IPAC Model
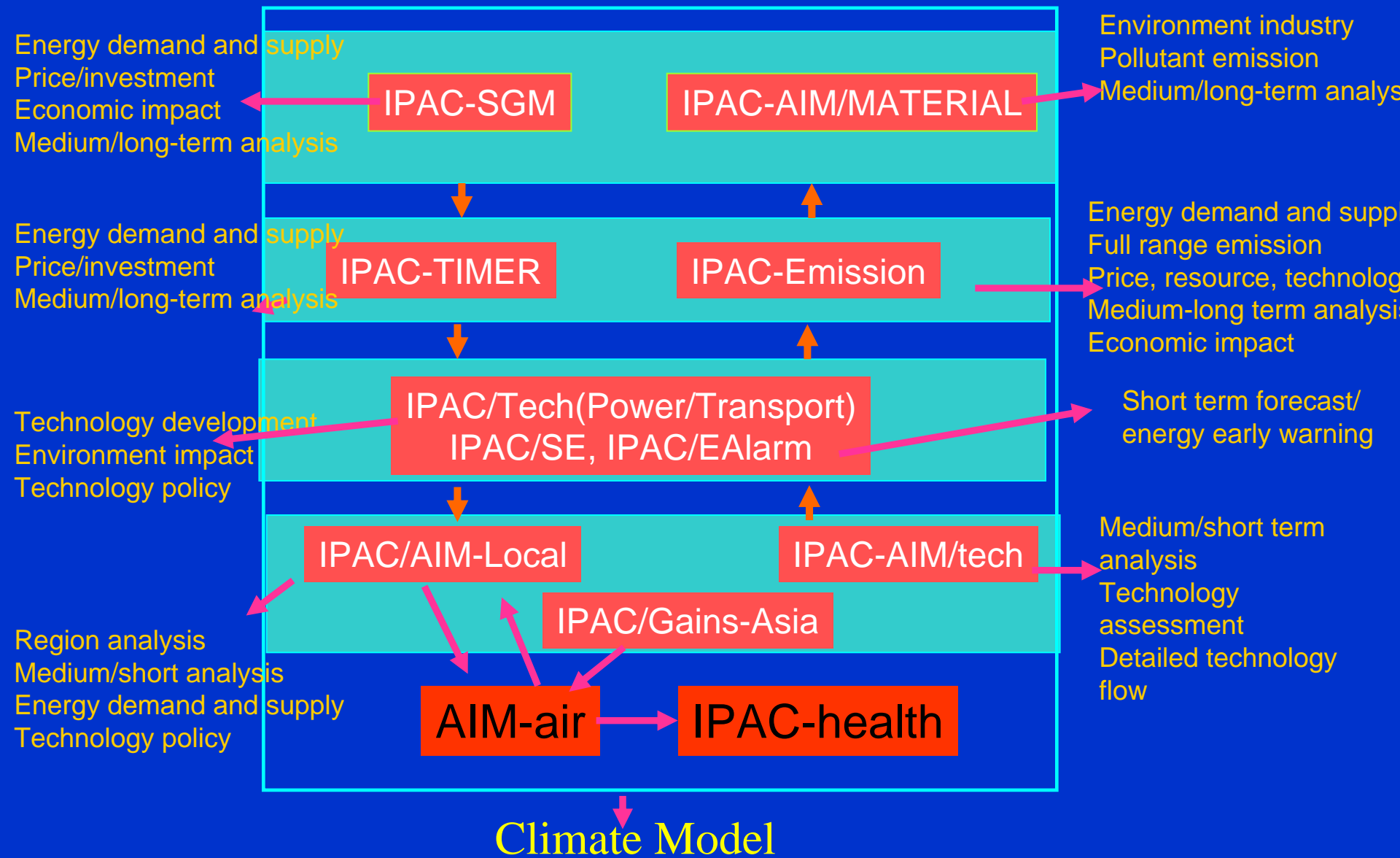# (Energy Research Institute)

