The 16th AIM International Workshop
Climate Change Research Hall at NIES
19-21 February 2011

Development of AIM/Enduse and element models and application to global and national analyses in the mid-term transition scenarios

Tatsuya Hanaoka
Osamu Akashi, Yuko Kanamori, Tomoko Hasegawa,
Go Hibino, Kazuya Fujiwara, Yuko Motoki
Mikiko Kainuma and Yuzuru Matsuoka

National Institute for Environmental Studies
Kyoto University
Mizuho Information and Research Institute

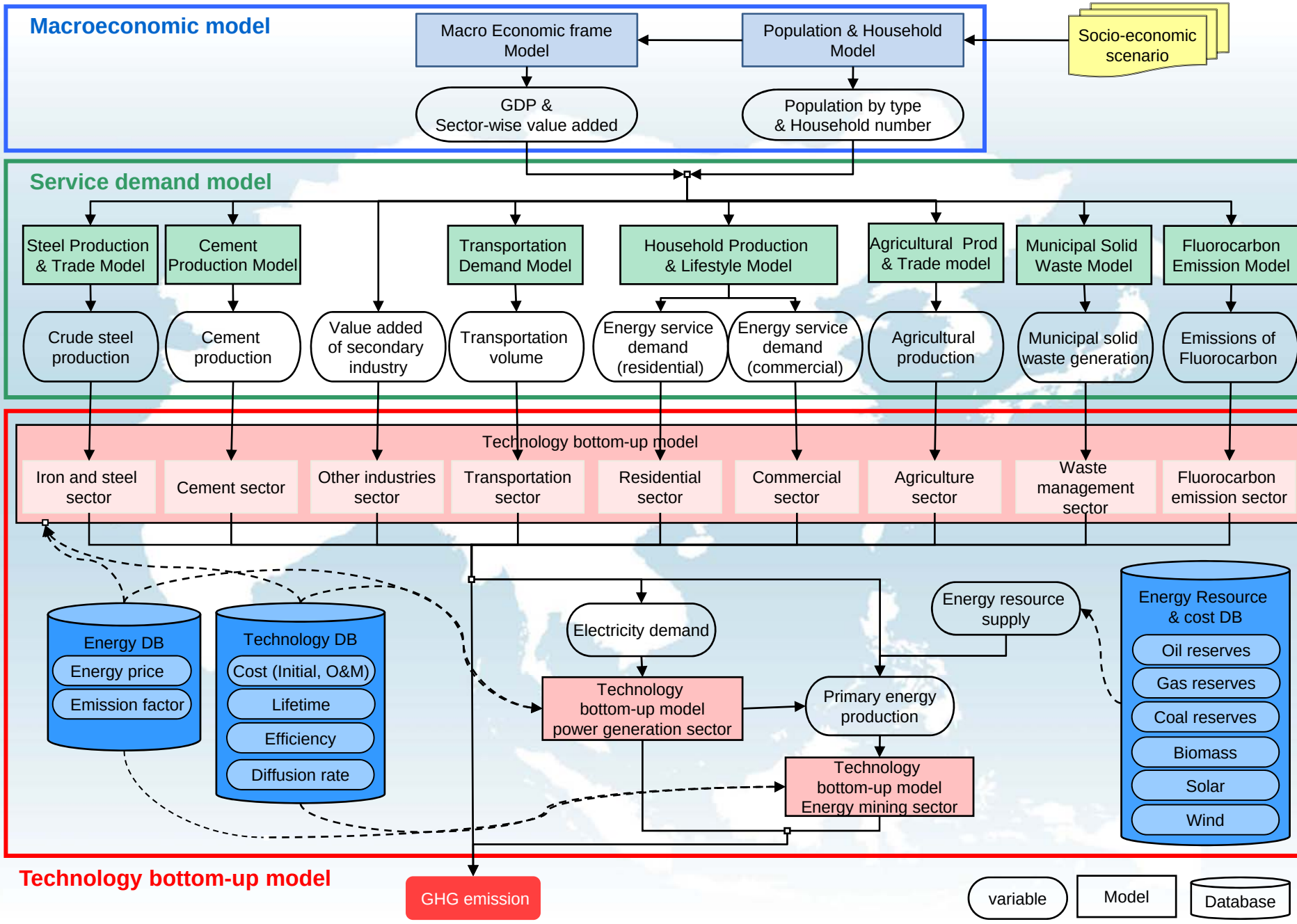
AIM
ASIA-PACIFIC INTEGRATED MODEL

NIES JAPAN

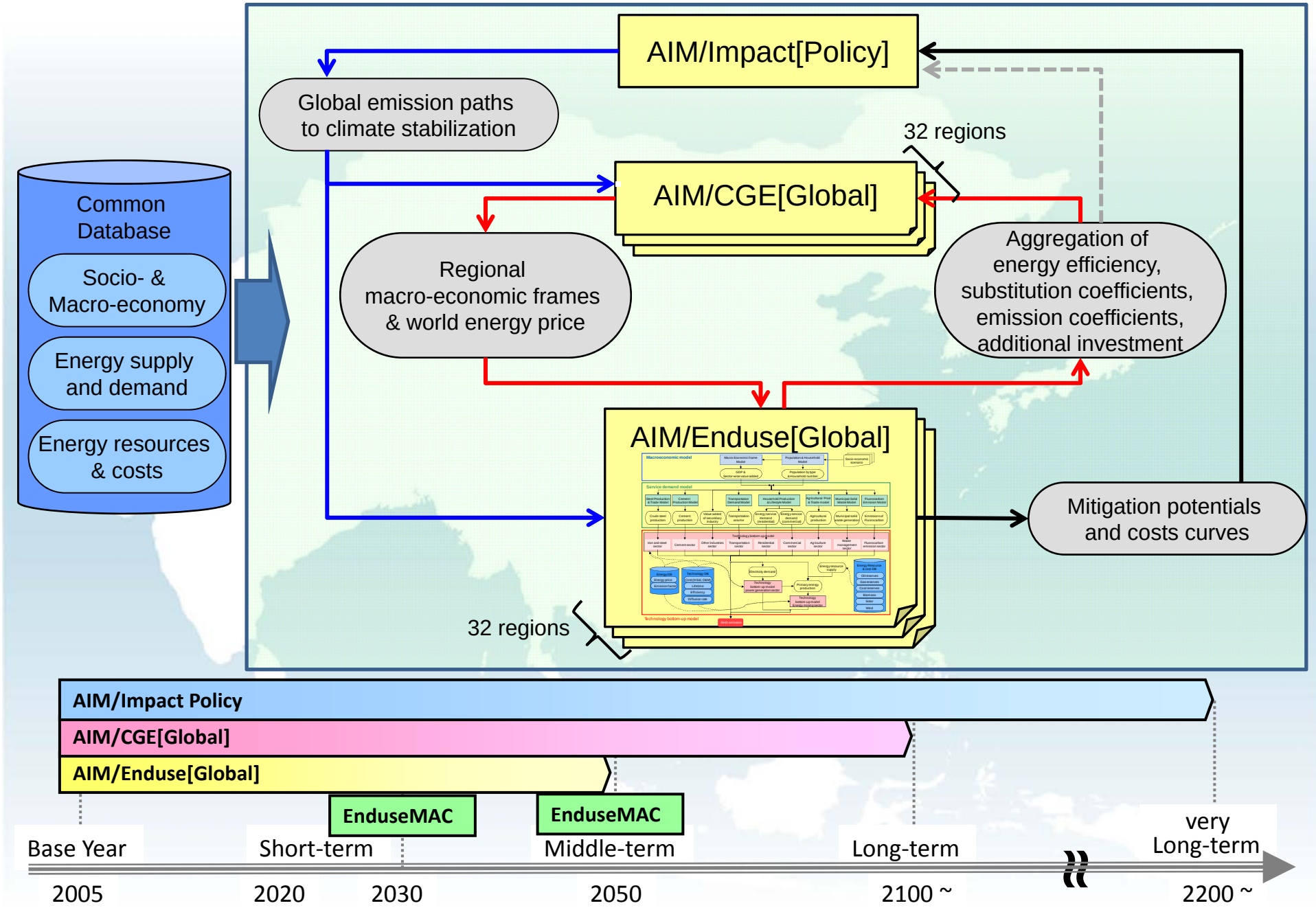
Outline of presentation

1. Overview of AIM/Enduse and element models
2. Progress & development
3. Outreach & results
4. Next steps

Overview of AIM/Enduse[Global] and element models



Relation among AIM/Enduse[Global] and other global models



Progress and developments

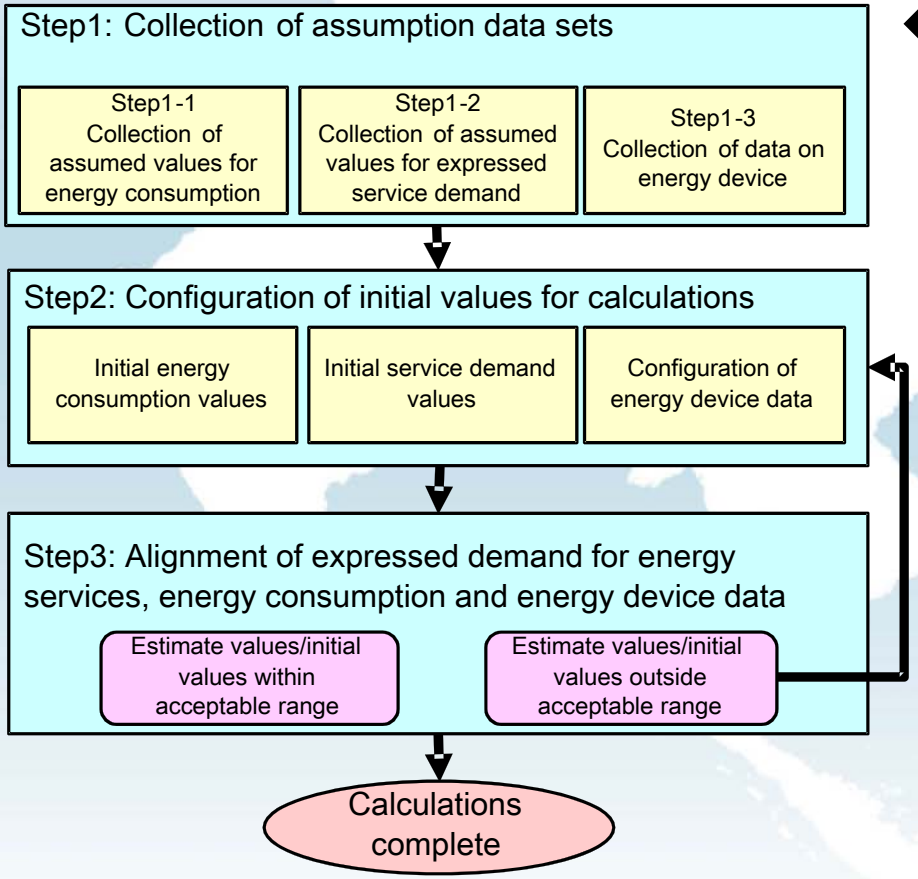
- Progresses and developments
  - Improving several functions in the AIM/Enduse and the AIM/EnduseMAC in order to analyze various types of scenarios more flexibly
  - Updating technology option database including not only realistic and currently existing technology but also future innovative technologies such as CCS, fuel cell in order to analyze the stringent GHG stabilization scenarios
