, adjusting energy fuel prices, introducing cleaner diesel fuels, and enacting the Special Act.
- MOE who acknowledged strategic benefits of CO<sub>2</sub> reduction from diesel passenger cars by rationalizing emission standard, but were difficult to endorse diesel passenger cars enthusiastically due to serious urban air pollution.
- 2002 World Cup Soccer game in Korea - public awareness
- Environmental NGO's attention on urban air pollution issue

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## Important context (1)

- Strange emission standard setting

Nations	CO	HC	NO <sub>x</sub>	PM
Korea (Jan, 2000)	1.2	0.25	0.62	0.05
Korea (July, 2002) Announced in April 2000	<b>0.5</b>	<b>0.01</b>	<b>0.02</b>	<b>0.01</b>
Europe (2000, EURO-3)	0.64	0.56 (NO <sub>x</sub> + HC)	0.50	0.05
US California ULEV (1999)	1.06	0.025	0.03	0.006
Japan (2002)	0.63	0.12	0.30	0.056

- Korean automakers (Hyundai, Kia) as powerful actors who were ready to manufacture and sell diesel passenger cars in Korea.
- **New diesel passenger cars, regarded as more beneficial in terms of CO<sub>2</sub> reduction than gasoline vehicles (20-50 % less CO<sub>2</sub> than Gasoline)**

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## Important context (3)

- Proposal of the Special Act, facing serious resistance from MOCIE, MOF, MOCT
- Interlinked issues with multiple stakeholders
  - Energy prices --> MOF, oil industries, automakers, gas producers
  - Clean fuels --> Oil industries, automakers
  - Emission standard setting --> Automakers (Hyundai, Kia, Samsung, Daewoo, Ssangyong) with different interests
- Relatively weak MOE compared to MOF, MOCIE, and MOCT

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## Strategic policy process (1)

- Strategic alliance between MOE and Environmental NGOs
- First tried regulatory negotiation in the Joint Commission (2002) where MOE, MOCIE, NGOs, Automakers, Oil, Gas, Experts participated, but failed to create consensus
- Environment Commission (early 2003) in a new political environment with Roh M-H administration ('Participatory Government')

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## Implications

- Linkage between Urban air pollution issue and Climate Change issue
- Linkage of multiple issues with multiple (but inter-dependent) stakeholders
- Complex, endogenous, (but not static) factors (economic and political atmosphere)
- Better (efficient, effective, wise, stable) policy formulation processes should be developed and practiced, where multiple stakeholders participate in building consensus.

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## Strategic policy process (2)

- Coalition formulation
  - MOE - Env NGOs
  - Automakers - MOCIE - MOF - others
- Issue linkage between 1) allowing the sales of diesel passenger cars in Korea and 2) allowing the Special Act to be enacted
- Task Force to finalize all issues in late 2003

14

Thank you.

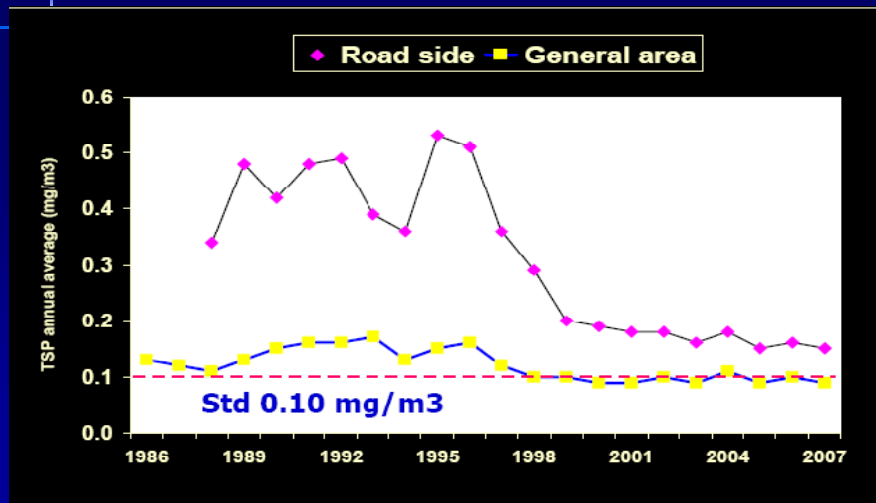
# The Study of Air Quality Management Policy of Thailand

Assoc. Prof. Dr. Noppaporn Panich  
 Environmental Research Institute,  
 Chulalongkorn University, Thailand  
 Email: Noppaporn.P@chula.ac.th

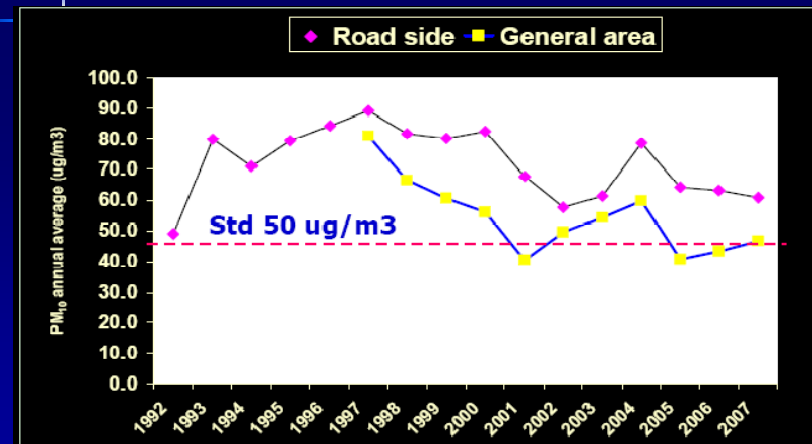
## Air Quality Trend

1960-1990	1991-2008
TSP - exceeded standard in most locations in Bangkok.	TSP, PM <sub>10</sub> - exceeded standards in most locations.
CO and lead - high in congested traffic area.	CO and lead - decrease significantly.
SO <sub>2</sub> , NO <sub>2</sub> TSP Exceeded standard in some industrial areas.	SO <sub>2</sub> , NO <sub>2</sub> TSP exceed in some (industrial) areas
Ozone and VOC - no problems.	Ozone and VOC - showed problems.

