Multi-gas Model Analysis on stabilization scenarios

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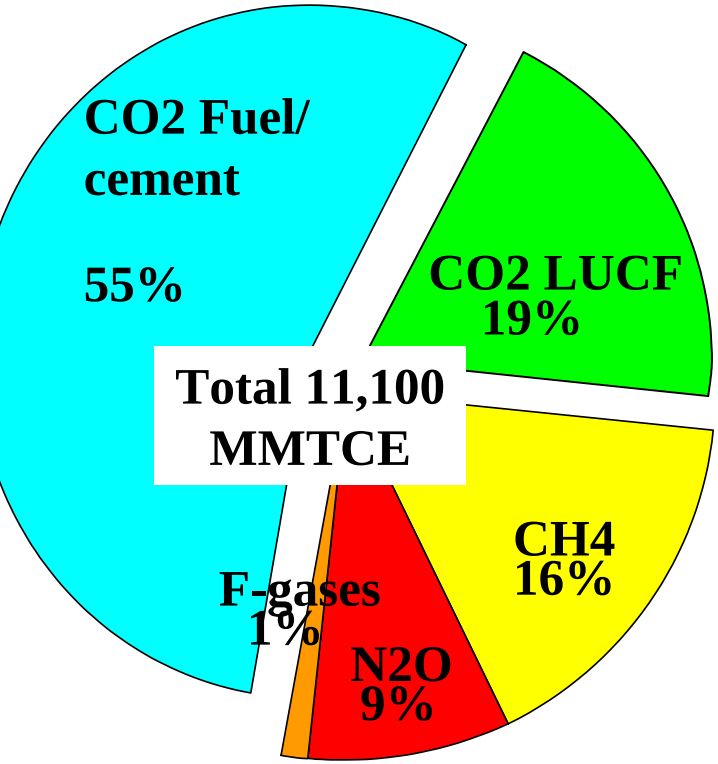
AIM model components for multi-gas study

- **AIM/CGE: Long-term scenario of Multi-gas**
  - Top-down economic global model
  - Recursive dynamics CGE model
  - Multi-regional, multi-sectoral, multi-gas model

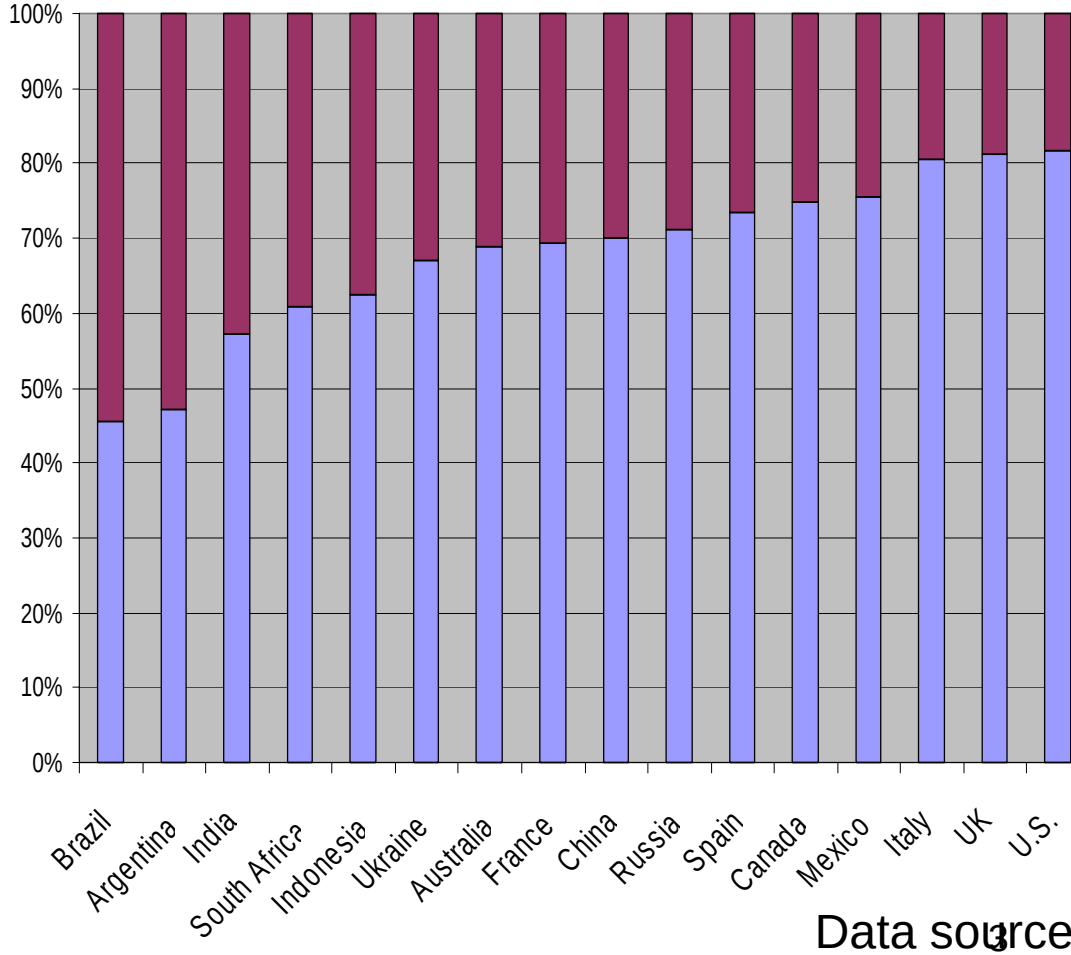
- **AIM/Enduse: Detailed Sketch of Multi-gas**
  - Technology detailed bottom-up model
  - AIM/Enduse [country], AIM/Enduse [global]



