Asia-Pacific
Environmental Innovation Strategy Project

Overview of APEIS-IEA

FY2003 Research Progress and FY2004 Implementation Plan

9th AIM International Workshop

12-14 March 2004

NIES, Tsukuba

Integrated Environmental Assessments (IEA)

A set of integrated assessment models as major tools of APEIS, 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 use

Systematic projections of environmental trends as well as assessments of innovation needs and innovation options based on the above models and database

FY2003 Progress of APEIS-IEA

(i) Provision of a set of integrated assessment models (second version) :

- Extended version of AIM/Trend for the World
- Advanced version of AIM/CGE
- Advanced version of AIM/Material
- Advanced version of AIM/Energy for extended countries
- Preliminary version of integrated AIM/Ecosystem
- Advanced version of AIM/Water

(ii) Provision of advanced version of strategic database with indicators focusing on Environmental Efficiency

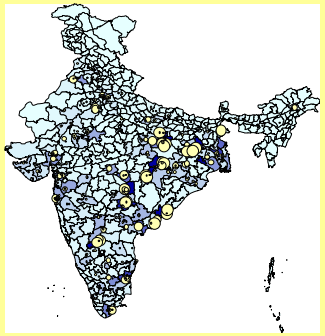
(iii) Provision of projections of environmental trends as well as assessments of innovative options focusing on selected countries

(iv) Holding Training Workshop at AIT, Thailand

Asia-Pacific Integrated Model (AIM) for APEIS

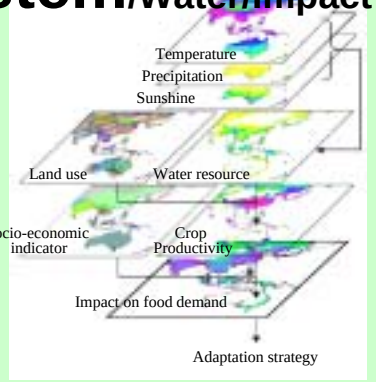
AIM/Energy/Technology/Country

A bottom-up technology selection model of energy use and emissions at country and local level



AIM/Ecosystem/Water/Impact

A set of ecosystem models, including a vegetation dynamics model, a water resource model, an agricultural productivity model and a health impact model



AIM/Bottom-up

A bottom-up technology & land use model for Asia-Pacific region

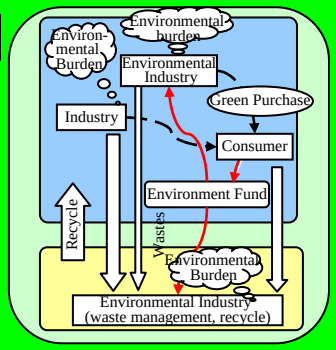
AIM Family

AIM/Top-down

A general-equilibrium-type world economic model

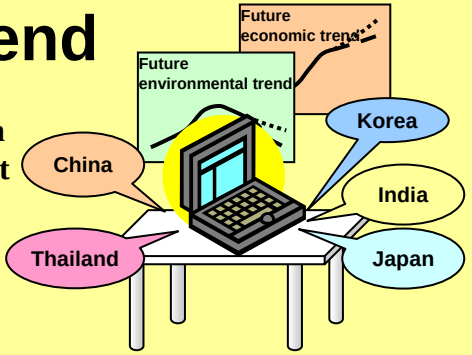
AIM/Material

A environment-economy integrated model with material balance and recycling process modules



AIM/Trend

A reduced-form model to project future socio-economic trends and environmental change for all 42 countries

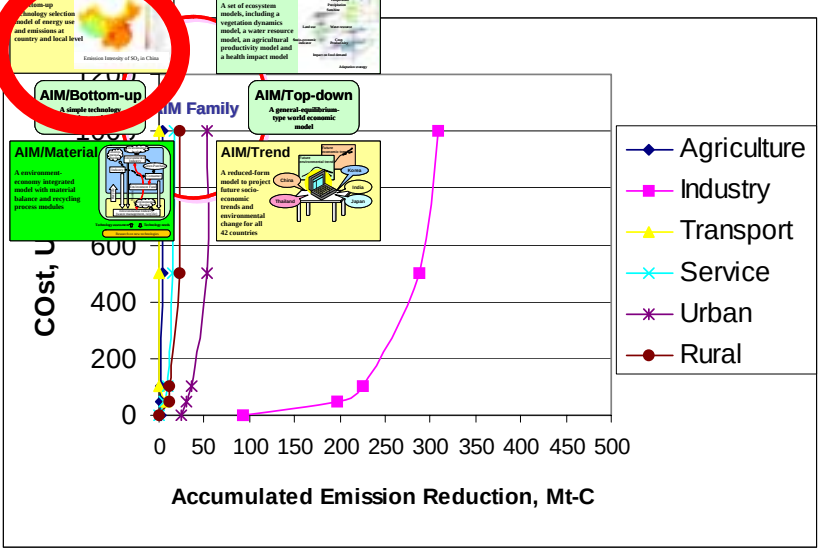


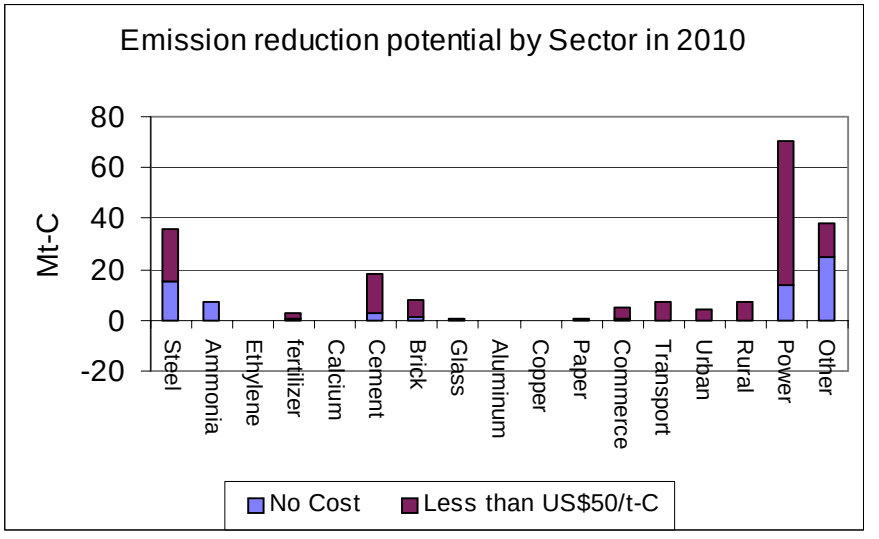
Integrated Environmental Assessment

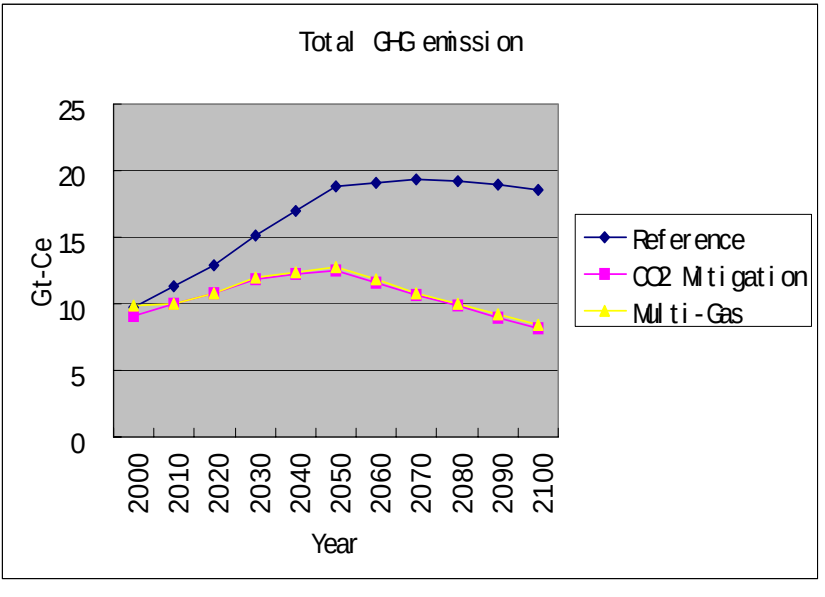
Model	Application	Policy Needs
AIM/Energy +Air +CGE	Assessment of Air Pollution Reduction Policies (Emission Projection, Diffusion Health Impacts)	Clean Air for Major Cities in Asia-Pacific (Beijing Clean Air Project)
+Top-down	Assessment of Technology Options for Climate Change Long-term Emission Scenarios CDM assessment for China	Mitigation/Adaptation Strategy of Climate Change
AIM/Material	Assessment of Effects of Environmental Constraints and Investments Trade-off between air pollution and health impacts	Strategy of Environmental Industry, Waste Treatment, Water Pollution, Climate Change, Health Policy, etc.