  - Updating drivers data based on the latest international statistical data
  - Retrofitting service demand models
  - Extending analyses with time horizons of 2050
  - Re-arranging and adjusting IEA Energy Balance and developing the new approach how to estimate service demands in residential and commercial sector
  - Improving the database interface for the AIM/Enduse

  and so on.

- Application to global and national analyses
  - AME (Asia Modeling Exercise)
  - EMF24 (Energy Modeling Forum 24)
  - ADB (Asia Development Bank) project
  - Japan Roadmap toward a 25% reduction target by 2020.

Energy service estimation in the residential sector

Main objective is to understand the structure of energy consumption by service, by energy type and by region, in the residential sector which has complicated structures depending on socio-economic feature and lifestyle.



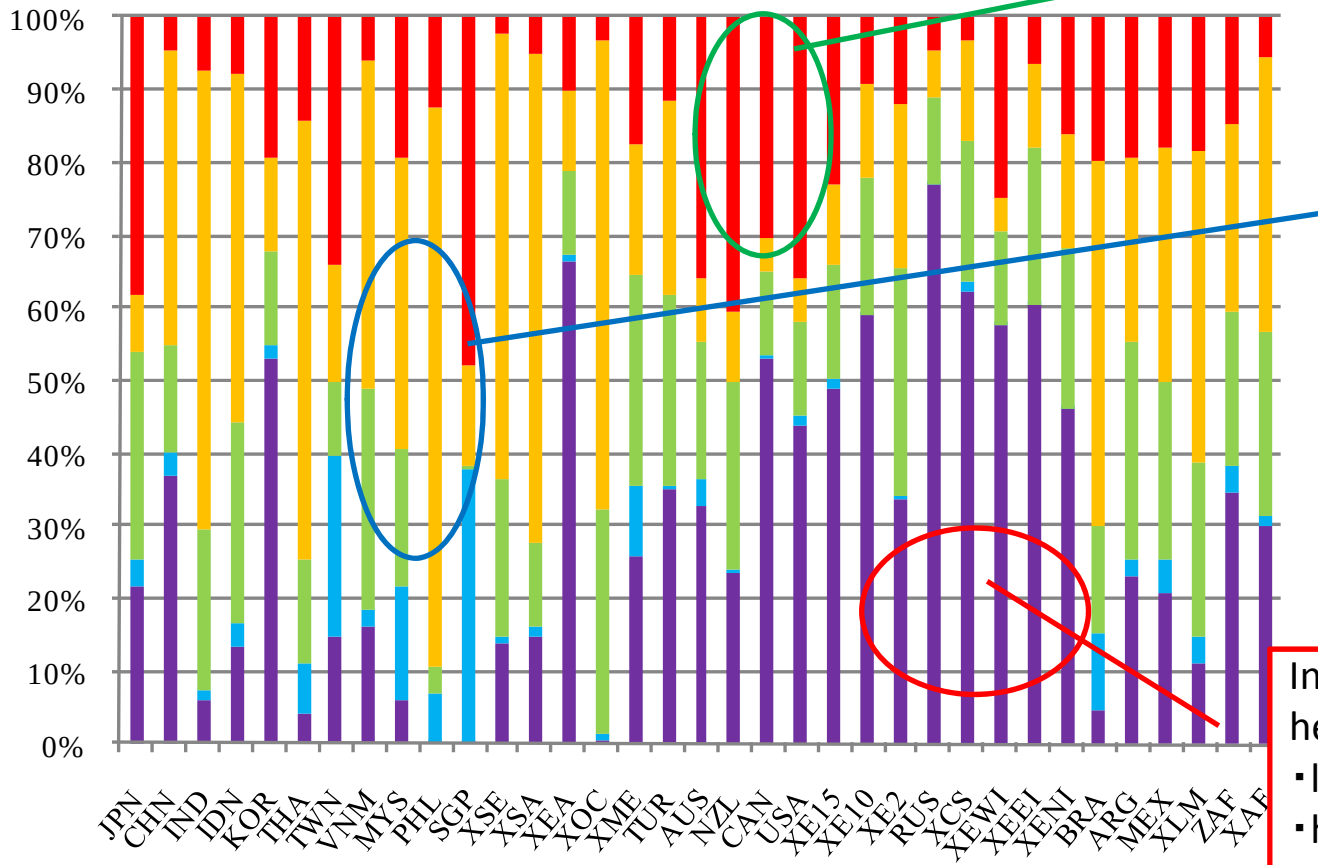
- Method:
  - Firstly, confirming the consistency between the variables relating to energy consumption, energy services demand and energy device data.
  - Then, taking the demand-and-supply balance of energy services

This method enables to figure out currently uncertain energy consumption and service, and to estimate detailed data on energy service by energy type, by service and by region.