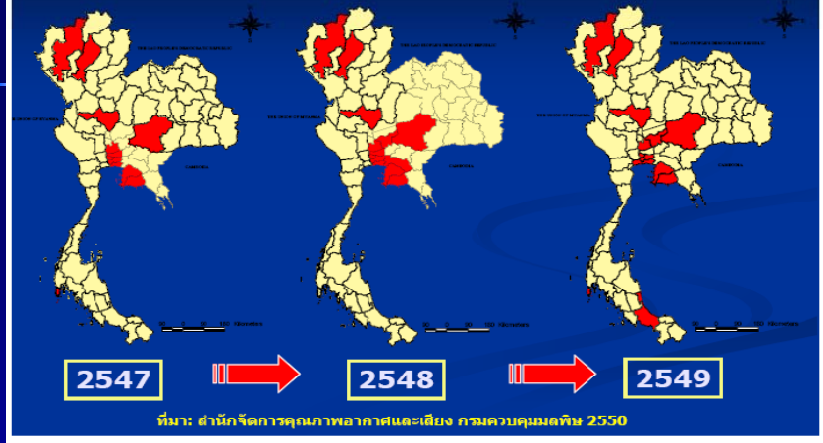
### TSP Annual average in Bangkok



### PM<sub>10</sub> Annual average in Bangkok

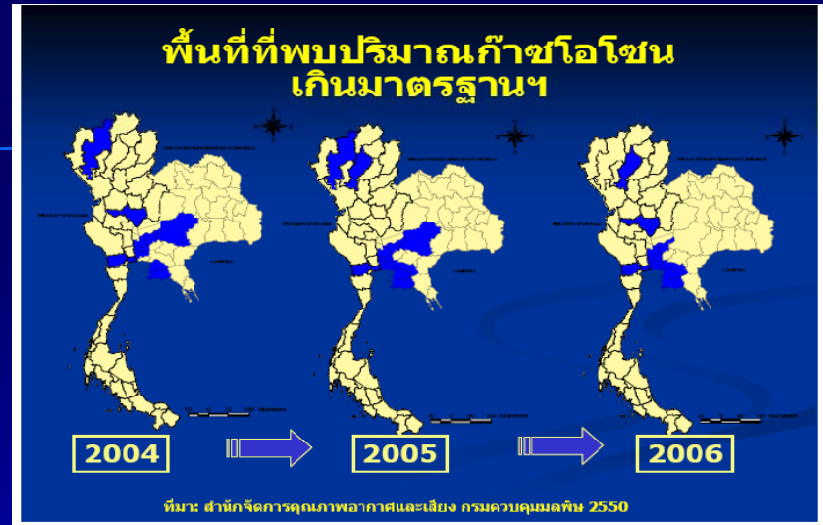


### พื้นที่ที่ปริมาณฝุ่นละอองขนาดเล็ก (PM<sub>10</sub>) เกินมาตรฐาน

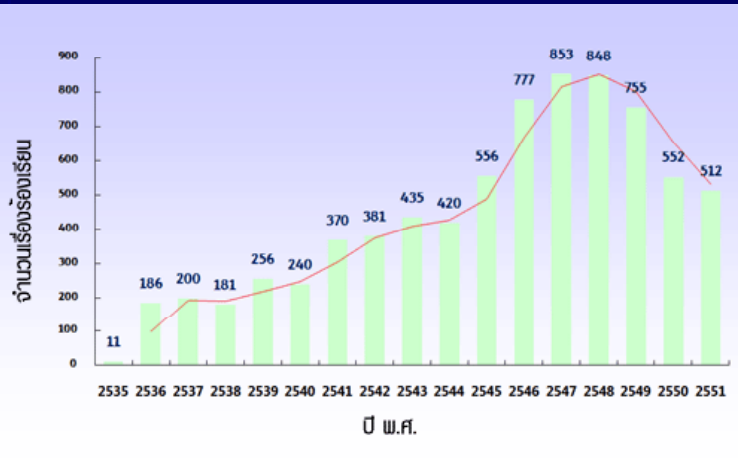


Areas where PM10 exceeded the ambient standard during 2004-2006

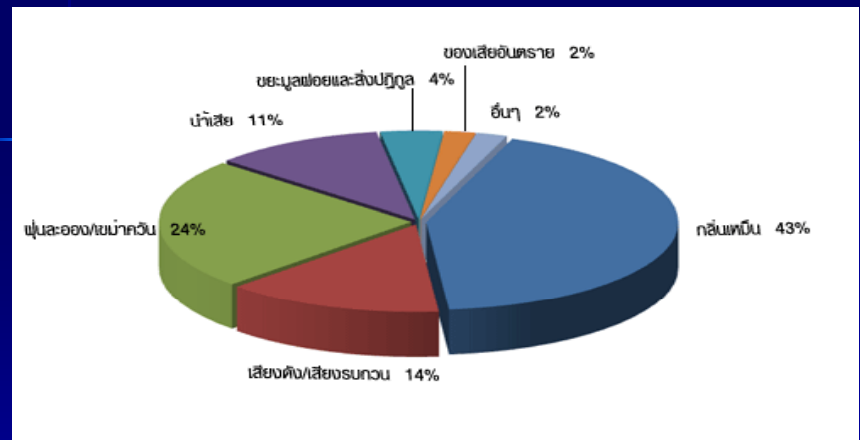
### พื้นที่ที่พบปริมาณก๊าซโอโซน เกินมาตรฐาน



The areas where ozone exceeded the standard



Compliant Statistics on Environmental Pollution 1992-2008  
(Complaints made to PCD, not including other agencies)



Type of complaint in 2008 :  
43% odour , 24 % dust and soot, 14% noise , 11% waste water , 4% solid waste, 2% hazardous waste and 2% others

## Sources of Air Pollution in Thailand

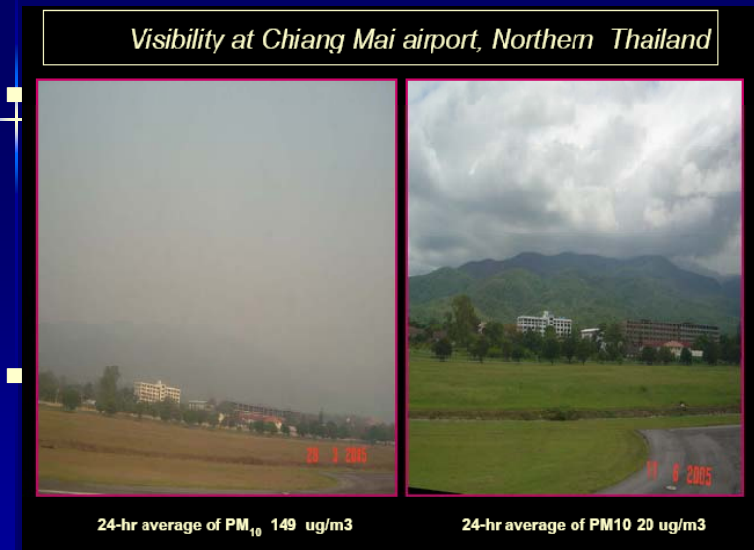
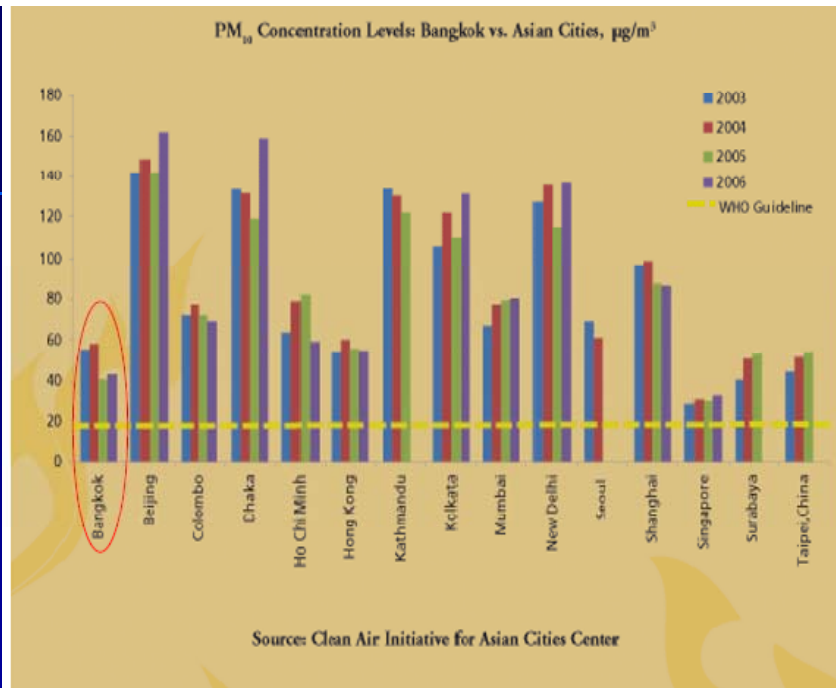
- the sources of Thailand's air pollution at the present are vehicular emissions, industrial emissions and open burning.
- In the south of Thailand there were events of transboundary air pollution from forest burnings in Indonesia.

9

## Present Air pollution trends

- Overview of air quality in Thailand in 2552 (2009) are promising when compared with last year
- Main problem remains PM10, followed by O3 and for TSP occasionally exceeded standard in the street space.
- Volatile organic chemicals (VOCs) in areas with heavy traffic are exceeded the ambient standard (benzene and 1,3 butadiene).

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- It can be summarized that air pollution in Thailand is serious in the congested cities due to **traffic problem**, and in industrial areas due to **industrial emissions**, and in some rural areas due to **open burning or wildfires**.

13

## How Thailand has managed to solve the problems?

- A combination of political will during a period of time.
- The management, good timing, and the timely support from international communities.

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## The economic and social development of Thailand and air quality management

- In 1961, the first national economic and social development plan was drafted and implemented.
- This was the first such plan (which followed by 10 more, until the present).

15

## The Start of Air Pollution Management in Thailand

- in 1976, the Enhancement and Conservation of National Environmental Quality Act was enacted, followed by the establishment of its secretariat, the Office of The National Environment Board (ONEB).

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- Air Quality and Noise Management was only a section in the Environmental Quality Standards Division( to establish ambient and emission standards for Thailand).
- there were almost none existed emission standards except for regulation on black smoke emissions by police for vehicles and by Department of industrial Works on factories (which were rarely enforced).

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- The fifth national plan (1982-1986) was the first plan that addressed concerns for degradation of the natural resources and environment.
- Because this plan supported the environmental causes, ONEB received more budgets and manpower, and aids from the United States, Japan and European Communities (EC).

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- The first air quality monitoring networks of 8 stations in Bangkok belonged to ONEB and started operation in 1983,
- followed by 5 more stations for industrial area, plus 1 mobile monitoring unit, from the cooperation with JICA.

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- An important development occurred in the eight national plan (1997-2001), because the issue of public participation was emphasized according to the new Thai Constitution of 1997.
- The government was also in the process of decentralization, allowing the local administrations to be more responsible for the environmental issues.
- Polluters pay principle, and public awareness and self-regulated industry became the ruling concepts during the period.

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## Ways of Air Quality Management in Thailand

- Thailand has the system of legislation that any agency must operate according to the governing law(s).
- If the laws overlap in their powers, then the agencies' responsibility also overlaps.
- Since the existing laws are not normally overruled by the later laws, it is often left to the interpretation, and often to the officials' judgment, on how to carry out the overlapped duty.

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## Keys laws and regulations

- Enhancement and Conservation of National Environmental Quality Act 1992 or NEQA (the original Act was in 1975)
- Public Health Act 1992
- Factory Act 1992
- The Land Transport Act (1979)
- Others :The Royal Thai Police also can check black smoke emissions according to the Land Traffic Act.

