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GHG reductions potentials and mitigation costs in world regions

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Development of Enduse[Global] presentaiton outline

1. Overview of Global Enduse model
2. Issues & Progress
3. Results in world regions by using the Enduse[Global] Database

GHG mitigation potentials and estimate marginal abatement costs in world regions.

- Comparison of region-wise & sector-wise reduction potentials and reduction costs

Overview of Enduse[Global]

Type : Regional Bottom-up optimization model with detail technology selection framework

Components:

Regional energy enduse module coupled with

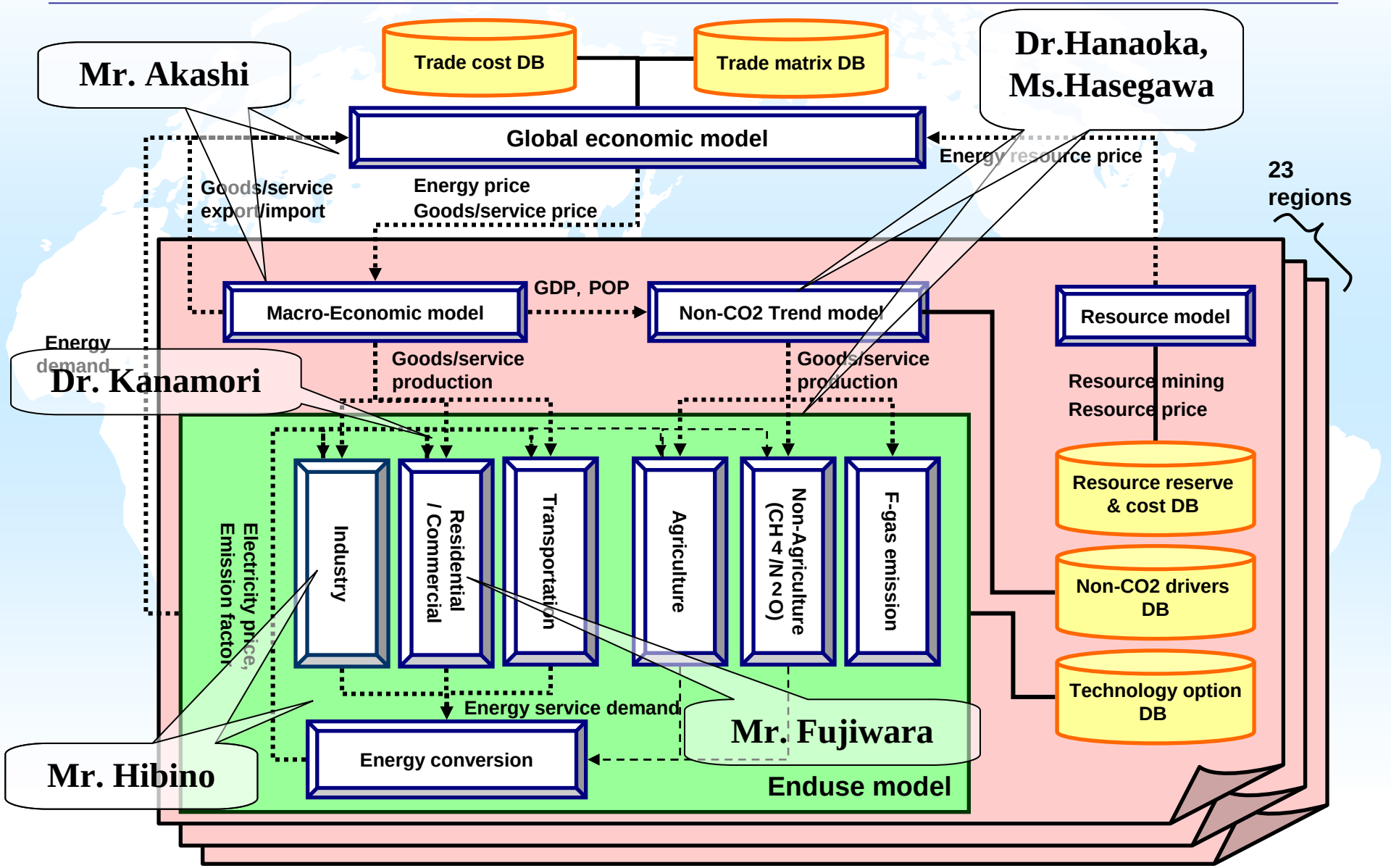
- Regional energy resource module
- International energy, basic materials balance module
- Regional macro-economy and energy service demand module

- **Target Regions : 23 geographical world regions**
- **Time Horizon : 2000 – 2050**
- **Target Gas : CO2, CH4, N2O, HFCs, PFCs, SF6**

  (expansion of GHGs to BC, OC, SO2, NOx, NMVOC, NH3, etc)
- **Target Sectors : multiple sectors**

  (Power generation / Industry / Residential / Commercial / Transport / Agriculture / F-gas emissions sector)

Overview of Enduse[Global]



Progress and Issues

- Overall
  - Updated data of driving forces and used the latest international statistical data.
  - Developed database of technology options
- Progresses and developments
  - Expanded target service: Cement service in industry sector (preliminary done)
  - Developed global economic model (Trade Balance Module of Energy, Materials and Food) and regional macro-economic model (Regional macro-economy and energy service demand module) and estimated steel production in 23 regions (preliminary done)
  - Developed global agriculture model (preliminary done)
  - Re-arranging (and adjusting) IEA Energy Balance in residential and commercial sector (On-going)
  - Considering the new approach how to estimate service demands in residential and commercial sector (On-going)
  - Expanding target GHGs such as BC, OC SO2 etc. (On-going)

  and so on
- Preliminary analysis
  - Estimated reduction potentials in 21 regions as the preliminary version

Results of reduction potentials by using the Enduse[Global] Database

- Target year : **2020**
- Discount rate:
  - **High discount rate case:**
    - **Industry, Transport, Residential & Commertial :33%/year**
    - **Power generation: 10%/year**
    - **Agriculture, MSW, Fgas: 5%/year**
  - **Low discount rate case: 5%/year**
- Definition of reduction potential

Reduction amounts are estimated by comparing the level of standard technologies diffused in the base year with the introduction of new mitigation technologies in the target year, target region and target sector.