Jiang Kejun

September 17, 2009
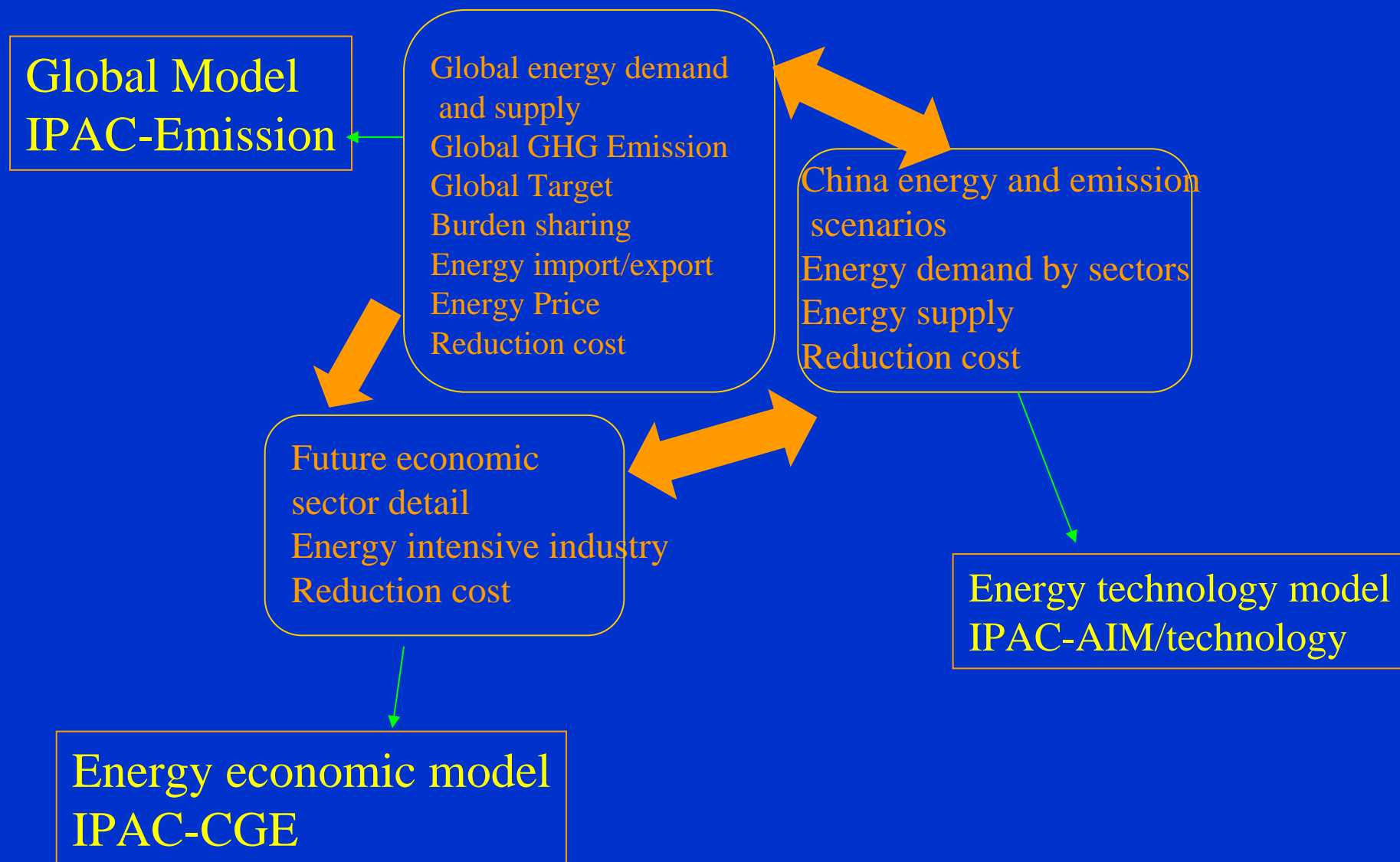
Tsukuba, Japan

Framework of Integrated Policy Model for China (IPAC)

Energy demand and supply
Price/investment
Economic impact
Medium/long-term analysis

IPAC-SGM

IPAC-AIM/MATERIAL

Environment industry
Pollutant emission
Medium/long-term analysis

Energy demand and supply
Price/investment
Medium/long-term analysis

IPAC-TIMER

IPAC-Emission

Energy demand and supply
Full range emission
Price, resource, technology
Medium-long term analysis
Economic impact

Technology development
Environment impact
Technology policy

IPAC/Tech(Power/Transport)
IPAC/SE, IPAC/EAlarm

Short term forecast/
energy early warning

IPAC/AIM-Local

IPAC-AIM/tech

Medium/short term
analysis
Technology
assessment
Detailed technology
flow

IPAC/Gains-Asia

Region analysis
Medium/short analysis
Energy demand and supply
Technology policy

AIM-air

IPAC-health

Climate Model

2050低碳情景模型分析框架
Methodology framework

Global Model IPAC-Emission

Global energy demand and supply
Global GHG Emission
Global Target
Burden sharing
Energy import/export
Energy Price
Reduction cost