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- at the policy and planning level, the NEQA is the governing law in air quality management,
- the standards are issued under it and to be used by other agencies under the respective laws.
- The implementation of the standards depends on the respective laws of the enforcement agencies, which NEQA will rather not interfere.

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## The Agencies Responsible in Air Quality Management

- **Ministry of Natural Resources and Environment (MONRE)**
  - -Pollution Control Department (PCD)
  - -Office of Natural Resources and Environmental Policy and Planning (ONEP).
- **Ministry of Industry**
  - -Department of Industrial Works
- **Local Administrations**
- **Private Sector**
- **The General Public, NGOs, and Public groups**
- **International Cooperation Agencies**

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## Tools in Air Quality Management in Thailand

- In order to improve air quality, a blend of science, management, and politics have to join in force.

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## How to Set Ambient and Emission standards

- The Thai standards have been drafted by *ad hoc* committees using data and information from other countries, researches, and monitoring reports which show the urgency of the problem and the impacts associated with it.
- Air quality standards and emission standards are not static, but have to be improved on the continuous basis.

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### Thailand National Ambient Air Quality Standards

Pollutants	Concentration (mg/m <sup>3</sup> )					Method
	1-hr average	8-hr average	24-hr average	1-month average	Annual average	
CO	34.2	10.26	-	-	-	Non-dispersive IR
NO <sub>2</sub>	0.32	-	-	-	(upcoming)	Chemiluminescence
SO <sub>2</sub>	0.78	-	0.3	-	0.1*	Pararosalinina/ UV Fluorescence
TSP	-	-	0.33	-	0.1*	Gravimetric High volume
PM10	-	-	0.12	-	0.05*	Gravimetric High volume
O <sub>3</sub>	0.2	0.14	-	-	-	Chemiluminescence
Lead	-	-	-	1.5**	-	Atomic Absorption Spectrophotometry

Note: \* Geometric mean  
\*\* is microgram/m<sup>3</sup>

**\*\* PM2.5 is coming up \*\***

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- The emission standards are still less stringent as compared to developed countries. This is due to the limited technological capability of the country.
- These limitations mean that even though the need for reduction of air emissions may be urgent, the emission standards can not be revised until proven technology is commercially available in other countries.

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## Evaluation of the achievement in air pollution management issues

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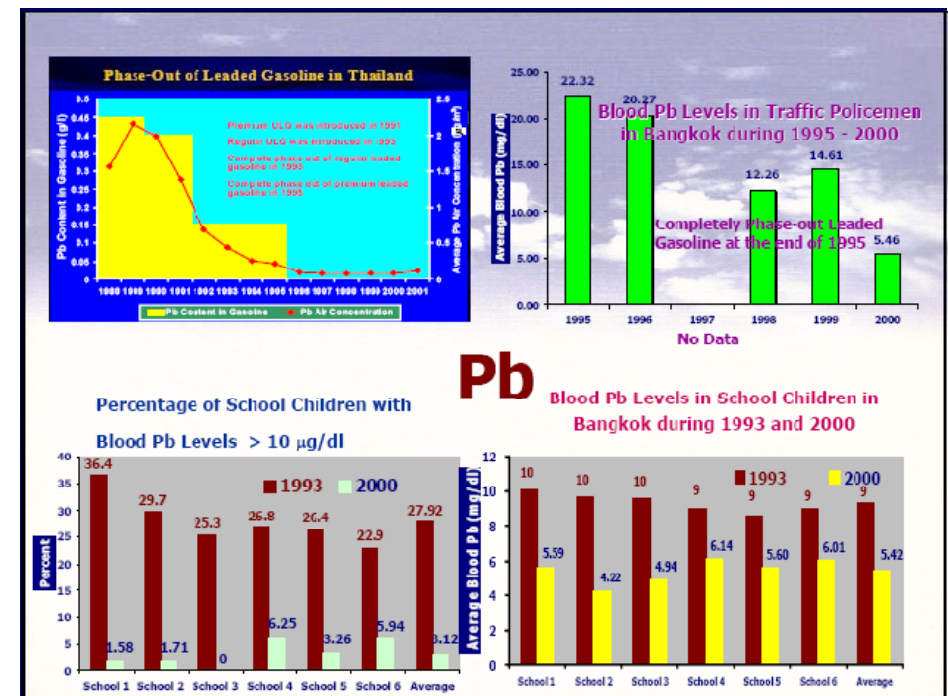
## Improvement of Fuel Quality and Vehicular Emission Standards

- The decision of the government to improve fuel quality and emission standards of Thailand at about the same time during 1989-2001 (most important achievement) .
- Within 12 years, the quality standards of gasoline and diesel as well as fuel oils, and corresponding emission standards for new gasoline and diesel vehicles were adopted and reflected the most advanced standards among the ASEAN nations.

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- At that particular time, unleaded gasoline and high quality diesel fuels were not used in any other ASEAN countries, even though they were used in developed countries.
- After much negotiation with the refineries and oil companies, the agreement was reached that Thailand would phase out leaded gasoline from 1 September 1993 and only unleaded gasoline was sold from 1 May 1998.

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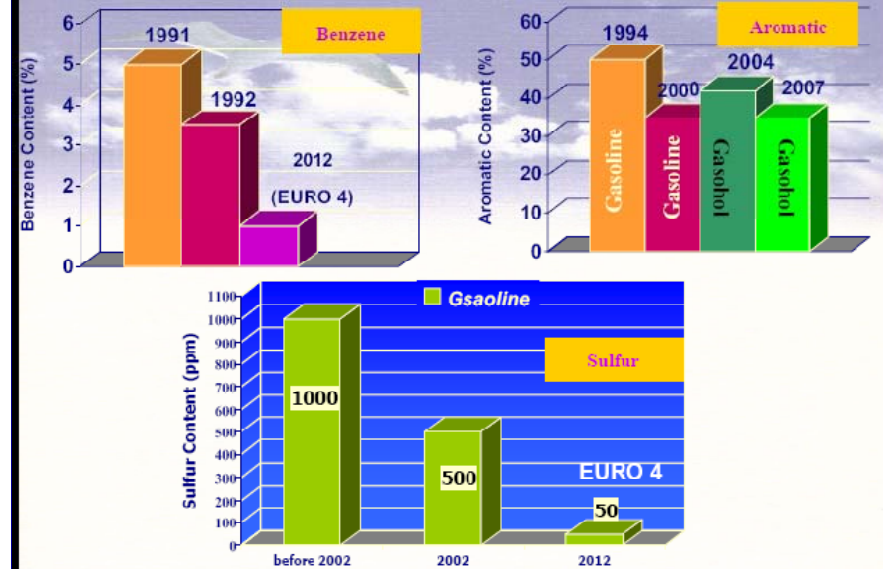


## Improvement of Gasoline

Year	Improvement
1993	-Lowering distillation point -Increasing oxygenated content -Reducing benzene content
1994	-reducing aromatics content
1995	-requiring of MTBE addition (to reduce CO emission)
This corresponds to emission standards for new gasoline vehicles (first in 1992 ,current is 96/69/EC).	

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## Gasoline Reformulation



## Improvement of Diesel Fuel

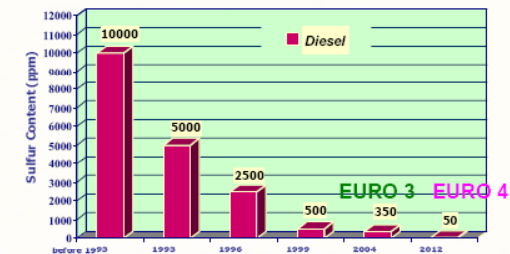
Year	Improvement
1992	Lower distillation point reduced from 370 ° C to 357 ° C
	Sulfur content reduced from 1% to 0.5%
1999	Sulfur content reduced from 0.5% to 0.05%
PCD's emission std for new diesel vehicles adopted since 1998; Current 96/69/EC for light duty vehicles Euro II for heavy duty vehicles	

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Year	Sulfur (%)	90% Distilled Temp. (oC)
1991		370
1992	1	357
1993	0.5	
1996	0.25	
1997		330 (Only for BMTA Bus)
1999	0.05	
2004	0.035	

## Diesel Reformulation

### Sulfur Reduction



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## Measure for Abatement of Industrial SO<sub>2</sub> Emissions in Urban areas

- In 1994 - Reduce the sulfur content of fuel oil to be used in Bangkok and Samut Prakarn Province from 3-3.5 % to 2 %.
- The significant reduction of sulfur dioxide in ambient air since then was mostly from the increasing use of gas as industrial fuel, due to the supply from Gulf of Thailand.