Geographical coverage

Focusing on major GHG emission regions, especially Again regions in detail

Region	Code	Annex[1)]
1) Japan	JPN	A Ⅰ
2) China	CHN	NA Ⅰ
3) India	IND	NA Ⅰ
4) Indonesia	IDN	NA Ⅰ
5) Korea	KOR	NA Ⅰ
6) Thailand	THA	NA Ⅰ
7) Other South-east Asia	XSE	NA Ⅰ
8) Other South Asia	XSA	NA Ⅰ
9) Middle East	XME	NA Ⅰ
10) Australia	AUS	A Ⅰ
11) New Zealand	NZL	A Ⅰ
12) Canada	CAN	A Ⅰ
13) USA	USA	A Ⅰ

Region	Code	Annex[1)]
12) Canada	CAN	A Ⅰ
13) USA	USA	A Ⅰ
14) EU-15 in Western Europe	XE15	A Ⅰ
15) EU-10 in Eastern Europe	XE10	A Ⅰ
16) Russia	RUS	A Ⅰ
17) Argentine	ARG	NA Ⅰ
18) Brazil	BRZ	NA Ⅰ
19) Mexico	MEX	NA Ⅰ
20) Other Latin America	XLM	NA Ⅰ
21) South Africa	SAF	NA Ⅰ
22) Other Africa	XAF	NA Ⅰ
23) Rest of the World	XRW	NA Ⅰ

Note1) A Ⅰ = Annex Ⅰ nations, NA Ⅰ = non-Annex Ⅰ nations

Target gas and sectors

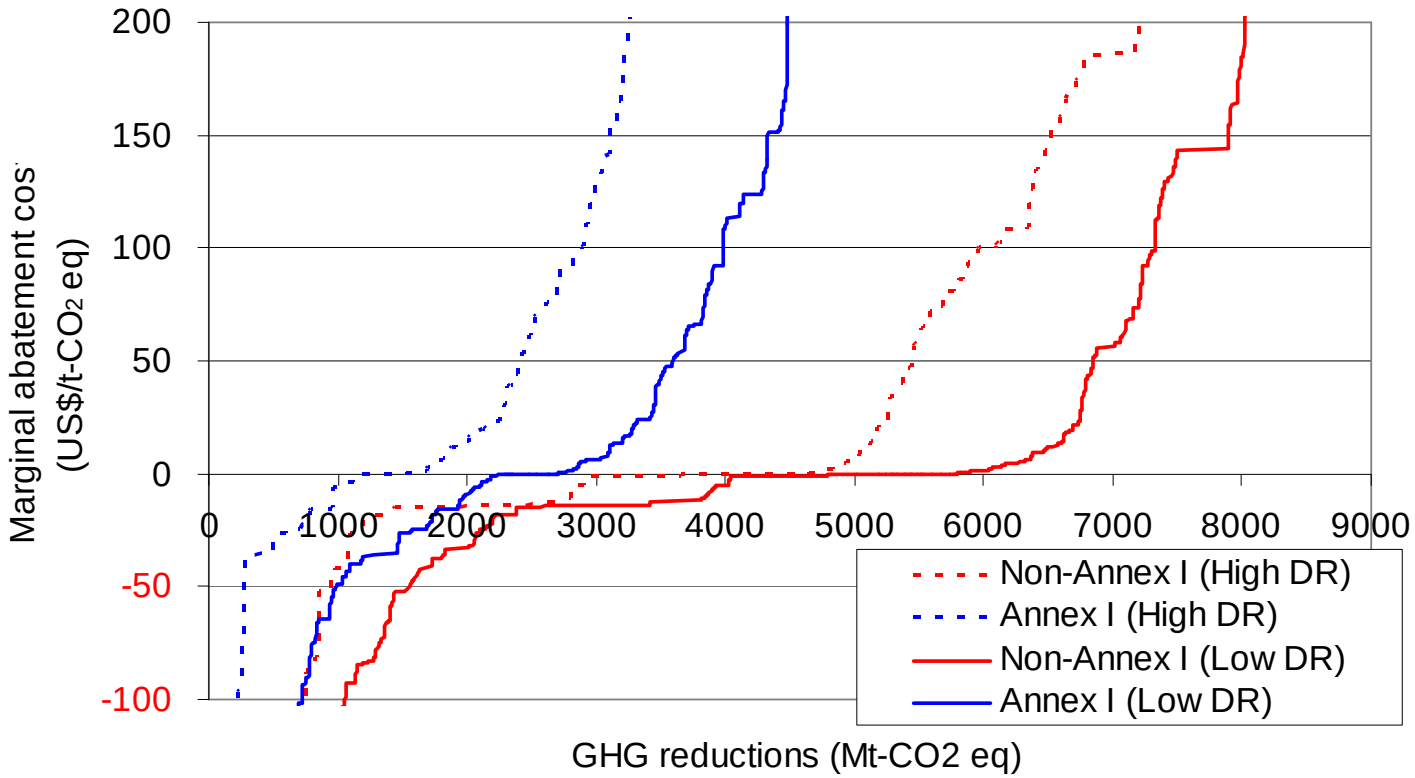
GHG	Sector	Services
CO_2	Power generation	Coal power plant, Oil power plant, Gas power plant, other powers generation (wind, biomass, PV)
	Industry	Iron and steel, Cement
		Other industries（Boiler, motor etc）
	Transportation	Passenger vehicle, truck, bus, ship, aircraft, passenger train, freight train (except for pipeline transport and international transport)
	Residential & Commercial	Cooling, heating, hot-water, cooking, lighting, refrigerator, TV (only residential)
CH_4 N_2O	Agriculture	livestock rumination, manure management, paddy field,
	MSW	Municipal solid waste
HFCPFC SF_6	Fgas emissions	By-product of HCFC-22, refrigerant, aerosol, foams, solvent, etching, aluminum production, magnesium production. Insulation gas, others.
CH_4	Fuel production	Coal production and transport, Natural gas production and transport