2000 Global Net GHG Emissions

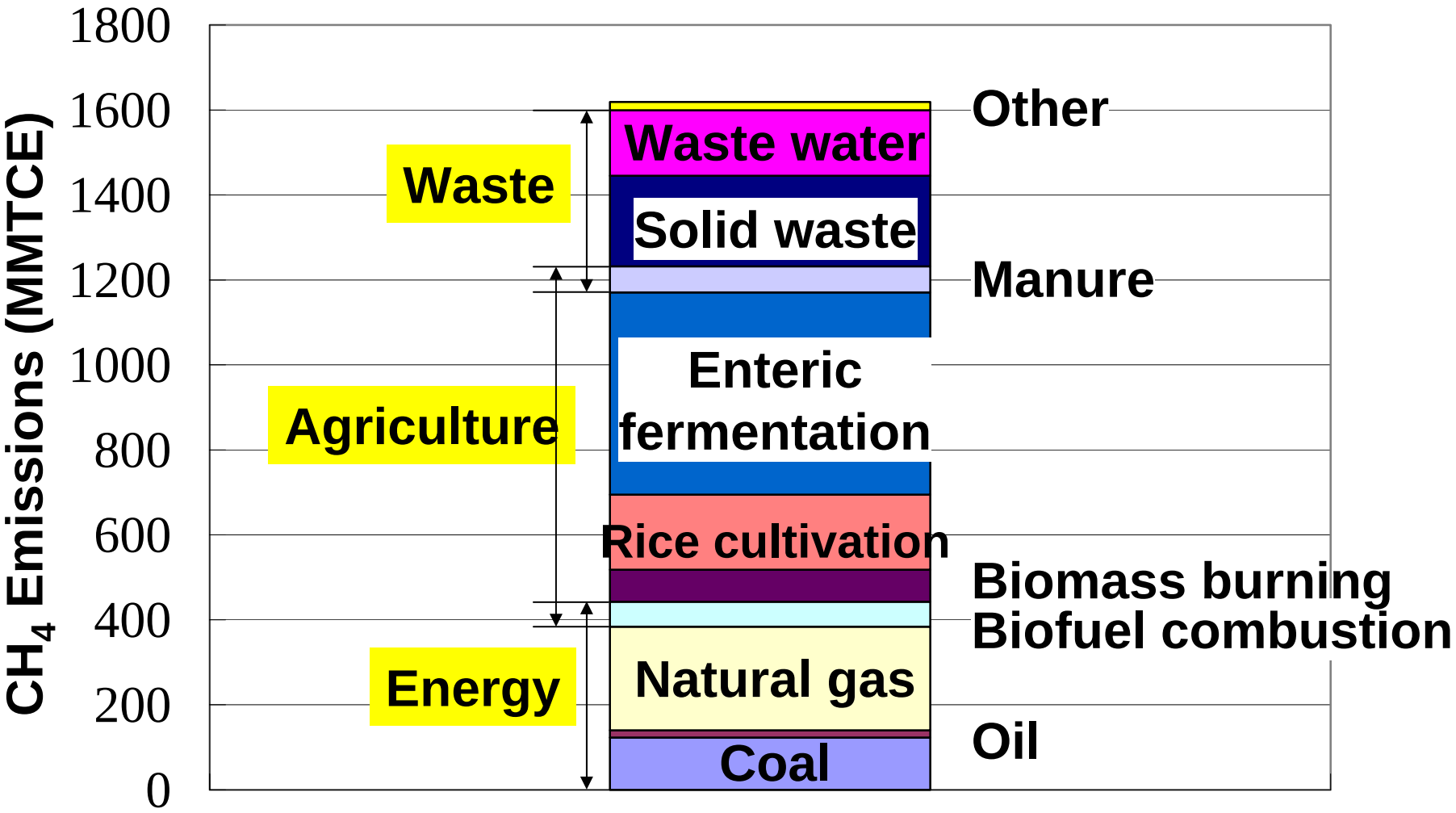
(MMTCE: Million Metric Ton Carbon Equivalent)

1997 GHG Emissions of selected countries



Data source: USEP

Global CH_4 Emissions in 2000



Data source: USEPA

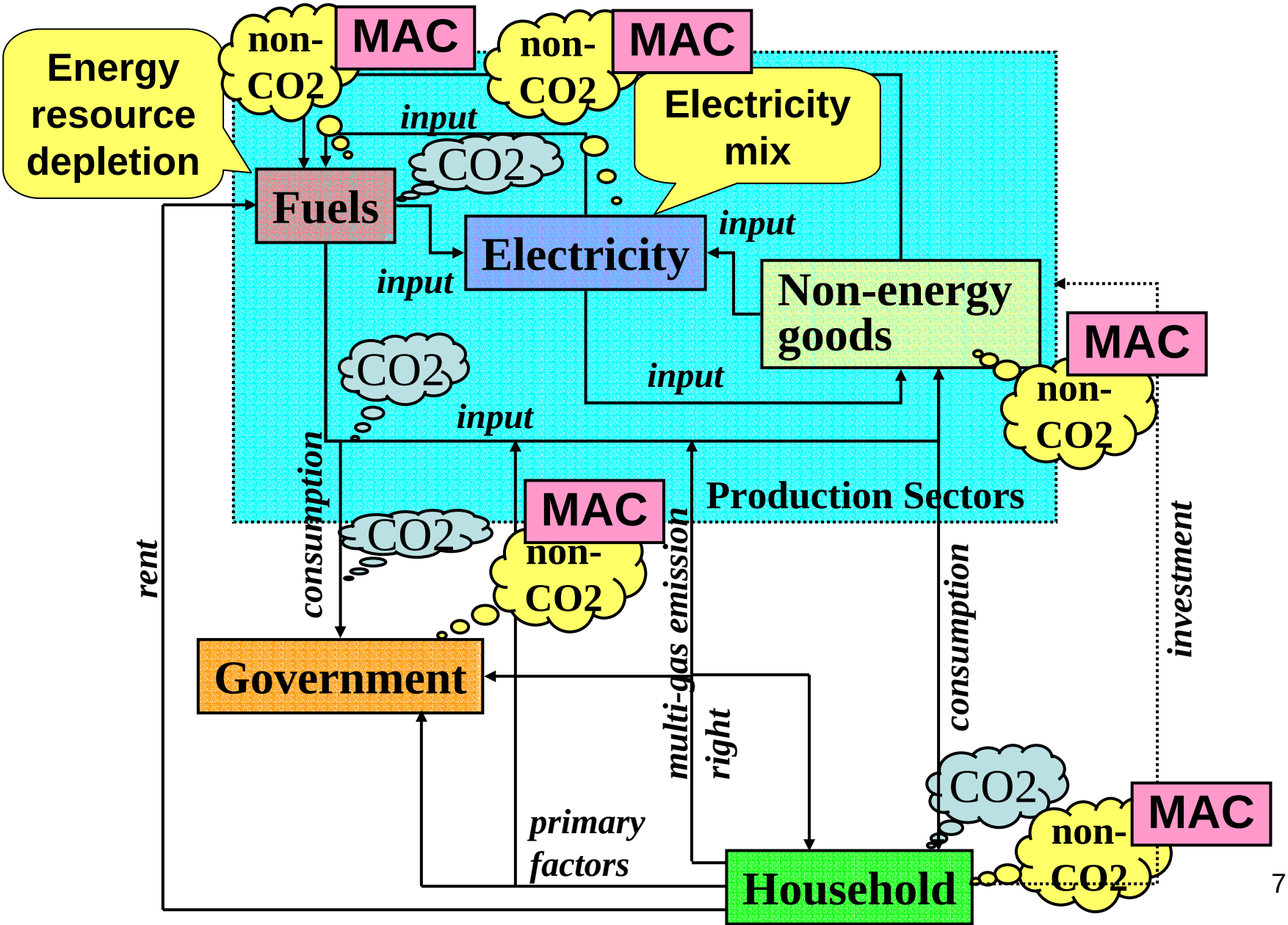
Basic framework of AIM/CGE

- Type: Top-down, CGE, recursive dynamics
- Program：GTAP-EG/GAMS/MPSGE
- Database：GTAP ver.5(1997), IEA
- Target Year: 2100
- Target Region: 18 regions
- Target Sector: 13 sectors
- Non-CO_2 gas abatement
- (Land use: use SRES/B2(AIM) scenario)