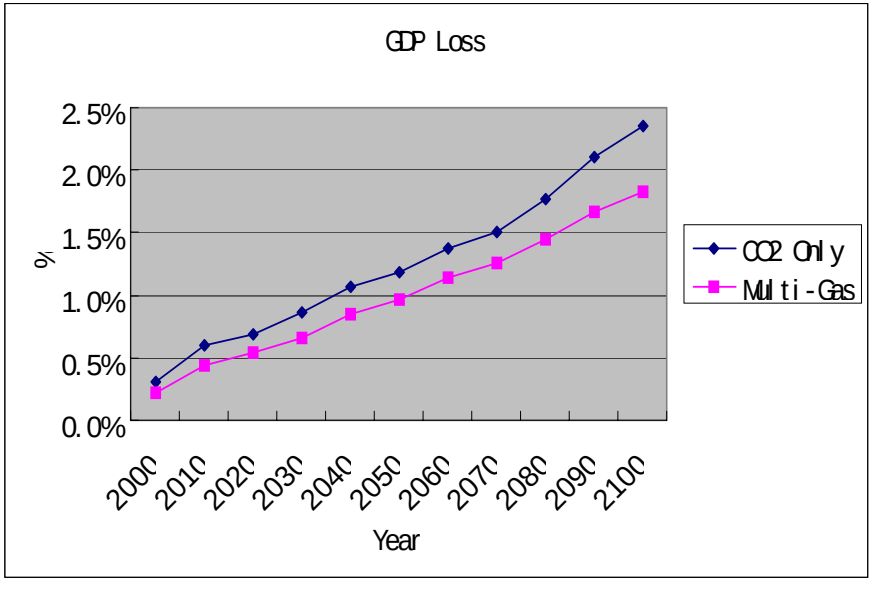
Integrated Environmental Assessment

Model	Application	Policy Needs
AIM/Ecosystem	Assessment of Natural Capital, Landuse Change, Water Stress, Energy Supply etc.	Strategy for Ecosystem Conservation
AIM/Trend	Projection of Greenhouse Gas Emission (GHG), Water Supply and Demand, Wastes, etc.	Communication Tool for Policy makers
AIM/CGE	Assessment of Free Trade Agreement GHG Stabilization Scenarios	Strategy for Environmental Policy through Trade Mitigation Strategy of Climate Change
Strategic Database	Assessment of innovation technologies under different socio-economic scenarios	Strategy of Environmental Industry, Waste Treatment, Water Pollution, Climate Change, etc.

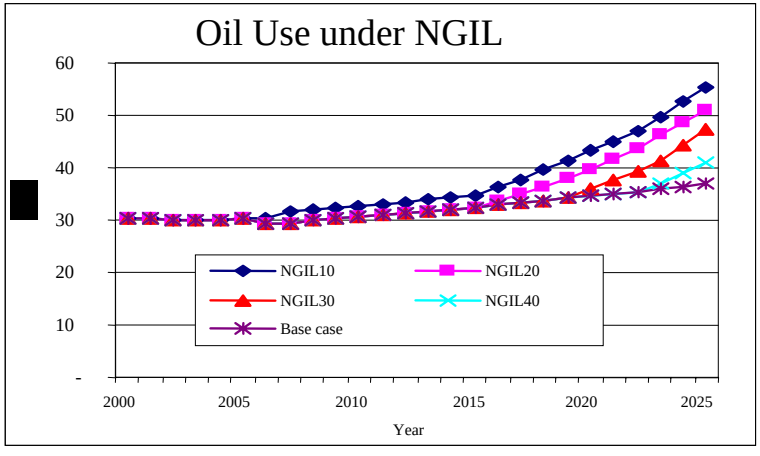

AIM/Bottom-up
AIM Family
AIM/Top-down
A general-equilibrium-type world economic model
AIM/Material
AIM/Trend
A reduced-form model to project future socio-economic trends and environmental change for all 42 countries
COst, U
0
200
400
600
0 50 100 150 200 250 300 350 400 450 500
Accumulated Emission Reduction, Mt-C
Agriculture
Industry
Transport
Service
Urban
Rural

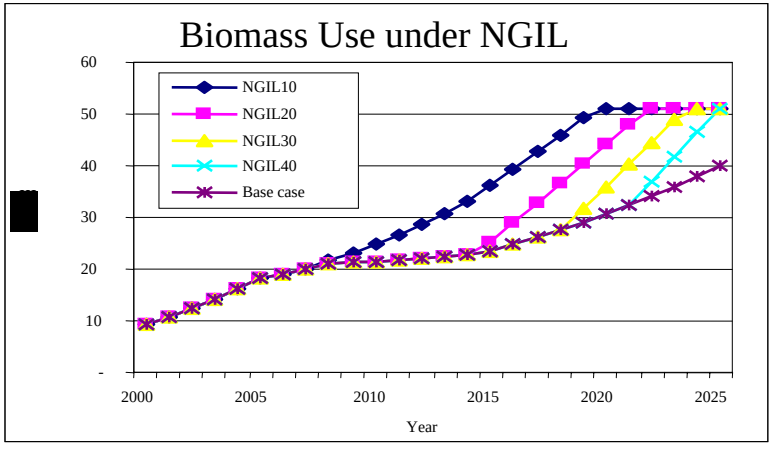

Emission reduction potential by Sector in 2010
Mt-C
80
60
40
20
0
-20
Steel
Ammonia
Ethylene
fertilizer
Calcium
Cement
Brick
Glass
Aluminum
Copper
Paper
Commerce
Transport
Urban
Rural
Power
Other
No Cost
Less than US$50/t-C

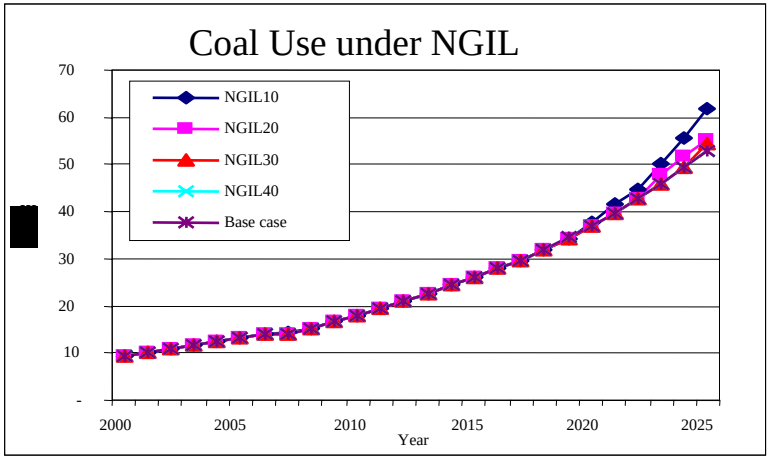

Total GHG emission
Gt-Ce
25
20
15
10
5
0
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Year
Reference
CO2 Mitigation
Multi-Gas


GDP Loss
%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
2000
2010
2020
2030
2040
2050
2060
2070
2080
2090
2100
Year
CO2 Only
Multi-Gas

Implications of Natural Gas Import Limitations (NGIL) in Thailand

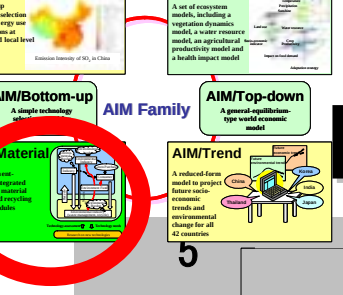




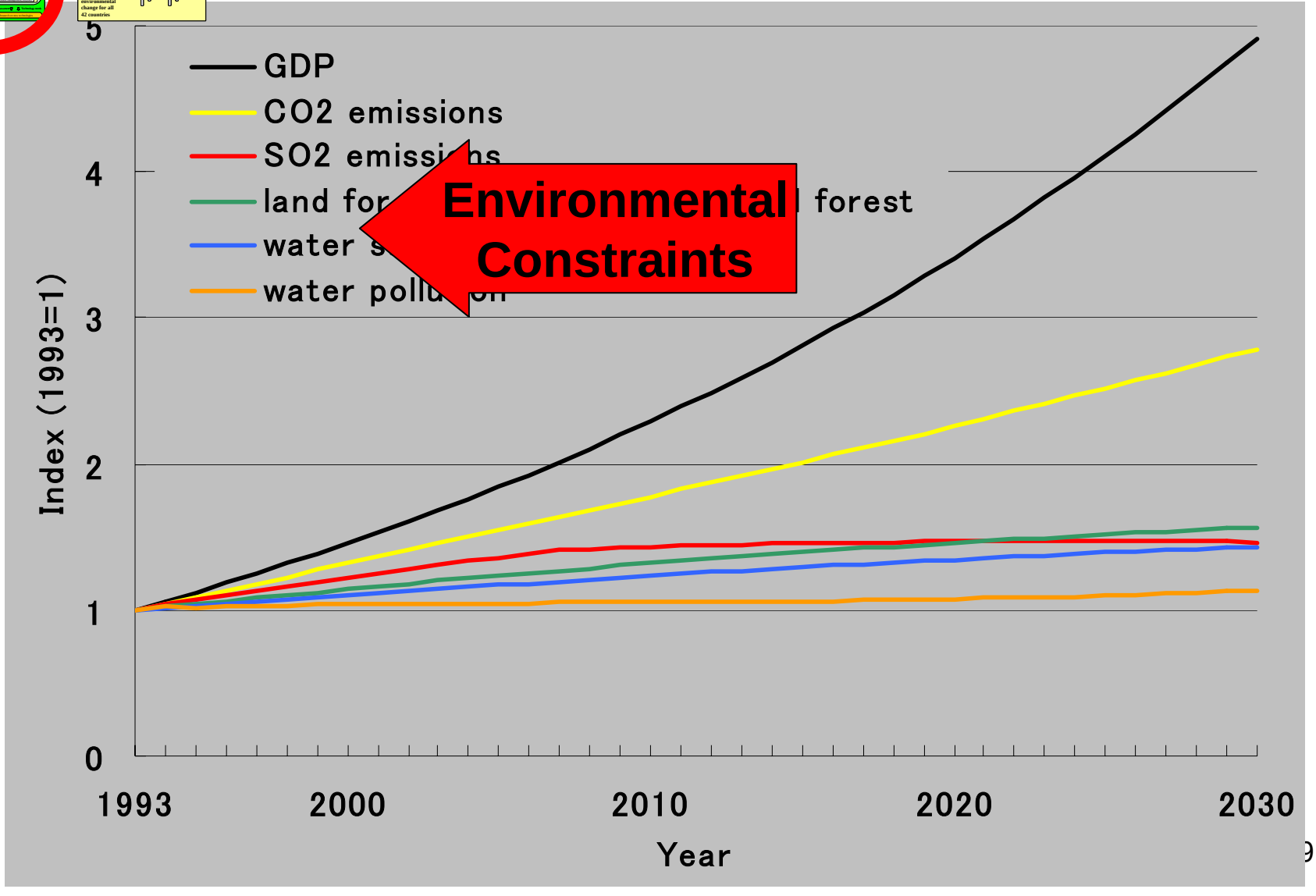


- There are limited resources of Natural Gas in Thailand. Impact on energy mix due to limits on Natural gas imports has been analyzed using the AIM/Enduse model of Thailand.

