Interactive Database for Emission Analysis
- IDEA -

A Tool for Urban Air Pollution Analysis

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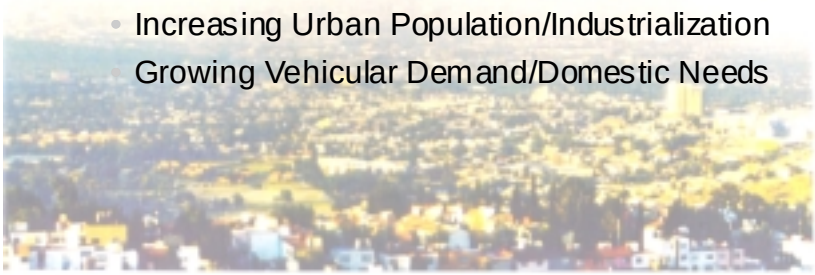
Outline

- Context of Integrated Air Quality Management (IAQM)
- Critical Need for Information in IAQM
- Interactive Database for Emission Analysis (IDEA)
- Case Studies
- IDEA – Potential Uses and Limitations
- Future Directions

Air Pollution

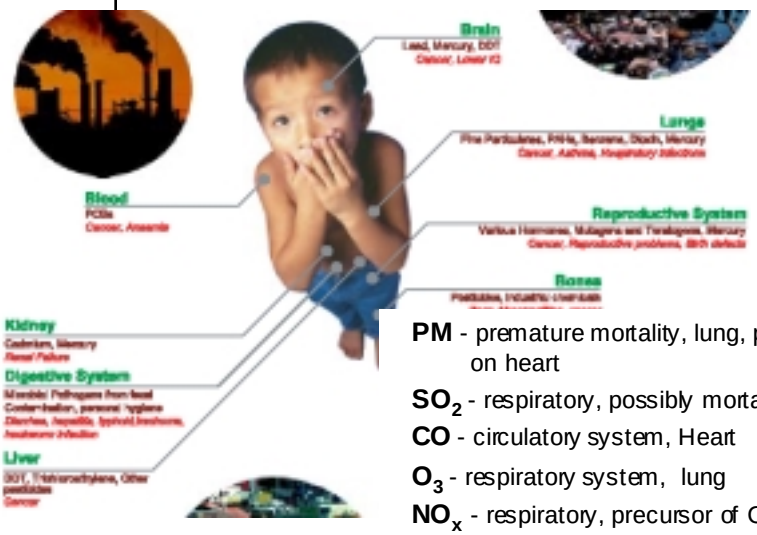
- Environmental degradation is a priority issue in the developing world
- Air pollution is a problem which has significant social, economic and environmental impacts
- Key factors:
  - Increasing Urban Population/Industrialization
  - Growing Vehicular Demand/Domestic Needs