China energy and emission scenarios
Energy demand by sectors
Energy supply
Reduction cost

Future economic sector detail
Energy intensive industry
Reduction cost

Energy economic model IPAC-CGE

Energy technology model IPAC-AIM/technology

Key Design Characteristics

- *Participating Model:* **IPAC-Emission**
- *Model Type: Integrated Assessment Model (IAM), using MAGICC as its atmosphere and climate model*
- *Participating Modelers: Jiang Kejun, Liu Qiang, Miao Ren, Hu Xiulian, Zhuang Xing, Wei Xun*
- *Time Step: 5-25 years*
- *Time Frame: 2005-2100*
- *Solution Type: Dynamic Recursive*
- *Equilibrium Type: Partial Equilibrium*
- *Underlying Computing Framework: Fortune*

Inputs and Outputs

- **Key inputs**
  - *Demographics:* population by region
  - *Economic:* Potential GDP, labor productivity, price and income elasticities.
  - *Resources:* Depletable resources by grade (e.g. fossil fuels and uranium); renewable resources by grade (e.g. wind, solar).
  - *Technology:* Technology representations of production, transformation and use technologies.
- **Key outputs**
  - *Economic:* GDP, World energy and agriculture prices (oil, gas, coal, wheat, rice, etc.)
  - *Energy:* Production, transformation, end use, and trade.
  - *Emissions:* CO_2 emissions by source, non-CO_2 emissions (CH_4, N_2O, etc.), short-lived species emissions (S, BC, CO, NMVOC, etc.).

Regional Scope & Other Detail

- **Regional Details:**
  - *Regional Scope:* Global
  - *Number of Sub-Regions:* 22
  - *Asian Regions:* China, India, Japan, Southeast Asia, South Asia, other East Asia, Middle East
- **Other Details:**
  - *Energy Demand Sectors:* Industry, Transportation, Buildings
  - *Energy Supply Sectors:* Fossil Energy Production, Electricity Generation, Hydrogen Production
  - *Other Sectors:*

Key Design Characteristics

- *Participating Model:* IPAC-SGM/IPAC-AIM/CGE
- *Model Type: Regional CGE*
- *Participating Modelers: Jiang Kejun, Liu Qiang, Miao Ren, Hu Xiulian, Zhuang Xing, Wei Xun*
- *Time Step: 5 years*
- *Time Frame: 2005-2050*
- *Solution Type: Dynamic Recursive*
- *Equilibrium Type: Market Equilibrium*
- *Underlying Computing Framework: Fortune*

Inputs and Outputs

- **Key inputs**
  - *Demographics:* population
  - *Economic:* labor productivity, price and income elasticities.
  - *Resources:* Depletable resources by grade (e.g. fossil fuels and uranium); renewable resources by grade (e.g. wind, solar).
  - *Technology:* Technology representations of production, transformation and use technologies.
- **Key outputs**
  - *Economic:* GDP, energy and products prices (oil, gas, coal, steel, etc.)
  - *Energy:* Production, transformation, end use.
  - *Emissions:* CO_2 emissions by source, non-CO_2 emissions (CH_4, N_2O, etc.)

Regional Scope & Other Detail

- **Regional Details:**
  - *Regional Scope: China*
  - *Number of Sub-Regions:*
  - *Asian Regions:* China
- **Other Details:**
  - *Energy Demand Sectors:* 34 sectors
  - *Energy Supply Sectors:* Fossil Energy Production, Electricity Generation, Hydrogen Production, biomass
  - *Other Sectors:*

Key Design Characteristics

- *Participating Model:* IPAC-AIM/technology
- *Model Type: technology least cost optimization model*
- *Participating Modelers: Jiang Kejun, Liu Qiang, Miao Ren, Hu Xiulian, Zhuang Xing, Wei Xun*
- *Time Step: 5 years*
- *Time Frame: 2005-2100*
- *Solution Type: least cost*
- *Equilibrium Type:*
- *Underlying Computing Framework: GAMS*

Inputs and Outputs

- **Key inputs**
  - *Demographics:*
  - *Economic:* output of major industrial sectors, energy price, taxes
  - *Resources:* Depletable resources; renewable resources.
  - *Technology:* detailed technology representations of production, transformation and use technologies, with cost, energy use, row material use, water use, labour, emission factor, for end use, conversion, and emission control technologies.
- **Key outputs**
  - *Economic: cost*
  - *Energy:* Production, transformation, end use.
  - *Emissions:* CO_2 emissions by source, non-CO_2 emissions (CH_4, N_2O, etc.)