Assumption of future service demands

Sector	Activities	Data sources
	POP GDP	UN World Population Prospects (2006) SRES B2
Power generation	Electricity generation (GWh)	IEA Energy Balances (2007) IEA World Energy Outlook (2007)
Industry (Steel)	Crude steel production (Mt)	International Iron and Steel Institute (2002), The Institute of Energy Economics (2007) U.S. DOE SAGE (2003) and so on
Transportation	Transport volume (vehicle/km, ton/km)	IEA Energy Balance (2007), U.S. DOE SAGE (2003) , Several Japan and international statistics, WBCSD (2004) and so on
Residential & commercial	Energy consumption (toe)	IEA Energy Balance (2007), U.S. DOE SAGE (2003) , World Development Indicators (2007), World Marketing Data and Statistics (2002),UN habitat (2007) and so on
Agriculture	Livestock (head), cultivation area (ha)	FAOSTAT (2005), The International Food Policy Research Institute (2002), Food and Agriculture Organization (2002) and so on
Fgas	Consumption	UNEP (2002), AFEAR (2007), IPCC/TEAP (2005), WMO/UNEP(1999), several papers and so on

Global MAC curves
- Annex I and Non Annex I -

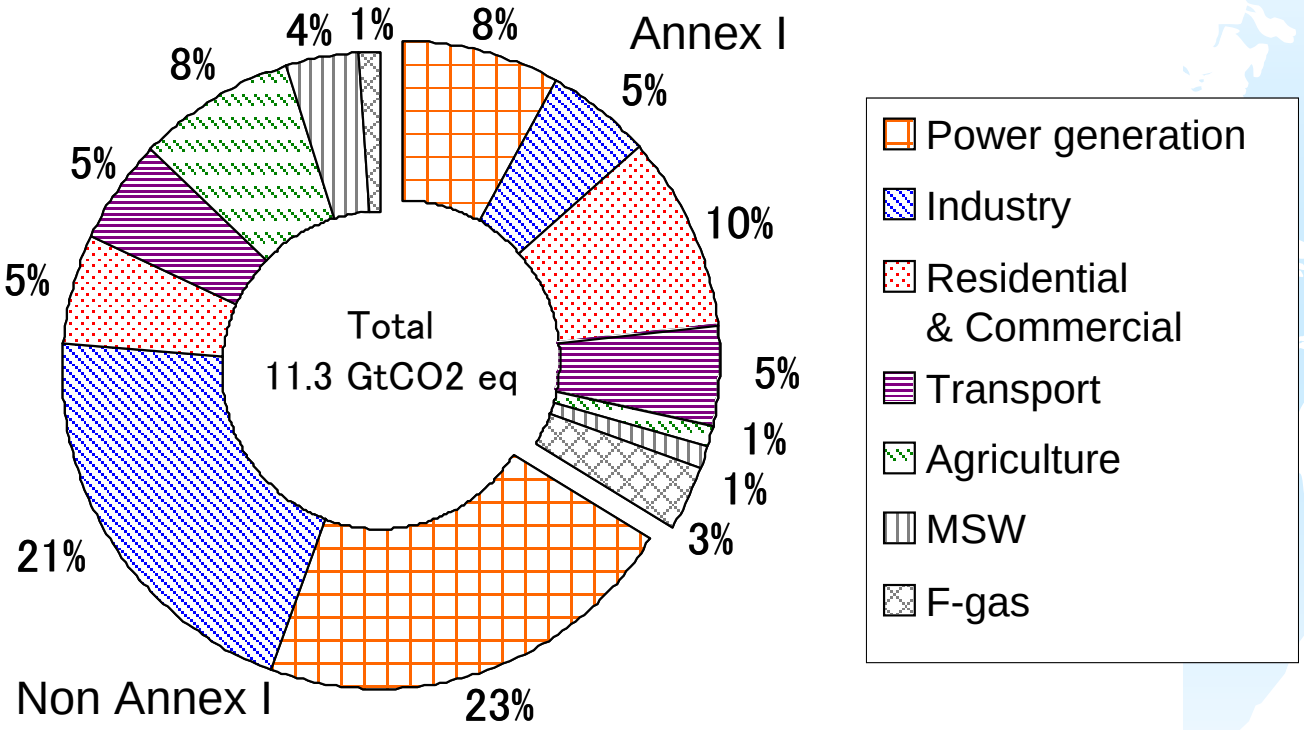
Comparison with LOW & HIGH discount rate case



- **Estimated mitigations are 8.7~11.3 GtCO2 eq in Global, 2.6~3.8 GtCO2 eq in Annex I and 6.0~7.5 GtCO2 eq in Non Annex I under the case of 100 US$/t-CO2 marginal abatement cost in 2020**

