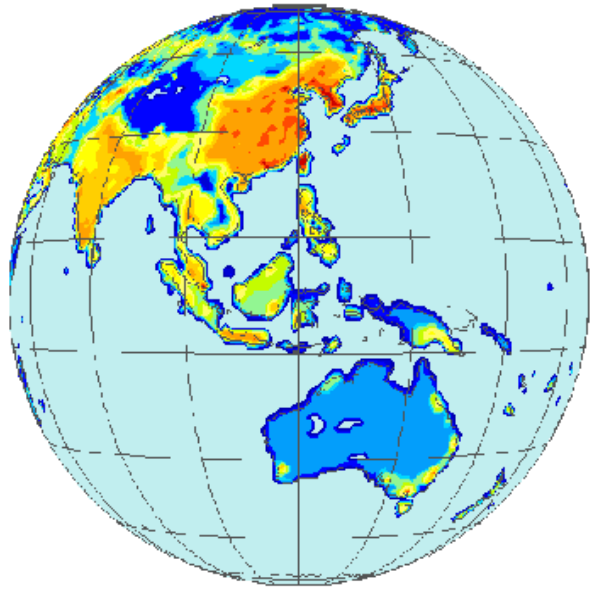
APEIS project: results in phase I and proposal in phase II



Mikiko KAINUMA

AIM Team, National Institute for Environmental Studies

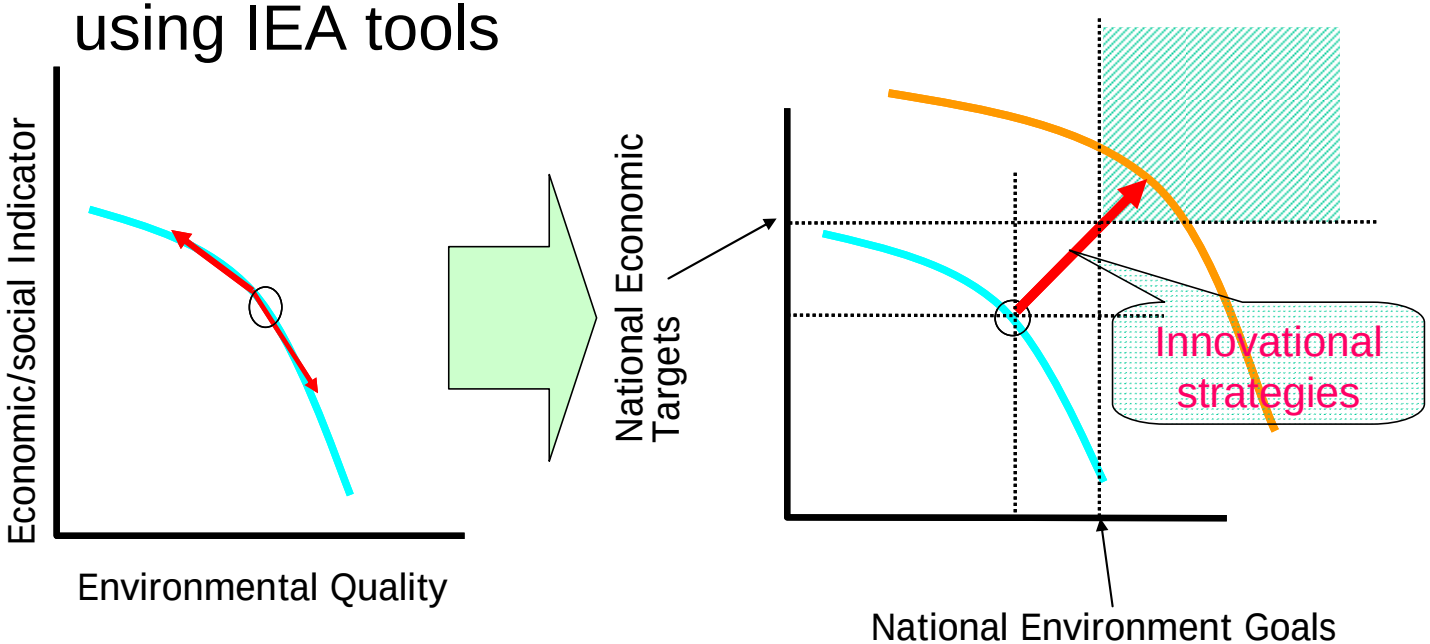
(Integrated Environmental Assessment Group, APEIS)

AIM/APEIS Workshop as a part of APEIS IEA activities

7-12 November 2005, NIES, Japan

Objectives of APEIS IEA

- Developing IEA tools to assess innovative options
- Diffusing and applying IEA tools for selected Asia-Pacific countries (China, India, Thailand, Korea)
- Developing quantitative innovative scenarios using IEA tools

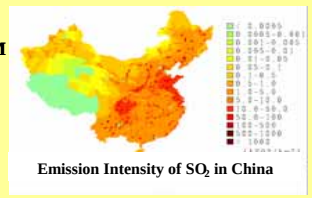


Structure of phase I in APEIS IEA

AIM Model Development for APEIS

AIM/ Local/Country/Inter-Provincial

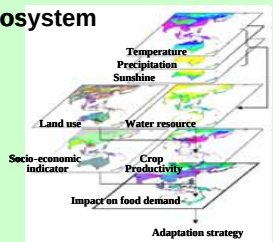
Developed for linking CO_2, SO_2, NO_2, SPM reduction program



Emission Intensity of SO_2 in China

AIM/ Impact/Ecosystem

Detailed process model for climate change impact assessment focused on surface water recycling, crop productivity and vegetation



AIM/End -use

Country Based Technology Model

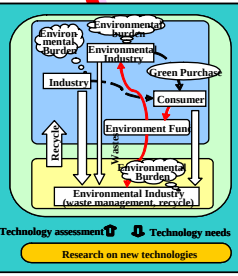
AIM Family

AIM/Top -down

World Economic Model

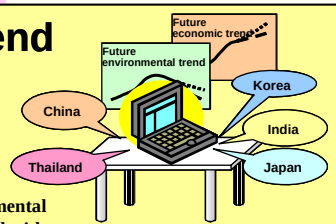
AIM/Material

One country CGE model with CO2 and material balance, interface with environmental technology model



AIM/Trend

Developed as a communication platform in order to construct Asia -pacific regional environmental outlook supported with multi -regional environment-economic CGE model



Strategic database

Fundamental Database

Model Base

Strategy Option Base

Index Base

Structure of phase I in APEIS IEA

- **A set of integrated assessment models as major tools of APEIS/IEA, including an environment-economy model, an ecosystem/health impact model, a water resource/agriculture model, a material/recycle-economy model and an energy technology model**
- **Strategic database as well as indicators for APEIS/IEA use**
- **Systematic projections of environmental trends as well as assessments of innovation needs and innovation options based on the above models and database**