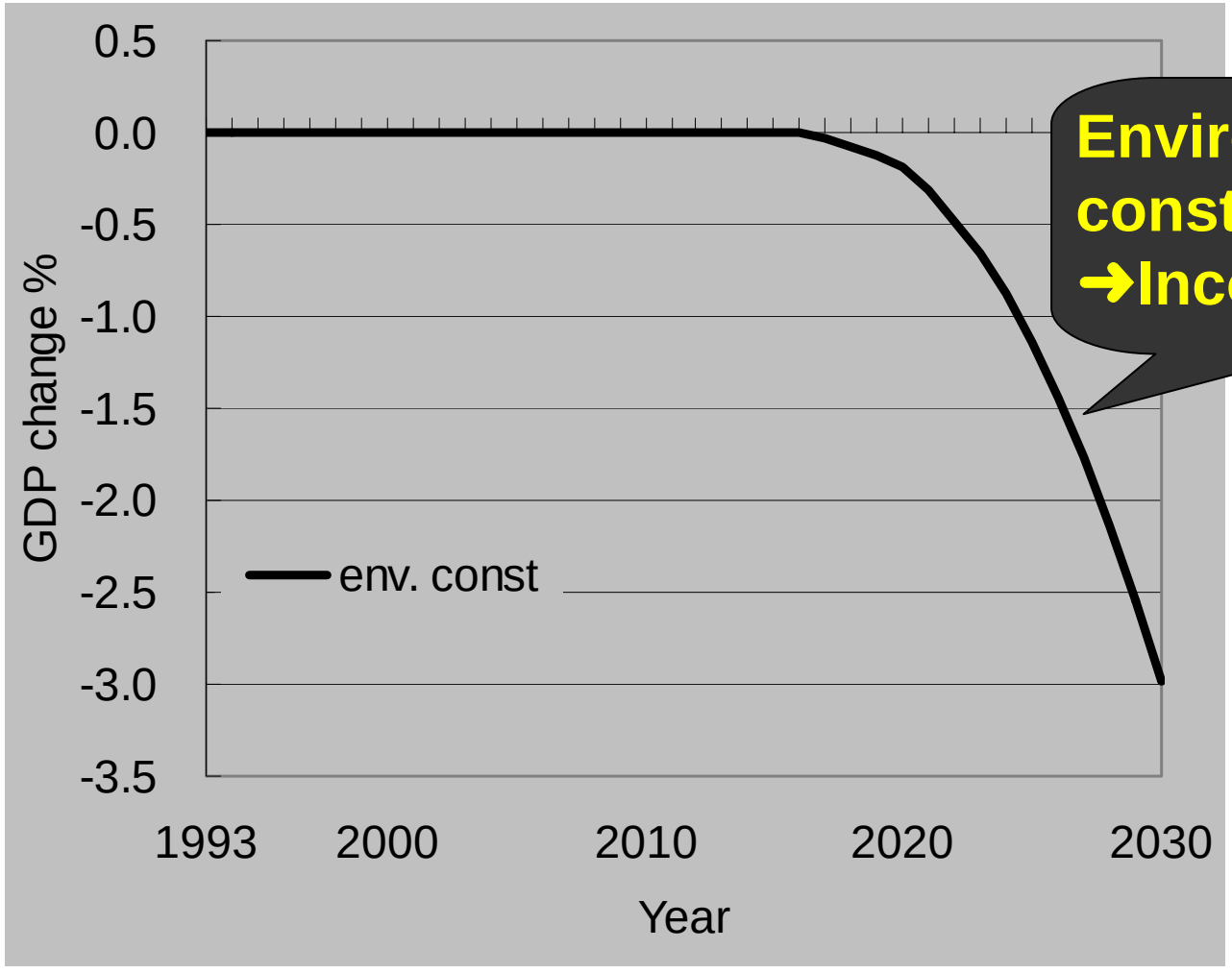
- In cases with smaller availability of natural gas through imports, more oil and biomass resource would have to be used in Thailand while coal use would remain almost unaffected (see figures).



Reference case results

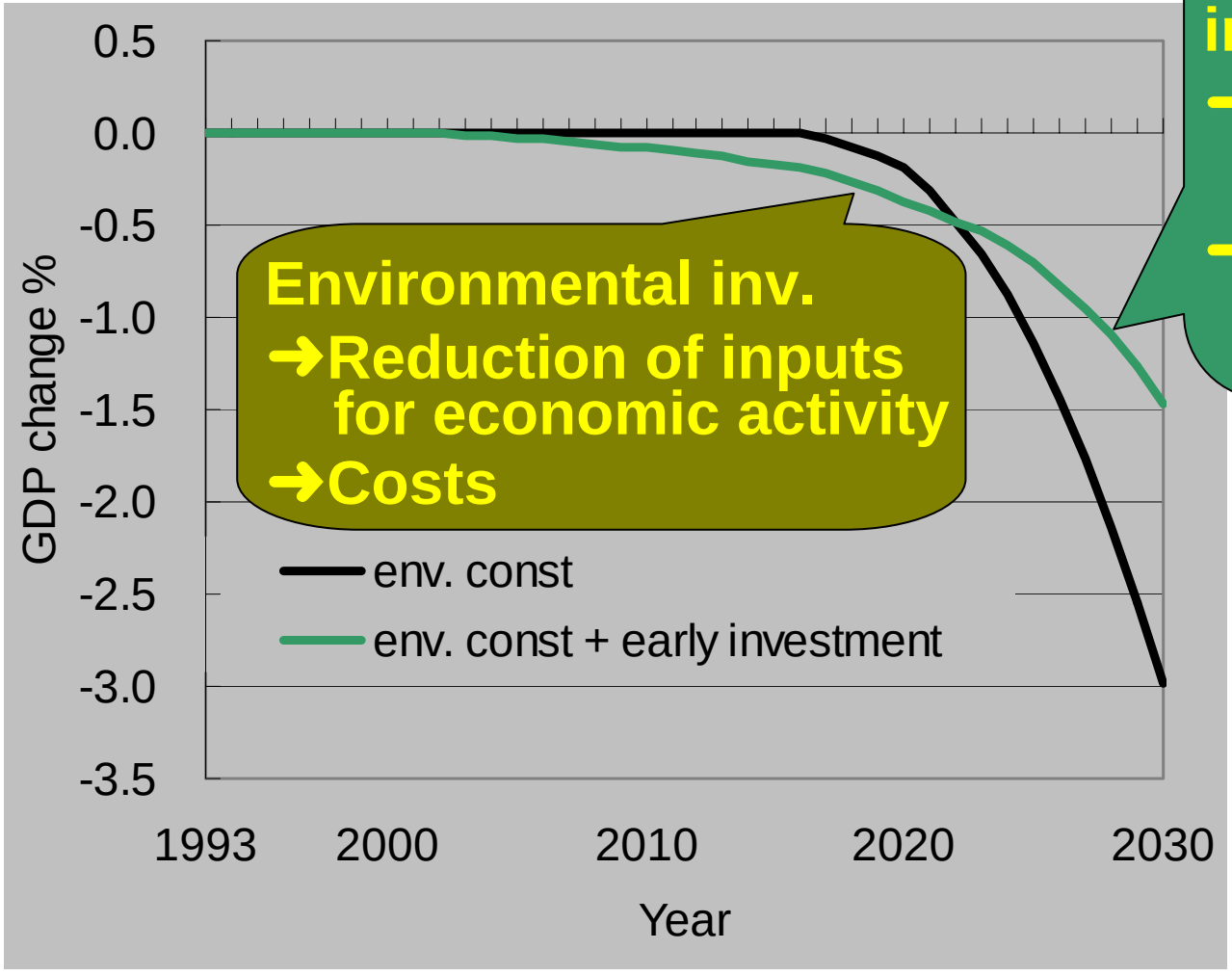


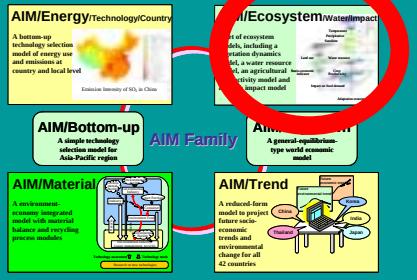
Economic Impact from Environmental Constraints