Sector-wise reduction potentials - Annex I and Non Annex I -

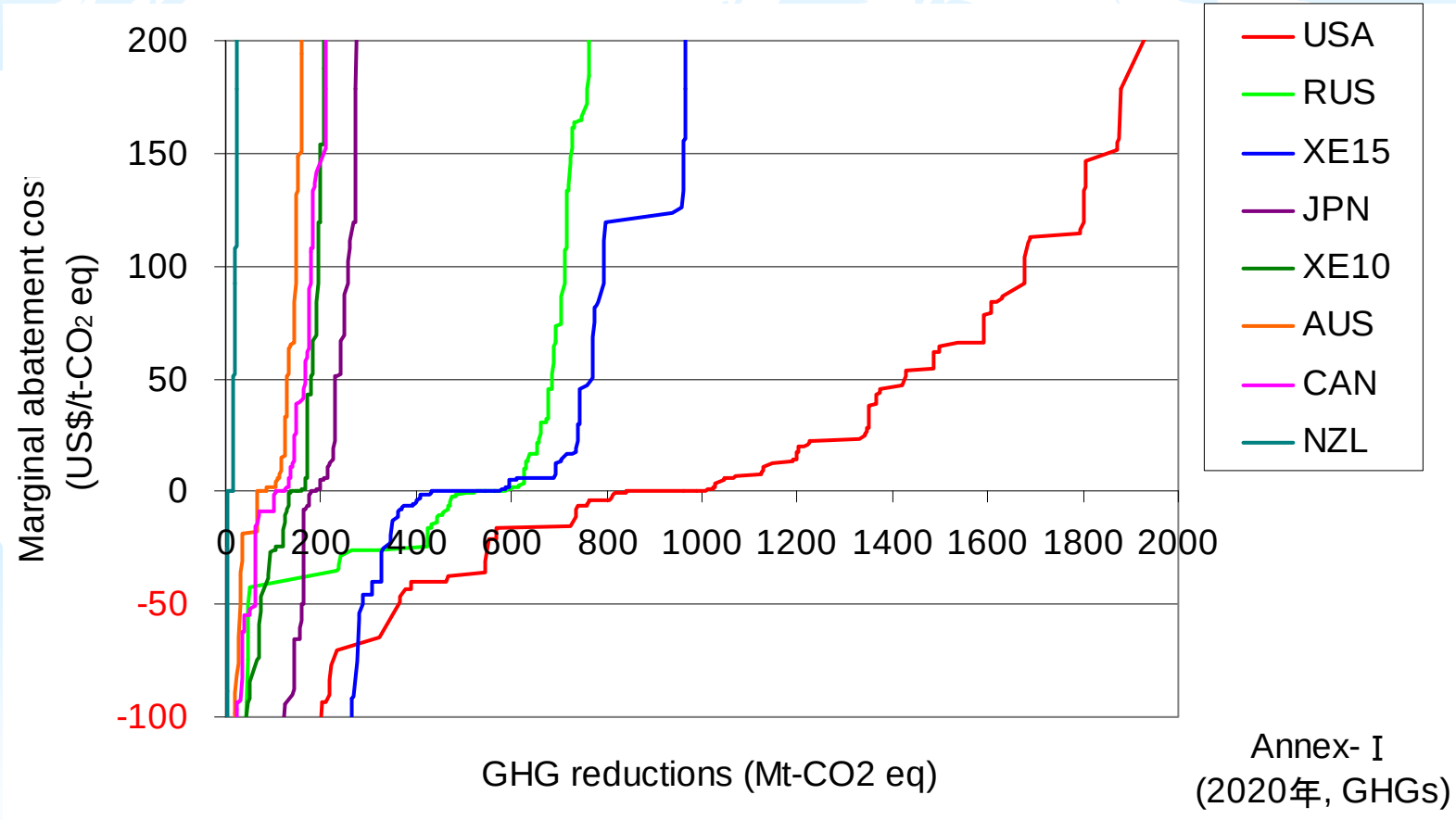
Low discount rate case（under 100US$/t-CO2)



- **large reduction potentials in power generation and industry sectors are evaluated due to the use of low energy-efficient technologies particularly in Non-Annex I in the current situation, and these sectors account for 56 % of world total reduction potentials.**