Urbanization is increasing…

Including in East Asia…

Health Risks of Air Pollution



PM - premature mortality, lung, potential effects on heart

SO_2 - respiratory, possibly mortality effects

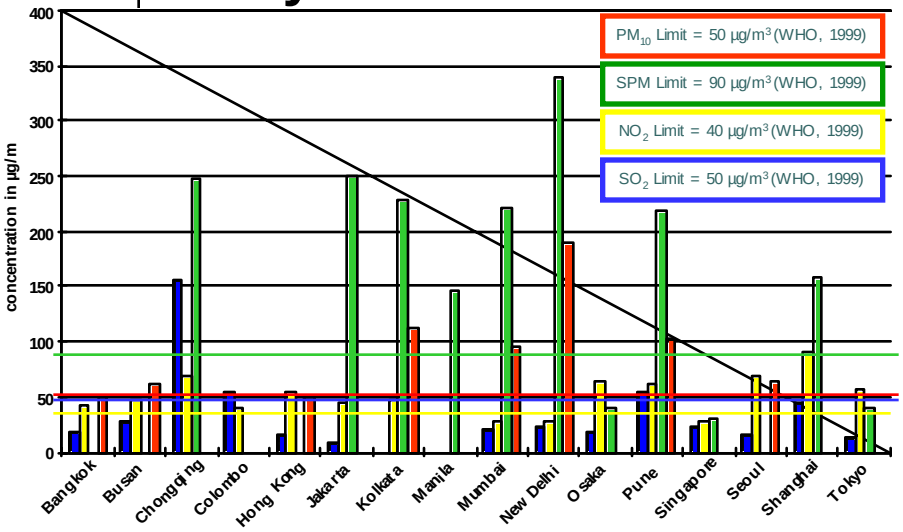
CO - circulatory system, Heart

O_3 - respiratory system, lung

NO_x - respiratory, precursor of O_3

Pb - nervous system, brain

Air pollution impacts many urban areas in Asia

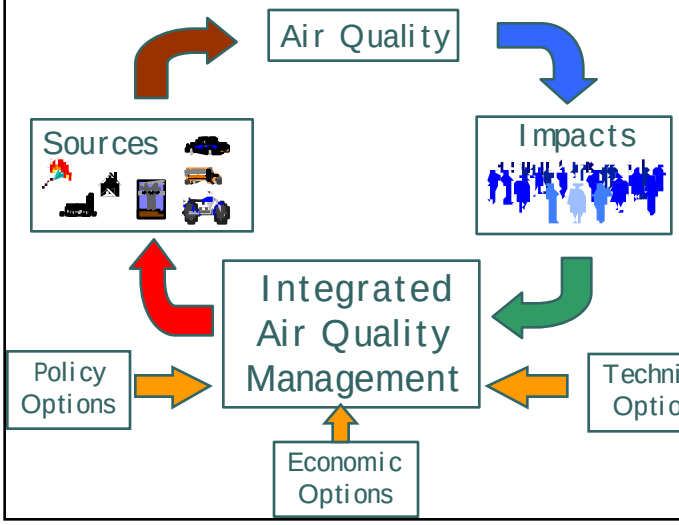


Source: Information collected from national and local government agencies through CAI-Asia network, 2003, detailed sources available from CAI-Asia Secretariat

How can this be addressed effectively?

- Recognition of problem and management options
- An integrated air quality management (IAQM) approach
- Adequate knowledge base and analytical tools
- Effective collaboration across stakeholders towards a shared goal

Key elements of IAQM



OBJECTIVES

- **Focus on key pollutants (e.g. fine particulates)**
- **Improve understanding of key pollution sources**
- **Assess impacts**
- **Analysis of alternative management strategies/options**

Typical constraints for IAQM

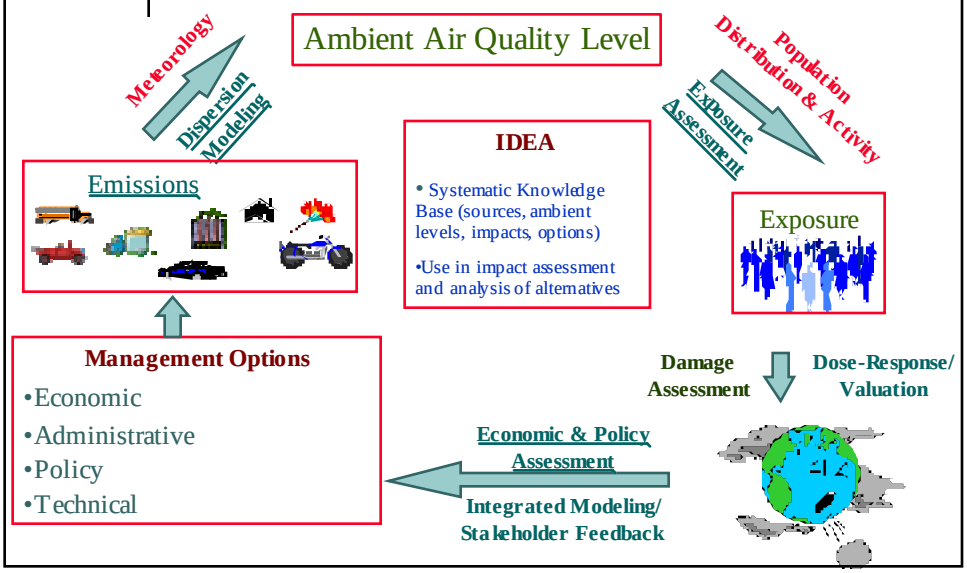
- Systematic **collation** of existing data and information
- Up-to-date and consistent **database** (on pollution sources and ambient levels, impacts, and responses) and effective integrative **analytical tools**
- **Stakeholder interaction** and **institutional capacity**