Environmental constraints ➜Income reduction

Effects of Environmental Investments

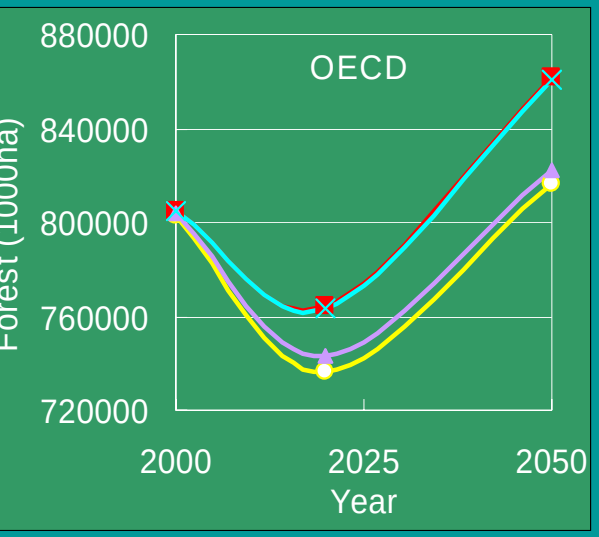


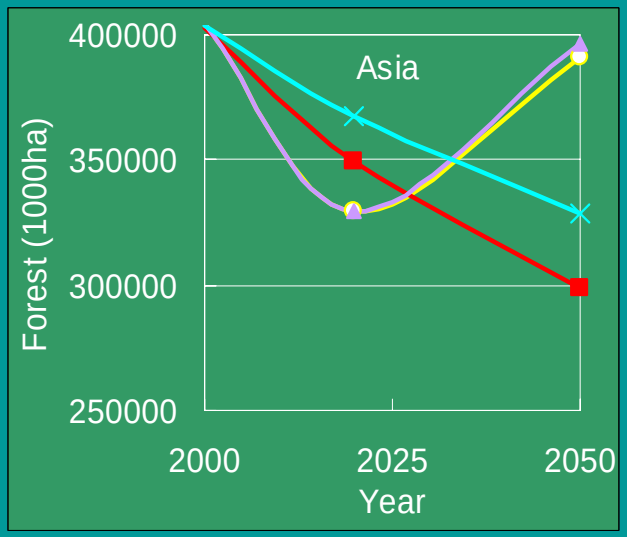


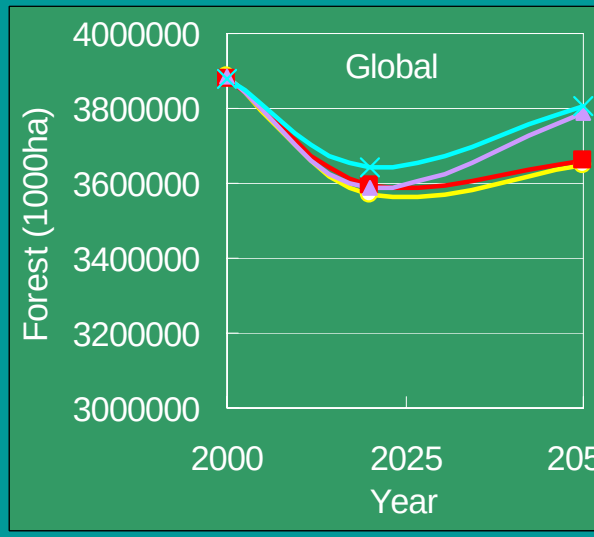
Contribution to Millennium Ecosystem Assessment

- Quantification of global long-term scenarios of natural and social environment
  - AIM models utilized for MA
    - ✓ AIM/Ecosystem
      - SOx, NOx, Land use change, Biomass energy
    - ✓ AIM/Water
      - Country-wise water-use (withdrawal and consumption), Country-wise renewable water resource, Spatial distribution of water-use and renewable water resources, Basin-wise water stress index
    - ✓ AIM/Agriculture
      - Potential crop productivity of Rice, Wheat and Maize

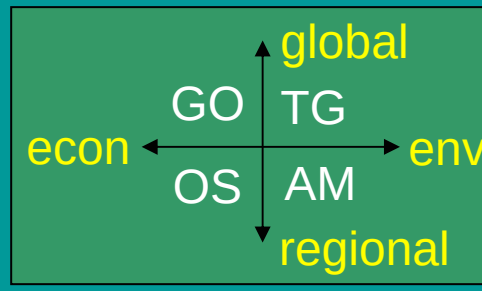
Simulation Results (Forest area)







Global Orchestration (GO) Technogarden (TG)
Order from Strength (OS) Adapting Mosaic (AM)



In any scenario, forest area decrease at the beginning of 21st century. Globally, forest in 2050 is smaller than that in 2000.

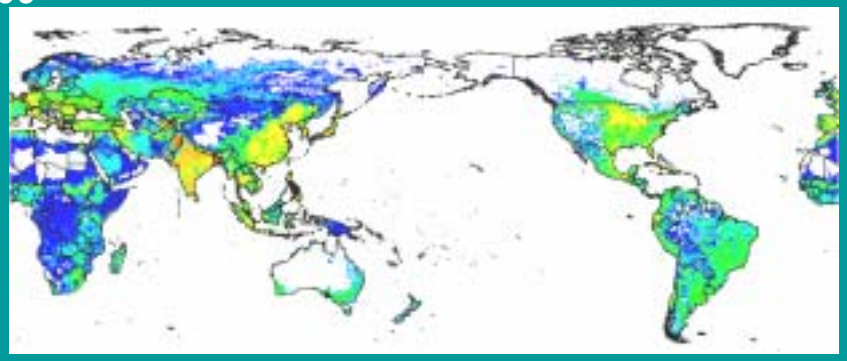
Pressure from other land use; agriculture, pasture & biomass plantation

GO: Pressure from meat demand & plantation biomass

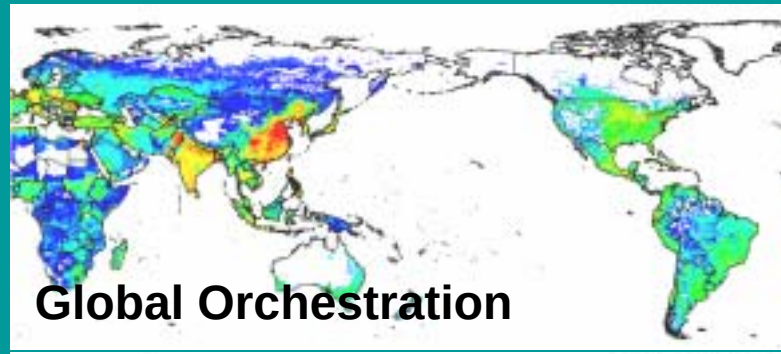
OS & AM (-2010): Pressure from general food demand

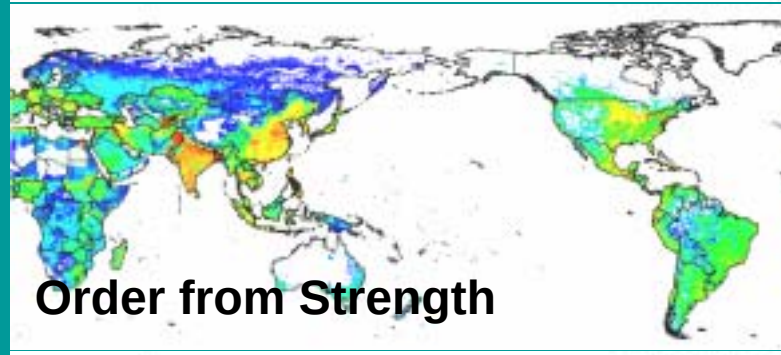
Pressure from globalization: GO & TG

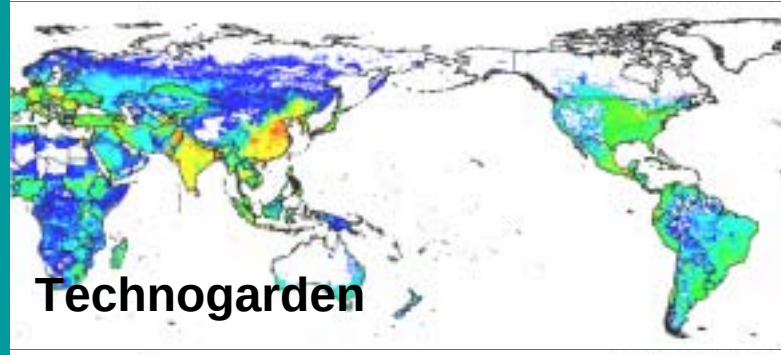
2000

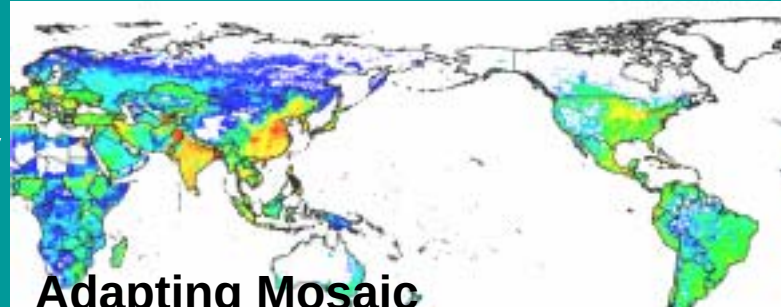


2100







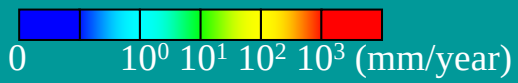


Water withdrawal per unit area in 2000 and 2100

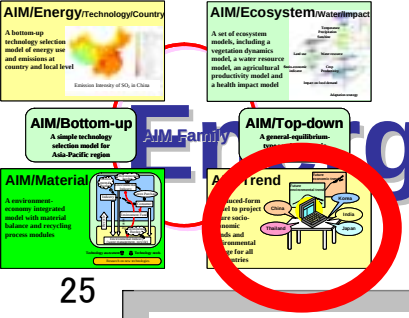
-Developing countries: Water demand density will increase especially under GO and OS.

-China & East Europe: Water demand increase under GO because of quite high economic growth rate.