By Dr. Kanamori

Energy consumption by energy service type

Energy consumption share by energy service type in 2005



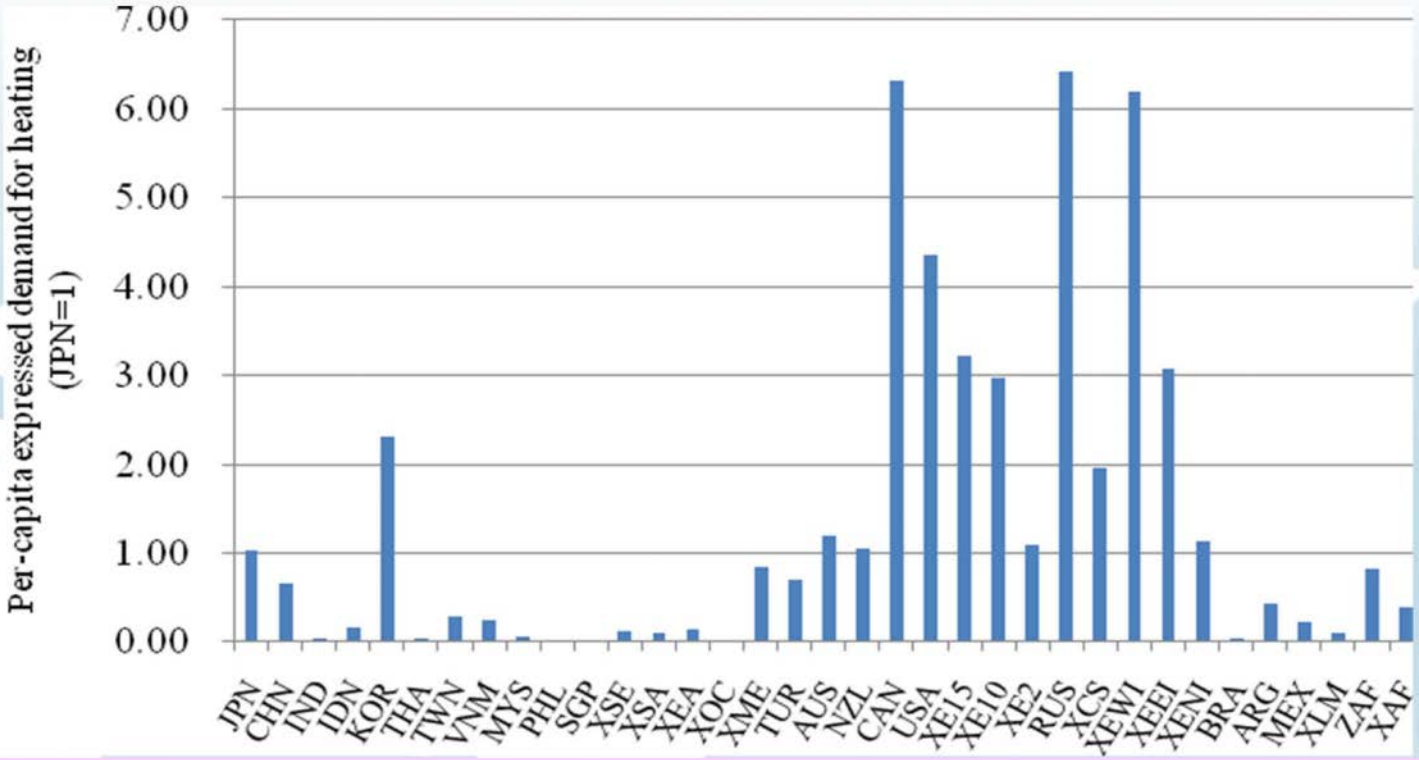
In the developed countries, around 20% to 35% of energy is consumed for other services.

- Cooking and hot water supply are essential services in any region
- Especially, in the developing countries, it accounts for about 80% of consumption.

In some countries, share of heating is large because of
- long heating period
- heating the entire building
- low energy efficient and high energy intensive devices instead of using efficient air conditioners

By Dr. Kanamori

Energy service demand per capita for heating



- Service demand for heating in 2005 vary widely from region to region. In Canada, Northern Europe and Russia where locate at higher latitudes, the per-capita demand for heating services is around six times larger than the use of Japan
- Heating demand in the US and EU is four times and three times as large as that of Japan, respectively. In South Korea, heating demand is nearly double than that of Japan.
- In Australia, New Zealand, Bulgaria, Romania, and the European regions at similar latitudes to Japan, the level of service demand for heating is similar to Japan.

By Dr. Kanamori

Application to global and national analyses

1. AME (Asia Modelling Exercise)
   based on the AIM/Enduse[Global]
2. EMF24 (Energy Modelling Forum 24)
   based on the AIM/Enduse[Global]

Time horizon of 2050

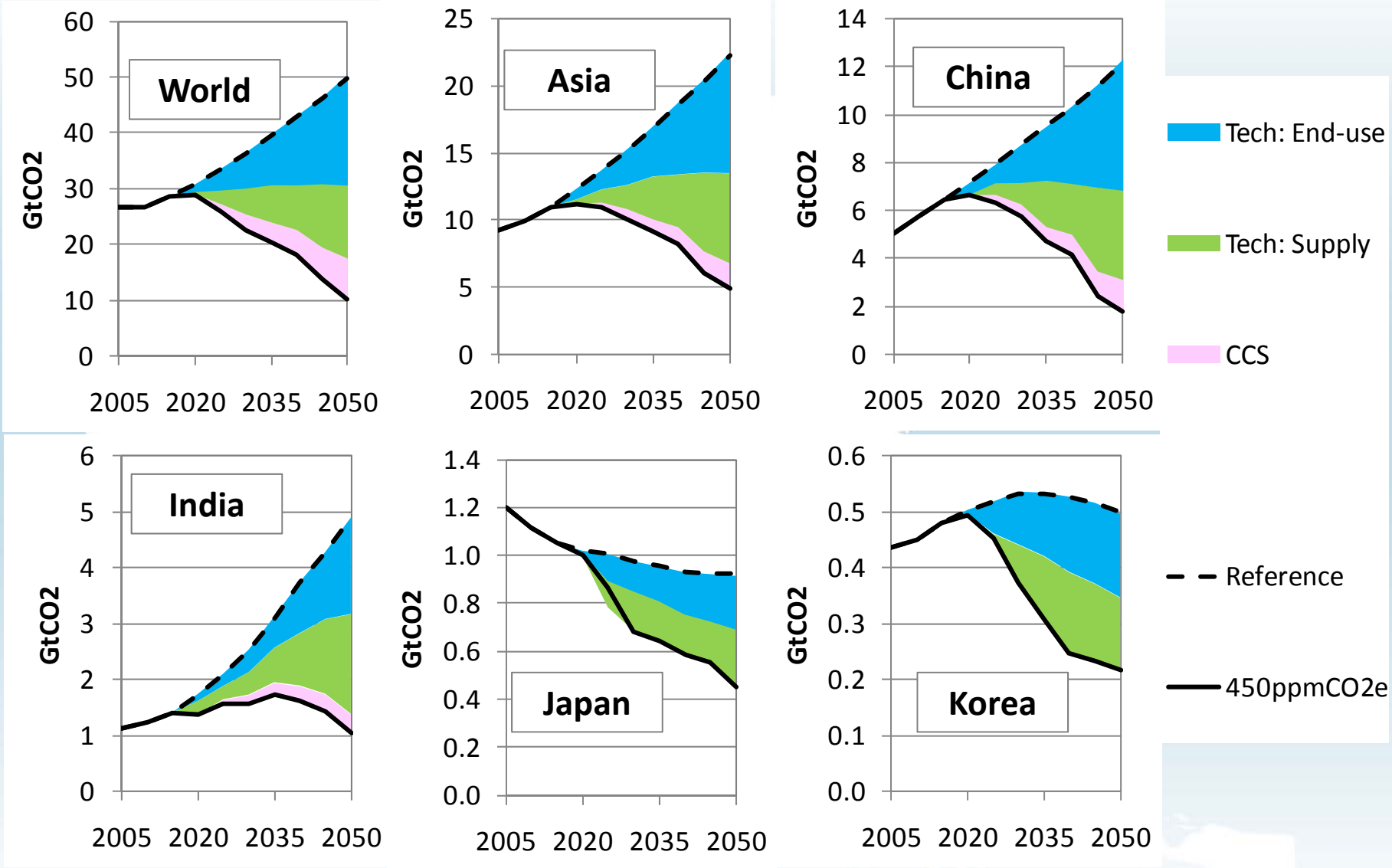
3. ADB (Asia Development Bank) project
   based on the AIM/EnduseMAC[Global]
4. Japan Roadmap
   based on the AIM/Enduse[Japan]