Conceptual framework for this initiative

- **Collation:** Systematically organize existing information on selected cities to aid IAQM
- **Database & Tools:** Development of **IDEA** – an Interactive Database for Emissions Analysis
- **Stakeholders:** Building partnerships to develop a shared knowledge base

Case Study Cities

What is IDEA?



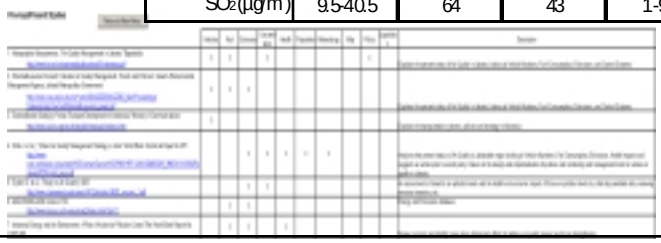
What Types of Information does IDEA focus on?

- General
- Sources & Emissions
- Ambient Levels
- Impacts
- Options

General

- Ongoing Projects
- Policies, Legislation
- Population
- GIS Databases
- Maps
- Studies

	Jakarta	Beijing	Shanghai	Hanoi
Population (2000)	11,018,000	13,820,000	16,740,000	3,751,000
Area (km^2)	661.52	1680.0	6340.5	918
Monitoring data				
TSP ($\mu g/m^3$)	11.6-189.2	370	162	
PM_{10} ($\mu g/m^3$)	45-146			
NO_x ($\mu g/m^3$)	45-187	71	62	
SO_2 ($\mu g/m^3$)	9.5-40.5	64	43	1-98



Pollutants and Sources

Anthropogenic Sources

Industrial and Power Sector
Coal, Fuel Oil, NG

Domestic Sector
Coal, Biofuels, NG/LPG

Transportation Sector
Gasoline, Diesel, CNG/LPG

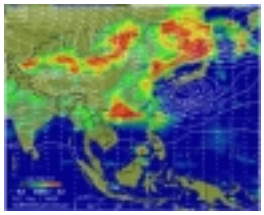
Pollutants and Sources

Natural Sources

Biomass Burning

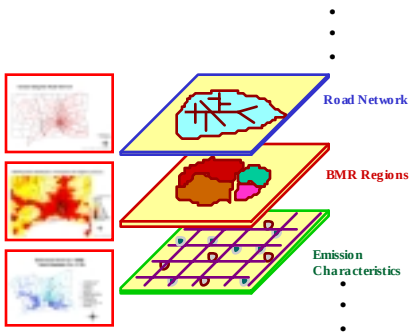
Controlled and uncontrolled combustion

Volcanoes



Dust Outbreaks

Emissions



Inputs

- Total Fuel Use – Coal, oil, gas, natural gas, alternatives
  - Industrial Fuel Use
  - Electricity Demand
- Vehicle Number by Age/Type
  - Vehicle Km Traveled
  - Trends
- Road Network
- Emission Factors for key pollutants – PM_{10}, SO_2, NO_x, CO_2
- Point Source Locations & Emissions
- Emission Control Scenarios/Options