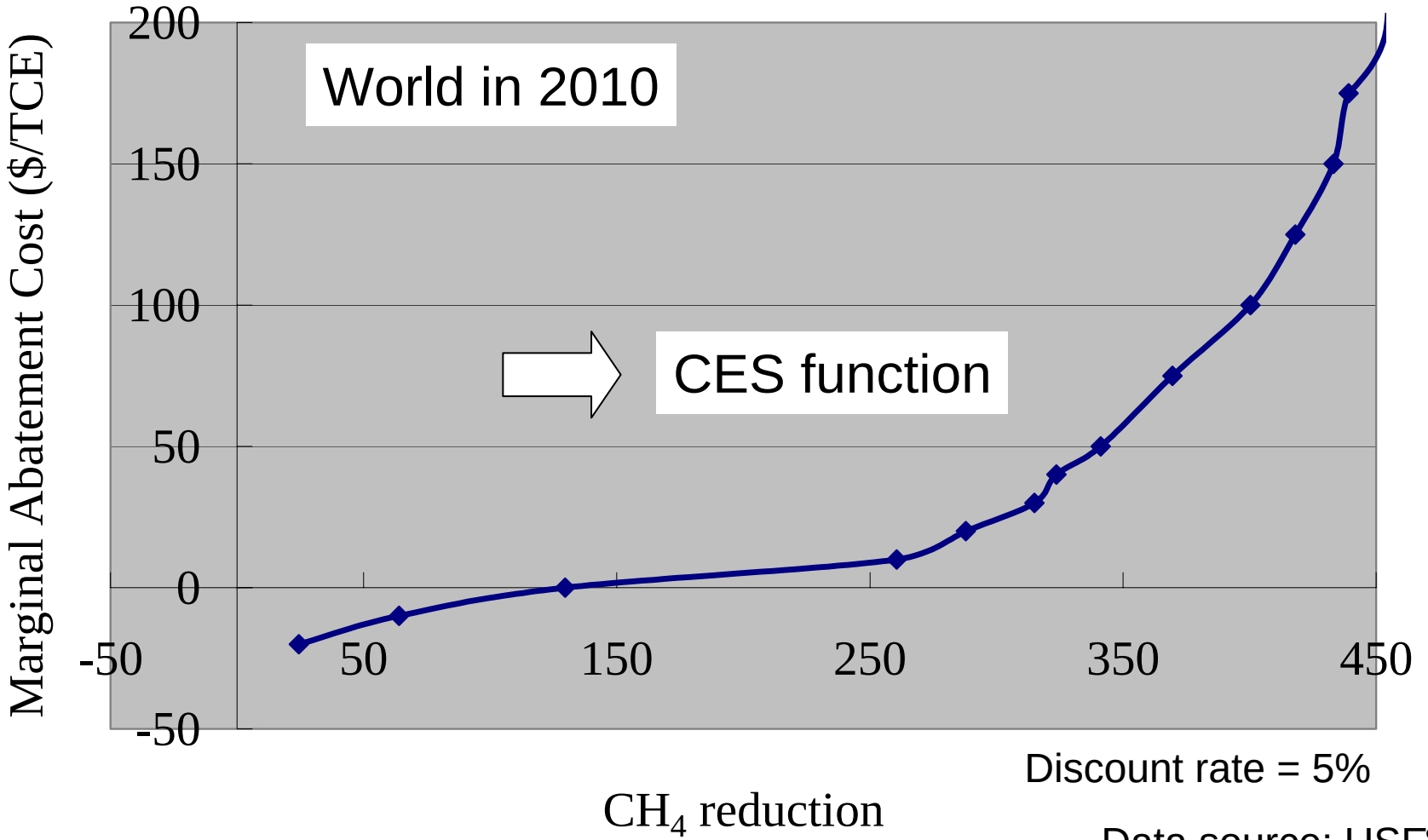
Sectors of AIM/CGE

1	GAS	Natural gas works	8	FRS	Forestry
2	ELE	Electricity and heat	9	FSH	Fishing
3	OIL	Refined oil products	10	EII	Energy Intensive Industry
4	COL	Coal transformation	11	OIN	Other Industry
5	CRU	Crude oil	12	T_T	Transport
6	AGR	Agriculture	13	SER	Service
7	LVK	Livestock			

Structure of AIM/CGE model



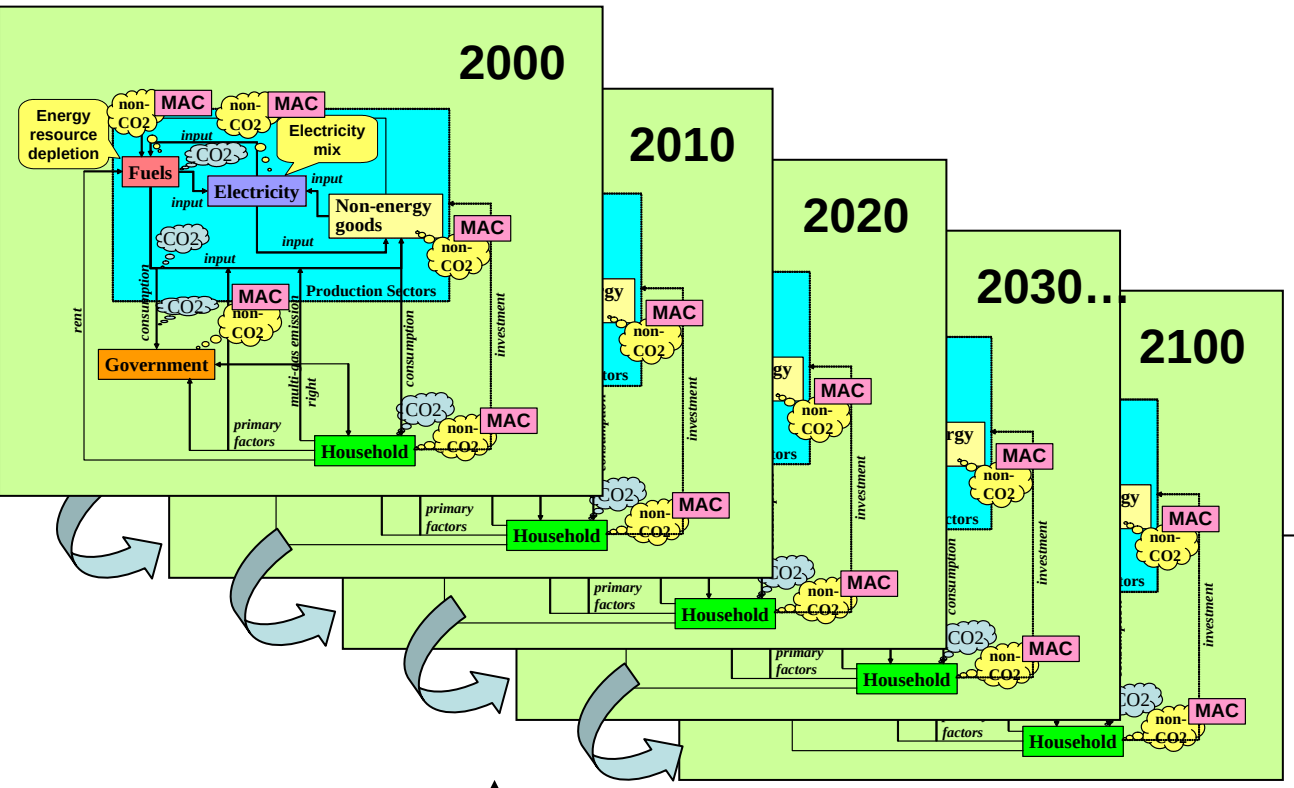
Marginal Abatement Cost Curves (MACs) for CH_4