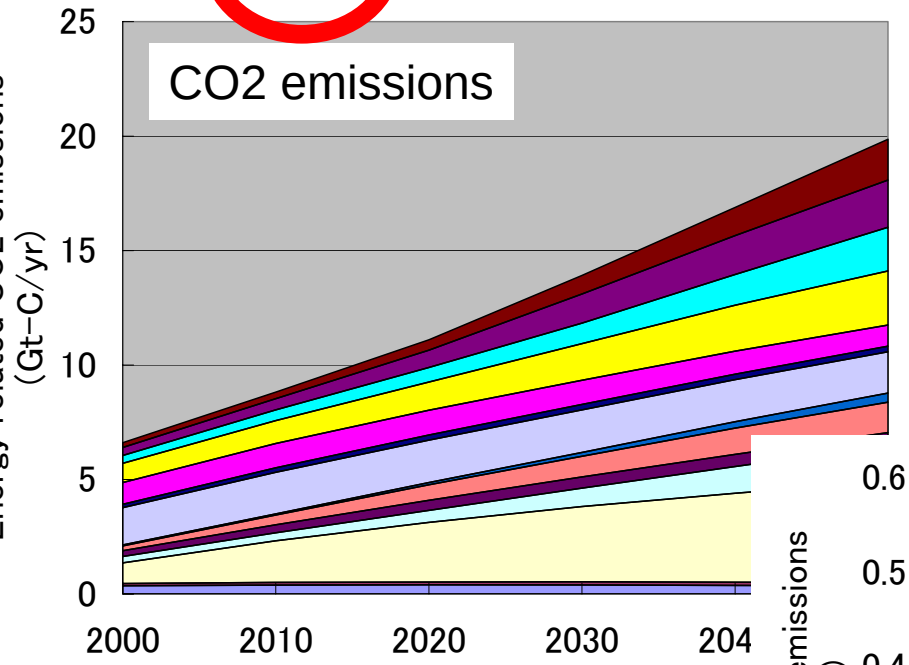
-Africa, Middle East & South Asia: Water demand increase under OS because of quite high population growth rate.



Water Withdrawal (total)

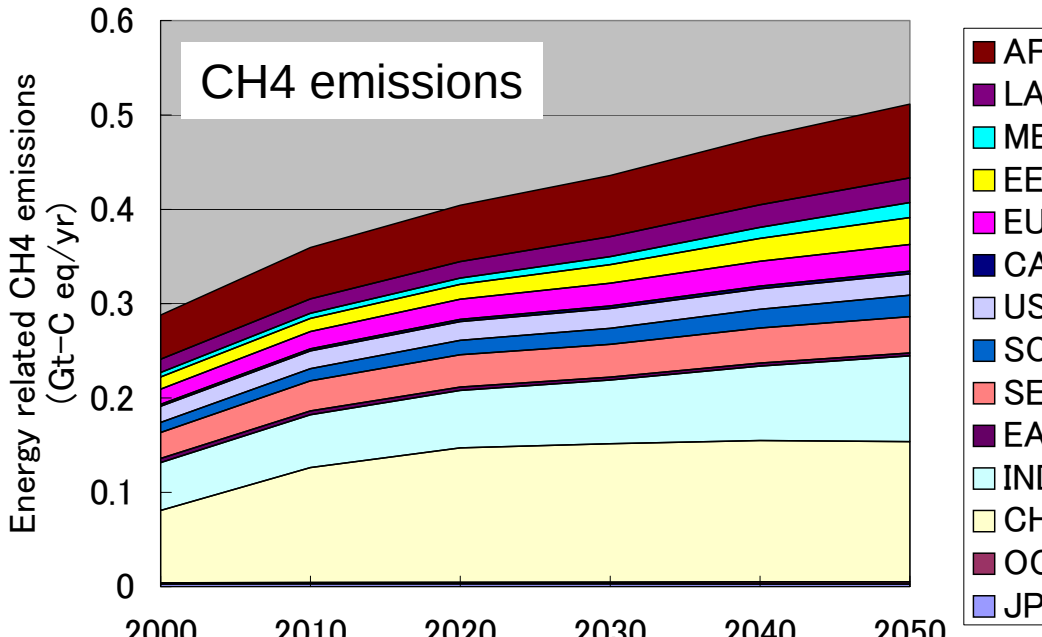


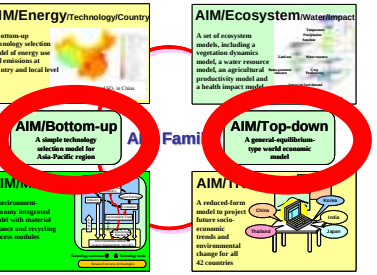
Energy related GHG emissions



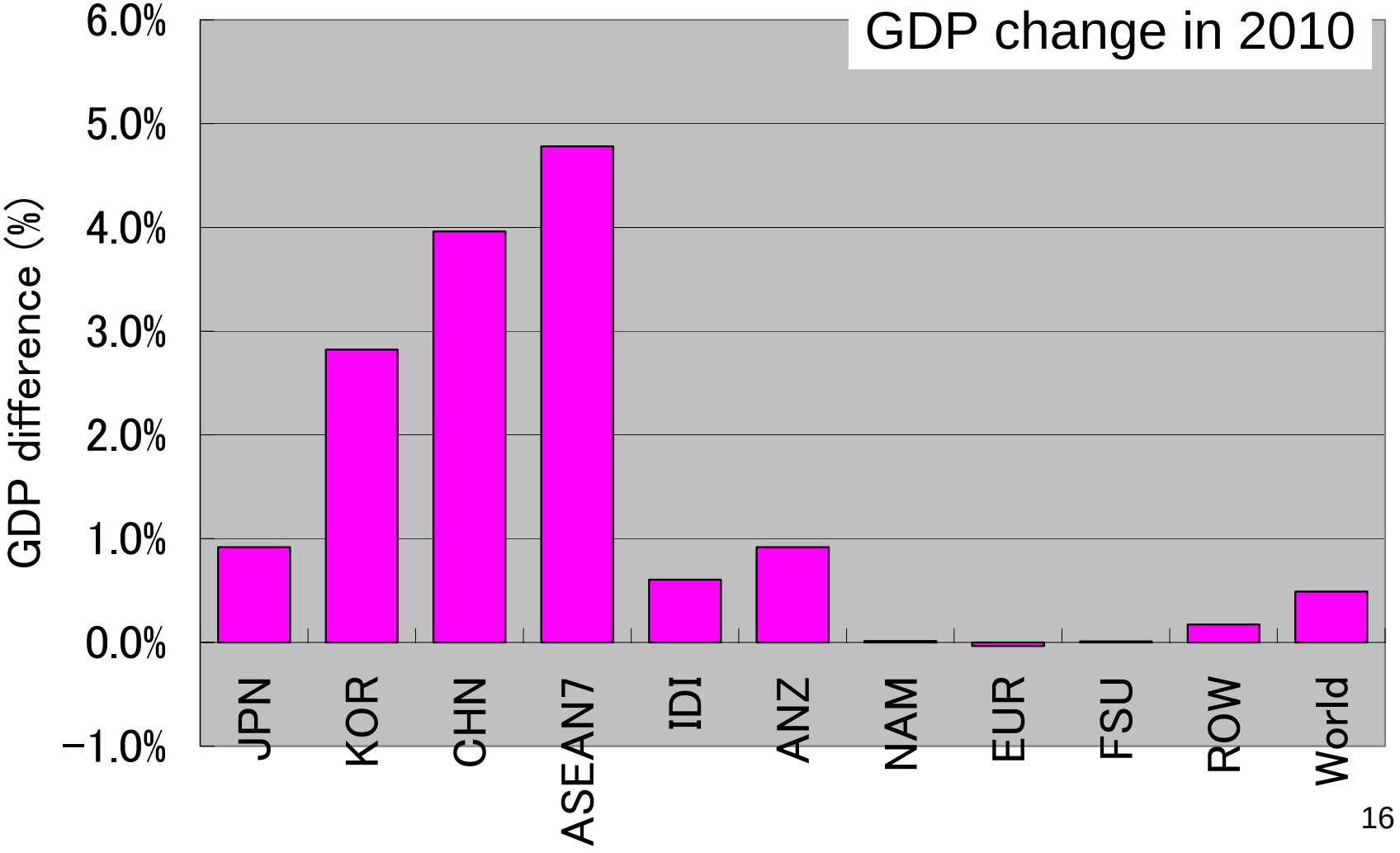
CO_2 emissions share of Asia will be increasing from 32% in 2000 to 44% in 2050.

Energy related CH_4 emissions share of Asia will be around 60%.