Time horizon of 2030

International model comparison studies

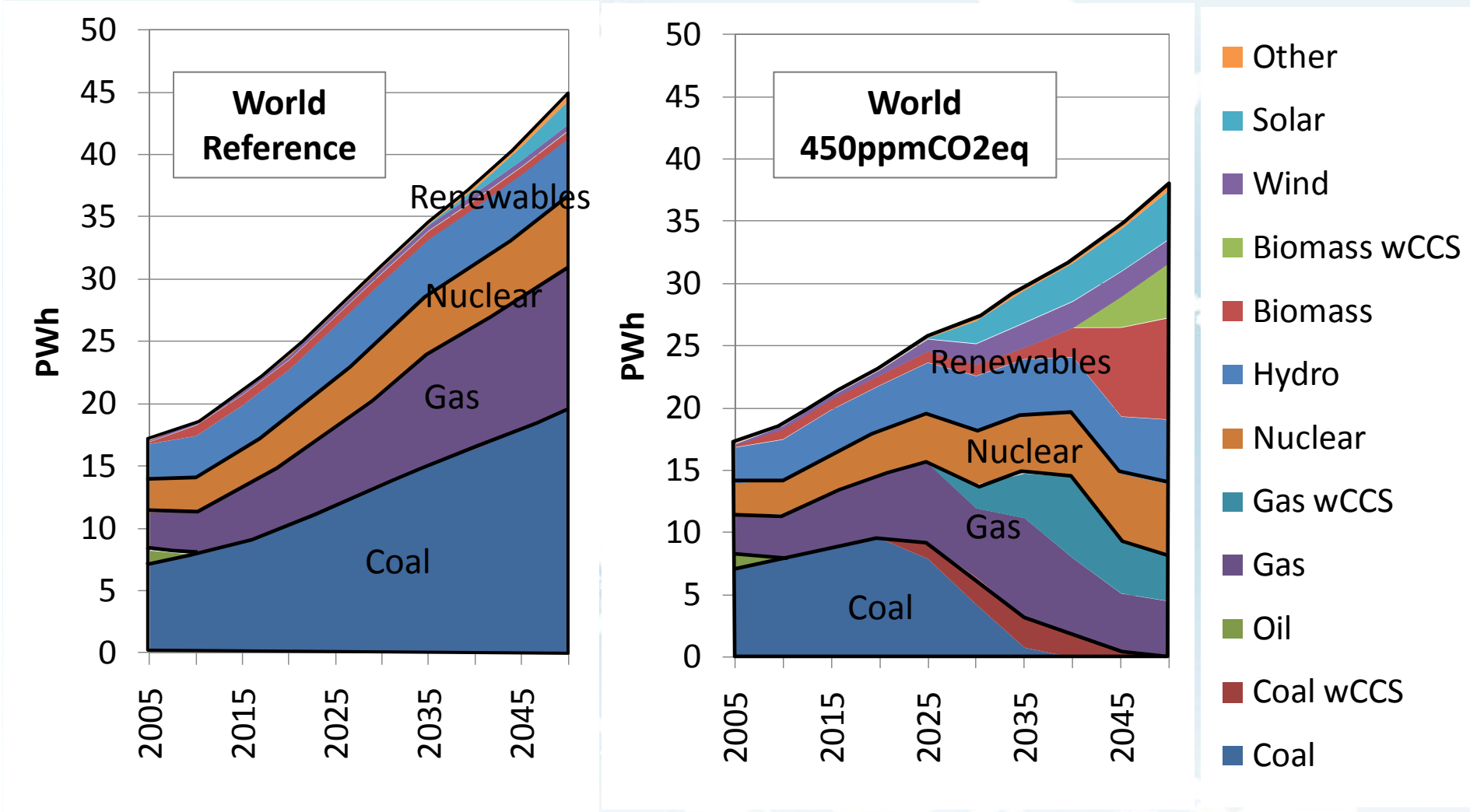
Asian Modeling Exercise	Energy Modeling Forum 24
International model comparison study initiated by PNNL (USA)	International model comparison study initiated by Energy Modeling Forum (USA)
28 models are participating	Major global model are participating
Goal: To articulate the role of Asia in addressing climate change	Topic: Technology strategies for greenhouse gas abatement
Scenarios: - Baseline - CO_2 price pathes - Global stabilizations (550ppmCO_2e, 450ppmCO_2e) - Policy scenarios	Scenarios: - Technology dimension (Energy intensity, CCS, Nuclear, Wind, Solar, Bioenergy) - Policy dimension (Baseline, 550ppmCO_2e, 450ppmCO_2e, Idealized G8, Muddling through)

CO_2 emissions and contribution of reduction options



By Dr. Akashi et al

Technological transition in the power sector



By Dr. Akashi et al

Application to ADB project

- **Project:**

  The Economics of Climate Change and Low Carbon Growth Strategies in Northeast Asia.

- **Contribution by the AIM team**

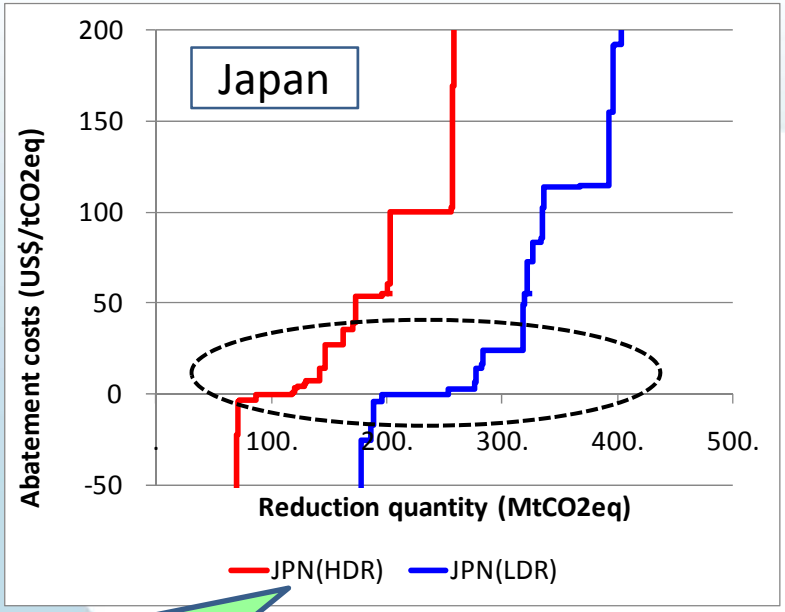
  AIM Impact team: the latest research information on impact studies

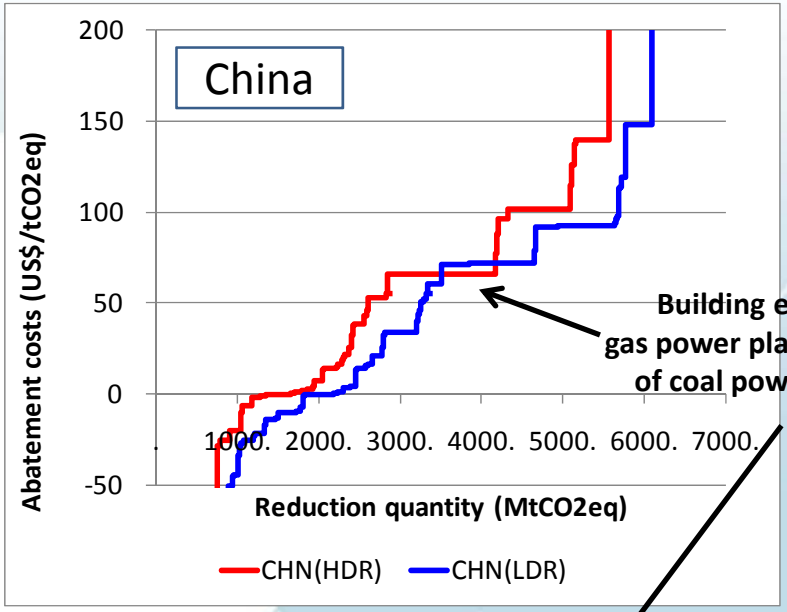
  AIM Emission team: analyses on emission targets and evaluation of technological mitigation potentials and costs.