Regional Scope & Other Detail

- **Regional Details:**
  - *Regional Scope: China*
  - *Number of Sub-Regions:* 31 provincials + Hong Kong
  - *Asian Regions:* China
- **Other Details:**
  - *Energy Demand Sectors:* 38 sectors
  - *Energy Supply Sectors:* Fossil Energy Production, Electricity Generation, Hydrogen Production, biomass, Coke making, heat
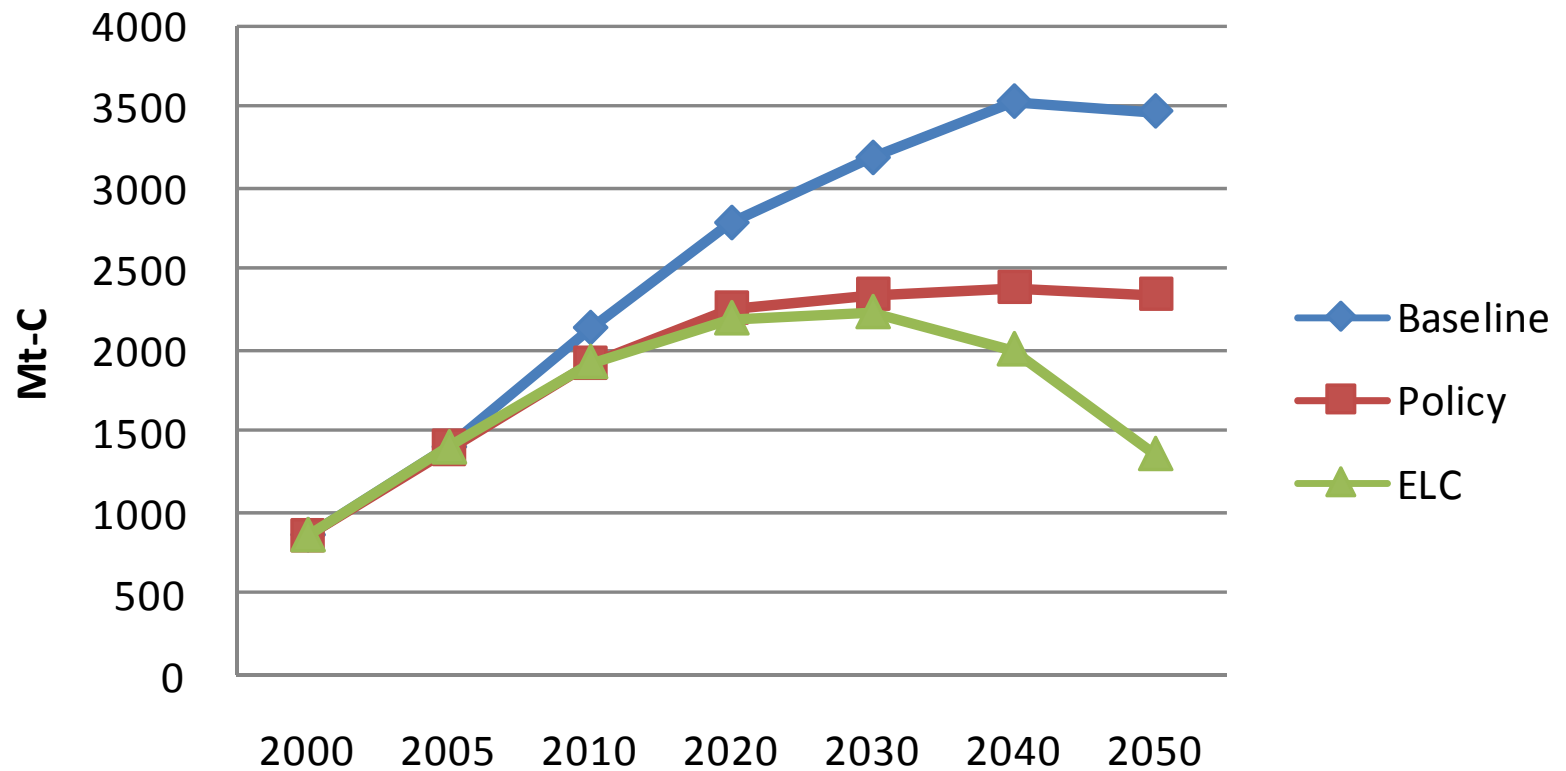 - *Other Sectors:*