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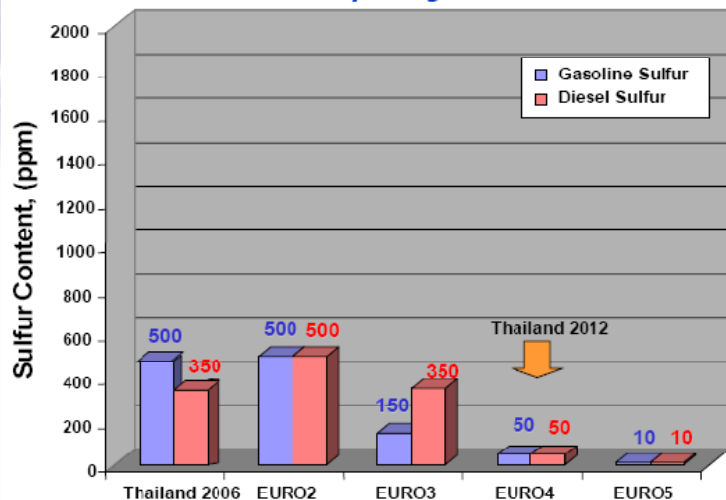
## Plan to improve fuel quality (January 2012)

Gasoline and Gasohol	Diesel
-Reduce olefin content less than 18 %(v/v)	-Reduce Polycyclic Aromatic hydrocarbon (PAH) to < 11 %(w/w)
-Lead content from 0.013 to 0.005g/L	-Reduce Sulfur from < 350ppm to < 50 ppm
-Reduce Sulfur from < 500ppm to < 50 ppm	Cetane number raised from 47 to 50
-Reduce Benzene from < 3.5 % to < 1.0 %	

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## Sulfur in Fuels Required by Euro Emission Standards

### Low Sulfur Levels Are Key To Tighter New Vehicle Standards



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- Pollution Control Department (PCD) estimated that the improvements will:
- reduce particulate concentration in ambient air by 4.05 µg/m<sup>3</sup>
- reduce impacts on health by about 600-1700 million US dollars per year.

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## Gasoline Evaporation Control (from gas stations and terminals)

- In 1996, the Cabinet's resolution to control Level I vapour control at new gas stations and all existing stations by 2000 (due to economic crisis in 1997, that was postponed to 2001).
- Level II vapour control has not been adopted for general gas stations (except the ones in narrow roads or within buildings)

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## Emission Standards for Power Plants

- PCD announced the emission standards from the existing power plants and new power plants using coal, fuel oil and gas in 1999 and 1996 respectively.
- This was timely because since then there have been numerous private power plants.
- The standards usually require desulfurization or very low sulfur fuels, and low NO<sub>x</sub>-burners.
- Since the standards were announced well in advance, the new power plants constructed in 2000s already planned for the additional investment costs.

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## Emission and Ambient Standards for Volatile Organic Compounds (VOCs)

- Due to the increasing ozone problem, the Japanese technical cooperation assisted Thai Government in developing environment and emission standards for VOCs (March 2006-February 2008)

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- The cooperation has resulted in the establishment of ambient air quality standards for 9 VOCs in September 2007 (benzene, 1,3-butadiene, chloroform, dichloromethane, 1,2-dichloroethane, 1,2-dichloropropane, tetrachloroethylene, trichloroethylene and vinyl chloride.)

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## VOCs ambient air standard in Thailand (2007)

		Annual average (ug/m <sup>3</sup> )
1.	Benzene	1.7
2.	Vinyl Chloride	10
3.	1,2-dichloroethane	0.4
4.	Trichloroethylene	23
5.	Dichloromethane	22
6.	1,2-Dichloropropane	4
7.	Tetrachloroethylene	200
8.	Chloroform	0.43
9.	1,3 Butadiene	0.33

Ref. : Notification of the National Environment Board No. 30 (2550)

- Plan is for setting emission standards for TCE, DCM, and PCE, VCM and 1,2 dichloroethane.
- Methodology for estimating Benzene and 1,3 Butadiene from mobile source as well as emission characteristics from mobile sources are currently under tests.
- This will lead to countermeasures of Benzene and 1,3 Butadiene from mobile source.

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## Introduction of Compressed Natural Gas (CNG) as Fuels in Industry and Transportation

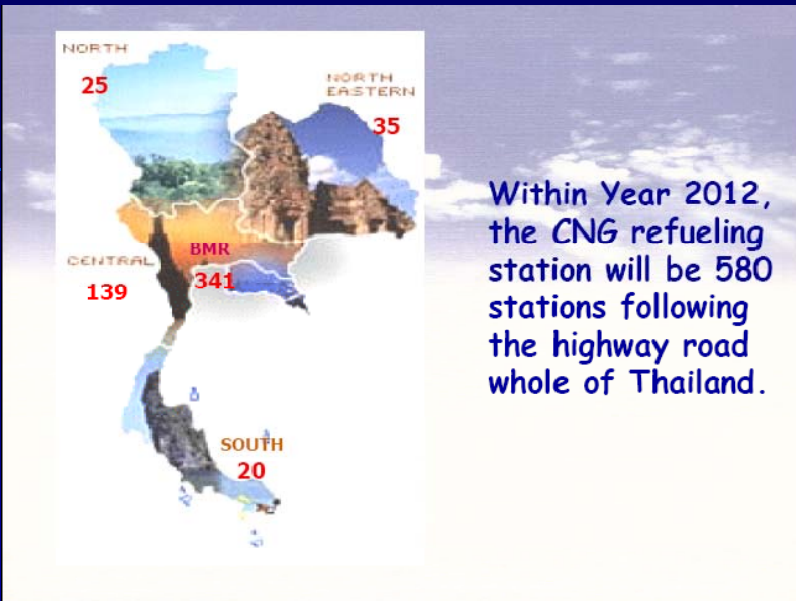
- Since the problem of inadequate CNG stations was solved, some of Bangkok's taxis have already converted to CNG.
- Heavy trucks also converted, even for the long-haul trucks, as NG stations have become available in outlying provinces.

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- Tax incentives (reduction of import tax on CNG canisters from 10 to 1 % and CKD (Chassis with Engine and Accessories) also helped.
- In fact, the measures have become so successful, that the country is now the net importer of natural gas.

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Within Year 2012, the CNG refueling station will be 580 stations following the highway road whole of Thailand.

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## The conversion of 2-stroke to 4-stroke motorcycles

- The pre-1994 motorcycles in Thailand which about 10 million were mostly 2-stroke engines type (87 to 13 % ratio of 2-stroke to 4-stroke in 1994).
- The coordination of PCD and Bangkok Administration, The World Bank, and motorcycle manufacturers in Thailand (including rebates) produced successful results.

50

- In only a few years, the popularity of 4-stroke motorcycles was so great that the price became cheaper.
- Subsequent emission standards which became more stringent made the ratio to 18 to 82 % ratio of 2-stroke to 4-stroke by 2001.

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## Responses to the Air Quality: Policy and Measures in 2009

- **PM-2.5 Ambient Air Quality Standard**
- PCD conducted three expert group meetings during 2004-2008 to consider the PM-2.5 standard, and it was agreed that the suitable standard should be based on the non-effect level of 60 µg/m<sup>3</sup> (24 hour average)

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## Discussion on Political institutions and decision making processes: The future

- The NEQA of 1992 has solved the lack of authority problem by using the environmental standards as the tool which requires other government agencies to follow.
- In the following years, more and air quality standards (ambient and emissions) have been issued and there have been relatively small problems with the existing agencies to adopt them.
- In fact, the success of this strategy appears to be satisfactory in the view of environmental agencies, such as PCD.

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- Thus, it appears that on the national policy making level, the support for environment issues will strengthen, also with the influence of climate change issue, which will support energy conservation and greener technology.
- This will be reflected in the future National Economic and Social Development Plans.

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- The obstacle in implementation still remains in the decision making level (ministerial)
- that are : the lack of understanding in the effects and economics of air pollution, less conviction that this problem is a priority, lack of initiative for policy change, insufficient communications among various agencies, and not supportive of integrated actions (sectoral egotism).
- So it will still be up to the government officials at the departmental level to push for the implementations for the years to come.

(Comments from Dr. Wicharn Simachaya  
Director of Air Quality and Noise Management Bureau,  
Pollution Control Department.)

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## The problem of knowledge Dissemination on Air Pollution Issues

- Environmental journalists in Thailand as lacking basic understanding of atmospheric environment and its effects and are unable to decide on the information required, and thus are often unable to draw correct conclusions.  
(comments from Dr. Wicharn Simachaya)

56

- The non-governmental organizations (NGOs) who are supposed to be the important links between the government and the public also have similar problems, so they do not have much contribution towards the policy decision making of government.

(comments from Dr. Wicharn Simachaya)

57

- In the academic circle, the discussions on how to provide knowledge on air quality management have been going on for a long time.
- The universities have the responsibility to train the students for future employment, and air quality management is not a likely career for students.