- **Contribution by using the AIM/EnduseMAC**

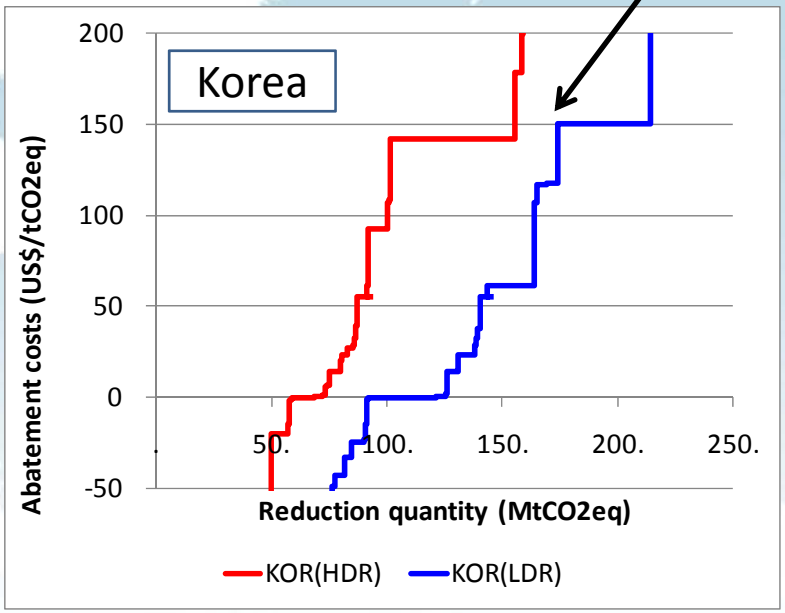
  - **target region: China, Korea, Japan, (and Mongolia)**
  - **target year: 2020 and 2030**
  - **target analyses: indicate technological mitigation potentials and costs under various kinds of assumptions**

Technological abatement cost curves





Building efficient gas power plants instead of coal power plants



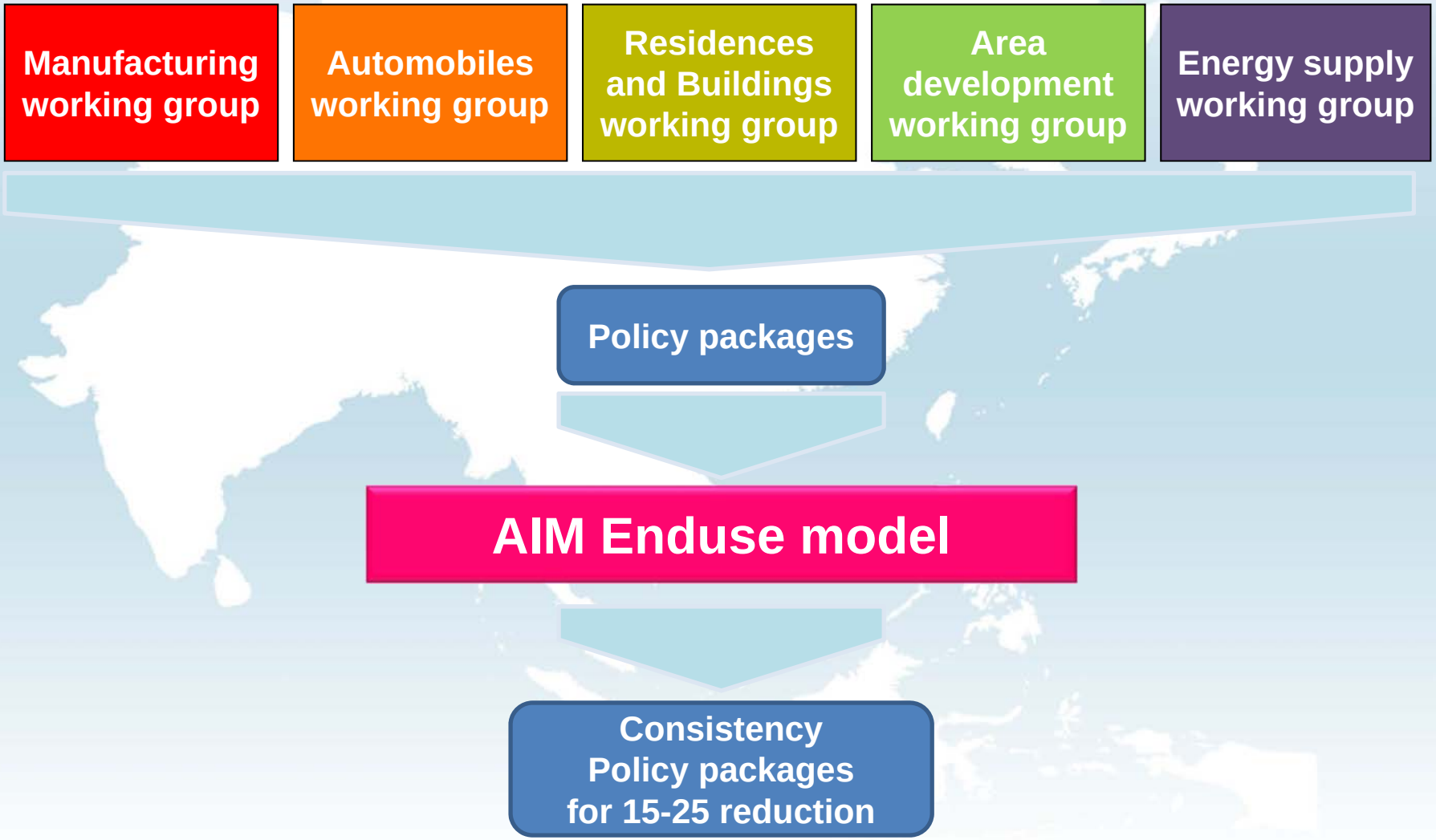
Settings of discount rate for investment have a large impact on mitigation potentials in the demand side in the low carbon price range because of high energy prices in Japan

Large impact on the supply side in the high carbon price range if composition of power sources are selected under cost optimization

By Dr. Hanaoka et al

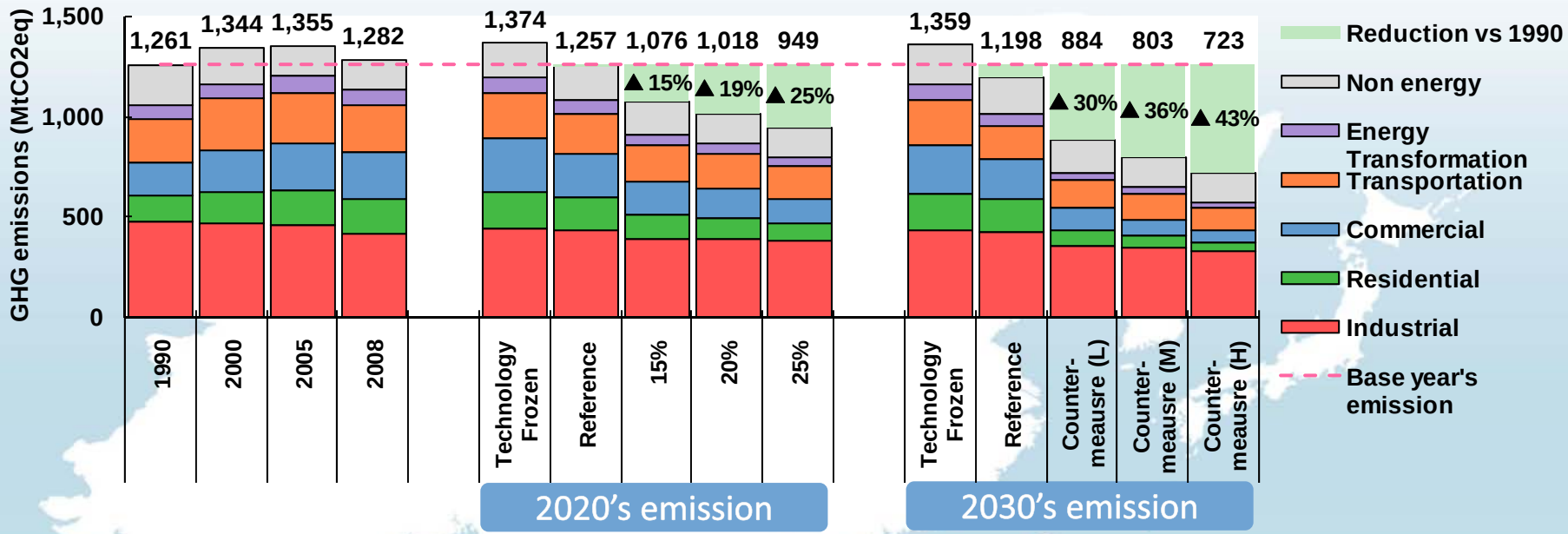
Application to Japan's mid-term emission target