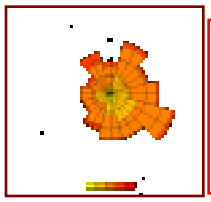
Emission Estimation for Key Pollutants

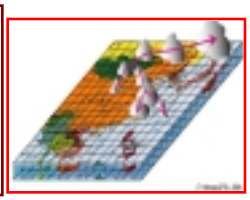
Outputs

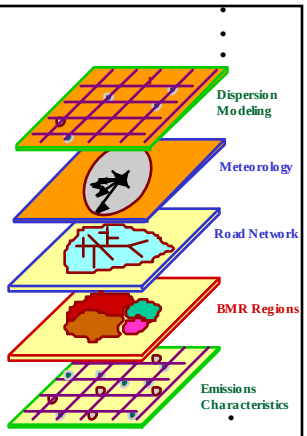
- Emissions apportionment by source
- Spatial distribution
- Projections under various scenarios
- Control vs Cost estimates for key pollutants

...input into **Dispersion Models**

Dispersion

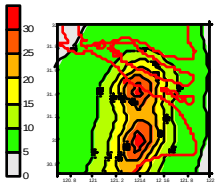






Inputs

- Emission Inventory
- Meteorology
- Ambient Concentration Data
- Scenarios/Options
- Maps/GIS information



Units: mg/m^3 PM_{10}

Spatial Distribution of Ambient Concentrations

Outputs

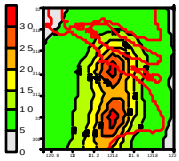
- Ambient Concentrations
- Projections under various scenarios
- Spatial patterns
- Exposure levels

...input into **Exposure Models**

Exposure

Inputs

- Ambient Concentrations
- Population Distribution
- Distribution of other sensitive receptors
- Scenarios/Options



Units: µg/m^3 PM_{10}

Impact/Exposure Assessment

Outputs

- Health Estimate
- Projections under various scenarios

...input into **Economic Analysis Models**

Typical Options for IAQM

- **Economic**: taxes, subsidies, pricing, charges, fines, tradable permits
- **Administrative**: emission, energy efficiency and fuel quality standards, restrictions on operation, inspection and maintenance, industrial compliance
- **Policy**: monitoring, compliance, transport systems, traffic management, public transport, NMT, industry, zoning, land-use
- **Technological**: fuel improvements, cleaner technologies, end-of-pipe control devices, cleaner production

Economic Analysis

$$$

Inputs

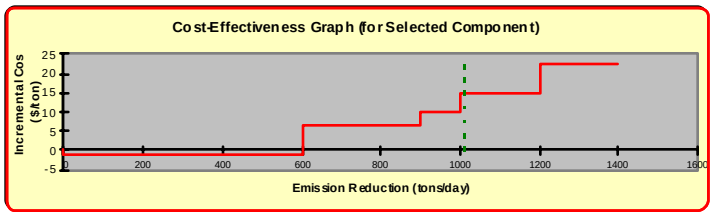
- Health and Other Damages and Valuation under various scenarios/options
- Costs of various options

Economic Analysis of Various Management Options

Outputs

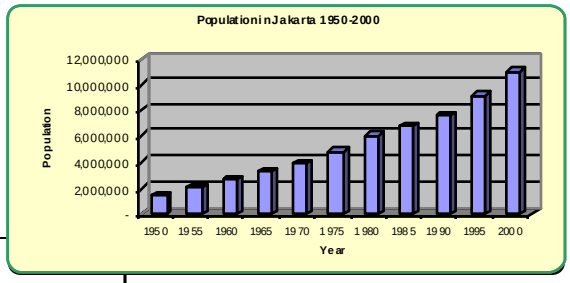
- Cost-Effectiveness of various options
- Net Benefits of various options