Discount rate = 5%

Data source: USEPA

Radiative Forcing/Temperature raise constraint and dynamic recursive model



GHG emissions

Other gases:
SOx, NOx
BB+FF

Emission path to satisfy stabilization target

Simple Climate Model Based on Joos model (AIM/SSG)

Stabilization scenarios

(1) BaU Modeler's reference (B2-like)

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(2) Long-term stabilization scenarios

Stabilize radiative forcing at 4.5 W/m^2
by 2150 relative to pre-Industrial times

(2-1) CO_2 only (2-2) multi gas

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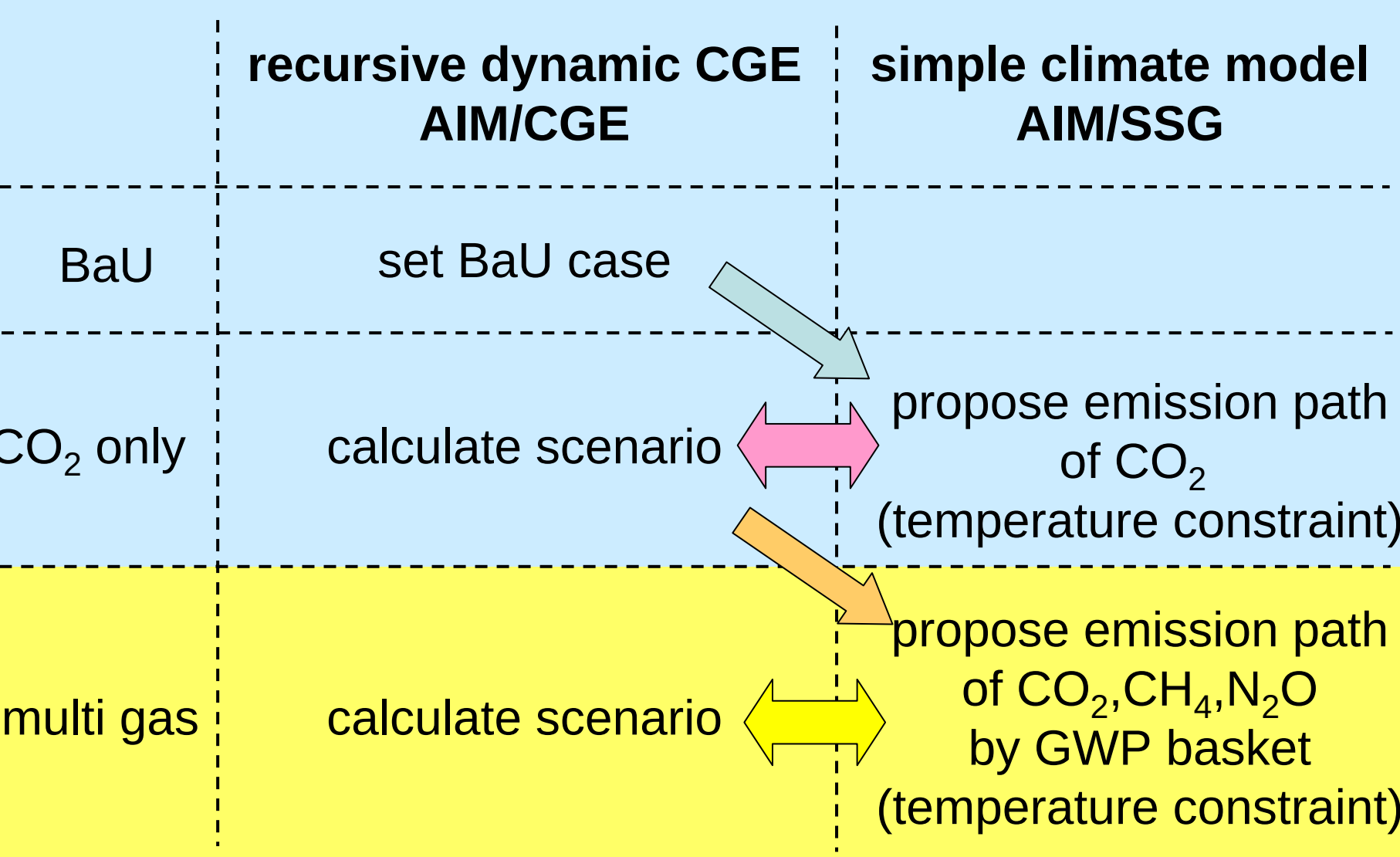
(3) Long-term stabilization scenarios
with rate of temperature change

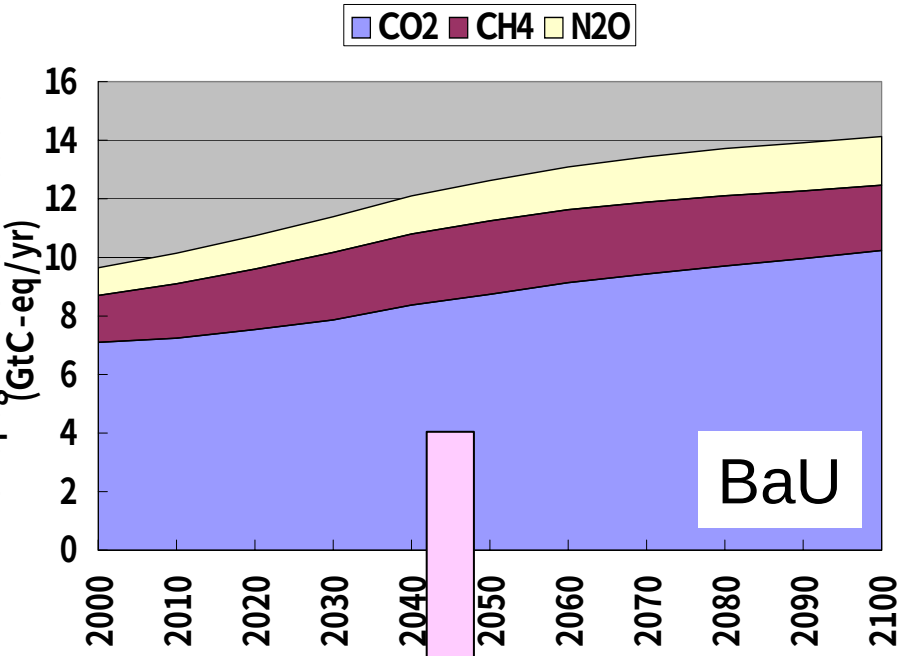
global mean temperature change to
an average decadal rate of 0.20ºC