Working groups composed of experts (academic, business and local government)

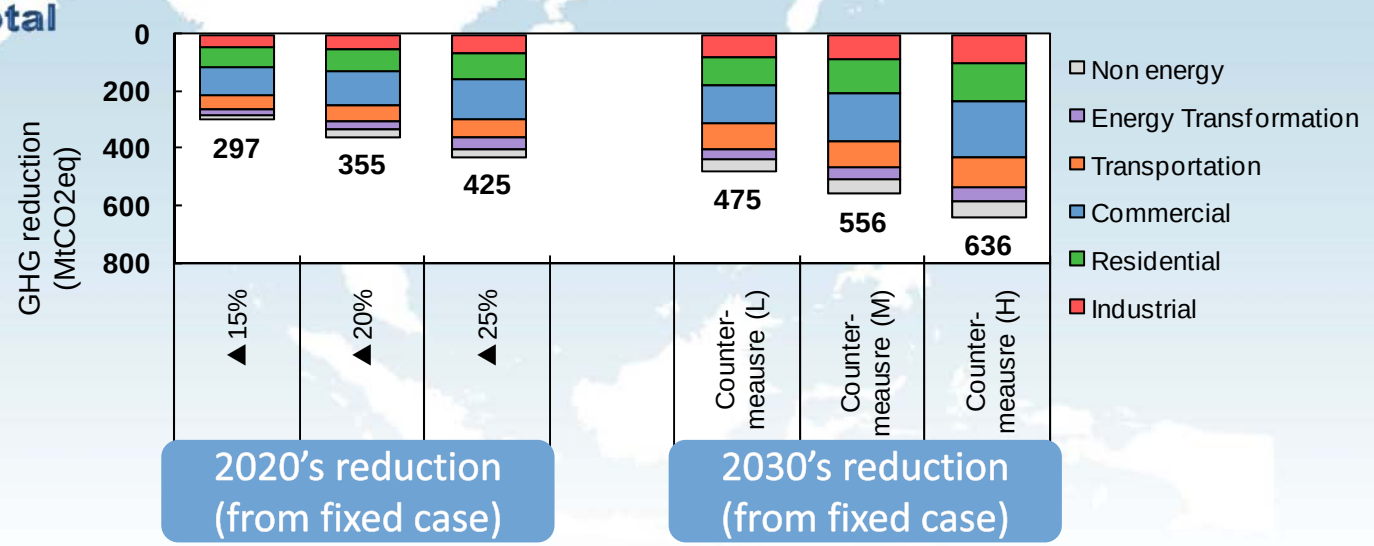


GHG emission in 2020/2030

GHG emission, total



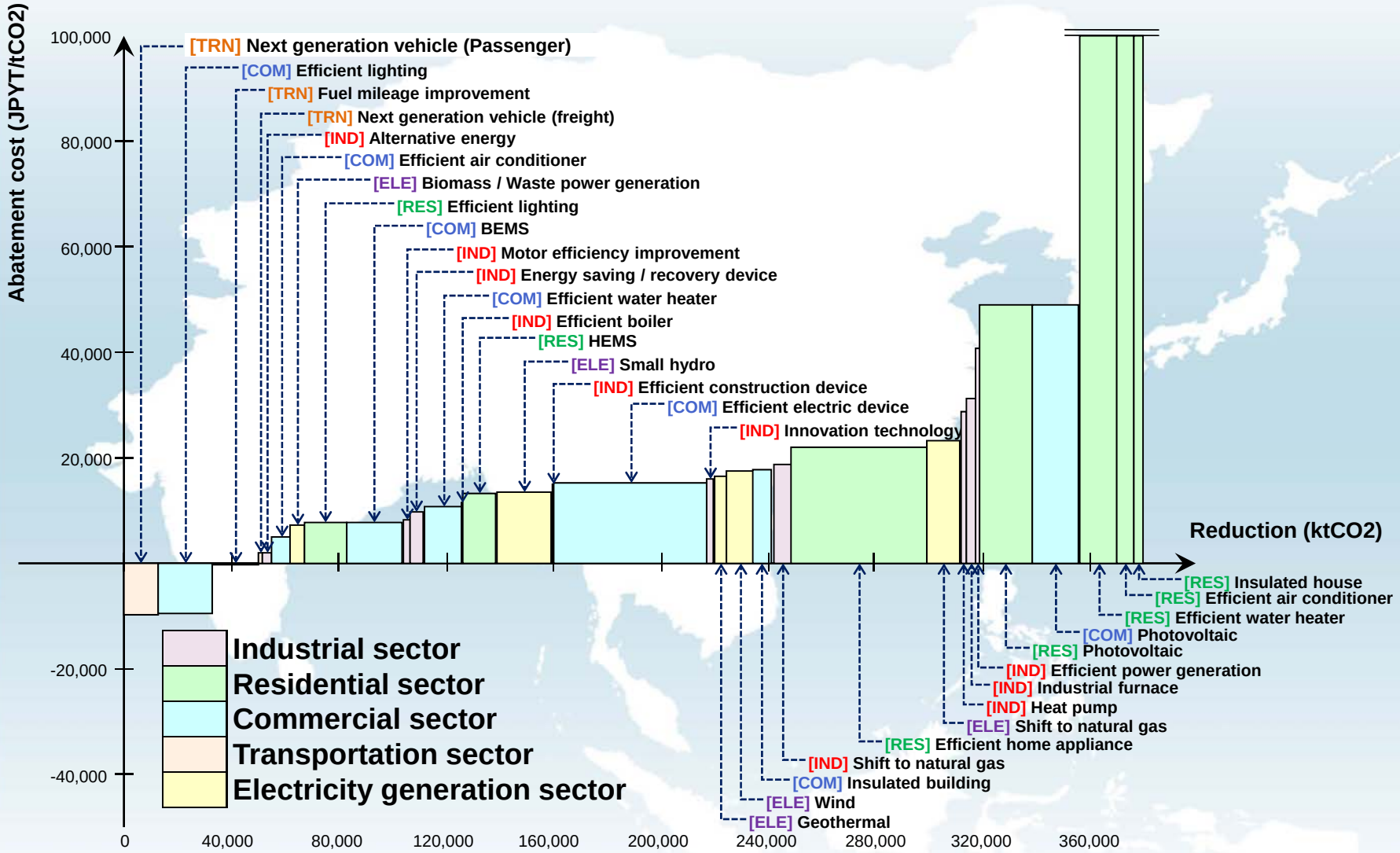
GHG reduction, total



By Mr. Hibino et al

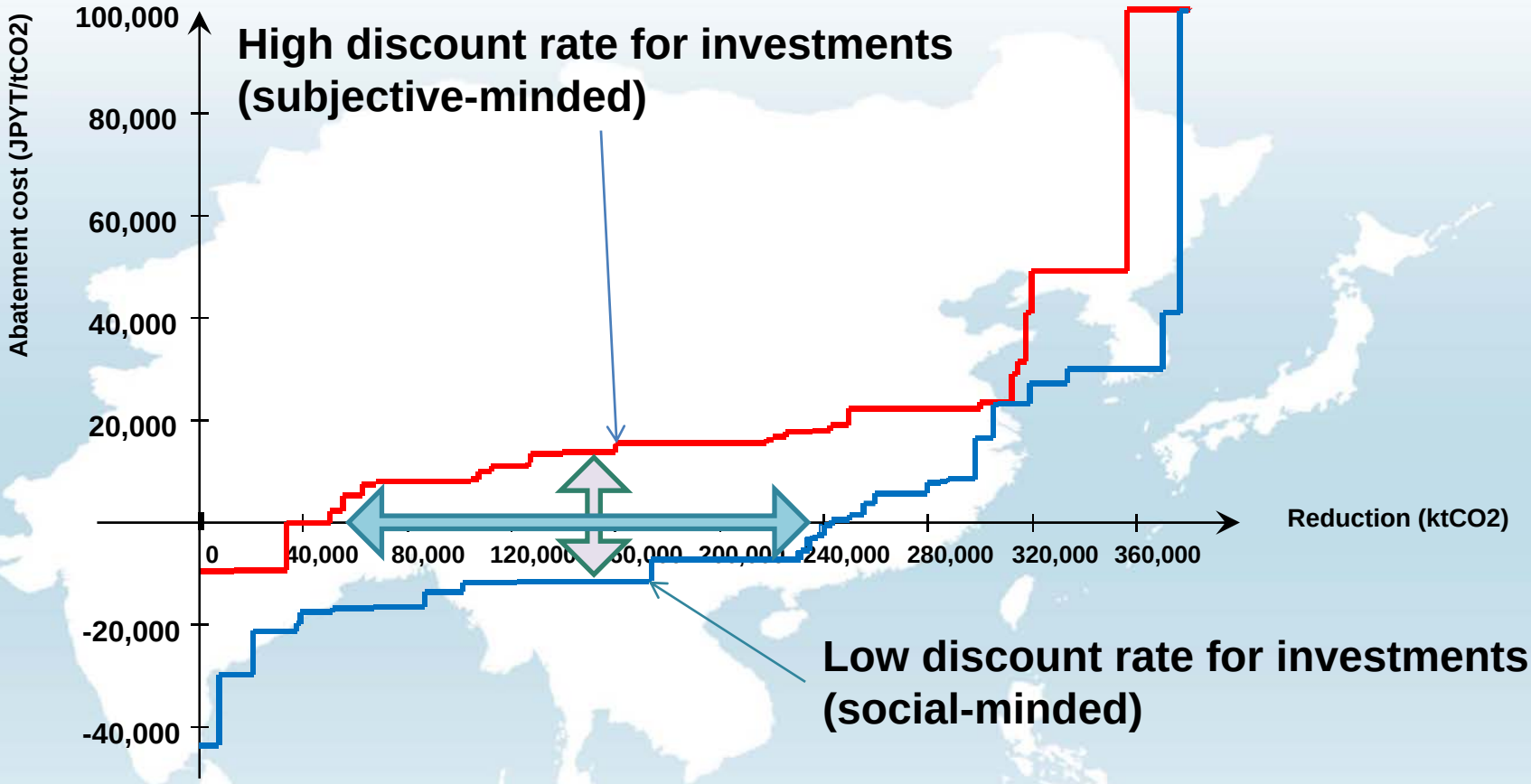
Abatement costs and reductions in 2020