Participating Organizations

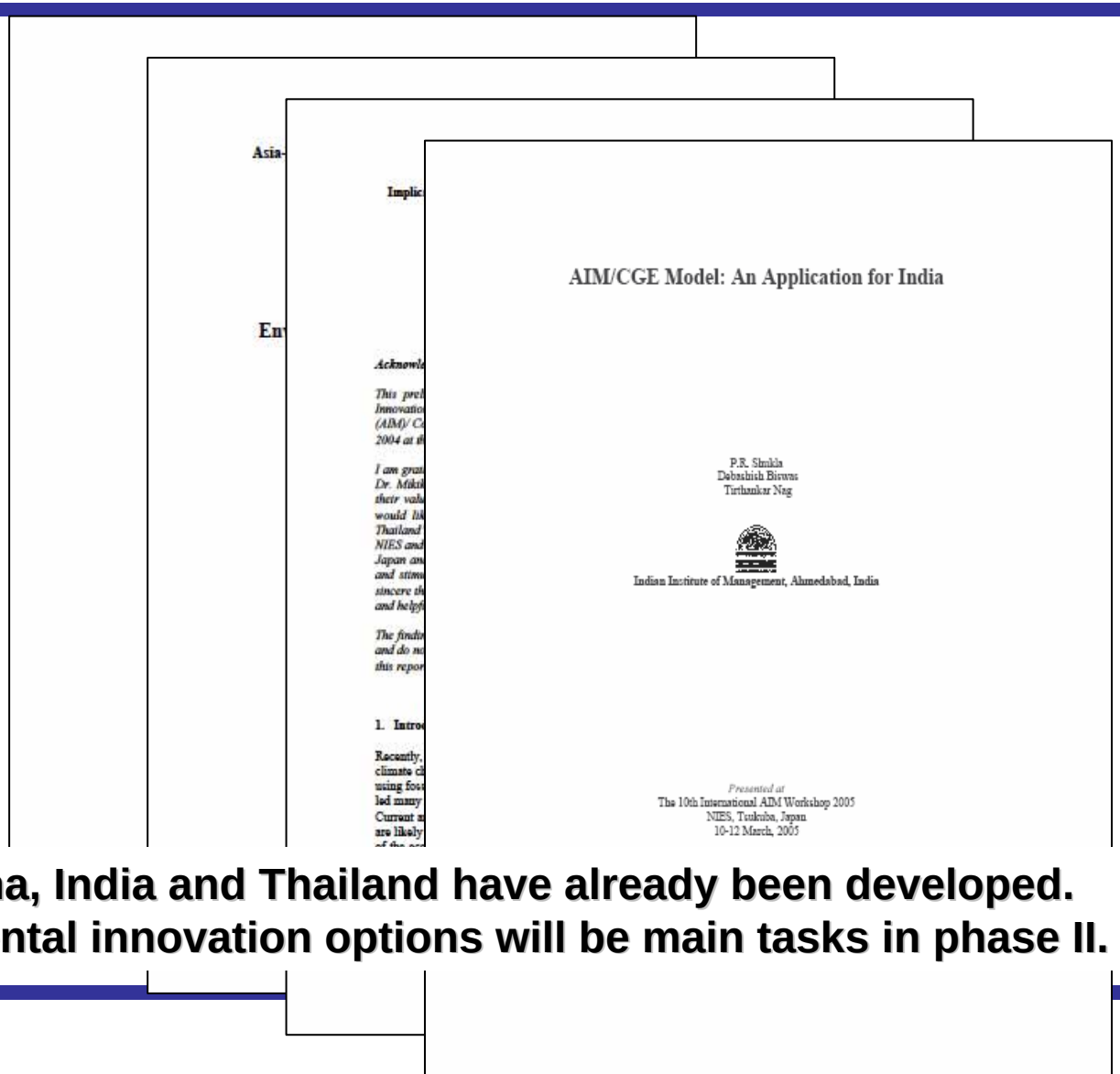
- NIES (Japan)
- Kyoto University (Japan)
- Energy Research Institute, State Development Planning Commission (China)
- Institute of Geographical Sciences and Natural Resources Research, CAS (China)
- Indian Institute of Management, Ahmedabad (India)
- Asian Institute of Technology (Thailand)
- Korea Environment Institute (Korea)
- Seoul National University (Korea)

Members of AIM team

Phase II in APEIS IEA

- Assessment of environmental innovation options by using country-scale CGE model for China, India, Korea and Thailand
  - Effectiveness of environmental protection
  - Impact on economic activities
- Integration of country models
  - Japan and Korea

Capacity building for partners



AIM/CGE Model: An Application for India

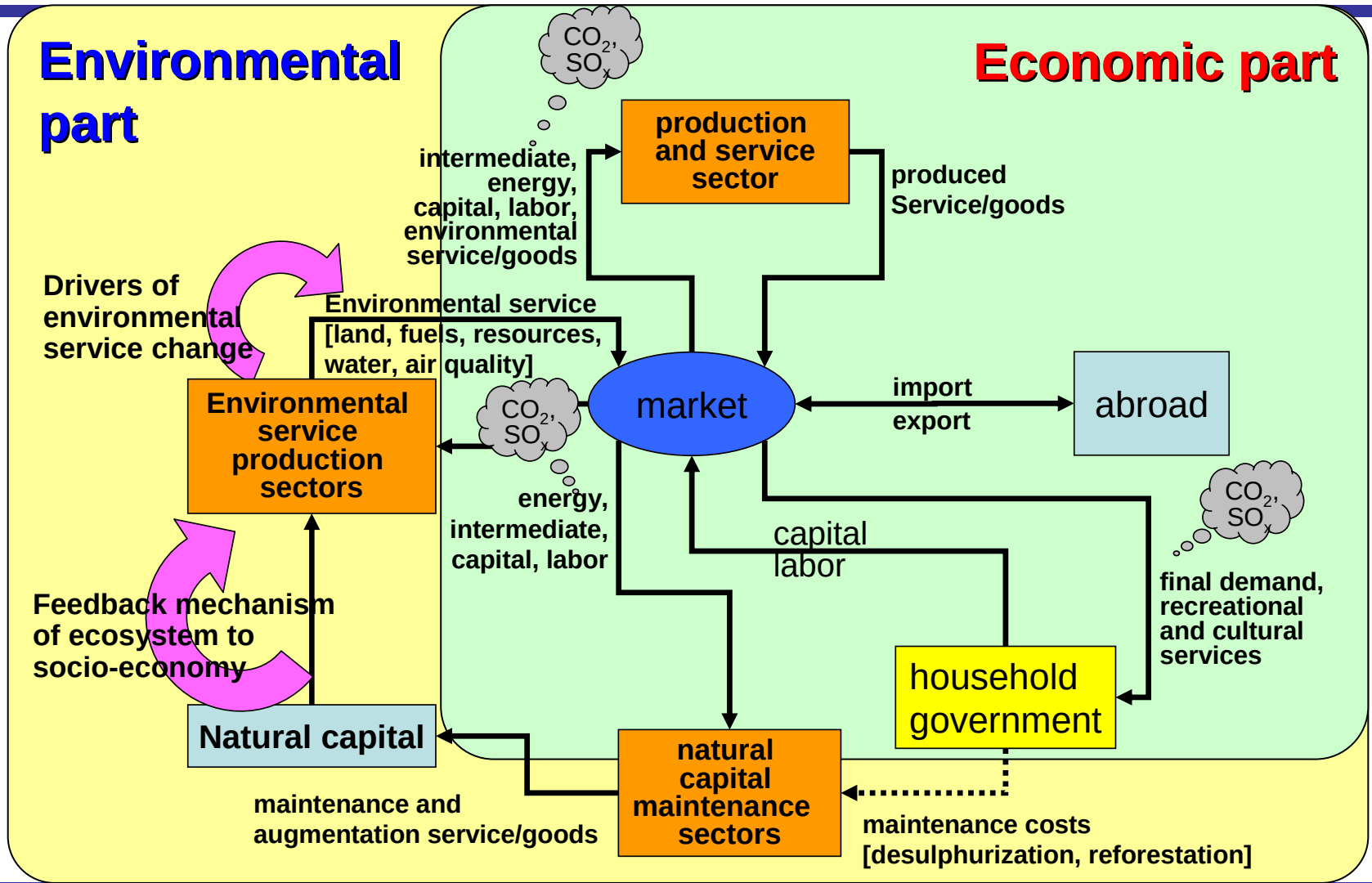
P.R. Shukla
Debashish Biswas
Tirthankar Nag

Indian Institute of Management, Ahmedabad, India

Presented at
The 10th International AIM Workshop 2005
NIES, Tsukuba, Japan
10-12 March, 2005

Prototype models for China, India and Thailand have already been developed. Assessment of environmental innovation options will be main tasks in phase II.

Features of CGE model



Examples of Innovation options (1)

Collection of qualitative information on innovative environmental options

26

Renewable Energy Promotion

Solar PV (water pumping, SHS),
Solar Water Heater and Dryer,
Biomass (thermal & electricity),
Biogas (thermal & electricity),
Capacity buildings, etc.

12

Residential Sector

Thin tube project,
Brown Rice Label 5 Project,
Hi-eff Air condition & refrigeration,
Energy efficient house,
Human awareness, etc.

21

Transport Sector

Biodiesel and Gasohol,
Electricity vehicles, NGV,
Walking Street,
Fixed route Van bus,
Vehicle Emission Clinic, etc.