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- It appears that air quality management program in Thailand has been successful to date, with the necessary standards and capabilities among the key agencies such as PCD are already in place.
- It would have to be pointed out that there have been many assistance from international agencies such as JICA, USAID, the World Bank, EU, and other countries, which contributed to much of the successes so far.

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- In order to address the problem of lack of personnel and interests, jobs in this field can be stimulated by research and development, which in developed countries the R&D activities are significant for industrial and institutions' development.
- Like any developing countries which depend on the readily available imported technology, for Thailand the problem of lack of R&D can not be resolved soon.

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- The recommendation is in term of economy and regional cooperation.
- For example, if common emission standards (much like the EU-style) are adopted in a region, the cost of manufacturing vehicles and pollution control equipment will be cheaper on larger mass production.

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- As East Asian countries are adopting free trade agreements, countries with more effective production bases can supply to other countries and thus the spreading of air pollution management technologies.
- The common standards can also help in transboundary transportation such as land traffic movements from country to country.
- The policy makers should be introduced to these advantages so they can make the appropriate decisions.

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# Atmospheric Environmental Issues:

## Integrated Policy Response

### CONTENTS

- ➔ **1. Existing Policy Responses**
  - 1.1 Asia
  - 1.2 Africa
  - 1.3 Europe
  - 1.4 Latin America and the Caribbean
  
- 2. Integrated Policy Response**
  - 2.1 Global Level
  - 2.2 Regional Level
  - 2.3 National Level
  - 2.4 Community Level

### Asia

Existing Response



**Central Asia**  
5 Central Asia countries formulated the Framework Convention on Preservation of Environment for Sustainable Development of Central Asia

**East Asia:**  
13 countries, which includes Northeast and Southeast Asia, working under the framework of East Asia Network on Acid Deposition

**Southeast Asia:**  
10 ASEAN member countries are working under the framework of ASEAN Haze Agreement

**South Asia:**  
8 countries are cooperating under the framework of Malé Declaration on Control and Prevention of Air Pollution and Its likely Transboundary Effects for South Asia



### Malé Declaration: National Implementing Agencies



**Development**

- March 1998: Policy Dialogue
- April 1998: Adoption of the Declaration

**Implementation**

- Phase 1: Awareness and baseline studies
- Phase 2: Local capacity building for monitoring and analysis
- Phase 3: Local capacity building for impact assessment

**Member States**

Iran, Pakistan, India, Maldives, Bhutan, Nepal, Bangladesh, Sri Lanka

## Governments and Stakeholders are working together

- Male' Declaration has been recognized as:

National forum on air pollution at the national level

Regional forum on air pollution at the national and regional level respectively

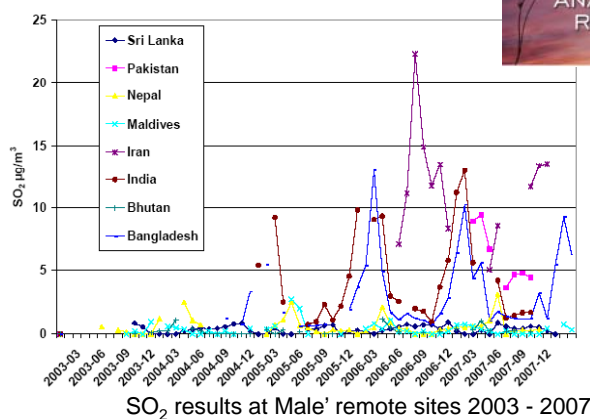


## Monitoring: Extended monitoring network

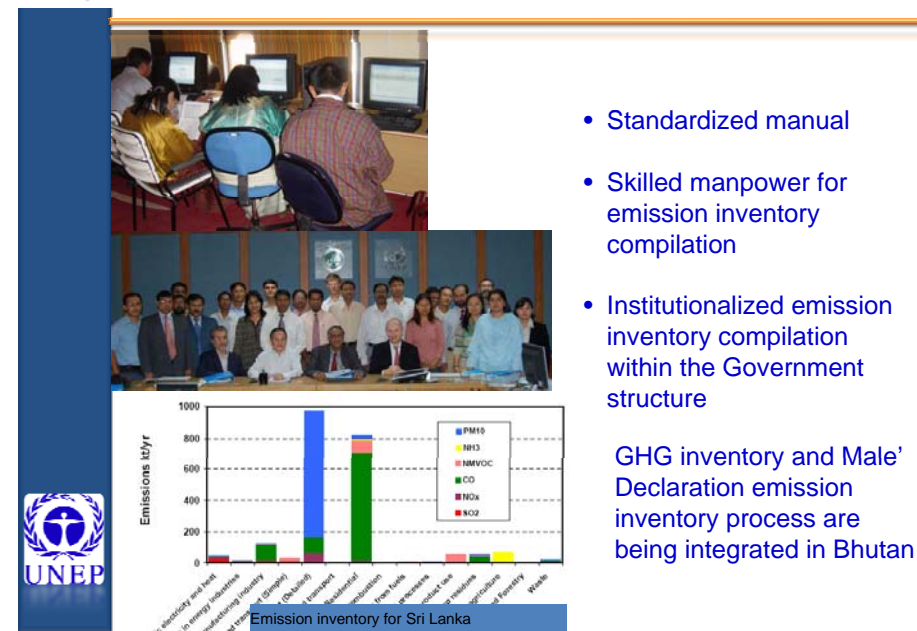


## MD: Established data trend

- Regional data base (monthly updates)
- Data report (3 annual reports)
- Synthesis report (1 period report)



## Emission Inventory





## Impact Assessment: Health Impact



Regional Training on Health Impact; February 2007, RRCAP, Bangkok



**Case study**  
Dhaka, Bangladesh (1618 school children)

- PEFR decreased by 40% when PM10 increased from its lowest level of 38 mg/m<sup>3</sup> to its highest daily mean of 385 mg/m<sup>3</sup>

- PEFR decreased by 30% when PM2.5 increased from its lowest level of 18 mg/m<sup>3</sup> to its highest daily mean of 233 mg/m<sup>3</sup>.

- 3.5 million school absence days per year

- 51 school age children would die of asthma per year.

## Impact Assessment: Corrosion Impact



Regional Training on Corrosion Impact Assessment; October 2006, RRCAP, Bangkok

First Capacity building training, October 2008

Second Capacity building training, February 2008



Corrosion monitoring track installed in Kathmandu, Nepal



Case study  
Tehran, Iran  
Agra, India  
Kathmandu, Nepal  
Colombo, Sri Lanka  
Maldives



## Impact Assessment: Crop Impact



Capacity building training  
August 2007 in Dhaka; March 2008  
Bangkok

- Indicator plants
- EDU experiment
- Passive sampler campaigns

Case Studies are being implemented in:

- Bangladesh
- Bhutan
- India
- Nepal
- Pakistan
- Sri Lanka



Mung Bean Plant protected for ozone

Mung Bean Plant without ozone protection

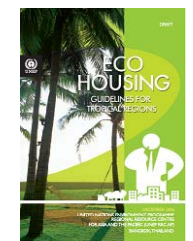


Study on Mung Bean Plant in Pakistan

## Decision Support Information

Technical support for demonstration

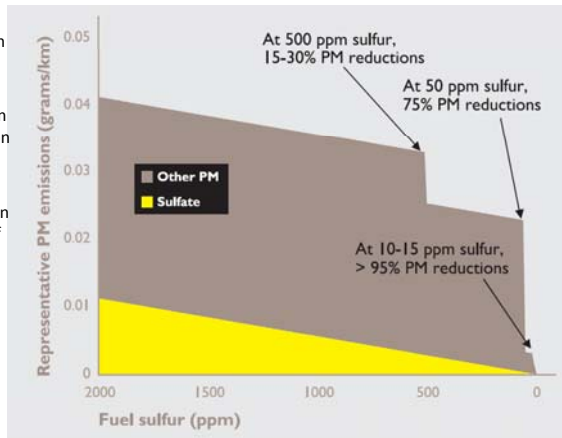
- Generic guidelines for the construction of eco-housing
- 4 training programmes on the concept of eco-housing
- Provided technical support for an eco-village demonstration project



## MD: Clean Fuels and vehicles

•Cleaner fuels are necessary for the introduction of cleaner, more efficient vehicles with functioning emission control devices

- When Sulphur content falls below certain levels, emissions control devices can be used
- 500ppm permits the use of oxidation catalysts, which can achieve up to a 30% reduction in emissions of particulate matter
- Sulphur levels no greater than 50ppm permit a reduction of up to 75% of particulate matter
- And around 10 to 15ppm permit reductions of particulate matter up to 95%



## MD: Clean Fuels and vehicles

- PCFV Global Campaign:
- Countries to introduce fuels with 50ppm or less Sulphur levels

### Clean Fuels and vehicles – Sulphur

In order to support the development of air pollution reduction policies, a regional workshop for member countries will be held to promote the adoption of clean fuels and vehicles policies and raise awareness of the issues surrounding such fuels. Activities will be initiated, during and after the workshop, to support member countries to **introduce 50 parts per million (ppm) low sulphur fuel and clean vehicle standards**. Regional and national fuels and vehicle data will be disseminated and best practices in vehicle emissions in South Asia identified. High-level policy makers in relevant ministries (Transport, Oil, Energy, Roads, Standards) will also be targeted to broaden the awareness of the issues.