Asian Baselines

CO2 Emission by Asian Regions
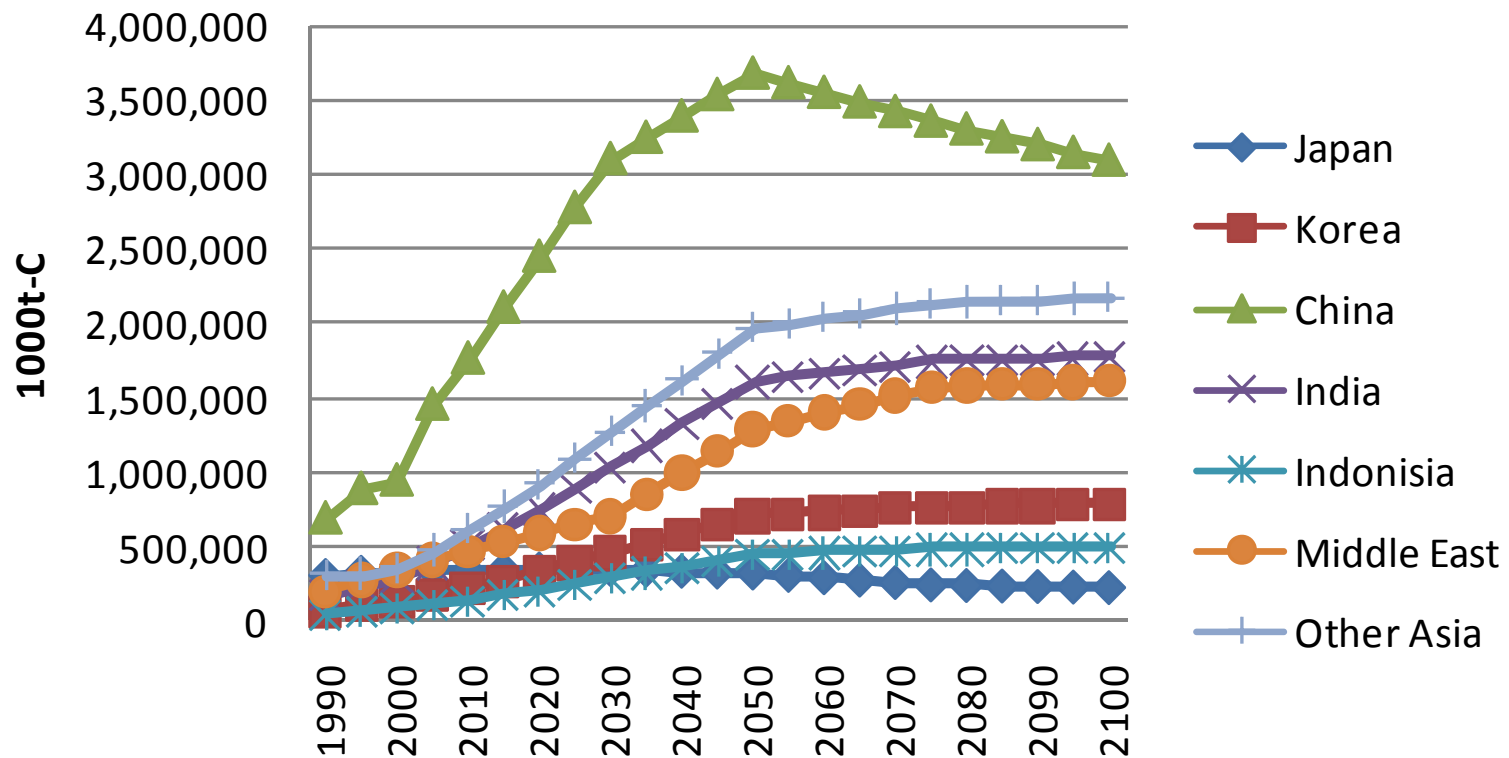
Asian Baselines

CO2 Emission in China

Previous Work on Asia

-**SRES**

- **EMF 21**

- **China 2050 Energy and Emission Scenarios(2003)**

- **China Low Carbon Society / Future(2006-2009)**

- **China Energy Scenario 2030**

- **Provincial energy and emission scenarios**

- **Energy Planning and Strategy for China**

- **City and province energy and emission scenarios**