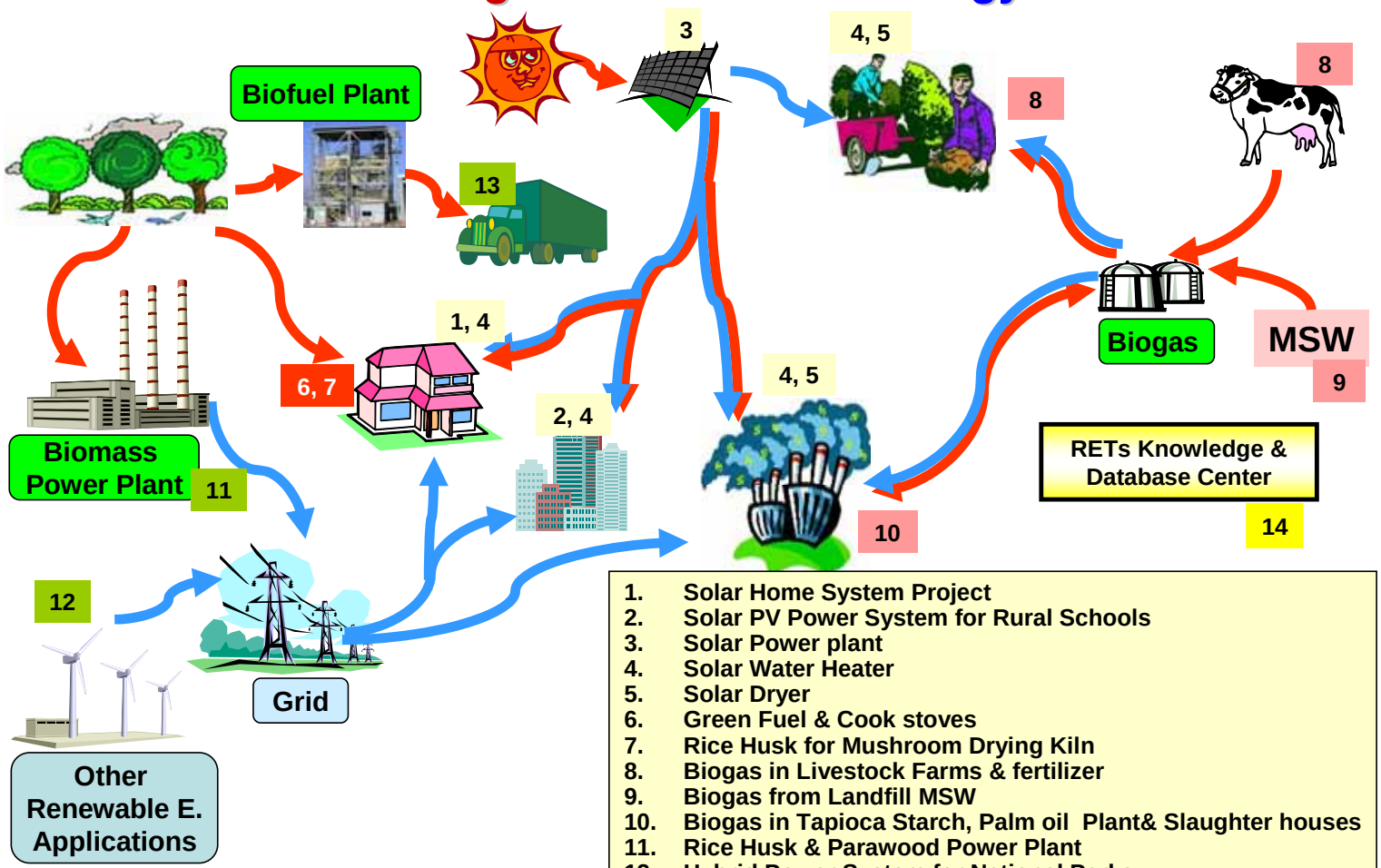
11

Solid Waste Management

Hi-eff. waste incinerator,
Fly ash application in concrete works,
Recycled PET bottle to be carpet,
Aluminum Recycling for Prosthesis,
Waste Bank in school, etc.

Examples of Innovation options (2)

Illustrations of Strategies: Renewable Energy Promotion

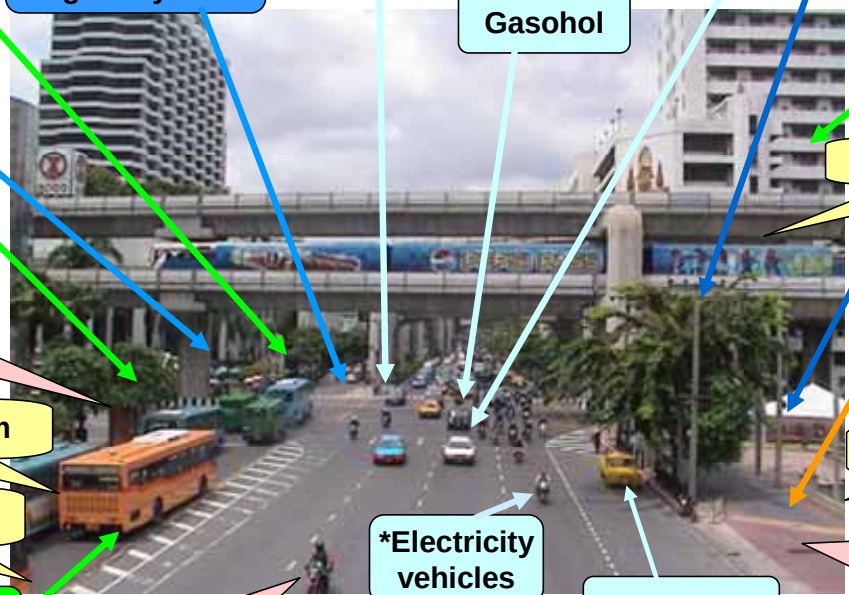


1. Solar Home System Project
2. Solar PV Power System for Rural Schools
3. Solar Power plant
4. Solar Water Heater
5. Solar Dryer
6. Green Fuel & Cook stoves
7. Rice Husk for Mushroom Drying Kiln
8. Biogas in Livestock Farms & fertilizer
9. Biogas from Landfill MSW
10. Biogas in Tapioca Starch, Palm oil Plant& Slaughter houses
11. Rice Husk & Parawood Power Plant
12. Hybrid Power System for National Parks
13. Biodiesel and Gasohol Program
14. Renewable Map, Database and Museum & TEENET

SDB flow sketch for Thailand by AIT

Examples of Innovation options (3)

Illustrations of Strategies: Transport Sector (Urban)



Eco-Mass Transit Program

Eco-Education Program

Alternative Fuel Program

Used Lubricating Oil System

*Smart Traffic Signal System

*Hybrid & H2

NGV

*Smart Street Lighting system

Gasohol

Workplaces near Residences Program

*Car Navigation System

Sky Train (*Extended)

Combat Illegal Oil

*Smart Parking system

*Econo-driving license

Bike Lane

*Rapid Bus System

Metro (*Extended)

Van Bus System

*Electricity vehicles

Speed limit & Vehicle Maintenance awareness

Tire Recycling program

Econo power contest

Biodiesel

Walking Street

Car Free Day

Emission Std.