## MD: Rise Awareness

### Networking with youths

- South Asia Youth Environment Network (SA'YEN) awareness



## MD: Future Development

- Conduct a feasibility study on the establishment of specialized regional centres
- Conduct a feasibility study on developing a regional framework such as convention on air pollution in South Asia
- Develop sustainable financing mechanism for the Malé Declaration





# Africa

Existing Response

## Northern Africa

Developed draft North African Framework Agreement on Air Pollution. A formal adoption by the Ministers is expected in early 2010.

## Eastern Africa

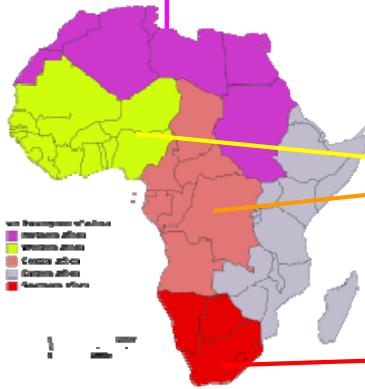
Adopted the Eastern Africa Regional Framework Agreement on Air Pollution (Nairobi Agreement-2008)

## Central and Western Africa

Adopted a regional framework agreement (Abidjan Agreement) on air pollution

## Southern Africa

Agreed on the Lusaka Agreement on Air Pollution



# Europe and North America

Existing Response

## LRTAP Convention

- Since 1979 the Convention on Long-range Transboundary Air Pollution has been addressing regional air pollution in UNECE region through scientific collaboration and policy negotiation.
- The Convention has been extended by eight protocols that identify specific measures to be taken by Parties to cut their emissions of air pollutants.
- The Convention, which now has 51 Parties



# Latin America and Caribbean

Existing Response: LAC

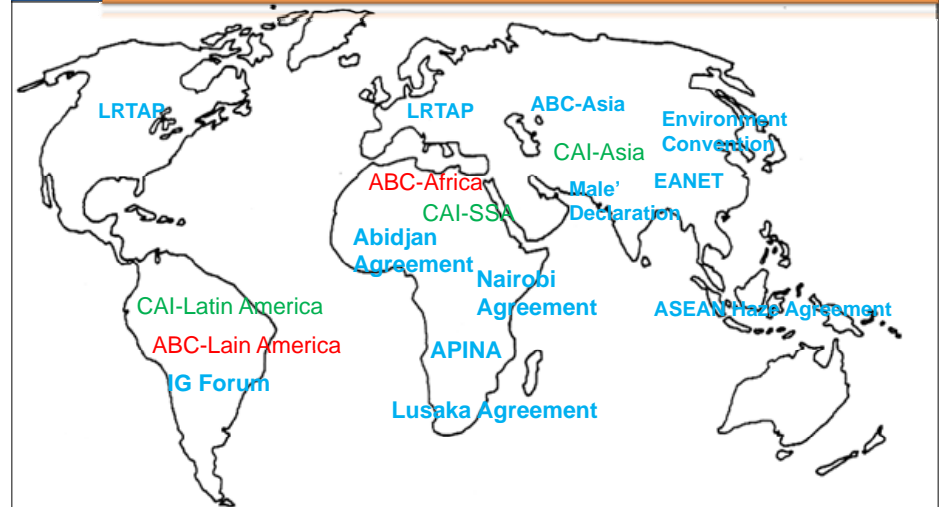


## The First Meeting

- Hosted by ROLAC in Panama
- Agreed on the need for the air pollution network in the region.
- A Ministerial level declaration is expected during the first quarter of 2010.



# Air pollution and ABC networks



Established Regional Air Pollution Networks  
 Networks under development  
 Established Urban Air Pollution Networks

# CONTENTS

## 1. Existing Policy Responses

- 1.1 Asia
- 1.2 Africa
- 1.3 Europe
- 1.4 Latin America and the Caribbean

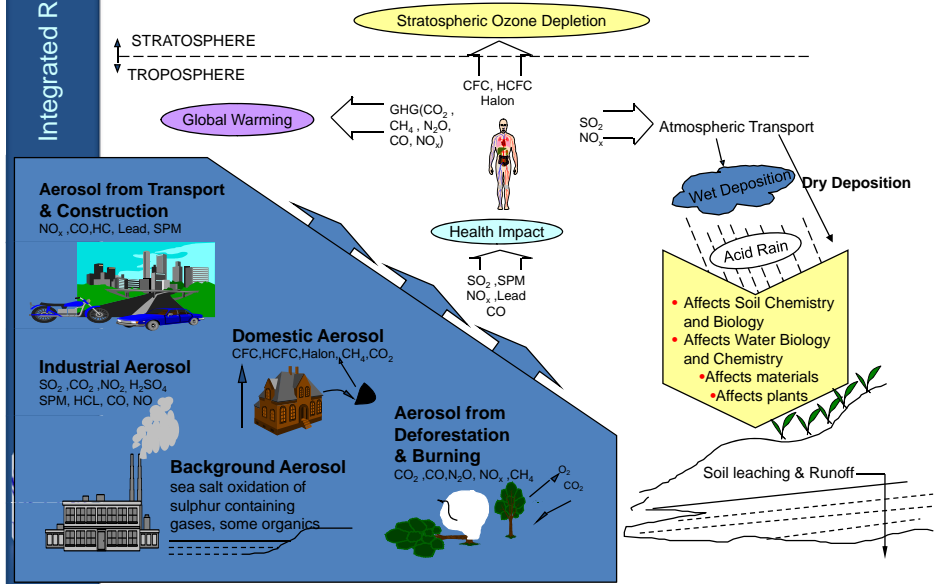
## 2. Integrated Policy Response

- 2.1 Global Level
- 2.2 Regional Level
- 2.3 National Level
- 2.4 Community Level