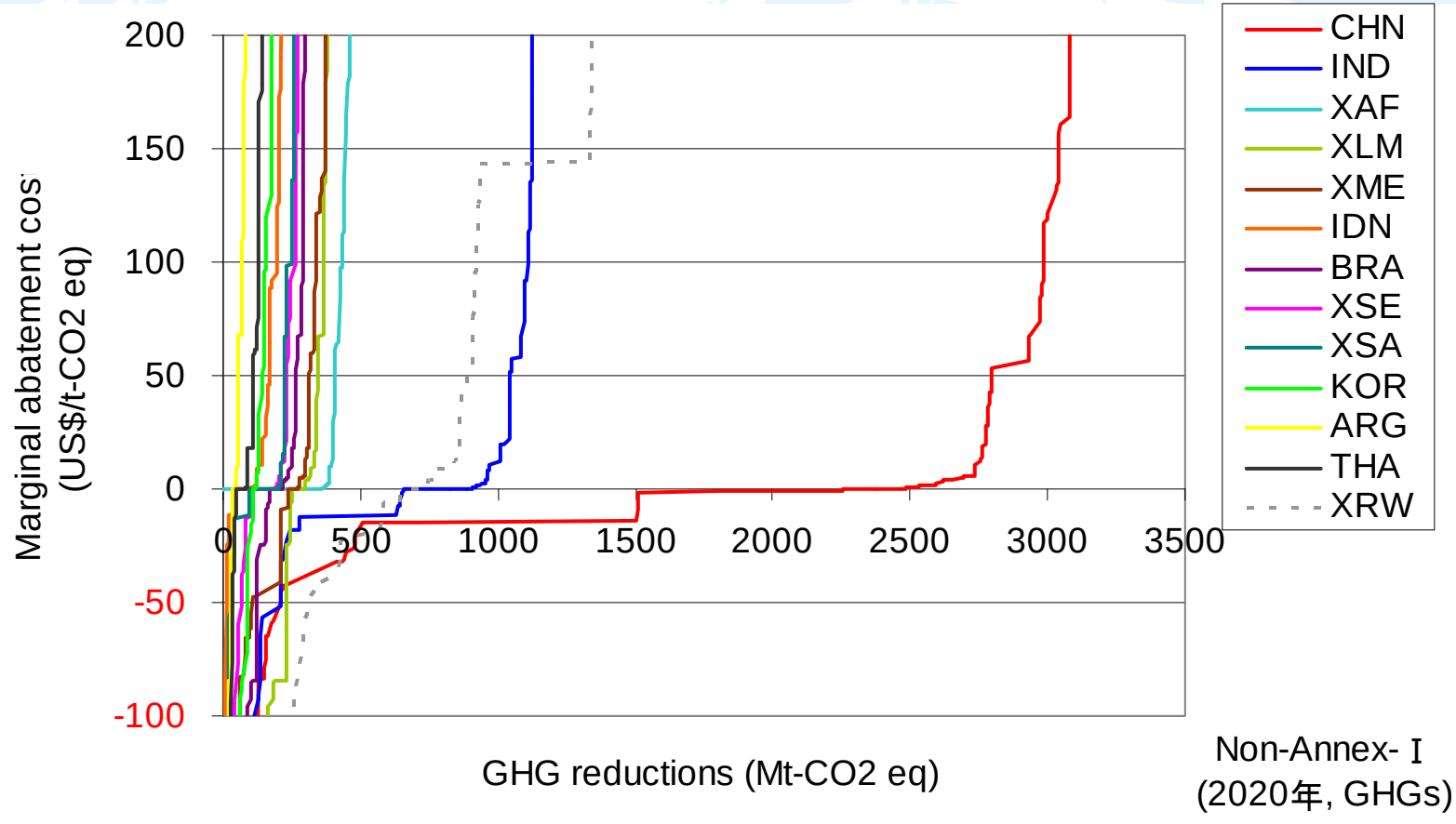
Regional MAC curves - Annex I nations -

Low discount rate case



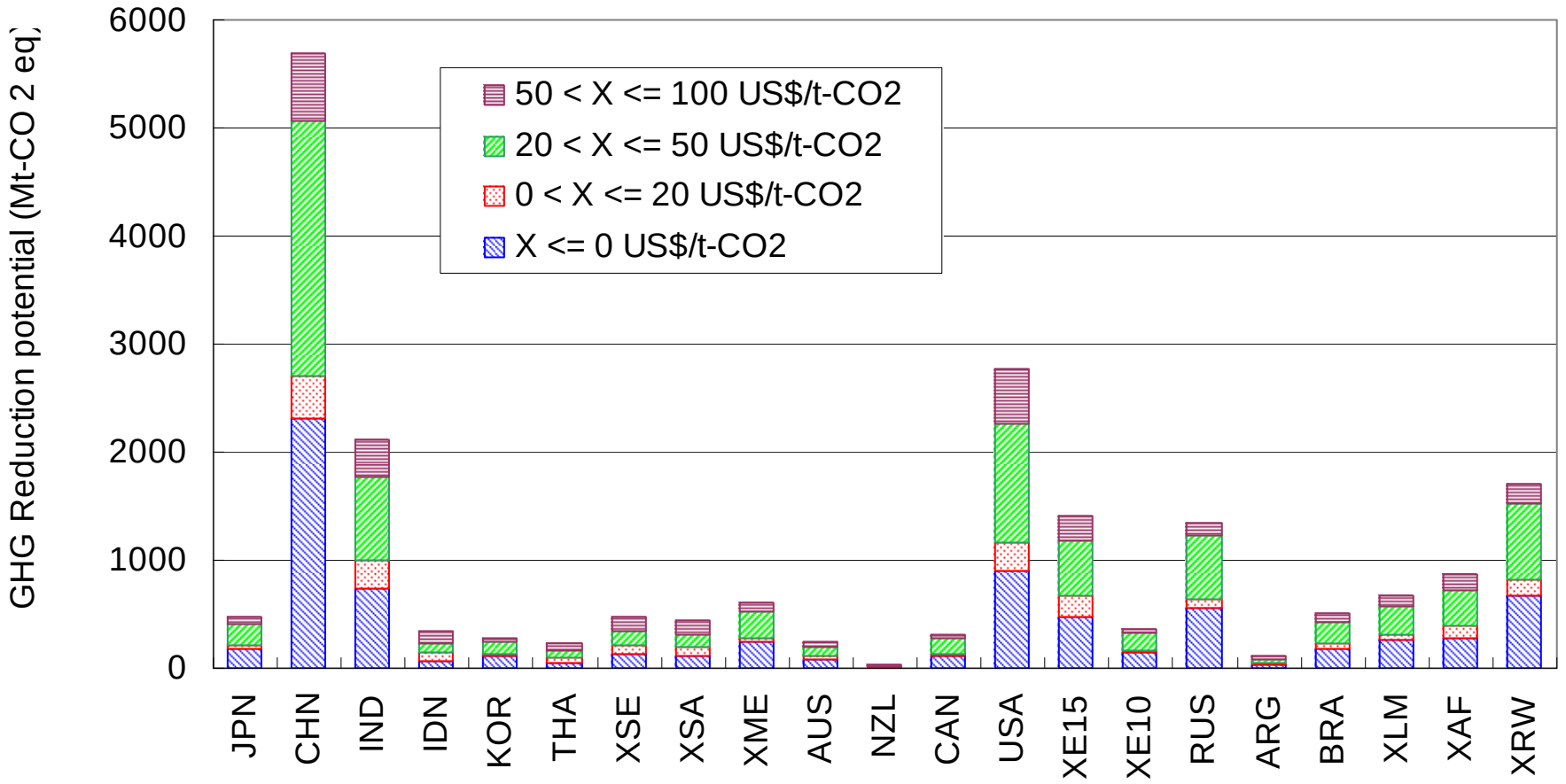
Regional MAC curves
- Non Annex I nations -