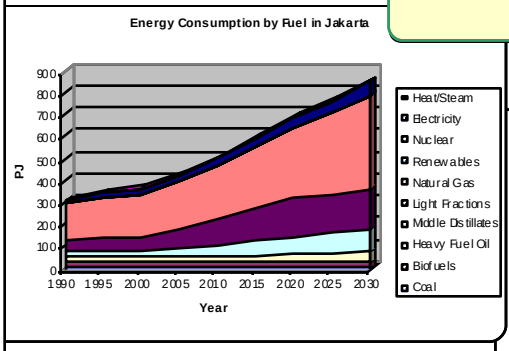
...input for **Decision Support**

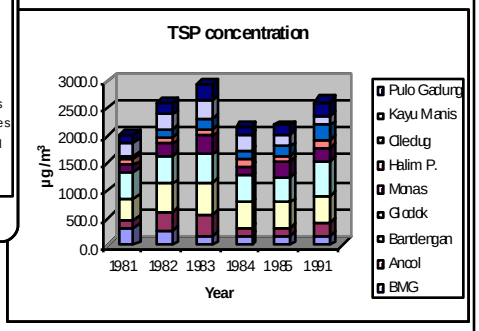


IDEA: An Excel-based Tool

Jakarta







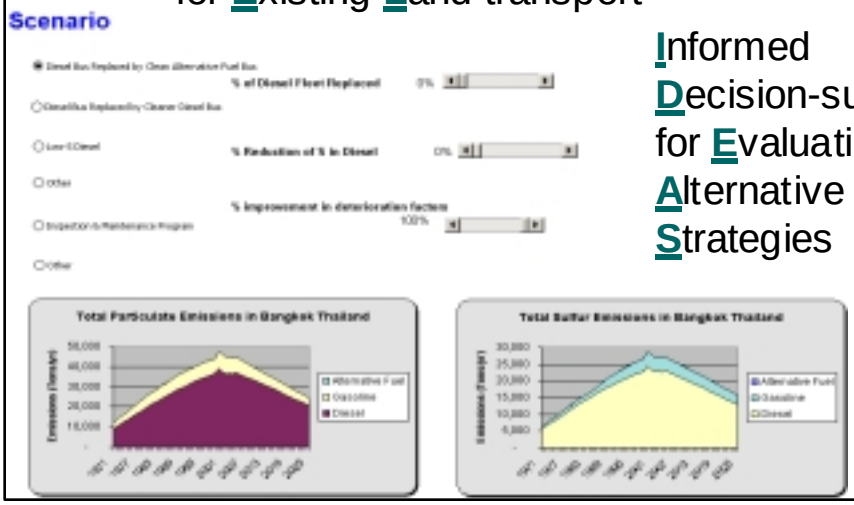
Potential Uses of IDEA

- City-level air quality databases
- Selection and Analysis of Options/Scenarios
  - Useful for environmental assessment (baseline, impacts, analysis of alternatives)
  - Modeling Framework Development and Application
- Common platform for collaboration at city-level

DIESEL-IDEAS program

Developing **I**ntegrated **E**mission **S**trategies for **E**xisting **L**and transport –

Informed **D**ecision-support for **E**valuating **A**lternative **S**trategies



Limitations

- Results are only as good as the databases – coverage, quality, consistency and access problems
- Consensus on types of options to be considered
- Evolving methodologies and tools for assessment
- Involvement of multiple stakeholders and disciplines
- Adequate reflection of political economy
- Actual **USE** and continuous updating of the systems developed

Next Steps

- Going deeper
  - Better Quality and Updated Data
  - Interface with Modeling Tools/Decision Support Systems
  - Better Impact Assessment and Analysis of Alternative Strategies/Options
- Going broader: More Cities
- Dissemination: Web-based Systems
- Institutional: Stakeholder collaboration for Shared knowledge base; Institutional “home”

In Conclusion…

- Organized information is essential for IAQM in urban areas
- IDEA is one approach to piloting the user-friendly organization of such information
- It could have many uses despite limitations

Thank You!

Questions?

Comments?