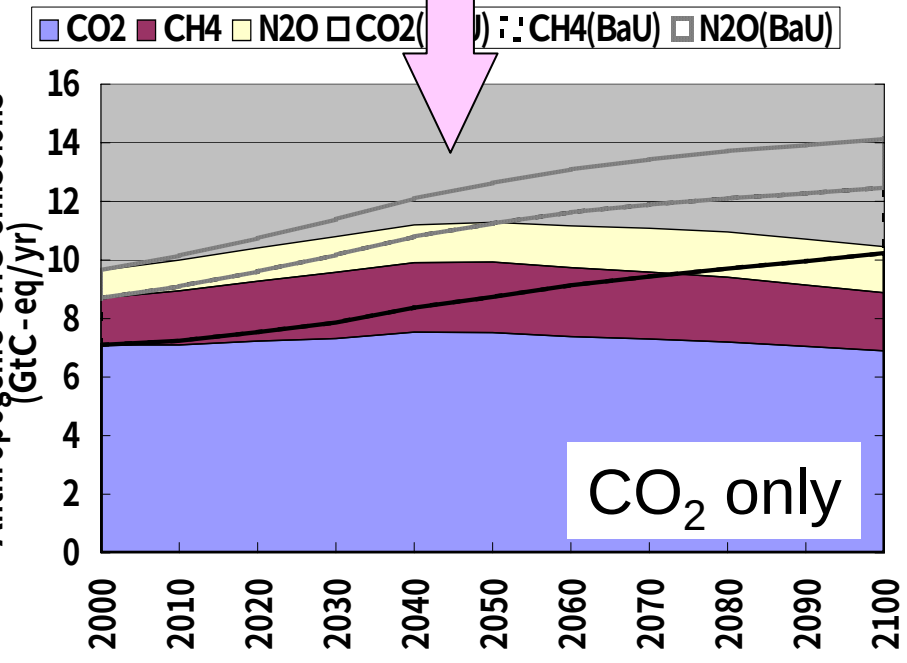
(3-1) CO_2 only (3-2) multi gas

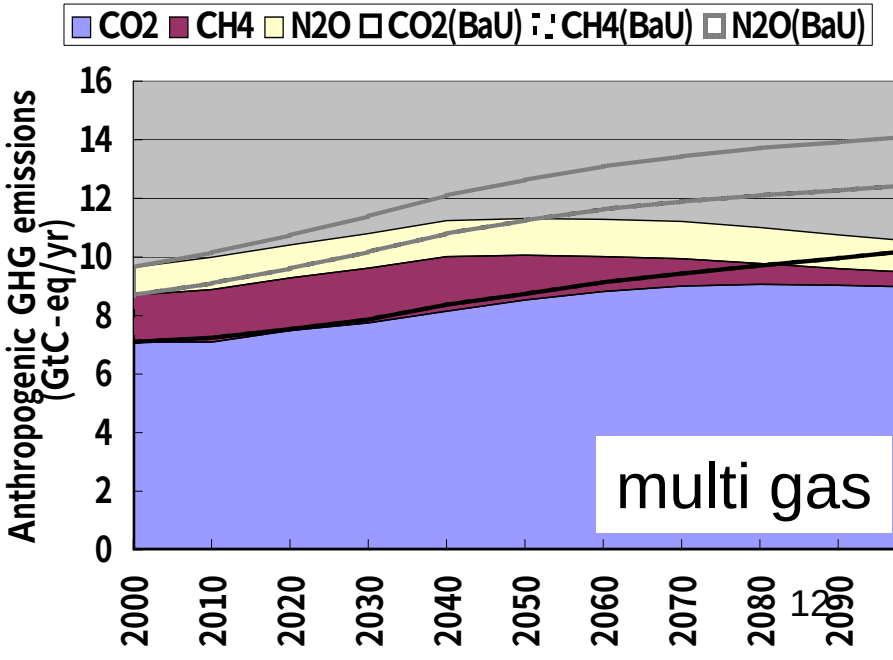
Calculation flow with AIM models



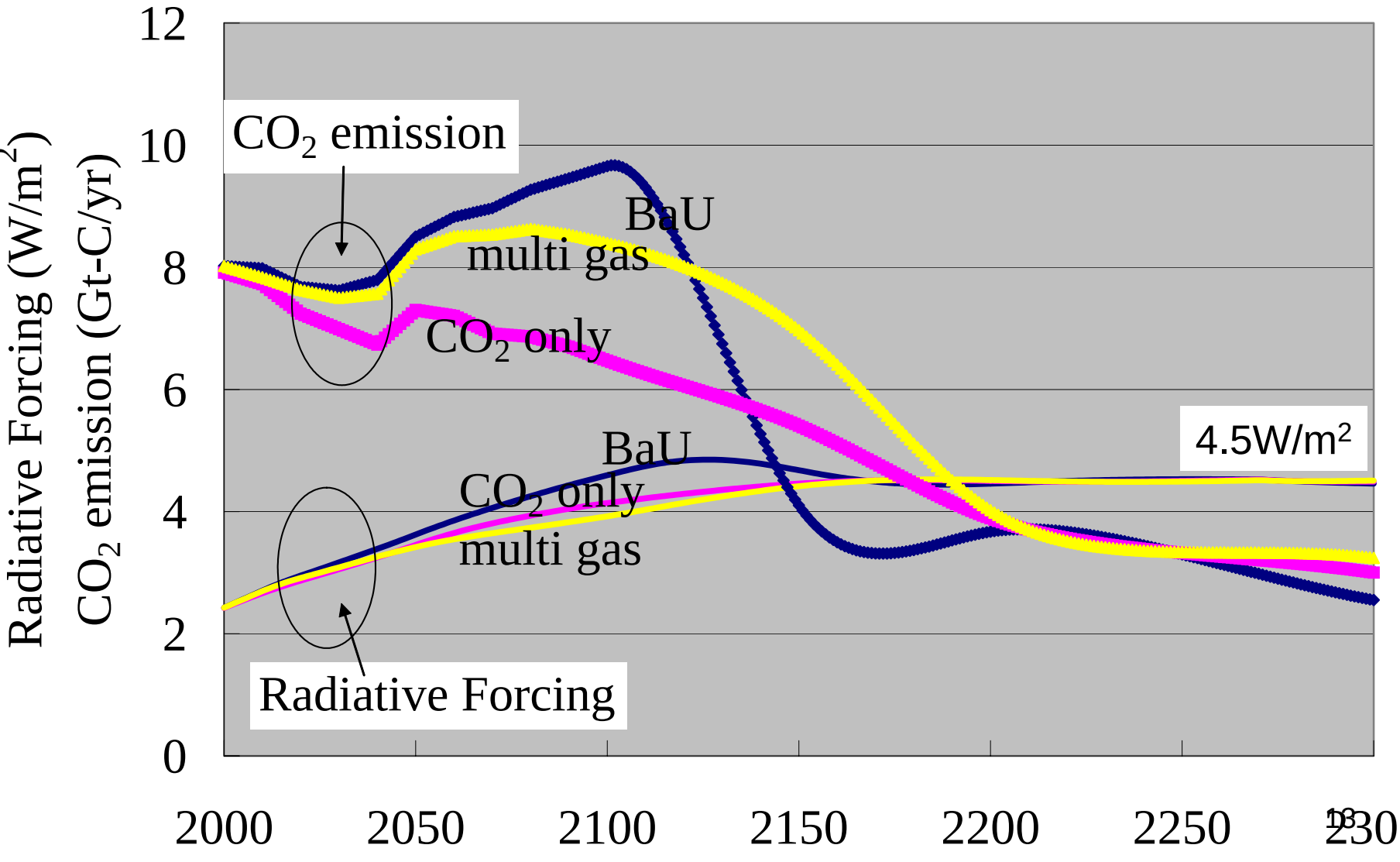