High discount rate for investments, 25% reduction in 2020



By Mr. Hibino et al

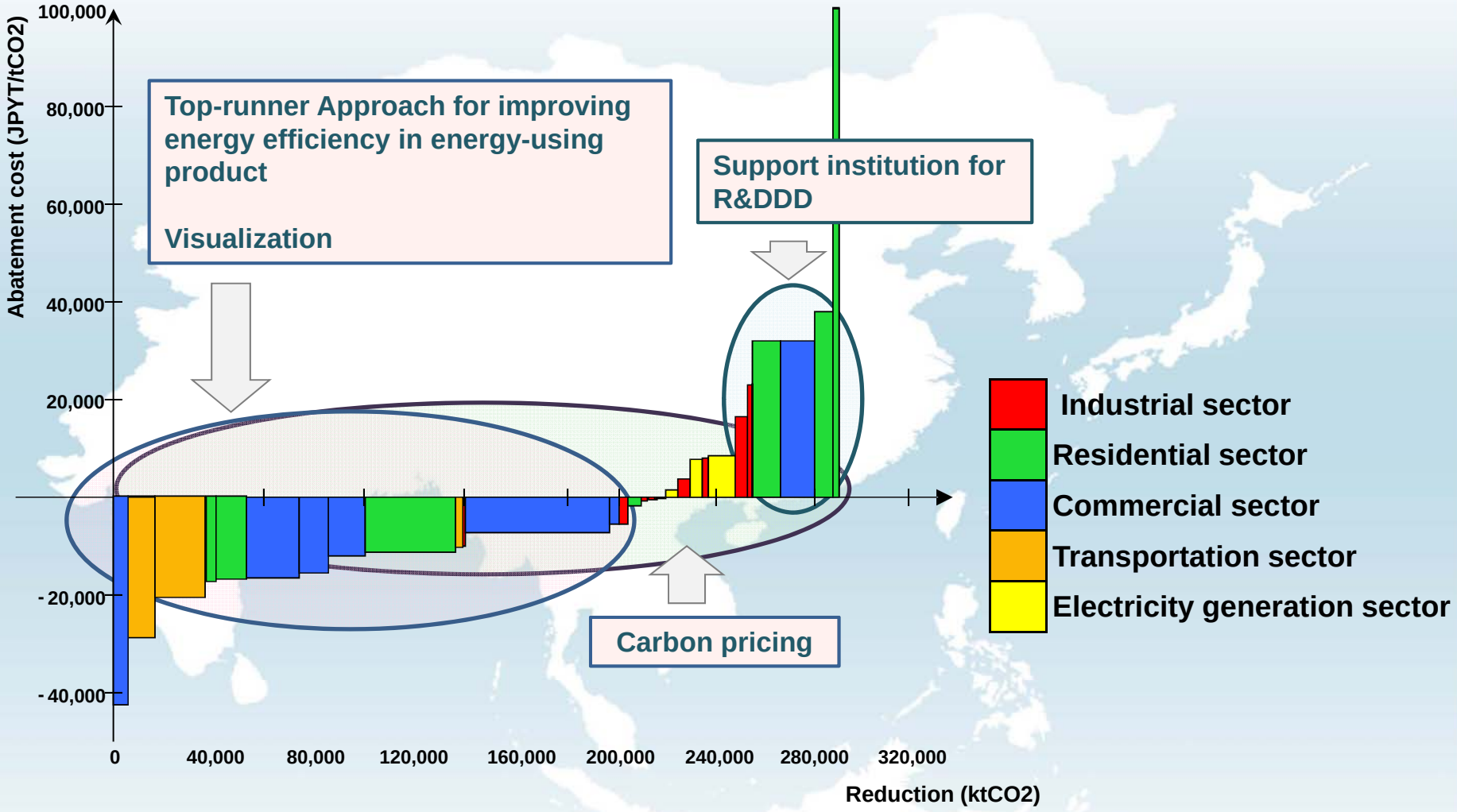
Abatement costs and reductions in 2020



Sector		Life-time	Discount rate	
			Subjective	Social
Industrial	Energy-intensive	30	10%	5%
	Others	20	33%	5%
Residential & Commercial	Appliance	10	33%	5%
	Building	30~40	33%	5%
Transportation	Vehicle	10	15%	5%
Renewables		20	10%	5%