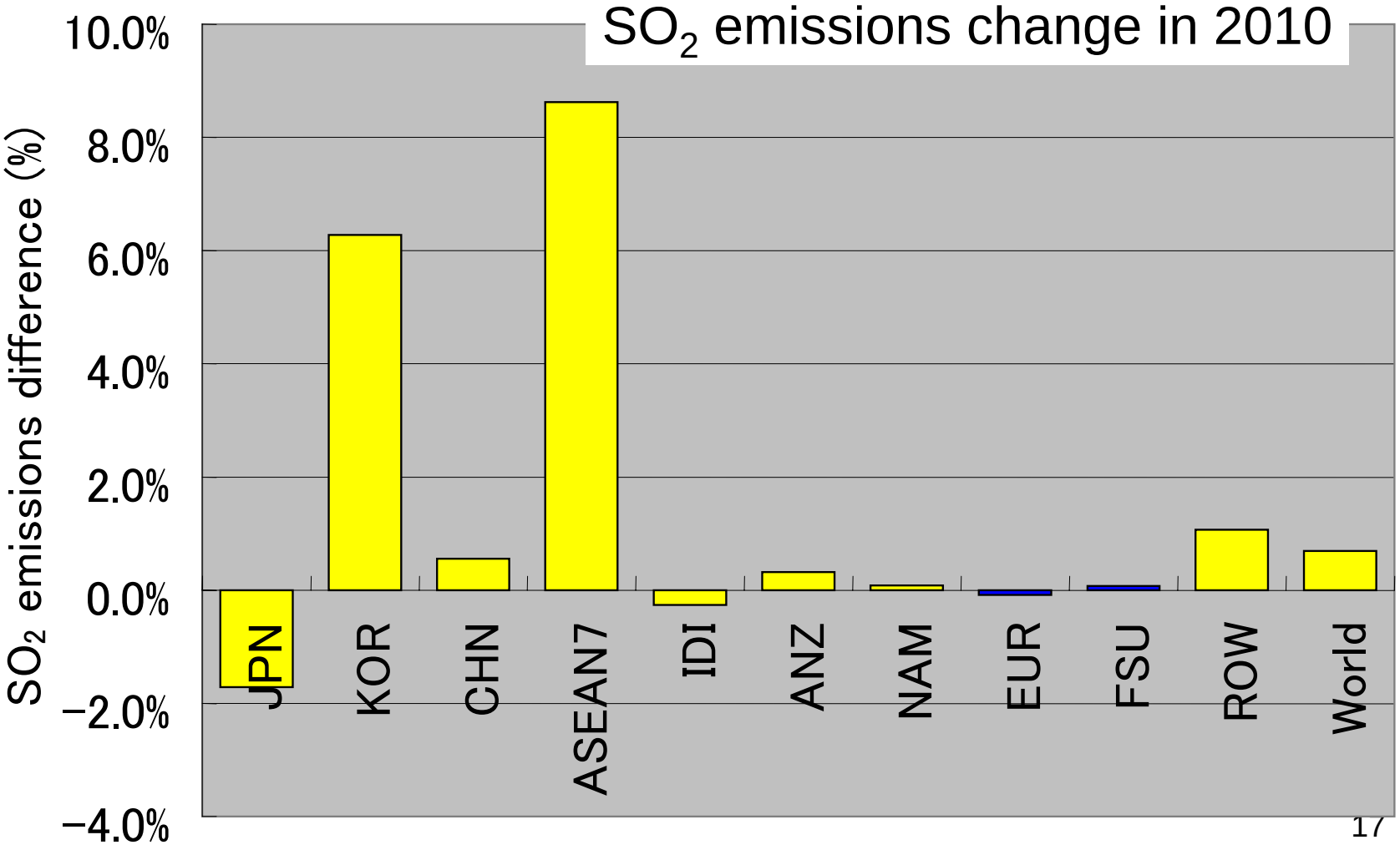


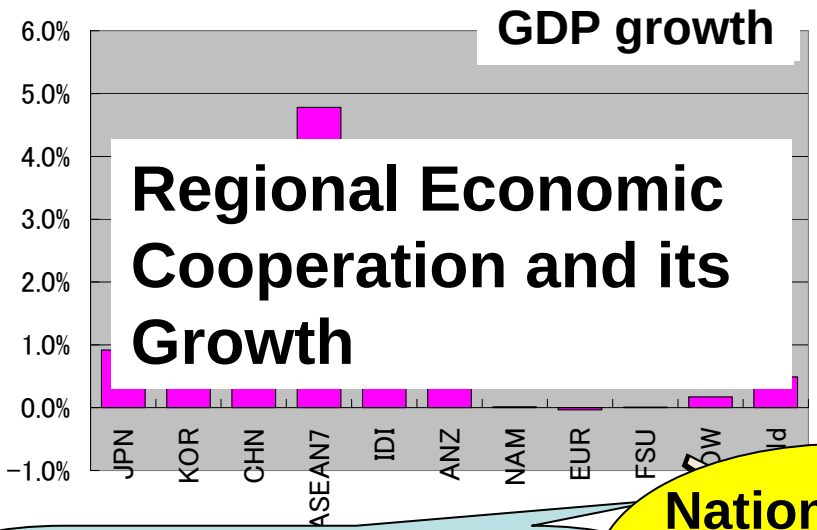


FTA impacts on Asia

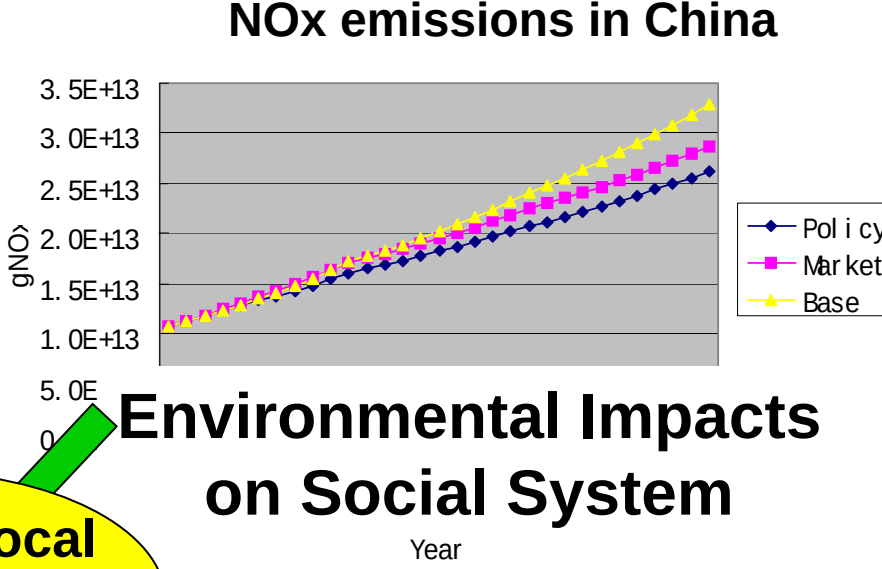


FTA impacts on Asia





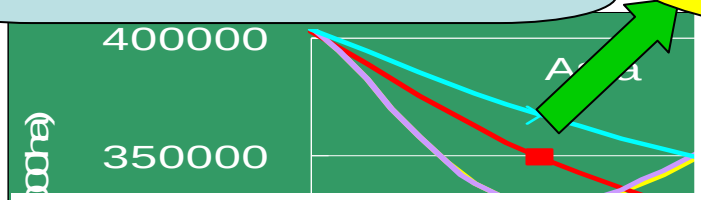
Regional Economic Cooperation and its Growth



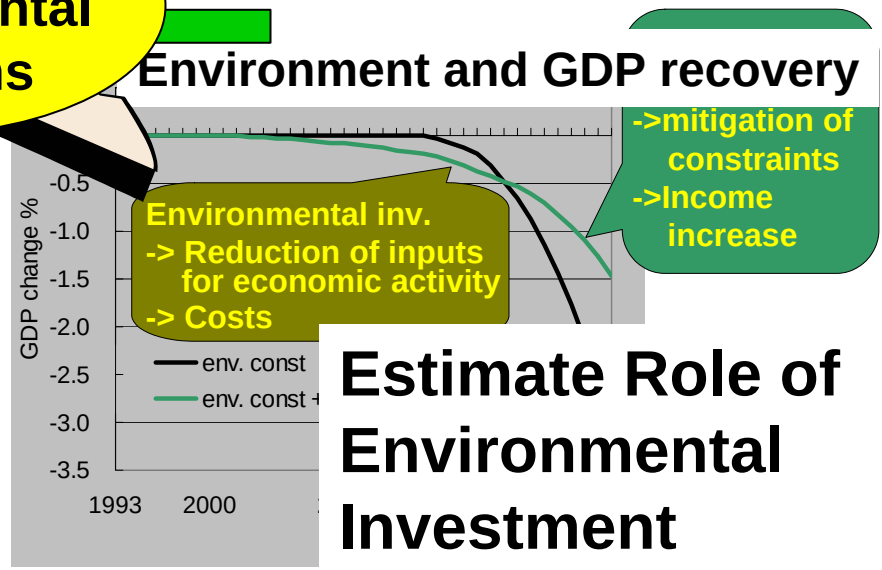
Environmental Impacts on Social System

National/Local Environmental problems

Bangkok Air pollution
Malaysia Deforestation



Environmental Impacts on Ecosystem



Estimate Role of Environmental Investment Towards SD

Integrated Assessment of Environmental Innovation Options for Sustainable Development

Concept of APEIS Strategic Database

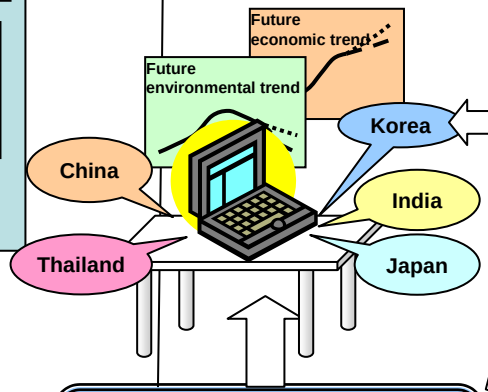
Policy Design & Assessment

Case Study

RISPO

Monitoring data by **IEM**

Policy Maker's Conference



Expert Meeting

Discussion on Availability and Barrier of Environmental Innovation Strategy

MODEL

AIM/Energy, AIM/Material
AIM/Trend, AIM/CGE
AIM/Ecosystem

Scenario Assessment

Population, GDP, Emission, Policy Option, Constraint ...

Scenario Database

Law, Policy, Target, Tax, Financial Marke...
Operation, Management, Governance ...

Institution and Management Database

Energy, Pollution, IT ...

Technology Database

Ecosystem Water, Agriculture, Health ...