Low discount rate case



Region-wise reduction potentials

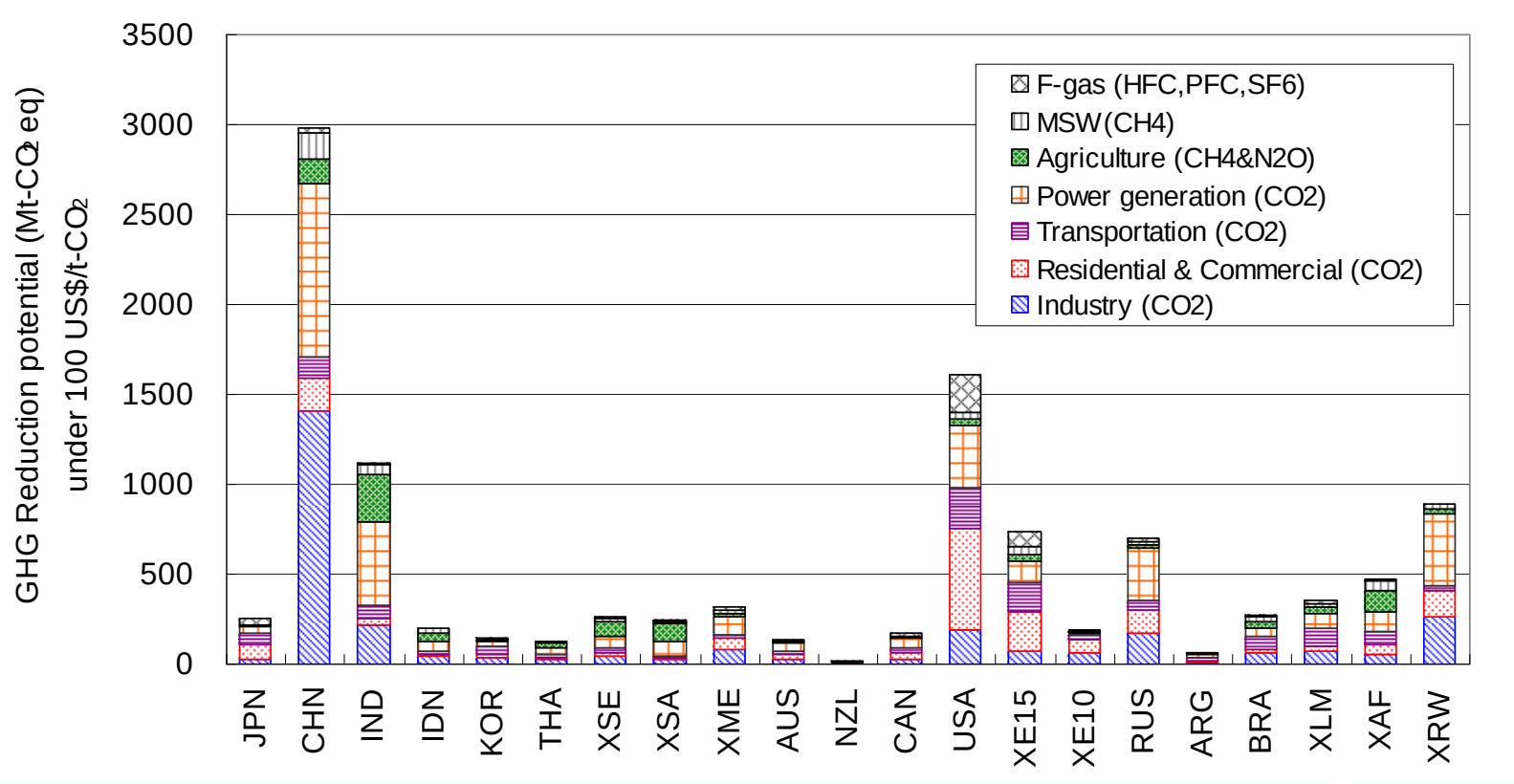
Low discount rate case（under 100US$/t-CO2)



- **China, US, India, Western Europe and Russia are major 5 regions where there are large reduction potentials, and it accounts for 63 % of total reduction potentials in the world. Top 10 regions account for about 80 % of total reduction potentials.**

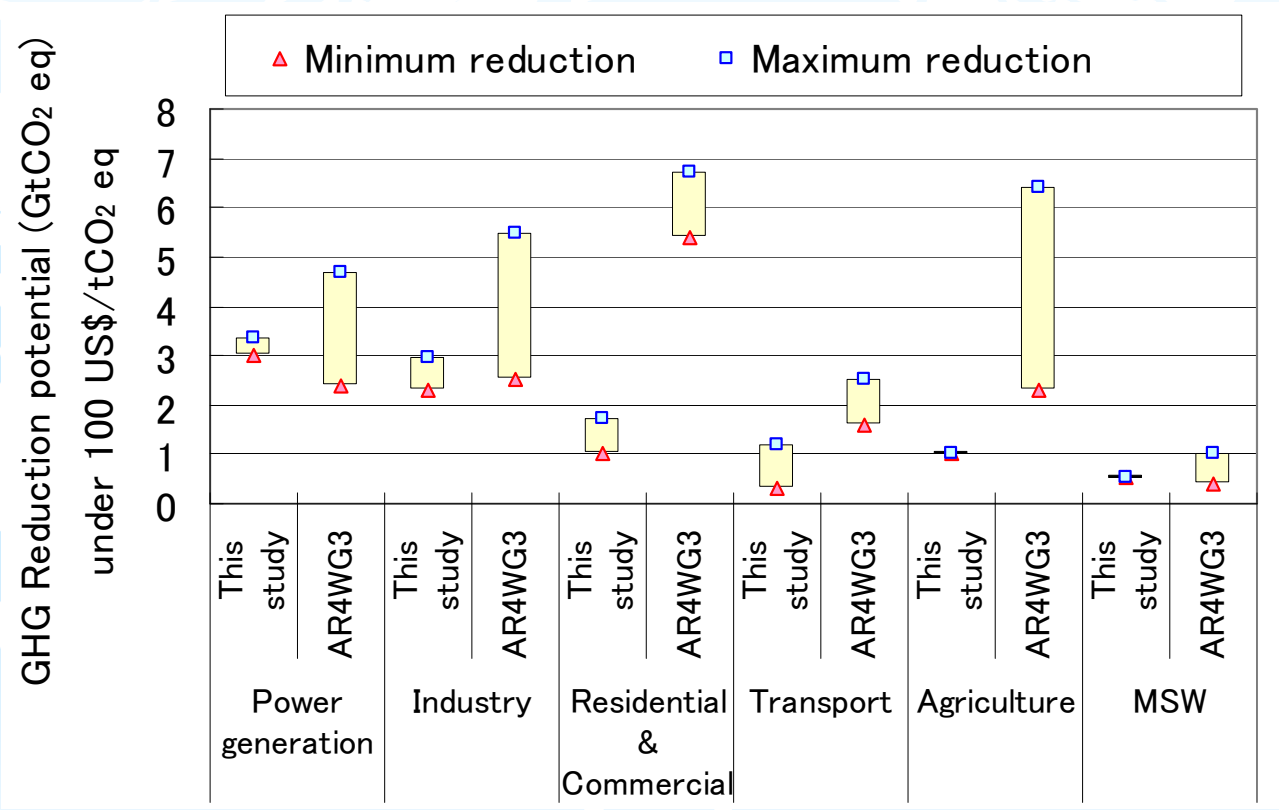
Sector & Region-wise reduction potentials under 100 US$/tCO2

Low discount rate case（under 100US$/t-CO2)