* = Future scenario

Efficient technology Program

Eco-friendly Transport Program

Eco-management Program

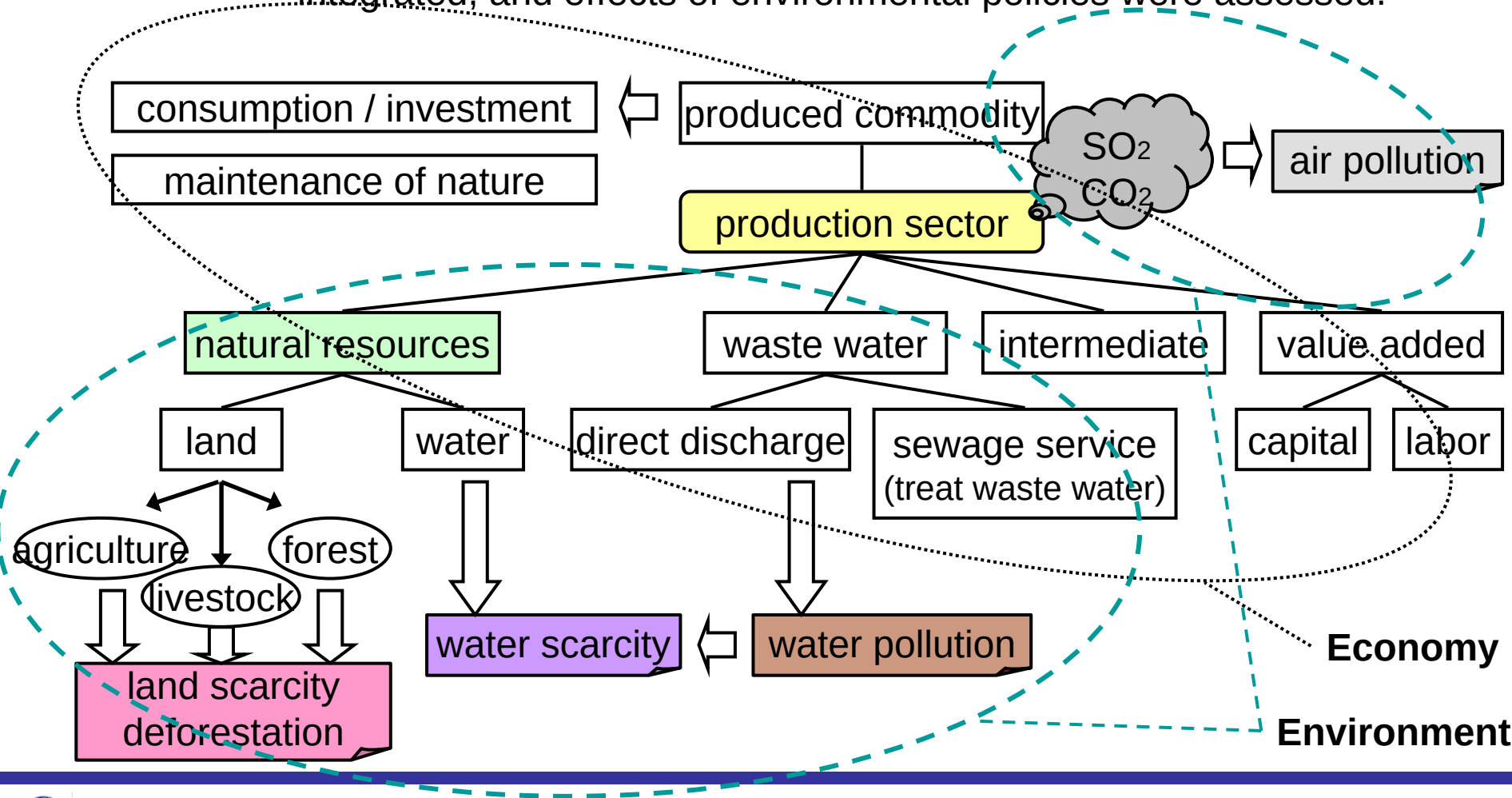
Image of results

- Preliminary analyses have already been done during phase I.
  - India: Water, air and land use
  - China: Air pollution and health impact

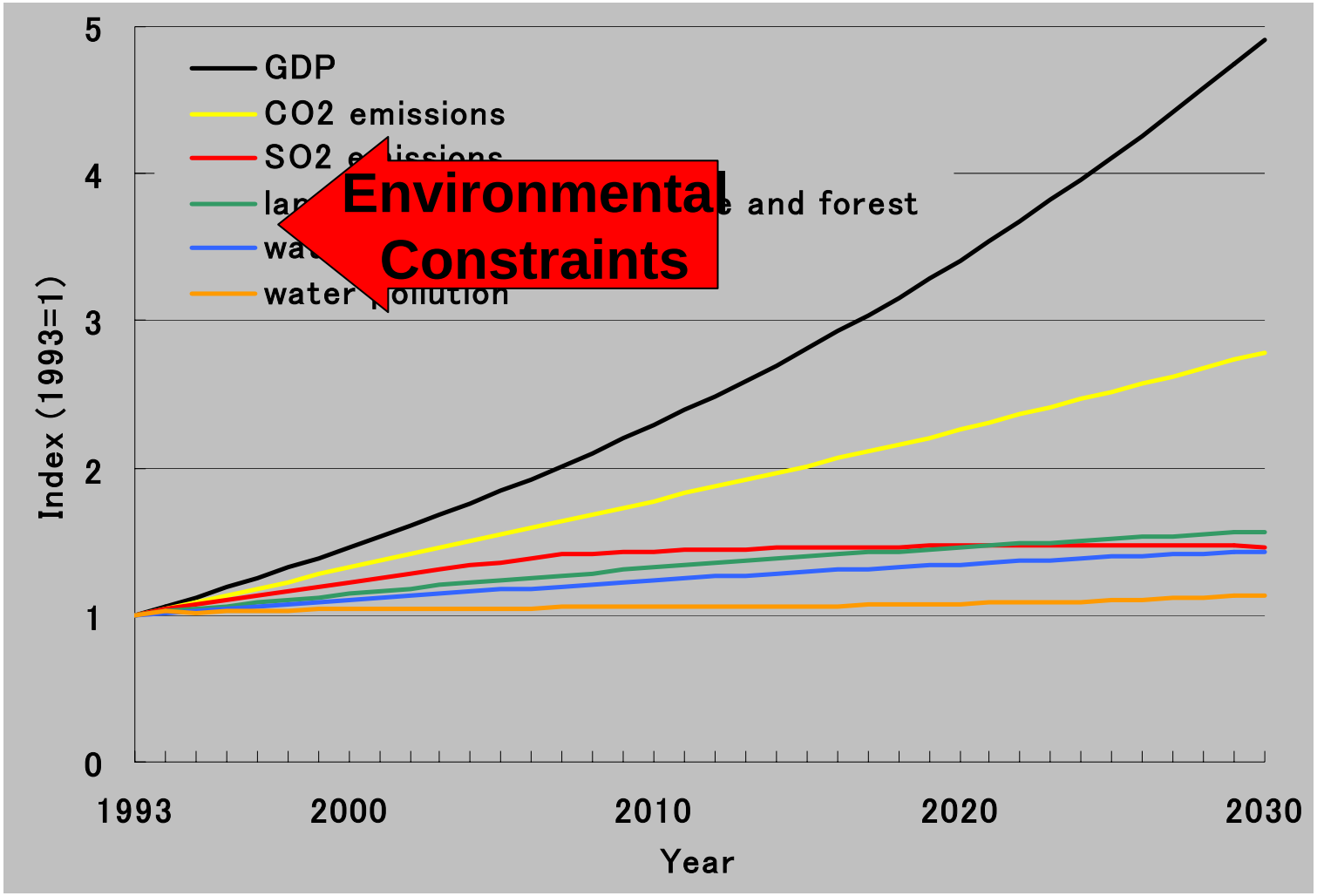
- During phase II, integration between country-scale models and strategic options will be implemented.
  - Water, air, solid waste, ...
  - Assessment of environmental protection and economic activity