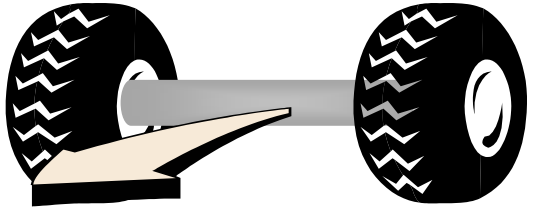
Adaptation Database

Objective of APEIS Strategic Database

Path to low environmental stress industries and lifestyle by making best use of innovative technologies

(Strategic Database gives the best timing and applicability of technologies toward environmentally sound society and estimates their impacts)

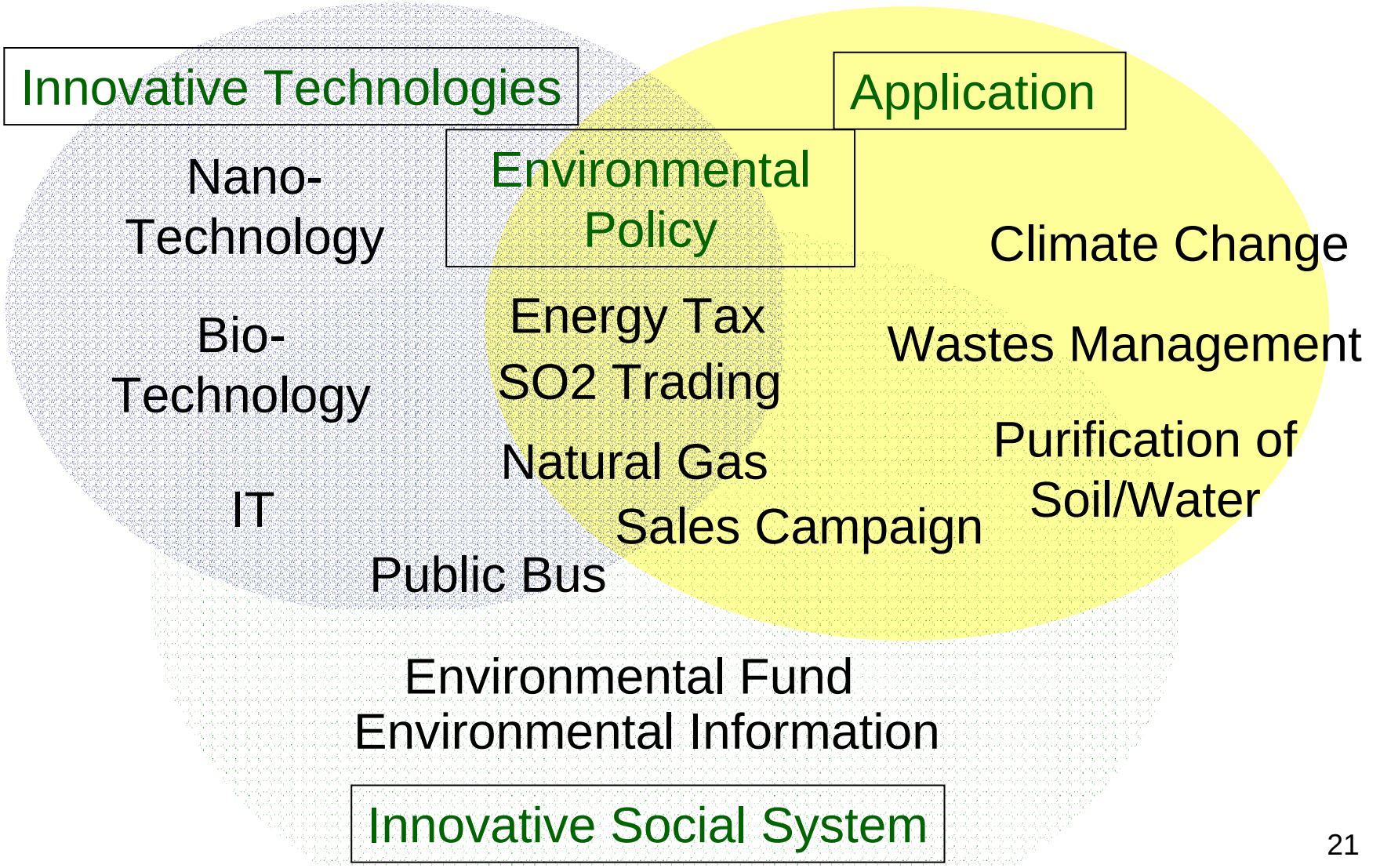
Innovative Technologies



Innovative Social System Breakthrough of Social Barrier

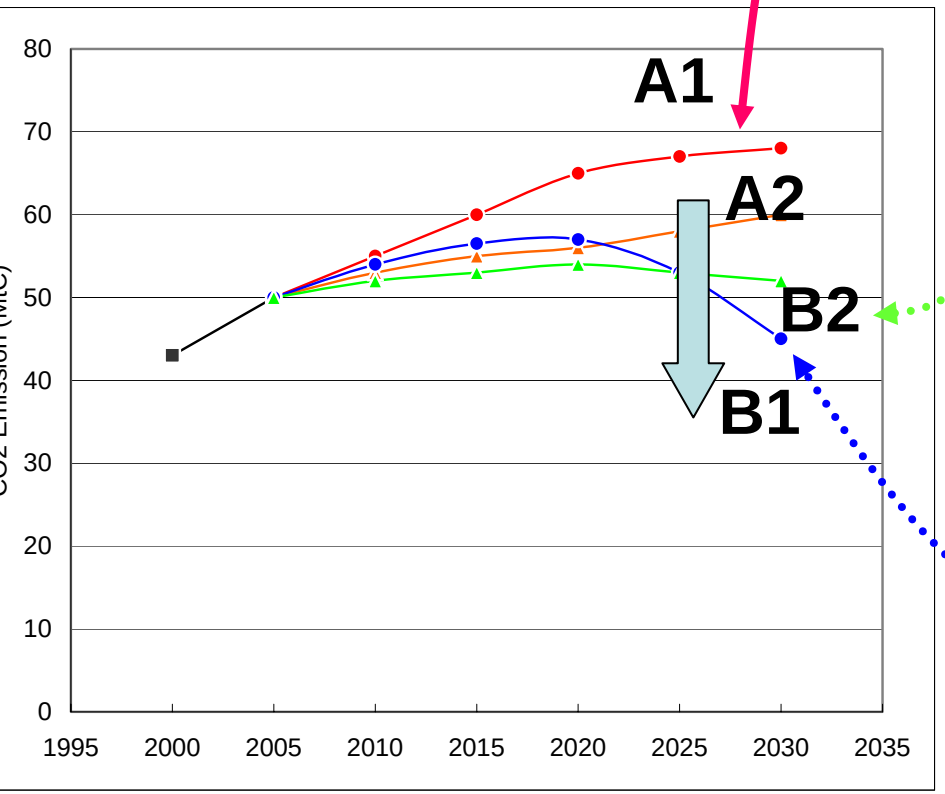
Environmentally Sound Society
(Low Environmental Loads & High Quality Life)

Items of Innovation Strategy



CO2 emission is estimated by SDB

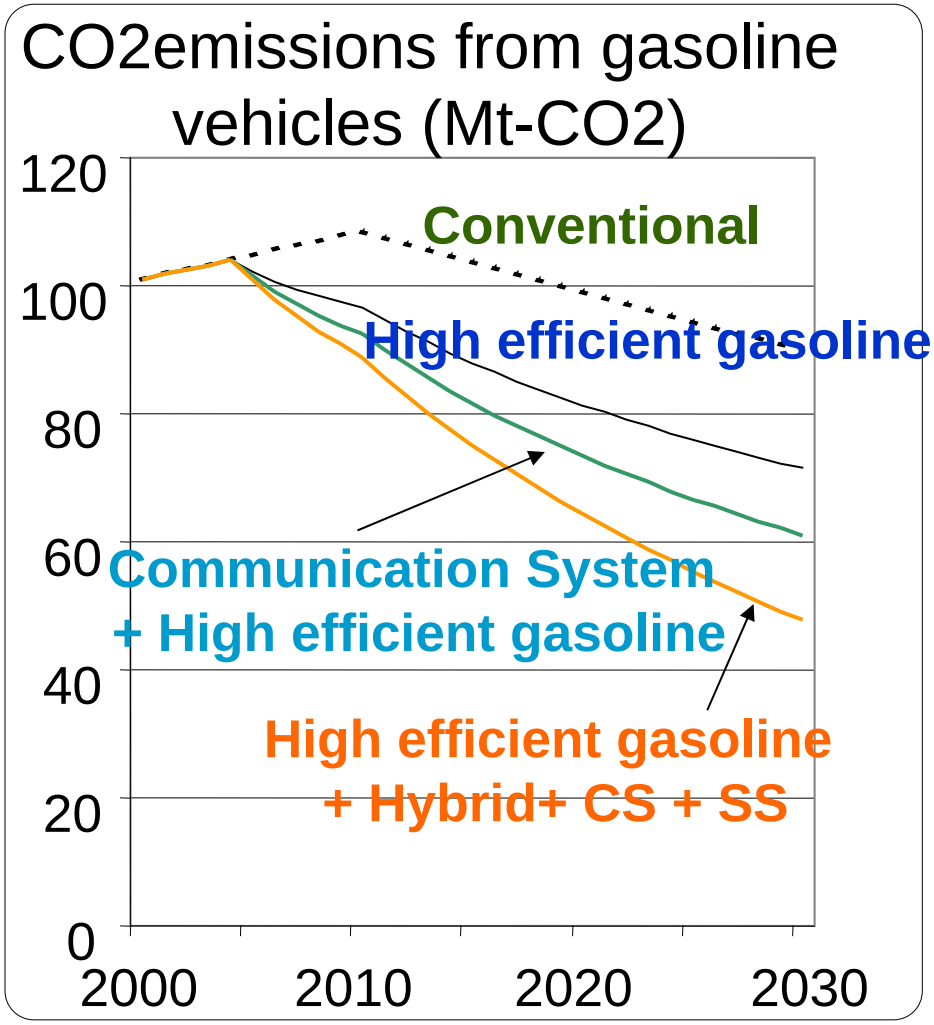
SDB cards are used according to socio-economic scenarios



- Fuel cell vehicle fueled by by-product H2 of industrial process
- Fuel cell vehicle fueled by H2 from oil
- Bikeway
- Eco-drive License
- Virtual communication system
- Advanced car sharing system
- Gasoline hybrid vehicle
- Fuel cell vehicle fueled by H2 from natural gas
- Bio-ethanol

Innovation strategy in CO2 reduction case

Japanese Transportation Sector



Market Case
Carbon Tax Case
High efficient remote communication system + Carbon Tax
Remote system + Car sharing + Carbon tax

Virtual Communication System (CS)

- Price : 800,000 Yen (Max)
- work at home : 3 days per week
- Saving : Transportation time Gasoline
- Share : 2% in 2005 to 50% in 2030

Car Sharing System (SS)

- Price : 130,000Yen/Year (Max)
- Persons to share a car : 3 persons
- Share : 2% in 2005 to 50% in 2030

* Carbon tax: 10,000 Yen/t-C
High efficient vehicles will be introduced by carbon tax.