- **Major sectors which have large reduction potentials vary differently depending on the socio-economic characteristics in each region. There are much larger potentials of cost-effective measures in developing countries.**

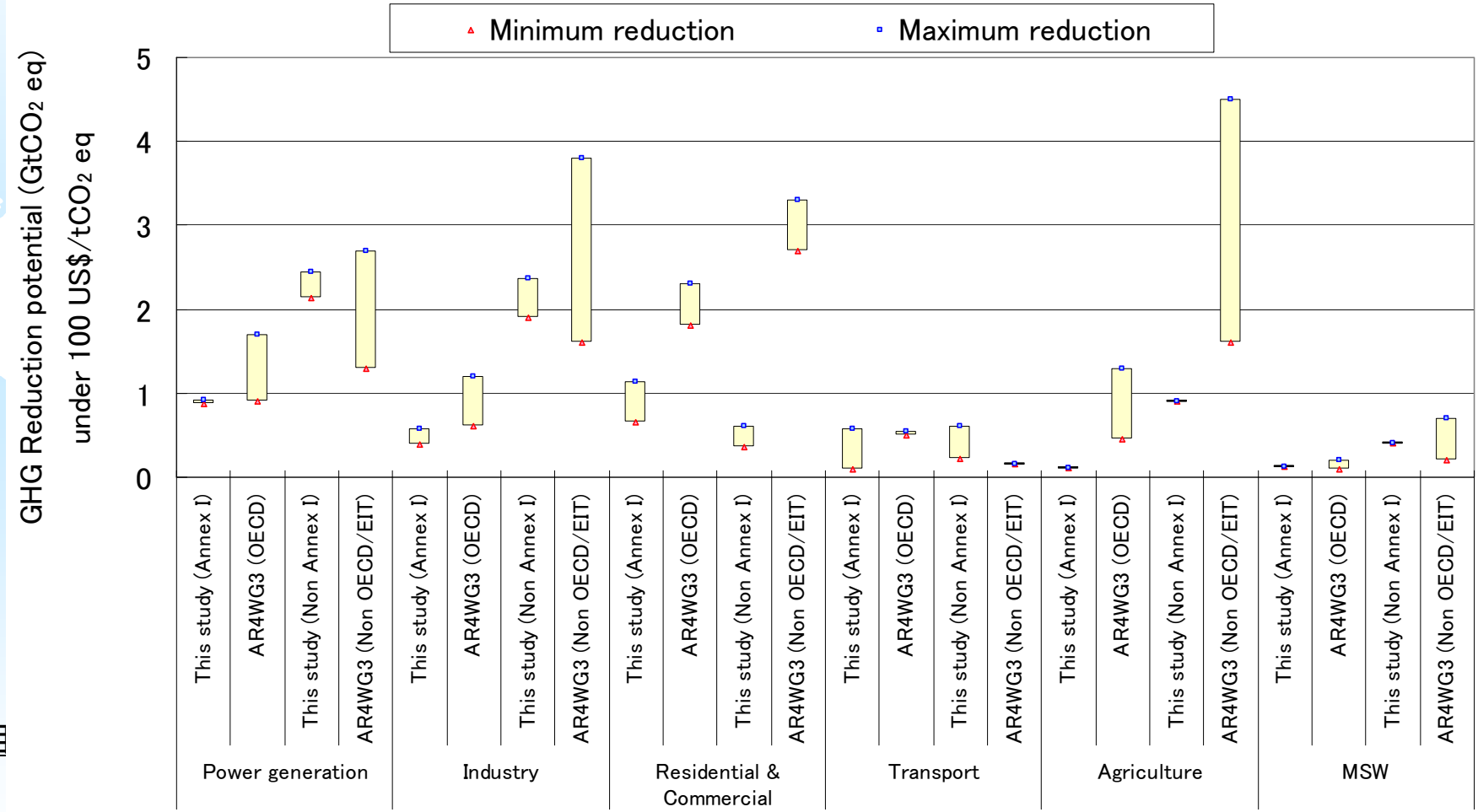
Comparison with the IPCC AR4



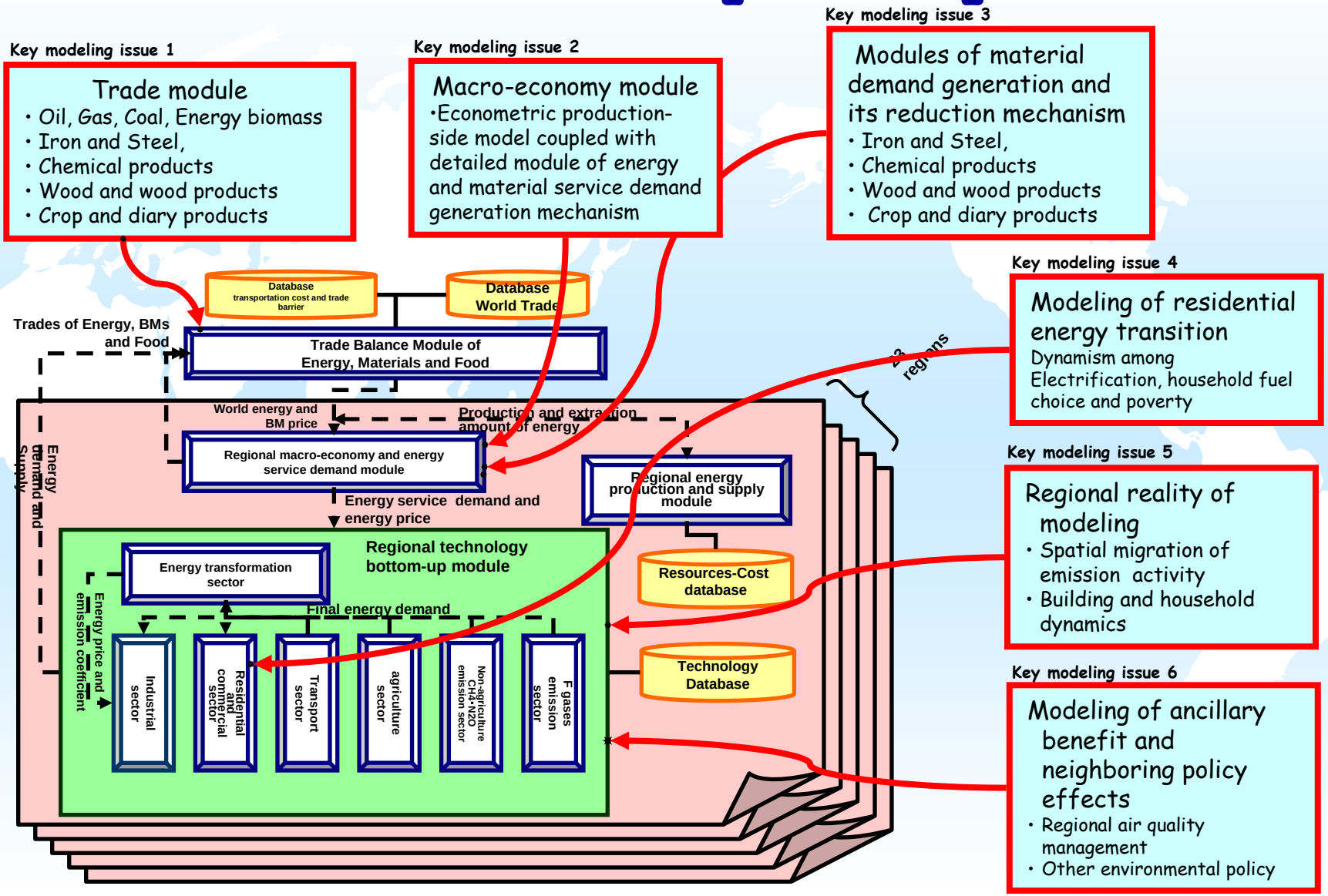
Note

- This study shows results in 2020, but results in IPCC AR4 are in 2030.
- Results in IPCC AR4 are based on SRES B2 and IEA World Energy Outlook(2004). The