Anthropogenic GHG emissions



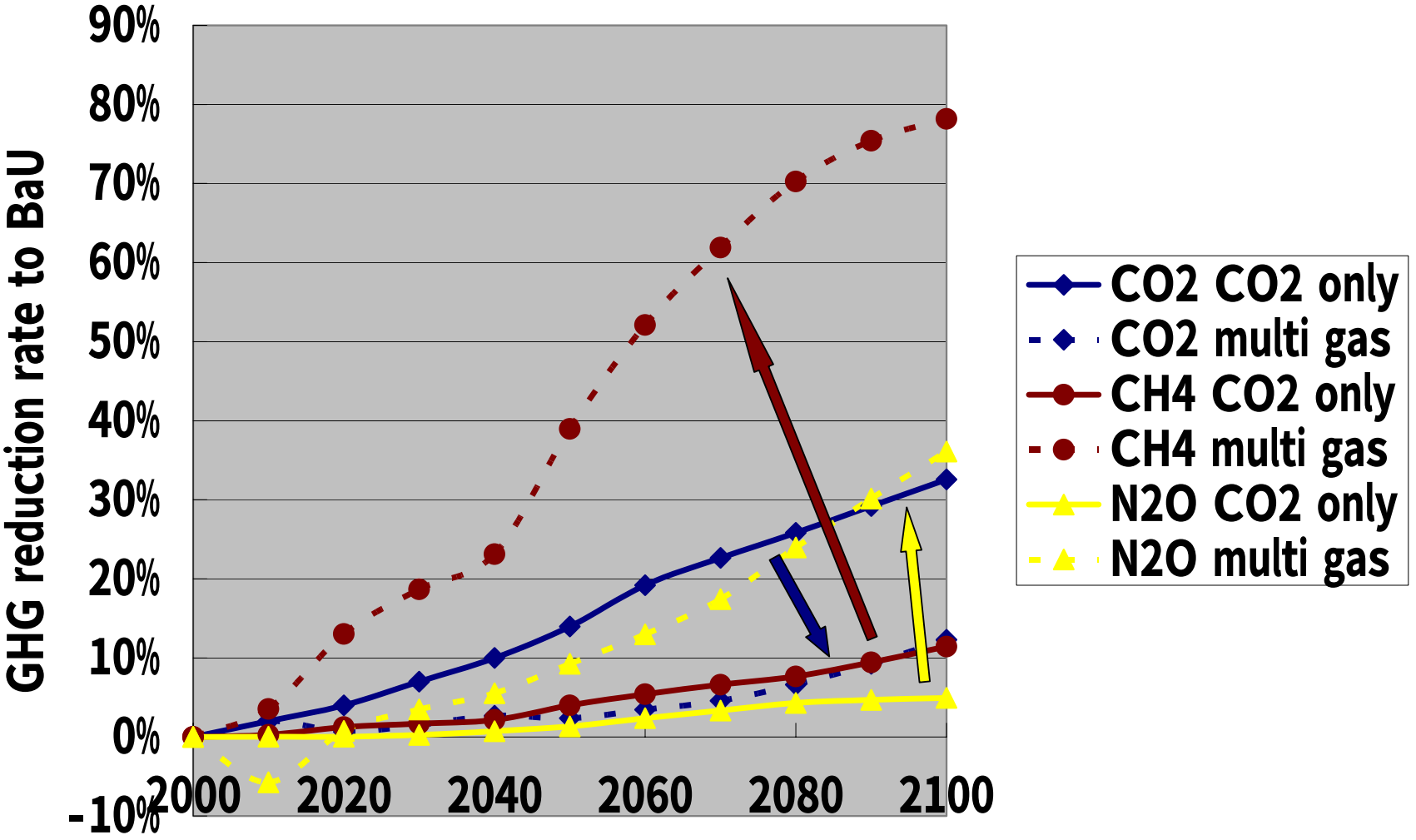




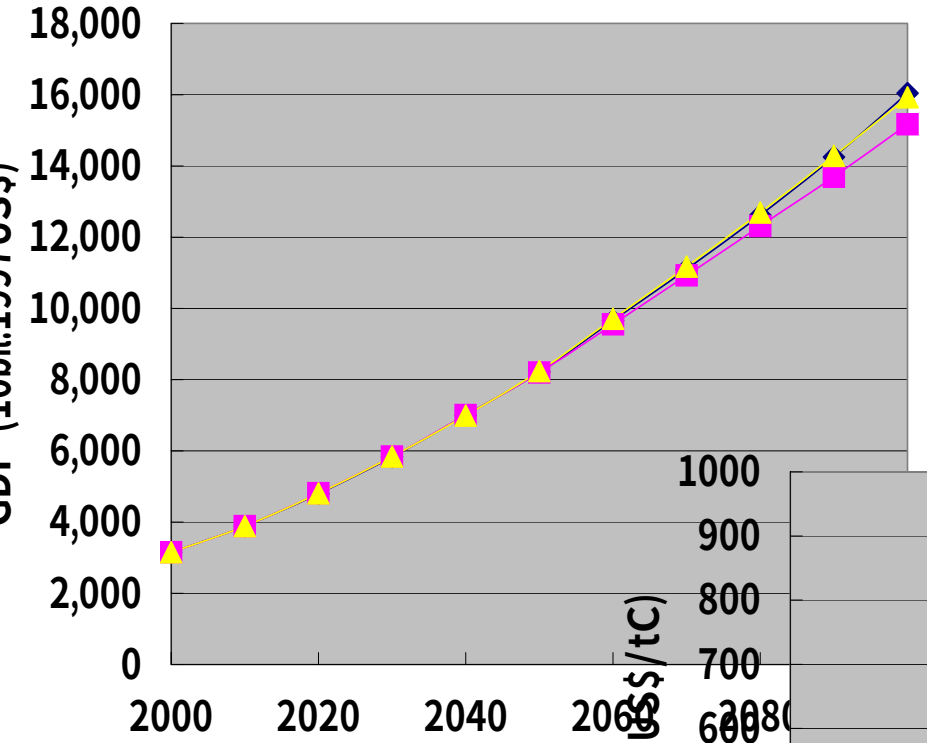
Radiative forcing and future CO_2 emission for stabilization