Image of results: India

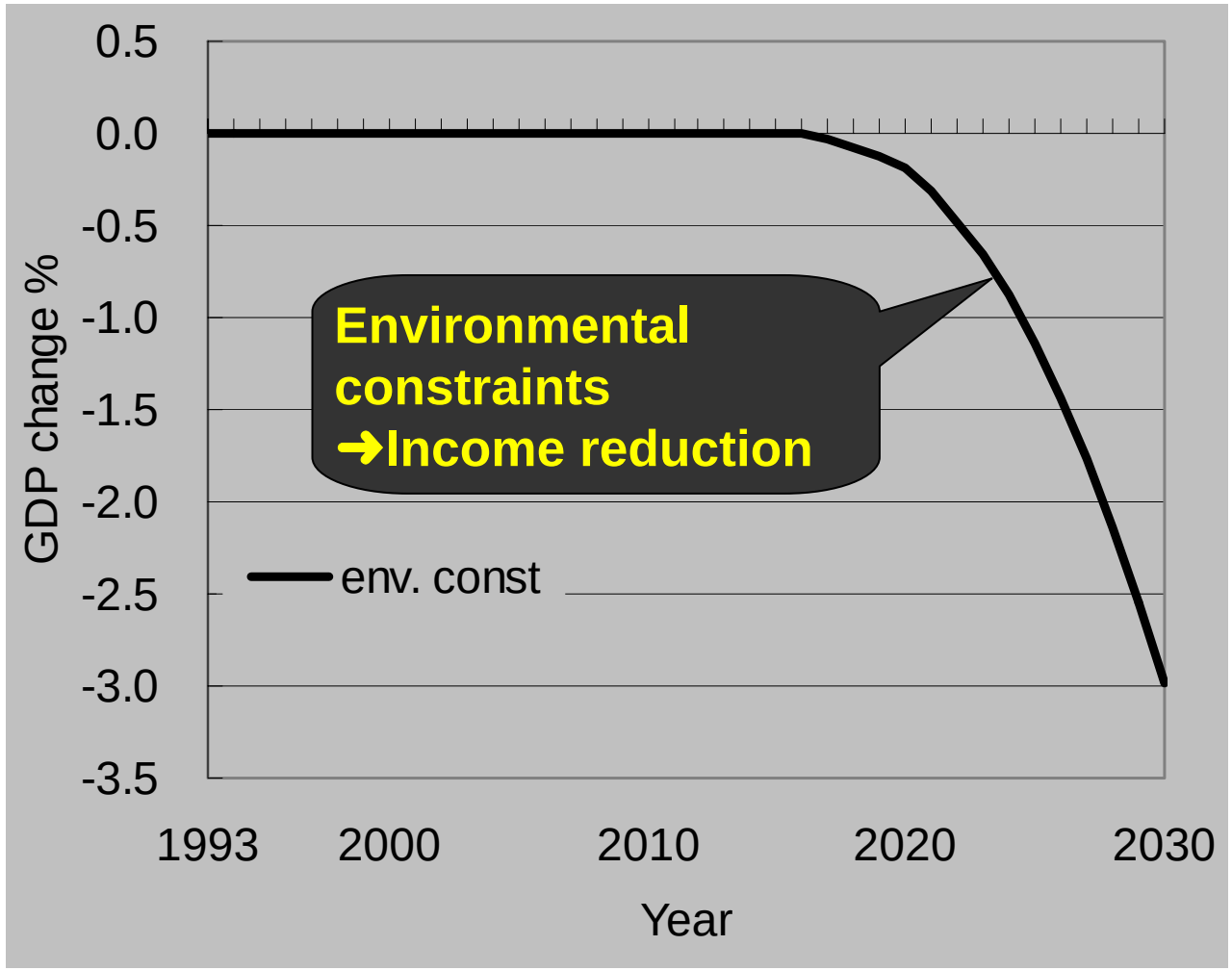
Economic activity and related impacts on water, air and land were integrated, and effects of environmental policies were assessed.



Reference case results



Economic Impact from Environmental Constraints



Effects of Environmental Investments

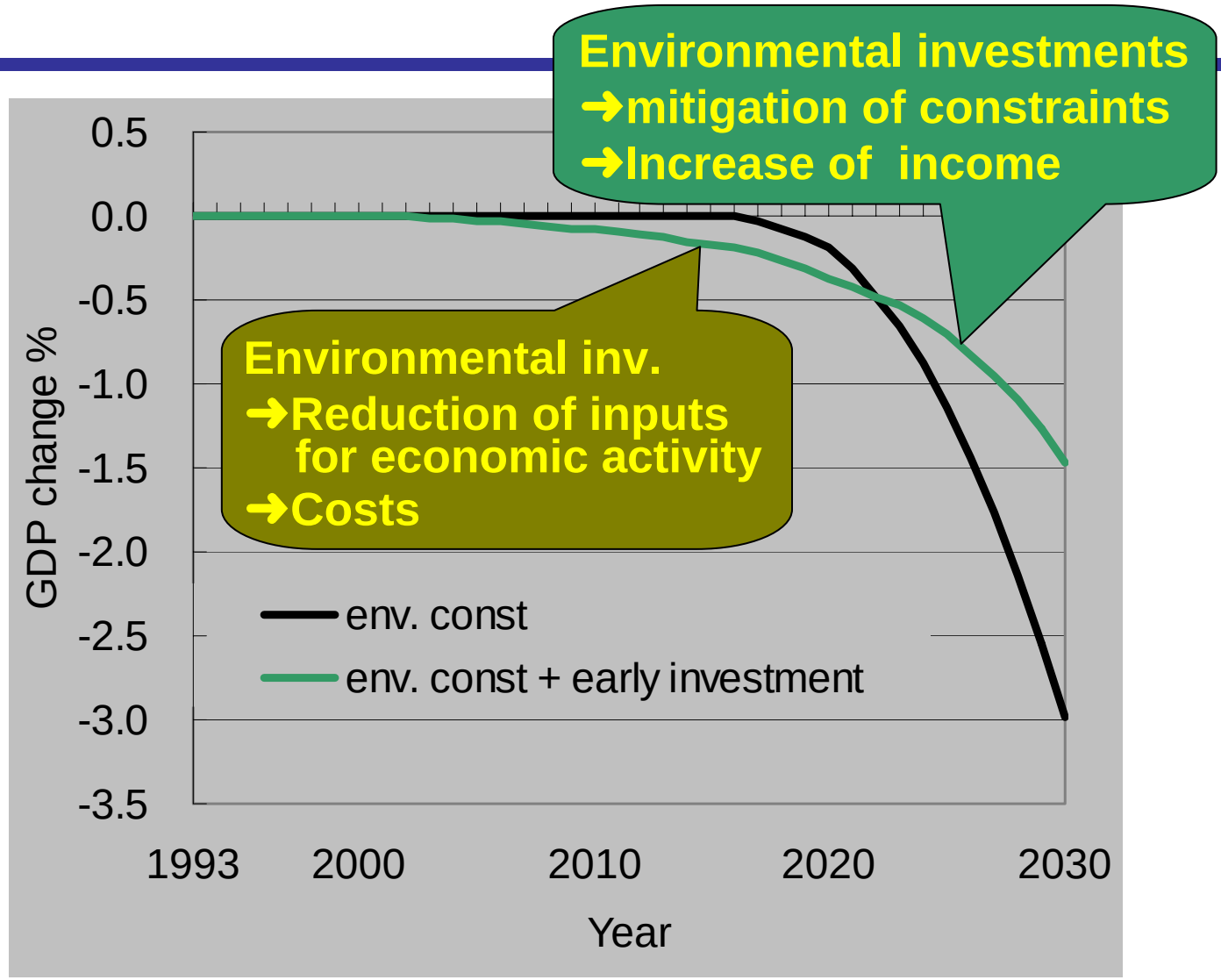
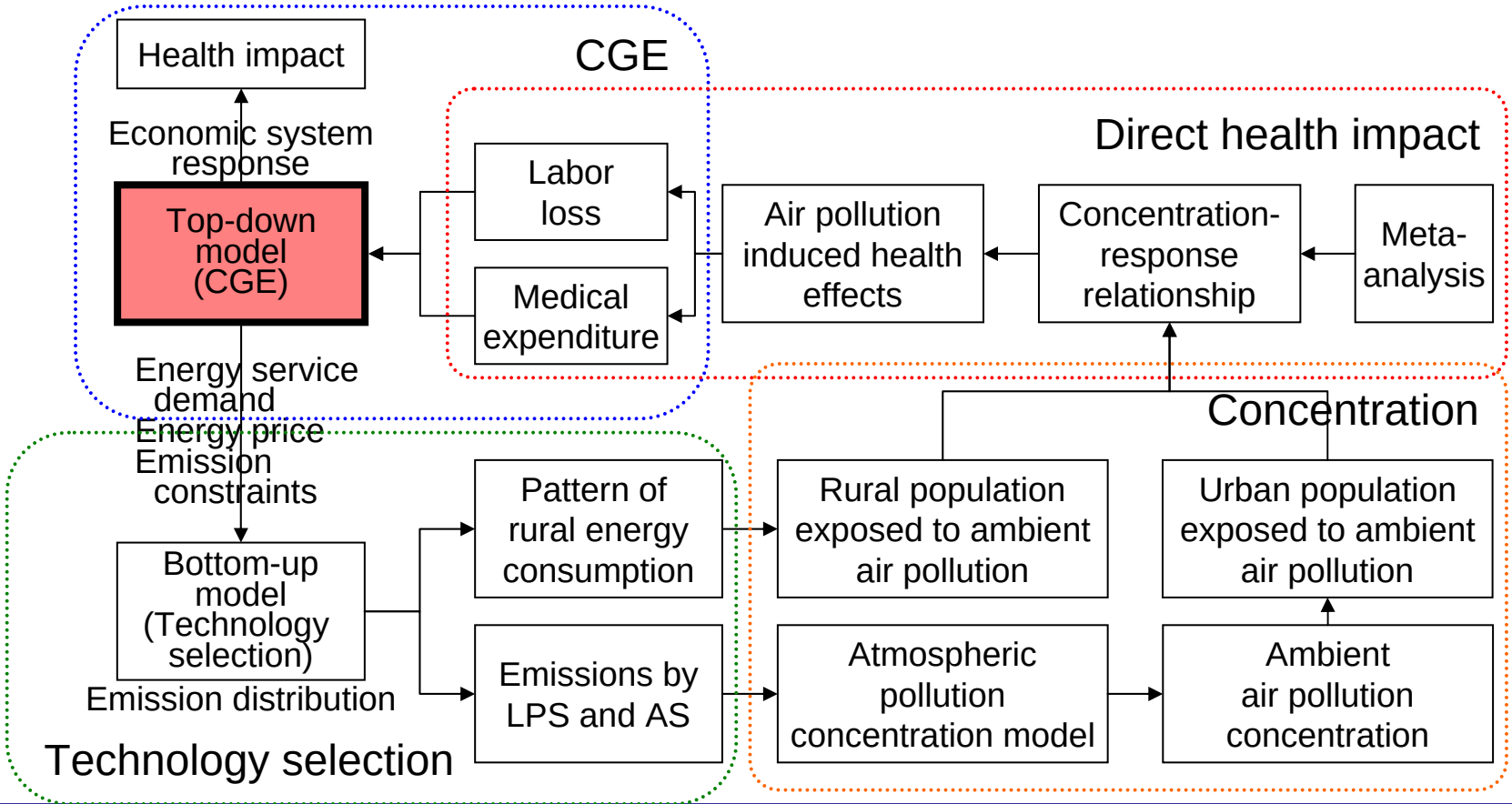
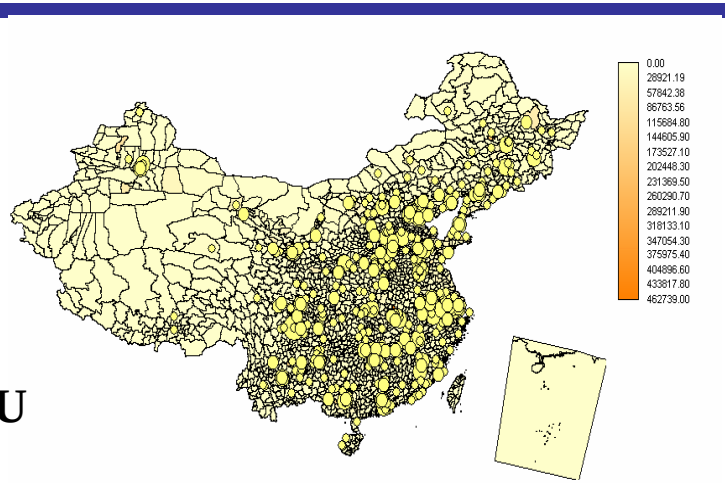