results of this study are based on SRES B2, UN mid estimation and IEA World Energy Outlook(2007).
- The amount of potentials in IPCC AR4 are larger than this study, not only because IPCC AR4 focuses on different year and so estimated activities' levels are different, but also because coverage of mitigation options are wider than this study.

Comparison with the IPCC AR4

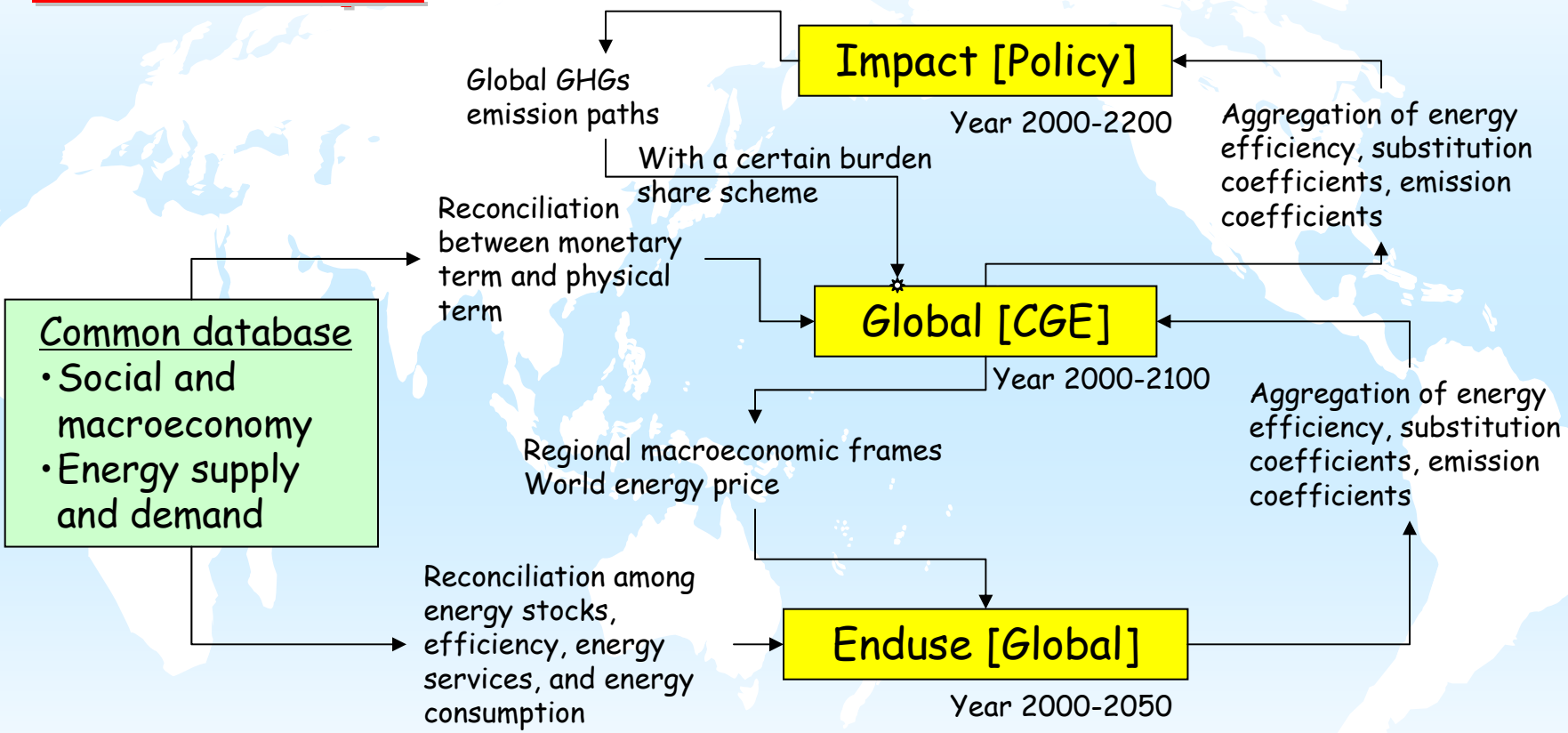


AIM/Enduse[Global]



Relation among three global models

Next Steps



All in soft linkage