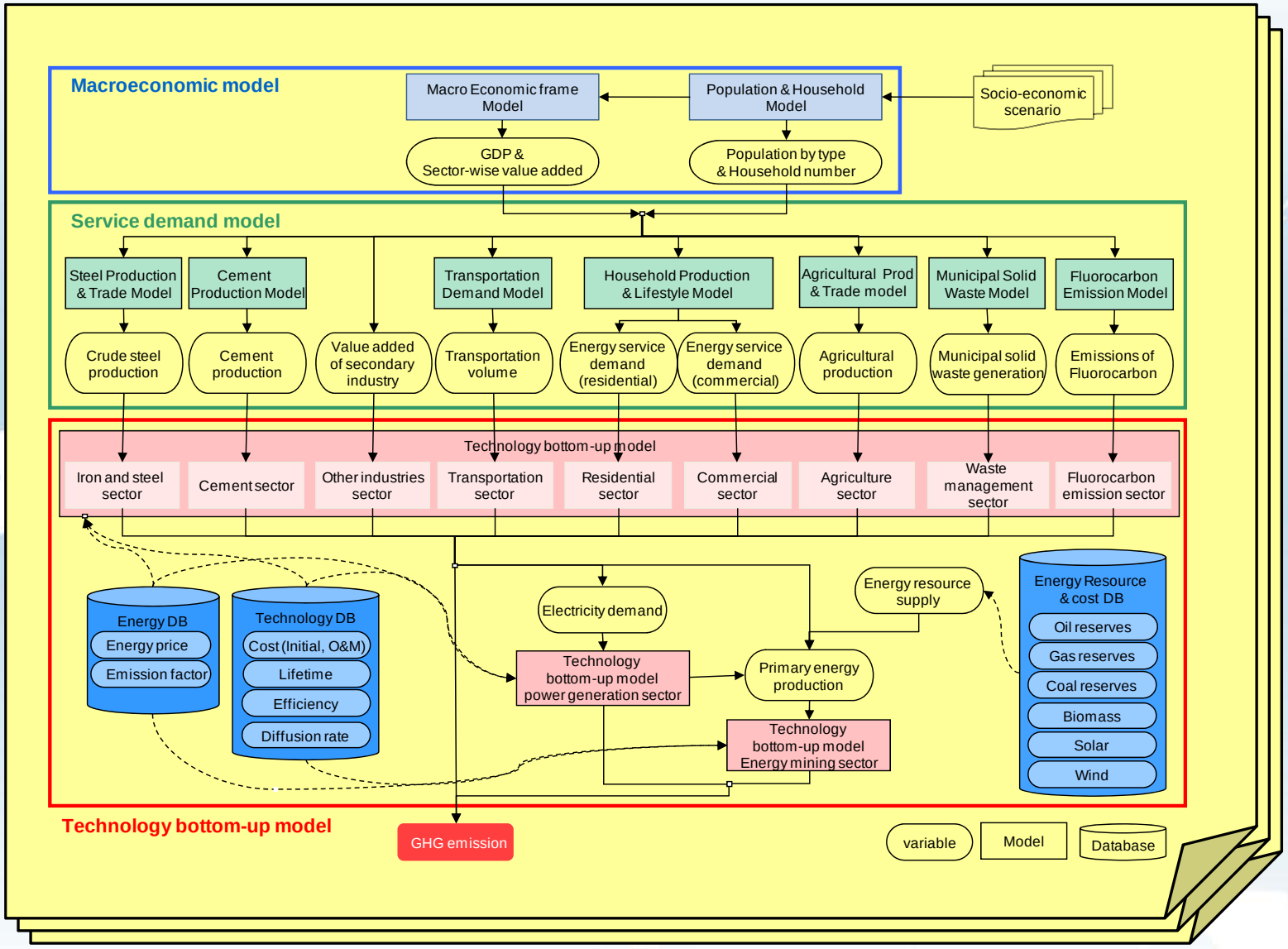
By Mr. Hibino et al

Abatement cost and countermeasure

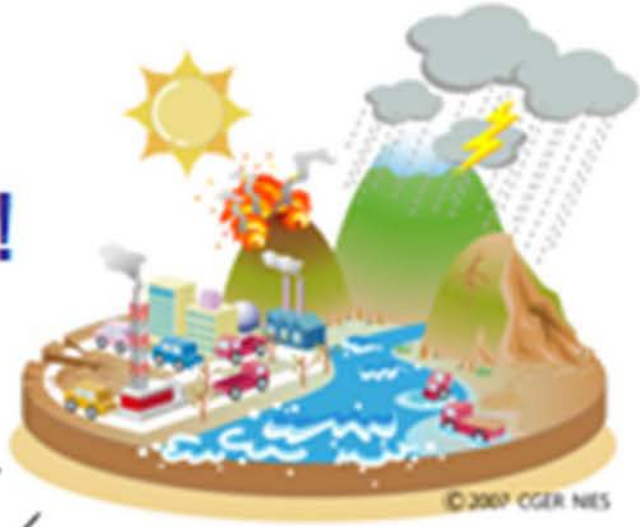


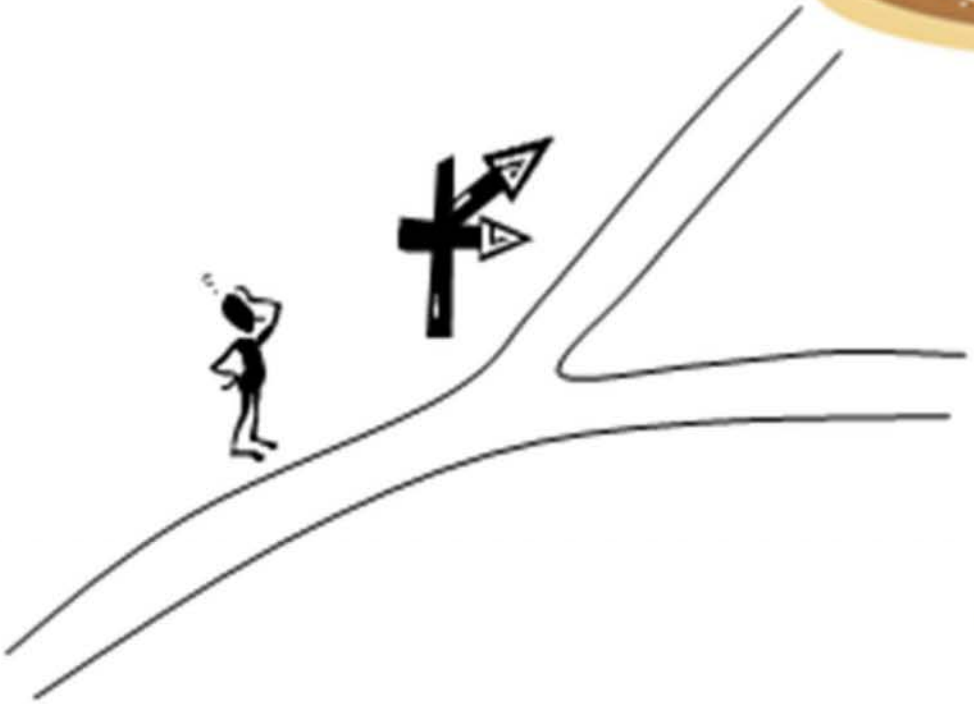
By Mr. Hibino et al

Next steps


Macroeconomic model
Macro Economic frame Model
Population & Household Model
Socio-economic scenario
GDP & Sector-wise value added
Population by type & Household number
Service demand model
Steel Production & Trade Model
Cement Production Model
Transportation Demand Model
Household Production & Lifestyle Model
Agricultural Prod & Trade model
Municipal Solid Waste Model
Fluorocarbon Emission Model
Crude steel production
Cement production
Value added of secondary industry
Transportation volume
Energy service demand (residential)
Energy service demand (commercial)
Agricultural production
Municipal solid waste generation
Emissions of Fluorocarbon
Technology bottom-up model
Iron and steel sector
Cement sector
Other industries sector
Transportation sector
Residential sector
Commercial sector
Agriculture sector
Waste management sector
Fluorocarbon emission sector
Energy DB
Energy price
Emission factor
Technology DB
Cost (Initial, O&M)
Lifetime
Efficiency
Diffusion rate
Electricity demand
Technology bottom-up model power generation sector
Primary energy production
Technology bottom-up model Energy mining sector
Energy resource supply
Energy Resource & cost DB
Oil reserves
Gas reserves
Coal reserves
Biomass
Solar
Wind
Technology bottom-up model
GHG emission
variable
Model
Database

Timing is important!





Thank you for your attention!