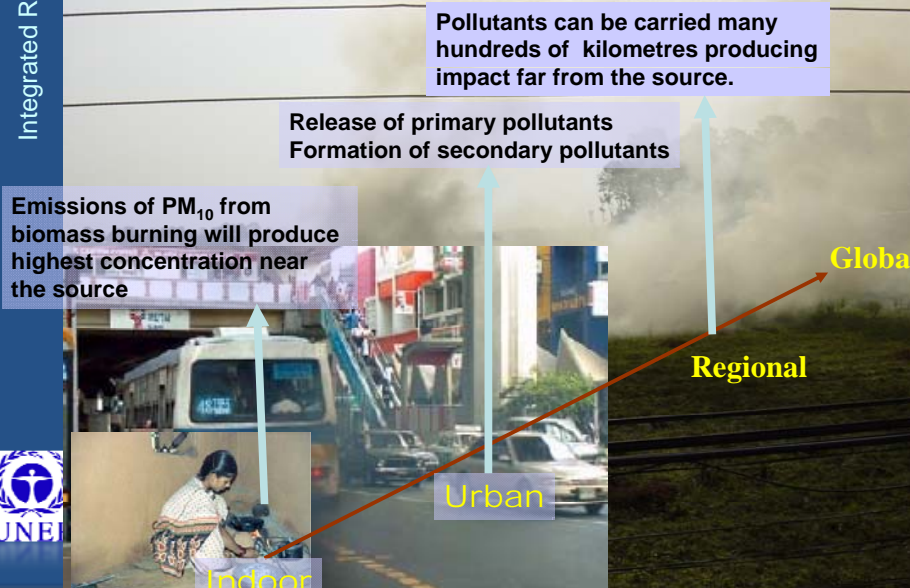
Integrated Response

# Multi-Sectoral, Multi-Pollutant Issue



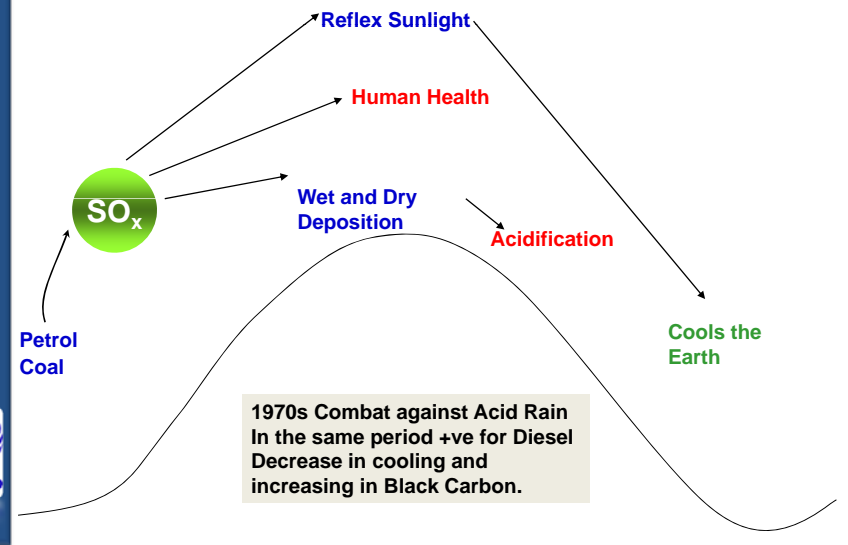
# Local to Global

Integrated Response

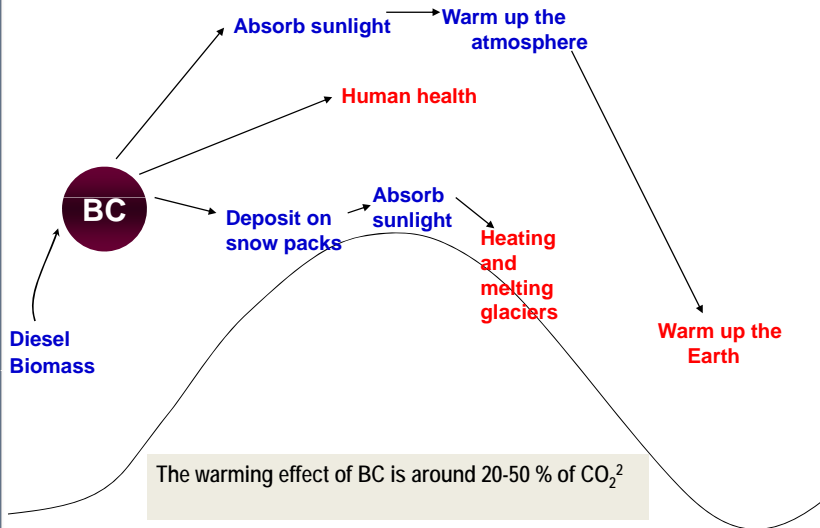


# Sulphate Story

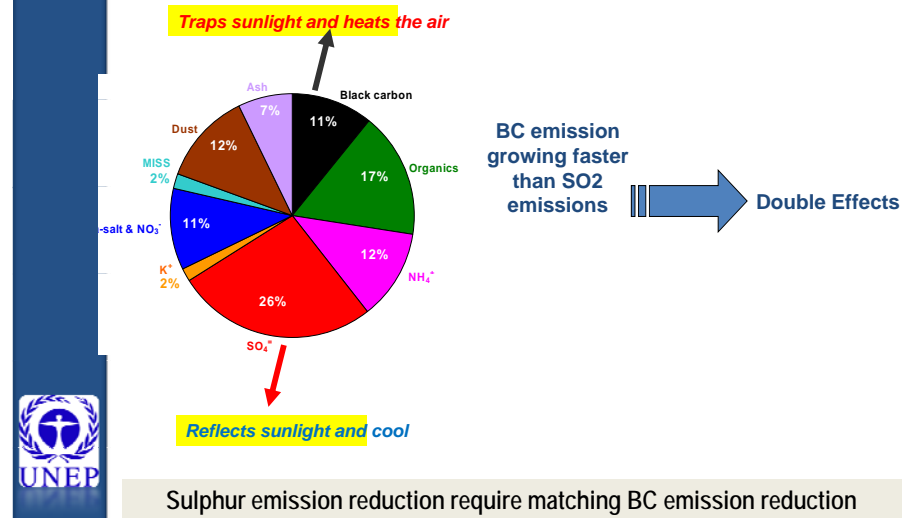
Integrated Response



# Black Carbon



# Black Carbon / Sulphur Ratio



# Pollutants around us

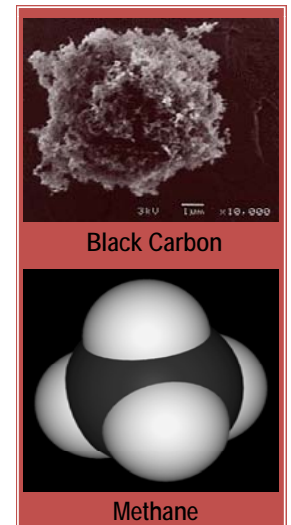
Components in the atmospheric emissions require an integrated approach considering the different effects

Compound	Residence time	Toxic properties	Climate change properties
Carbon dioxide	150 years	Acidification of sea water	Climate gas, long residence time
Nitrous oxide	110 years	Destruction of the stratospheric ozone	Climate gas, long resident time
Methane	10 years	Precursor of ground level ozone	Climate gas, intermediate residence time
Ozone	1 month	Adverse effects on health and vegetation	Climate gas, short resident time
Sulphur dioxide	1 week	Acidification, health effects	Sulphate particles suppressing global warming
Soot	1 week	Health effects	Soot and BC particles increase global warming
Nitrogen oxides	1 week	Precursor of ground level ozone, acidification, eutrophication	Nitrate particles may suppress global warming
Ammonia	< 1 week	Acidification, eutrophication	Ammonium particles may suppress global warming

Source: Air Pollution & Climate Change: Two sides of the same coin. 2009

# Fast Cooling from Non-CO<sub>2</sub>

- Big: non-CO<sub>2</sub> = 50% of warming
  - Black Carbon (20-50% of CO<sub>2</sub> RF)
  - Tropospheric ozone (20% of CO<sub>2</sub> RF)
  - Methane (30% of CO<sub>2</sub> RF)
  - HFCs (20% of CO<sub>2</sub> RF)
- Fast: most are short-term forcers: days/decades



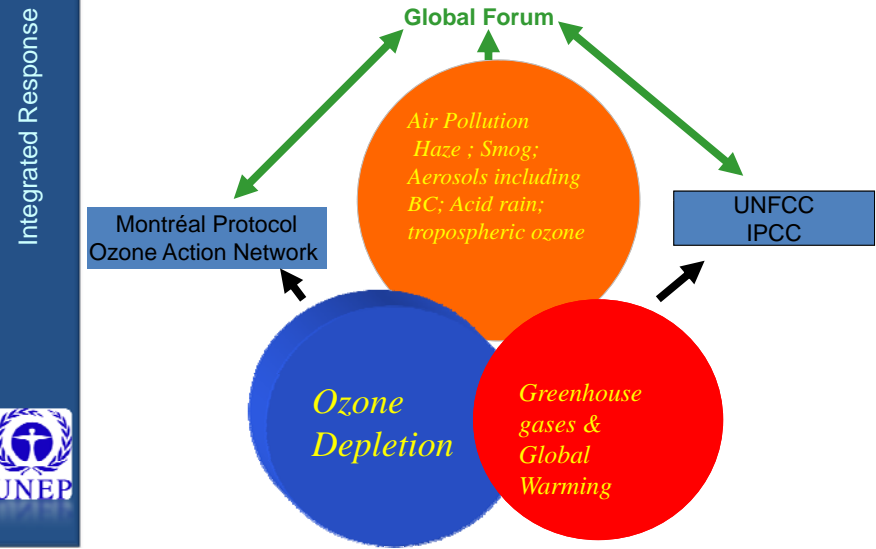
## Feasibility

- **Technical:**  
Technologies exist to reduce most emissions of BC and Ozone precursors without limiting the underlying activities.
- **Economical:**  
Typically amenable to lower cost end-of-pipe control or equipment fixes which are readily deployable.
- **Psychological:**  
me, mine and local as opposed to global goods!

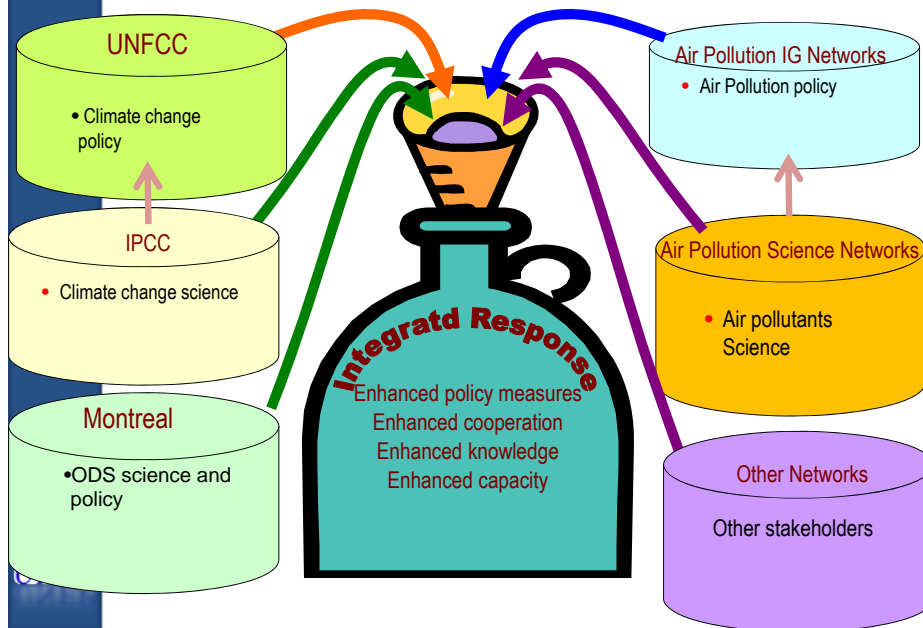


## Global Level

Closer cooperation among atmospheric policies are promoted at the global.  
Example, Global Atmospheric Forum:



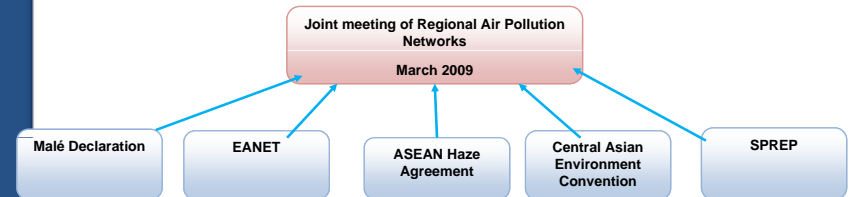
## Long-Term Vision



## Regional Level

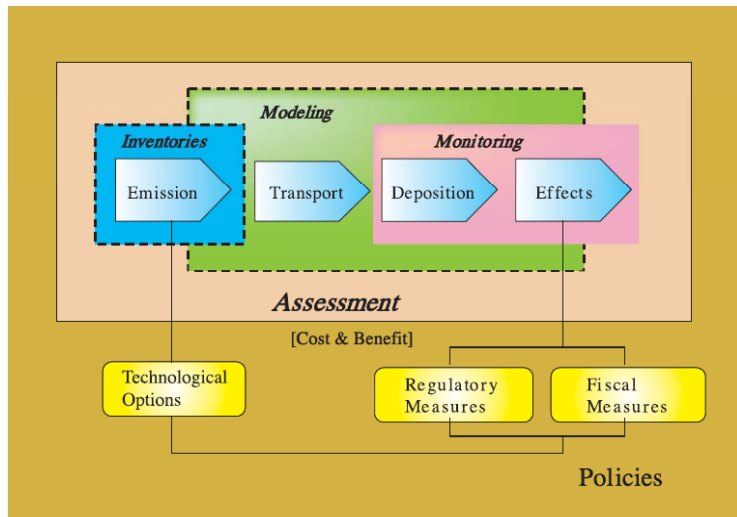
Closer cooperation among regional air pollution networks are promoted to enhance harmonization and sharing of good practices.

Example, Joint Meeting in Asia:



# National Level

An integrated approach involving the emissions, transport, effects, and policy measures are promoted at the national level for the management of atmospheric approach



# Community level

Multi-sectoral, Multi pollutant approach is demonstrated at the community level:

Example, Eco-village in Sri Lanka:

- 55 tsunami affected families rehabilitated in 8 acres
- Project execution by Sarvodaya Shramadana movement and the residents.
- Increased ventilation, sun protection, and day lighting by landscaping, house orientation & shading.
- Rainwater harvesting tanks, shared by houses
- Solar panels for lighting for individual houses
- Source segregation of waste. Recycling and Composting of waste
- Residents participation in site planning, construction and operation & maintenance



Water harvesting tanks

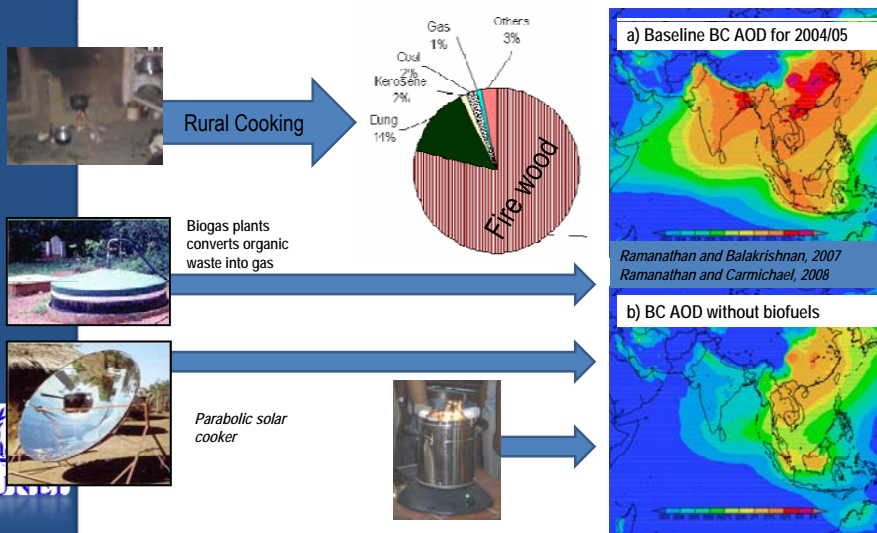


A child in the eco-village

Integrated Response



# Individual Level (Project Surya)





International Experts Workshop  
on International Framework and Co-benefit Approach to Promote Air Pollution  
Control Countermeasures in East Asia 2010  
23-24 January, 2010, Hayama, Japan

**Programme**

**23<sup>rd</sup> January (Sat), 2010**

9:00-9:30	<b>Registration</b>
<b>Morning Session</b>	Moderator: Mr. Hideyuki Mori, IGES
9:30-9:50	<b>Opening remarks:</b> Prof. Katsunori Suzuki, Kanazawa University
9:50-11:00	<b>Introductory Presentation:</b> Prof. Katsunori Suzuki, Kanazawa University <b>Sub-theme1:</b> Research on Regional Framework and Co-benefit Approach to Promote Air Pollution Control in East Asia Prof. Katsunori Suzuki, Kanazawa University
11:00-11:35	<b>Sub-theme 2:</b> Research on Restrictive factors and Barriers to the Promotion of Negotiations in Major Related Countries Dr. Mark Elder, IGES
11:35-12:05	<b>Discussions</b>
12:05-13:05	<b>Lunch</b>
<b>Afternoon Session (1)</b>	Moderator: Prof. Jusen Asuka, Tohoku University
13:05-13:40	Presentation of case study on Thailand Assoc. Prof. Noppaporn Panich, Chulalongkorn University
13:40-14:15	Presentation of case study on Korea (1) Assoc. Prof. Esook Yoon, Kwangwoon University
14:15-14:50	Presentation of case study on Korea (2) Asst. Prof. Dong-Young Kim, KDI School of Public Policy and Management
14:50-15:40	<b>Discussion</b>
15:40-16:00	<b>Coffee Break</b>



<b>Afternoon Session (2)</b>	Moderator: Dr. Mark Elder, IGES
16:00-16:35	Presentation of case study on China (1) Assoc. Prof. Mingyuan Wang, Tsinghua University
16:35-17:10	Presentation of case study on China (2) Prof. Zifa Wang, Institute of Atmospheric Physics, Chinese Academy of Sciences
17:10-17:40	<b>Discussion</b>
18:30-	<b>Reception</b> (at Katsura, Shonan Village Center)

### 24<sup>th</sup> January (Sun), 2010

<b>Morning Session</b>	Moderator: Dr. Mark Elder, IGES
9:30-10:05	Presentation of case study on Japan Dr. Naoko Matsumoto, IGES
10:05-10:40	<b>Sub-theme3:</b> Study on the Effective/Efficient Policies Based on Science on the Atmospheric Management in East Asia Dr. Ken Yamashita, Dr. Nawahda Amin, ADORC
10:40-11:15	<b>Sub-theme5:</b> Economic Analyses of Co-benefit Environment Policy for Global Climate Change and Local Air Pollution: Asian MERGE model Prof. Jusen Asuka, Tohoku University
11:15-12:00	<b>Discussion</b>
12:00-13:00	<b>Lunch</b>
<b>Afternoon Session (1)</b>	Moderator: Dr. Ken Yamashita, ADORC
13:00-13:35	<b>Sub-theme4:</b> Air Pollution Institutional Architecture in East Asia Should Be Diffused and Start with High-level Political Agreement Assoc. Prof. Norichika Kanie
13:35-14:10	Atmospheric Environmental Issues: Integrated Policy Response Mr. Mylvakanam lyngararasan, UNEP
14:10-14:40	<b>Discussion</b>
14:40-15:00	<b>Coffee Break</b>
<b>Afternoon Session (2)</b>	Moderator: Prof. Katsunori Suzuki, Kanazawa University
15:00-17:00	Discussion on the presentation Discussion on the future research
17:00-17:25	<b>Wrap-up:</b> Prof. Katsunori Suzuki, Kanazawa University
17:25-17:30	<b>Closing remarks</b> Mr. Nobuhiro Kino, Ministry of the Environment, Japan

International Experts Workshop on International Framework  
and Cobenefit Approach to Promote Air Pollution Control  
Countermeasures in East Asia

23-24 January, 2010, Hayama, Japan

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