Image of results: China

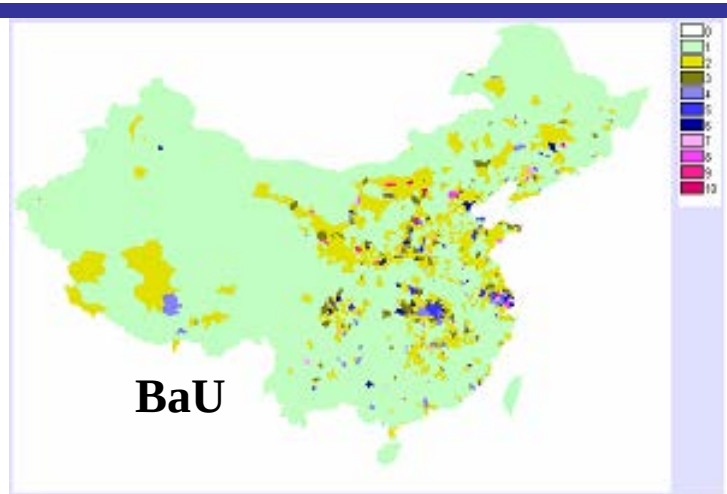
CGE and other models (Technology selection model, simple concentration model and health impact model) applying China are integrated for assessing direct and indirect air pollution impact.



PM10 emissions and concentration in BaU and policy case

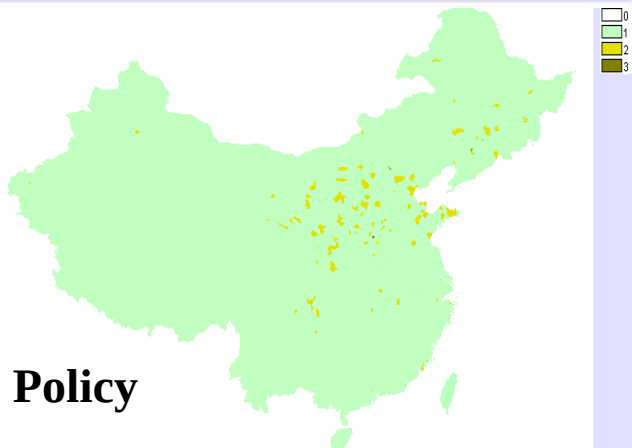


BaU



BaU

Policy

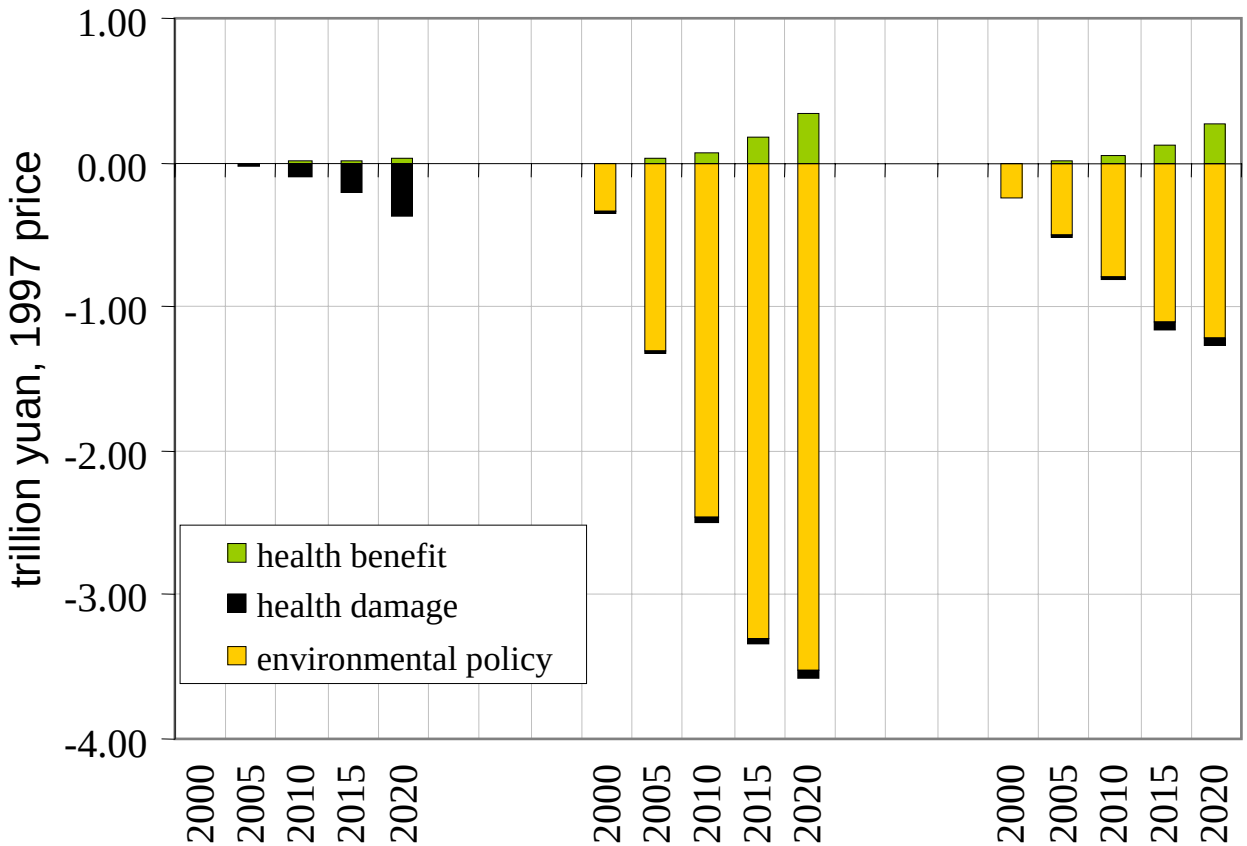


Policy

Geographical distribution of PM_{10} emissions across China in 2020 (unit: ton)

Ambient concentration of PM_{10} in urban areas of China in 2020

Economic impact of air pollution management and recovery from countermeasure



Although only introduction of environmental constraint will bring economic damage, appropriate countermeasures will be able to mitigate the economic damage.