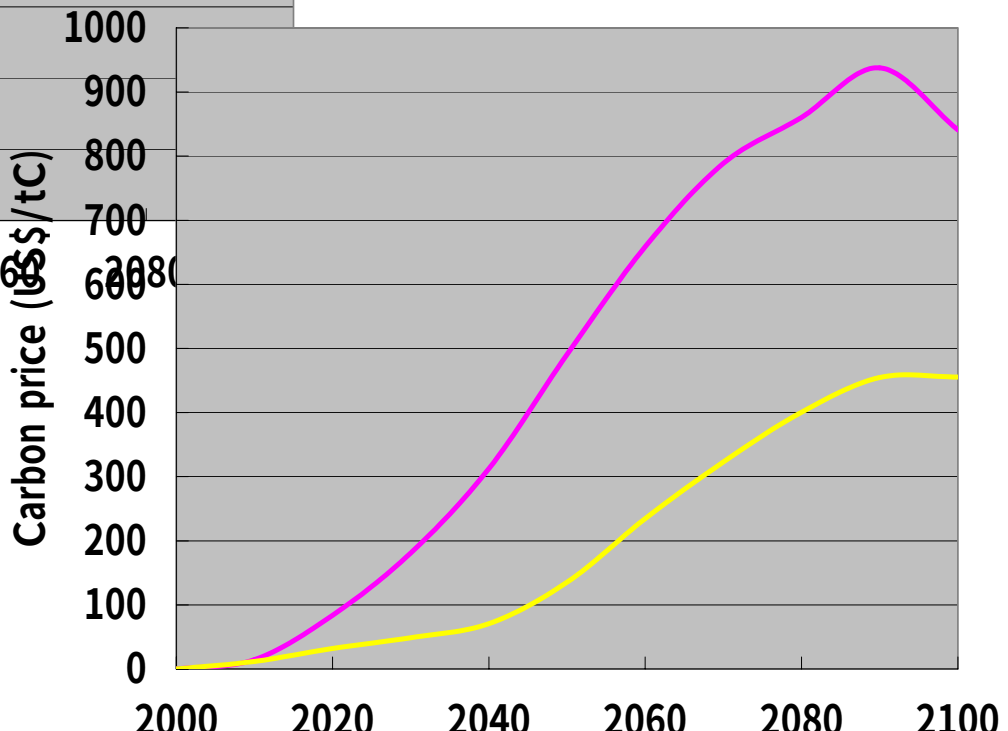


GHG reduction rate



Economic impact

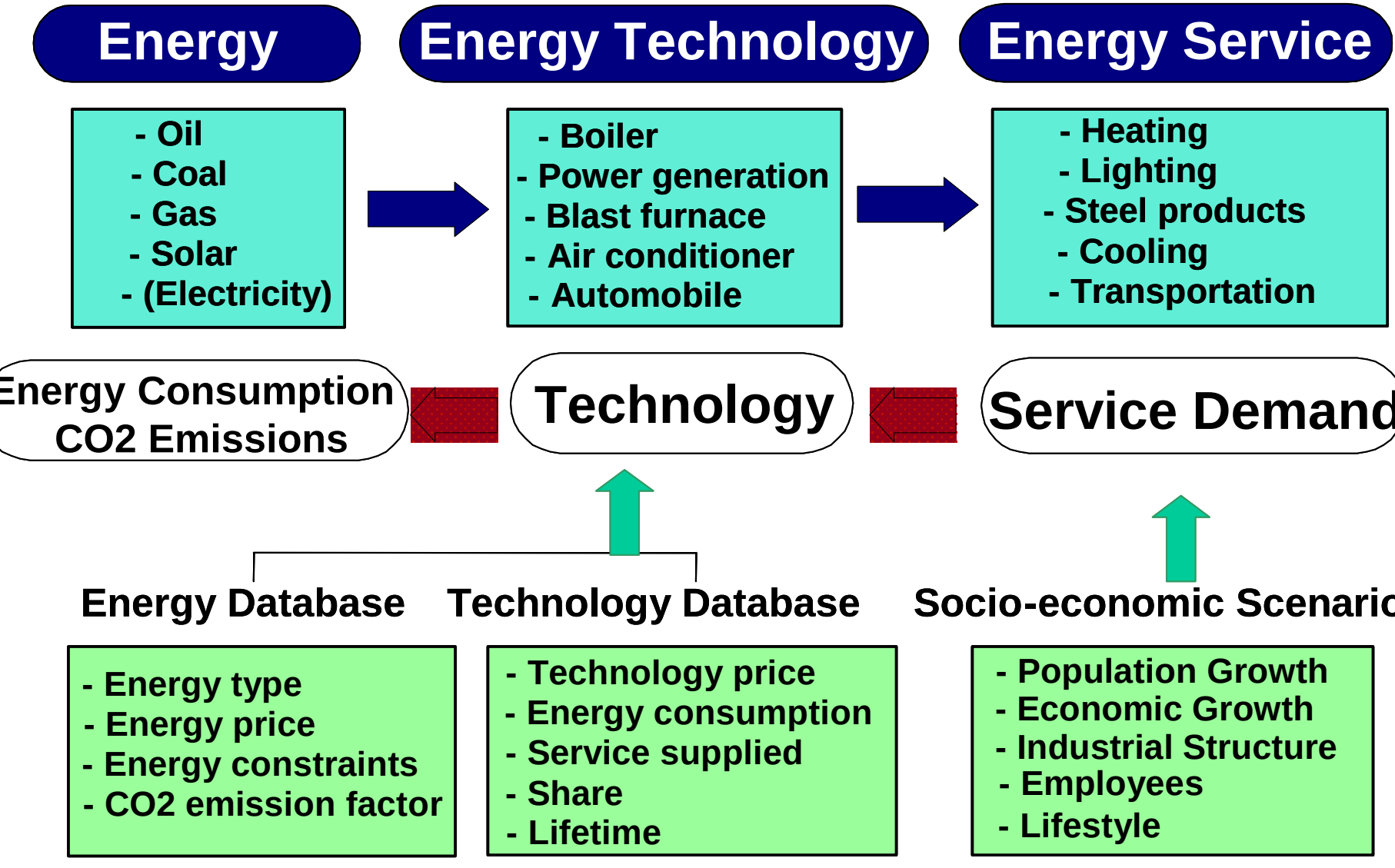




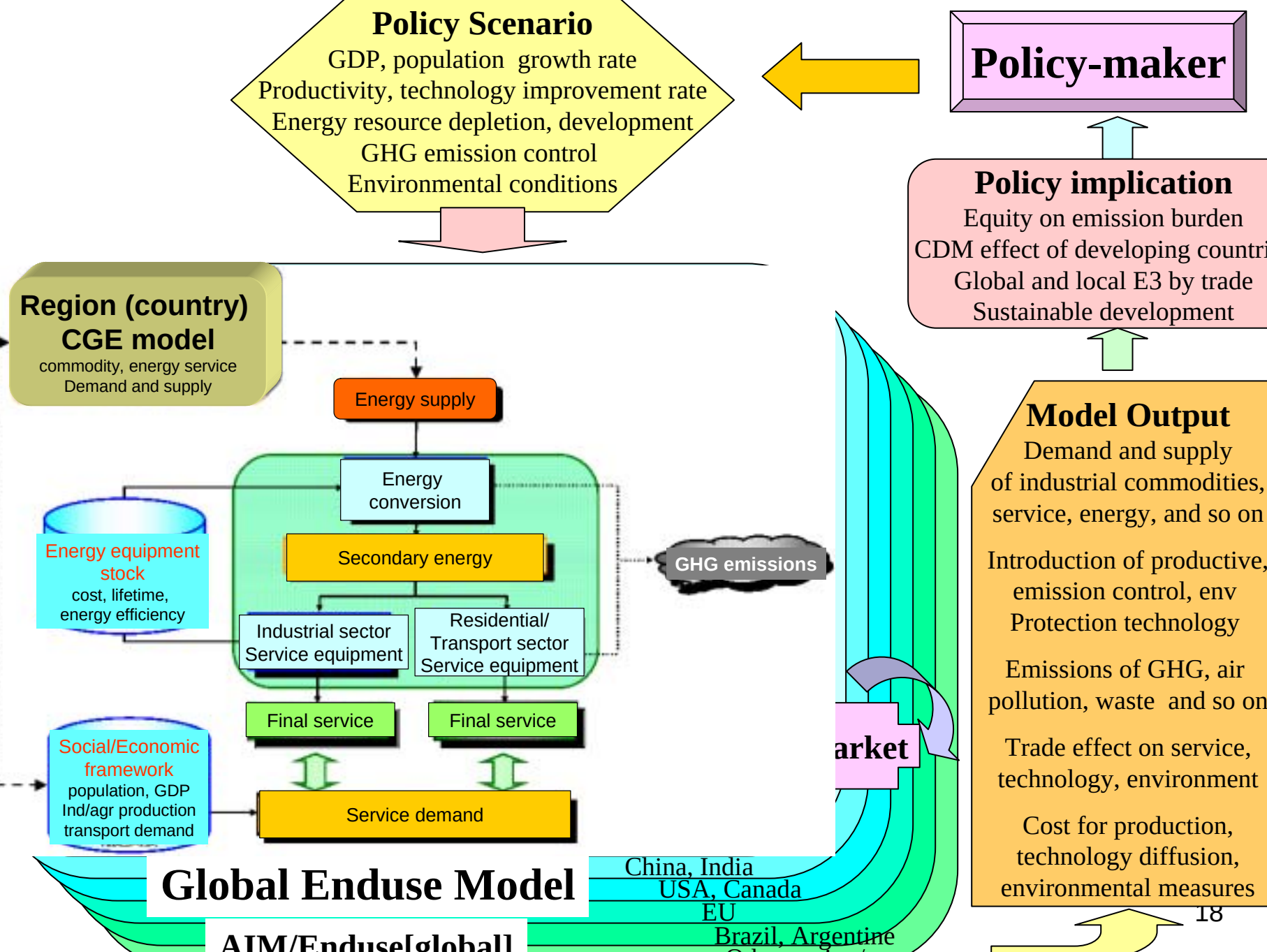
Bottom Up Modeling Approach for Non CO2 Gases: An Overview

Bottom Up analysis using the AIM/Enduse model

- AIM/Enduse models energy and materials through detailed representation of technologies
- Based on a linear optimization framework where system cost is minimized under several demand and supply constraints
- The model is being structured to include Non CO2 gas emission sectors and linking to removal processes



Framework of the AIM/Enduse Model


Policy Scenario
GDP, population growth rate
Productivity, technology improvement rate
Energy resource depletion, development
GHG emission control
Environmental conditions
Policy-maker
Policy implication
Equity on emission burden
CDM effect of developing countri
Global and local E3 by trade
Sustainable development
Model Output
Demand and supply
of industrial commodities,
service, energy, and so on
Introduction of productive,
emission control, env
Protection technology
Emissions of GHG, air
pollution, waste and so on
Trade effect on service,
technology, environment
Cost for production,
technology diffusion,
environmental measures
Region (country)
CGE model
commodity, energy service
Demand and supply
Energy supply
Energy
conversion
Secondary energy
Energy equipment
stock
cost, lifetime,
energy efficiency
Industrial sector
Service equipment
Residential/
Transport sector
Service equipment
GHG emissions
Final service
Final service
Social/Economic
framework
population, GDP
Ind/agr production
transport demand
Service demand
arket
Global Enduse Model
China, India
USA, Canada
EU
Brazil, Argentine
AIM/Enduse[global]

Key issues of non-CO2 gas abatement technology options

- **To evaluate ancillary benefit of non-CO2 gas abatement technology options**
  - Energy recovery from CH4 related technology options
  - Substitute fertilizer with organic one to reduce N2O and for energy saving
  - Energy saving with non-F refrigerator
- **How to diffuse agriculture related options**
  - Dispersed emission sources
  - Regional specific situation
  - Impact of global warming on agriculture sector
- **To evaluate CDM potentials**

Final remarks

- Develop global AIM/CGE model to evaluate multi-gas mitigation options for stabilization scenarios and estimate economic impact w/wo non-CO2 gas mitigation options.

- We are now building up technology bottom-up model to evaluate the possibility of multi-gas mitigation options and potential of CDM.

- Soft linkage between economy top-down model and technology bottom-up model will be examined.