Combination of virtual communication system and car sharing can reduce CO2 emissions greatly in future

Japanese companies have started to invest in about 400 technologies in the environmental field

- Zero-emission technologies
- Information technologies
- Bio-technologies
- Nano-technologies, etc.

Environment improvement is a major factor influencing this investment

Indian Transport Sector : Roadmap

Coverage	Passenger Cars, light commercial vehicles & heavy duty diesel vehicles	2 & 3 wheelers
Entire Country	Bharat Stage II * - 1.4.2005 EURO III Equivalent - 1.4.2010	Bharat Stage II - 1.4.2005 Bharat Stage III+ - Preferably from 1.4.2008 But not later Than 1.4.2010
111 major cities (Delhi / NCR, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahmedabad, Pune, Surat, Kanpur & Agra)	Bharat Stage II - 1.4.2003 EURO III Equivalent - 1.4.2005 EURO IV Equivalent - 1.4.2010	

* EURO II equivalent Indian vehicular emissions norms

+ To be reviewed in 2006 for enhanced implementation

Narrative Description Card

Sales Campaign for Electric Vehicle

Reva: India's First Electric Car

Reva is the India's first zero-polluting electric vehicle heralds a new era of non-polluting, cost effective, quiet city transportation - A boon for city commuters. This elegant, light-yet rugged, two-door sedan comfortably seats 4 people. It has a range of 80 kilometers in stop-and-go city driving, and a top speed of 65 km/h. Reva runs 80 Km on a single charge of 9 units of electricity. The cost of the vehicle is approximately $ 7000.

Eco-Friendly

Being an Electric Vehicle, Reva is zero polluting and noiseless. It does not require frequent oil changes. Moreover Reva has high recyclable content

High on Technology

Two computers and the state-of-the-art electronics in the Reva provide an efficient energy management system with advanced computerized vehicle diagnostics. The regenerative braking in the Reva recovers useful electricity by putting it back into the batteries. Regenerative braking lets the motor act as a generator, converting the vehicle's momentum into electricity….

Soci-Economic Scenarios in passenger transportation sectors

IA1

- High globalization and growth
- High transportation service demand
  → Growth in allied sectors
- Efficiency Improvements
- Key Drivers: competition and private participation, Access to global finance and technology, Technology R&D, transfer and capacity building, Reduced risk perception

IA2

- Economic development along the same lines as existing government policies
- Increase in share of commercial Energy
- Lower trade flows and relatively slower technological change
- Key Drivers: GDP growth, Energy efficiency, Non-fossil fuels vs. fossil fuels, Oil consumption, Technological change, Movement on the fuel ladder

IB1

- Sustainable development scenario with high environmental and social consciousness
- Efficiency improvement, low and carbon free technologies, and cleaner fuels
- Key Drivers: Strong environmental awareness and conservationist values, Environmental integrity, consumption changes, Shift away from fossil fuels, Local capacity building

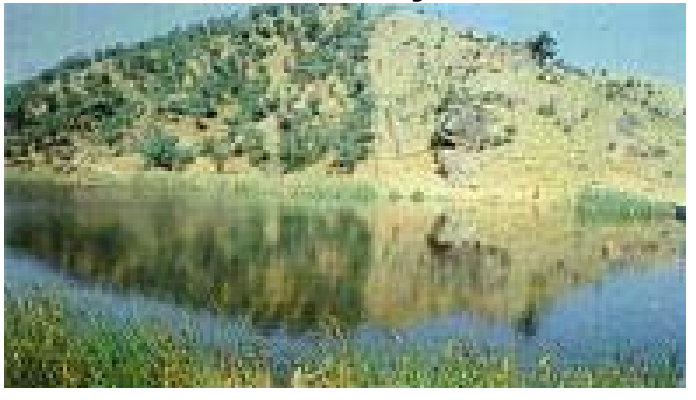
IB2

- Low growth scenario with increased decentralization of governance and insulation of economy
- Slow improvement in energy efficiency and penetration of new technologies
- Key Drivers: GDP growth, population, Local emissions, Productivity, Importance of Agriculture, Resource intensity, Self-reliance

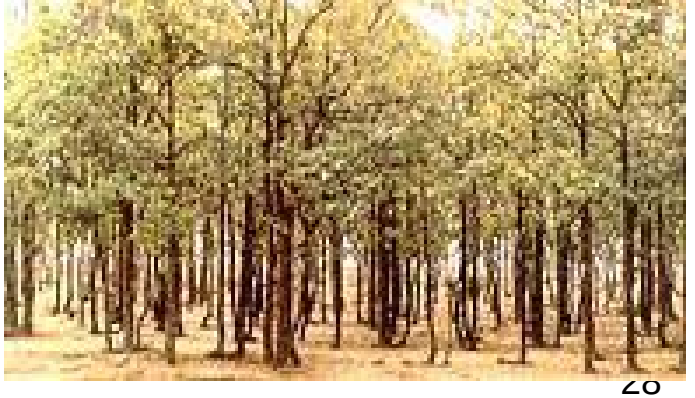
Other Innovation in India: Joint Forest and Water Management

- Community participation and local sustainable development
- Efficient conservation of forests and water resources
- Local livelihood enhancement
- Participatory Wasteland development

Managed and unmanaged areas in Rajasthan



Revival of Arabari Forest in West Bengal



Messages from IEA

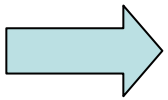
1. Technological innovation potentials for the environment are very large, much different among countries, therefore great opportunities of regional collaboration.
2. Technological innovation is effective if integrated with social innovations.
3. Policy options effective for global environment can reduce local environmental burden as well and enhance technology development.

Messages from IEA (cont.)

4. Environmental investment in earlier stage is more cost effective in a long run.
5. Globalization would introduce innovations mainly in emission reduction, while it could affect the incentives to sustain ecosystems
6. Free Trade Agreement would have varied economic and environmental impacts on different Asian countries

Expected Outcomes from IEA for Phase I

1) Integrated Environmental Assessment with AIM Family Models
2) Concept Design and System Development of Strategic Database to Evaluate Environment Innovation Strategy Options
3) Apply Strategic Database to Selected Countries in Asia
4) Expand and Diffuse Environment Innovation Strategies through Interaction with Policy-makers in Selected countries



Scenario Analysis for Millennium Ecosystem Assessment

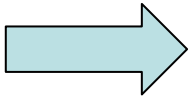
Environmental Policy Proposal for Eco-Asia

Environmental Strategy Assessment in the Great Mekong Subregion

Capacity Building in Asian Countries

Plan for the Second Phase of APEIS-IEA

1) Extended Application and Policy Assessment with AIM Family Models
2) Application of Strategic Database to Specific Environmental Problems in Asian Countries
3) Modeling case studies of environmental strategies and choice of policy instruments
4) Estimate Appropriate Timing to Introduce Environment Innovation for each target Asia-Pacific country
5) Expand and Diffuse Environment Innovation Strategies through interaction with policy-makers

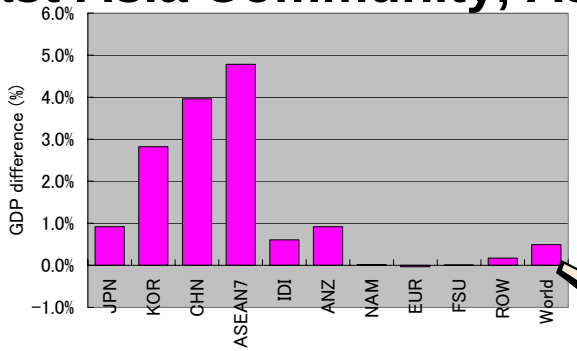


Sustainable Development Strategy in Asia-Pacific Region

Thank you !

Application of APEIS studies on specific environmental problems

Regional economic cooperation
e.g. East Asia Community, Asia FTA



APEIS/Strategic Database

RISPO policy options

Innovative Social System

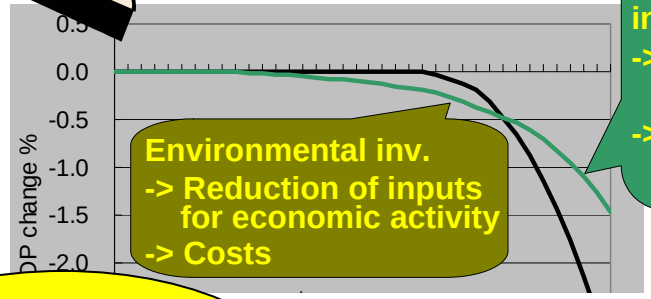
National/Local policy-makers interaction

Bangkok Air pollution
Malaysia Deforestation

Innovative Technologies

IEM monitoring data

AIM models application



National/Local Environmental problems

ntally Sound Society
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gh Quality Life)