Activities in APEIS Phase II

Scenario Analysis for Promotion of Sustainable Development in the context of Regional Economic and Environmental Integration

- Through AIM model application liked with Strategic Database (SDB)
- Environmental policy linkage related to Millennium Development Goals (MDGs)

- Support of Model Building in Asian countries
  - Focus on environmental problems in each country such as solid waste management, energy system and environmental investment/industry

- Promote international collaboration through international projects such as 'National Performance Assessment and Strategic Environment Framework Phase II, Great Mekong (SEFII', Network of Institute for Sustainable Development (UNEP-NIED), and UNEP-GEO4

Millennium development goals, Indian targets and Climate Change

Millennium development goals and global targets	India's 10th plan (2002-2007) and beyond targets	How these address climate change concerns?
Goal 1: *Eradicate extreme poverty and hunger*	Double the per capita income by 2012	Income effect would enhance choices for cleaner fuels
Target 1: Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day	Reduction of poverty ratio by 5 percentage points by 2007 and by 15 percentage points by 2012	Reduce GHG Emissions due to lower population
Target 2: Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Reduce decadal population growth rate to 16.2% between 2001-2011 (from 21.3% during 1991-2001)	Enhanced adaptation capacity due to improved food & health security; resilience to cope with risks from extreme events
Goal 2: *Achieve universal primary education*	All children in school by 2003; all children to complete 5 years of schooling by 2007	Enhanced adaptation capacity due to improved skills, flexibility to shift vocations/locations
Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Increase in literacy rates to 75% by 2007 (from 65% in 2001)	

Millennium development goals, Indian targets and Climate Change

Millennium development goals and global targets	India's 10th plan (2002-2007) and beyond targets	How these address climate change concerns?
Goal 3: *Promote gender equality and empower women* **Target 4:** Eliminate gender disparity in primary and secondary education, preferably by 2005 and in all levels of education no later than 2015	At least halve, between 2002 and 2007, gender gaps in literacy and wage rates	Enhanced capacity of women to deal with added social risks from climate change Fuel substitution away from unsustainable traditional biomass
Goal 4: *Reduce child mortality* **Target 5:** Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate	Reduction of Infant Mortality Rate (IMR) to 45 per 1000 live births by 2007 and to 28 by 2012 (115 in 1980, 70 in 2000)	Enhanced resilience of children to health effects of climate change due to improved access to health services
Goal 5: *Improve maternal health* **Target 6:** Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio (MMR)	Reduction of MMR to 2 per 1000 live births by 2007 and to 1 by 2012 (from 3 in 2001)	Enhanced resilience of women to health effects of climate change due to improved access to health services

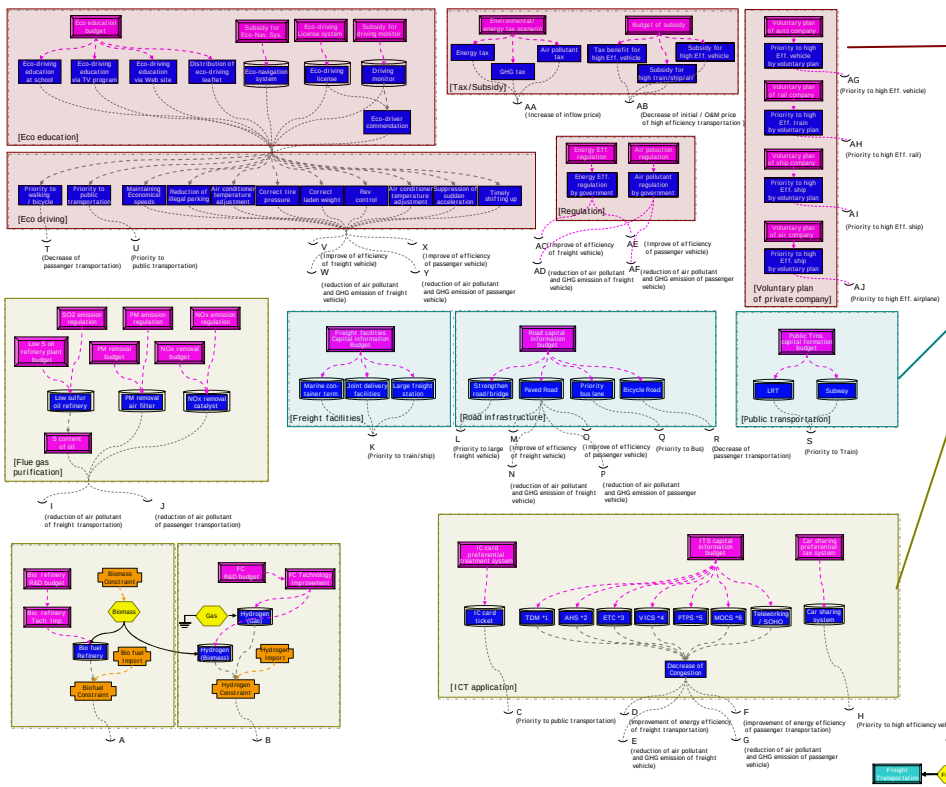
Millennium development goals, Indian targets and Climate Change

Millennium development goals and global targets	India's 10th plan (2002-2007) and beyond targets	How these address climate change concerns?
Goal 6: *Combat HIV/AIDS, malaria and other diseases* **Target 7:** Halted by 2015 and begin to reverse the spread of HIV/AIDS **Target 8:** Have halted by 2015 and begin to reverse the incidence of malaria and other major diseases	Have halted by 2007; 80 to 90% coverage of high risk groups, schools, colleges and rural areas for awareness generation by 2007 25% reduction in morbidity and mortality due to malaria by 2007 and 50% by 2010	Higher resilience of the population due to enhanced capacity to deal with epidemics Enhanced resilience to added risk of Malaria and other vector borne diseases
Goal 7: *Ensure environmental sustainability* **Target 9:** Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources **Target 10:** Halve by 2015 the proportion of people without sustainable access to safe drinking water **Target 11:** Have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers	Increase in forest cover to 25% by 2007 and 33% by 2012 (from 23% in 2001) Sustained access to potable drinking water to all villages by 2007 Commission 14.4 GW hydro and 3 GW by other renewables between 2002-2007 Electrify 62,000 villages by 2007 through conventional grid expansion, remaining 18,000 by 2012 via decentralized sources like solar, wind, small hydro and biomass. Cleaning of all major polluted rivers by 2007 and other notified stretches by 2012	Lower GHG and local emissions; lower fossil imports; reduced pressure on land, resources and ecosystems Higher adaptive capacity to climate variability due to enhanced water supply Higher adaptive capacity due to enhanced reach of health/ education facilities in rural areas

Millennium development goals, Indian targets and Climate Change

Millennium development goals and global targets	India's 10th plan (2002-2007) and beyond targets	How these address climate change concerns?
Goal 8: *Develop a global partnership for development* **Target 12:** Develop further an open, rule-based, predictable, non-discriminatory trading and financial system (includes a commitment to good governance, development, and poverty reduction - both nationally and internationally) **Target 16:** In cooperation with developing countries, develop and implement strategies for decent and productive work for youth **Target 17:** In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries **Target 18:** In cooperation with the private sector, make available the benefits of new technologies, especially information and communications technologies	Expeditious reformulation of the fiscal management system to make it more appropriate for the changed context Tenth plan includes state-wise break up of the broad developmental targets. Higher integration with the global economy Create 50 million employment opportunities by 2007 and 100 million by 2012 (current back-log of unemployment is around 9%, equivalent to 35 million persons)	Higher mitigative and adaptive capacity from access to global resources and technologies Enhanced flexibility of jobs and migration Improved capacity to deal with health risks due to access to advanced medicine and health services Enhanced adaptive capacity to deal with extreme events from access to advanced information and communication systems

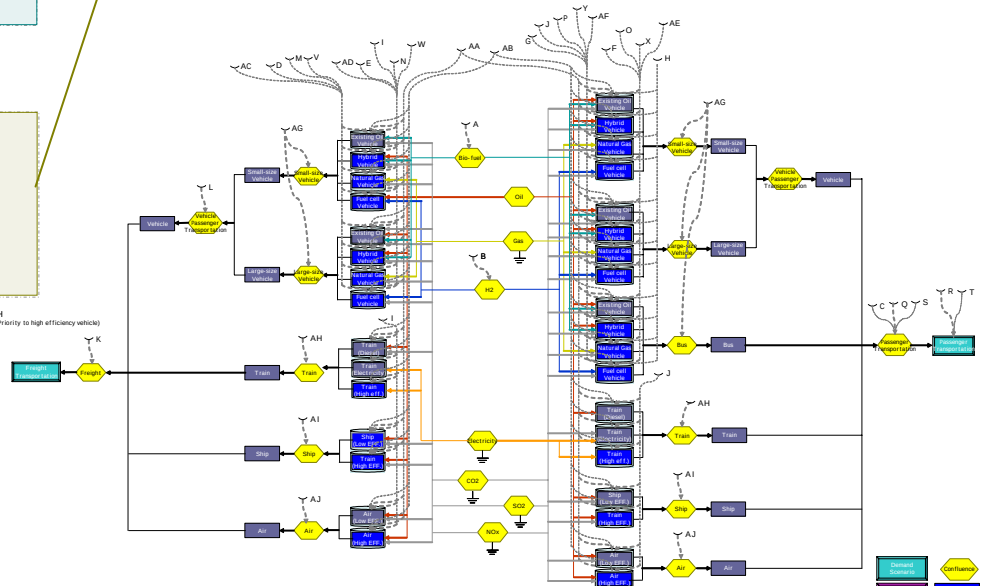
Design SDB flow diagram: Transportation sector



A: Activation of New Environmental Markets

B: Research and Development of New Environmental Technologies

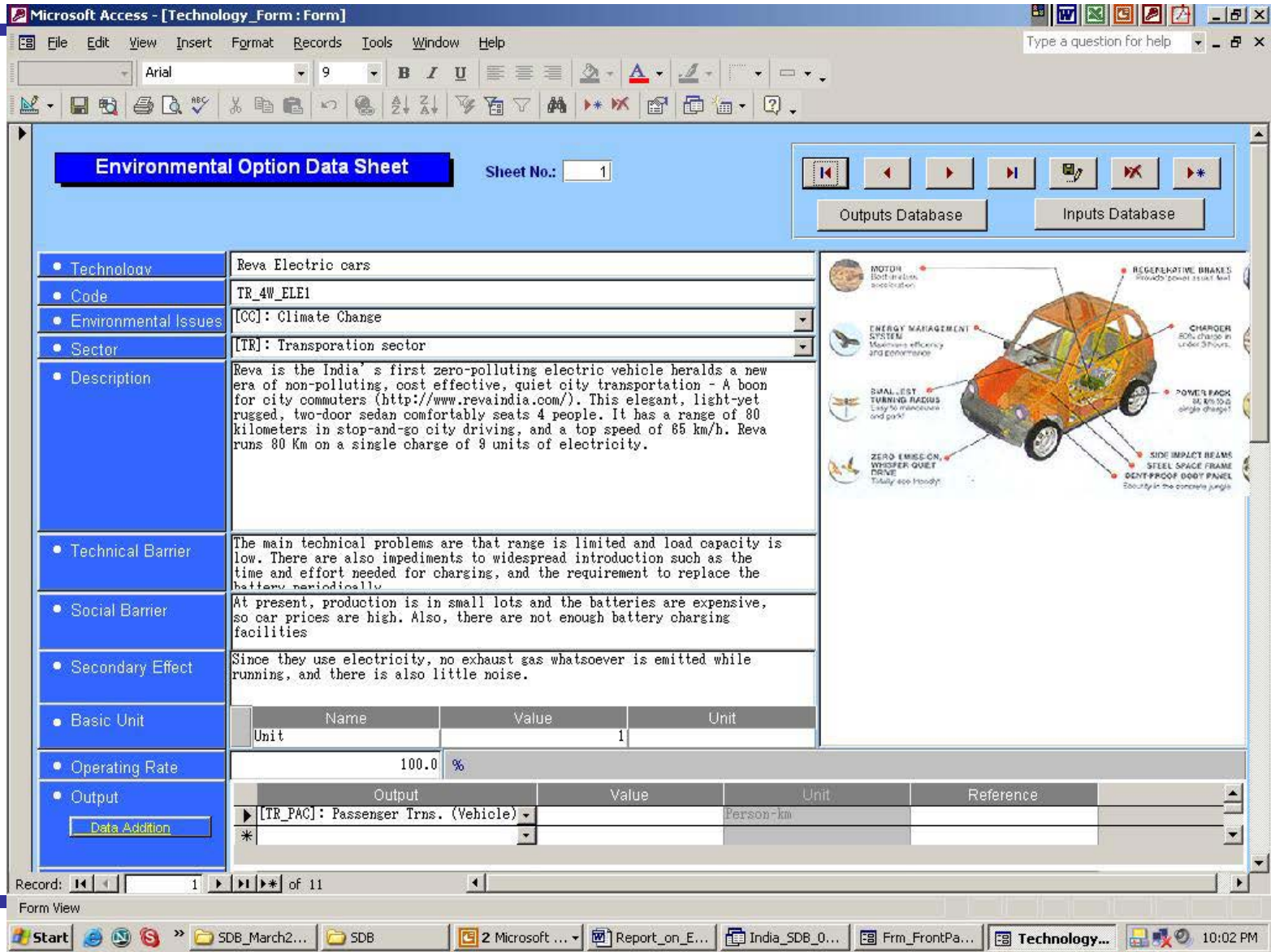
D: Development of New Environmental Infrastructures



Over 70 innovation options are combined in systematic manner

*1 TDM: Traffic Demand Management
*2 AHS: Advanced Cruise-Assist Highway System
*3 ETC: Electronic Toll Collection
*4 VICS: Vehicle Information and Communication System
*5 FTPS: Public Transportation Priority Systems
*6 MOCS: Mobile Operation Control Systems

Quantitative SDB Card



Production of environmental service (regulating)

Service		Service production sectors	Related Natural Service	Human and Natural capital	Human and Natural augmentation of capital
Regulating : Benefits obtained from regulation of processes					
Climate control	CO2 absorption	CO2 sequestation industry	terestrial absorbtion ocean sink	Forest area	Construction, Maintenance
	CO2 emission reduction	Energy saving Energy mix change		Energy device Power facility	
	Urban climate stabilization	Air conditioning facilities		Forest area	Construction, Maintenance
Air quality control		Emission reduction service Energy mix change Energy saving	natural absorbtion oxidation decompsition	Emission reduction devices, Energy plants	Construction, Maintenance
Flood control	Mitigation factor	disaster prevention industry	water retention Impoundment	Green area, Impoundment Forest area, Crop area, Impoundment	Construction, Maintenance Construction, Maintenance
Water purification	Load reduction	public water supply wastewater industry	self-purifiction	Forest area, Crop area Water works, Well Natural and man-made impoundment	Construction, Maintenance Maintenance

Production of environmental service (provisioning)

Service	Environmental service	Environmental service production sectors	Related Natural Service	Natural and Human capital	Human and Natural augmentation of capital
Provisioning : Goods produced or provided by ecosystems					
Water supply	Irrigation, Domestic and Industrial water supply	Water industry, Irrigation service sectors	Water hervesting, Surface runoff, Evapotransipiration control Ground water harvesting	Natural base discharge Primary water resource Ground water resource	Forest maintenance, Crop area increase Natural and man-made impoundment
Food supply	Food production	Agriculture (Paddy rice, Wheat, Cereal grains, Vegetables, Fruit, Nuts, Oil seeds, Sugar cane, Fibers)	Soil formation, Green water, Nutrient cycling	Potential crop production	Climate mitigation, Soil adjustment, Fertilizer, Irrigation, Water harvest
Animal product	Livestock	Bovine cattle, Sheep and goats, hourses, Animal products, Milk, Wool, Silk-worm	Soil formation, Green water, Nutrient cycling	Livestock feeding capacity	Climate mitigation, Soil adjustment
Fuelwood supply	Fuel wood production	Fuel wood industry	Forest primary production	Forest primary production (vegetation area)	Forest maintenance, Climate mitigation, Maintenance labor