AIM/Provincial and Inter Provincial Model

Hongwei Yang

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- Brief history of AIM energy models with bottom-up approaches
- Major extension from AIM-Local-2001 to AIM-Local-2002
- Applications of AIM-Local in the case of China

- Necessity to go to provincial level
- Demonstration of Provincial/Inter-provincial studies
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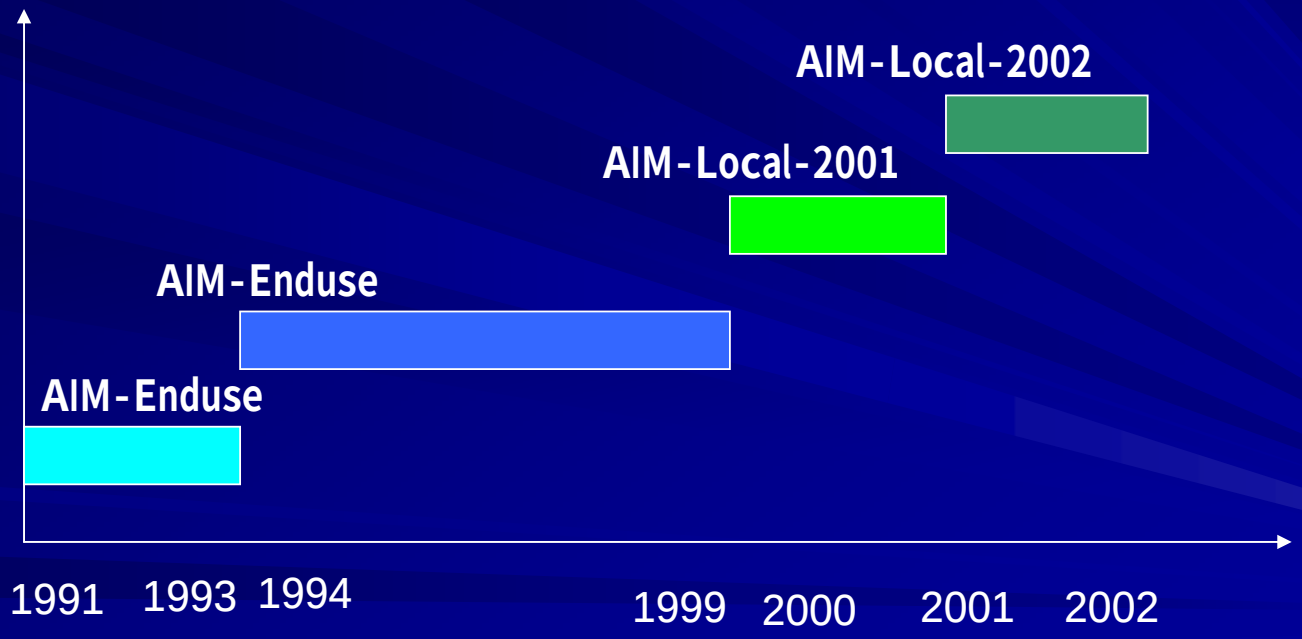
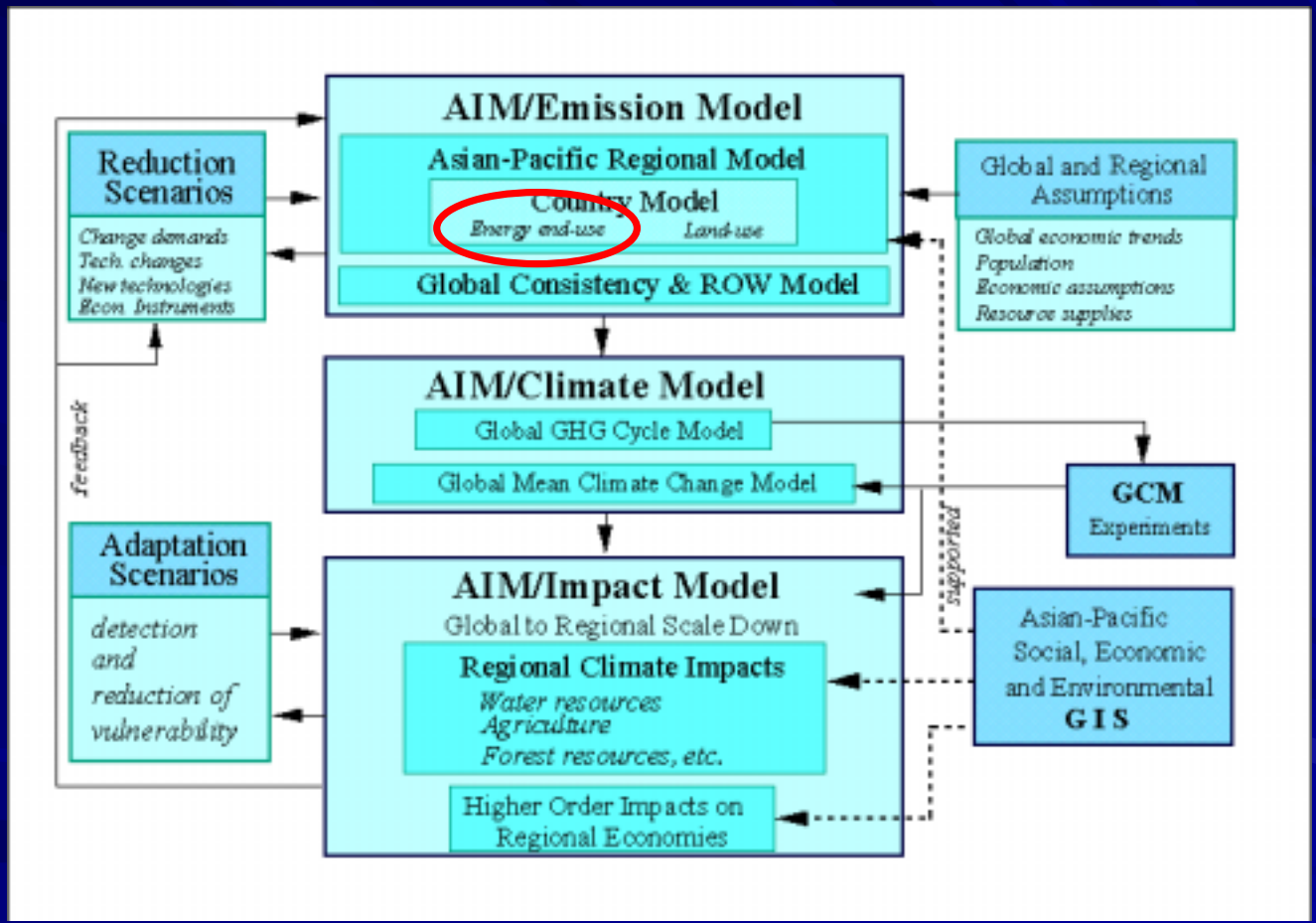
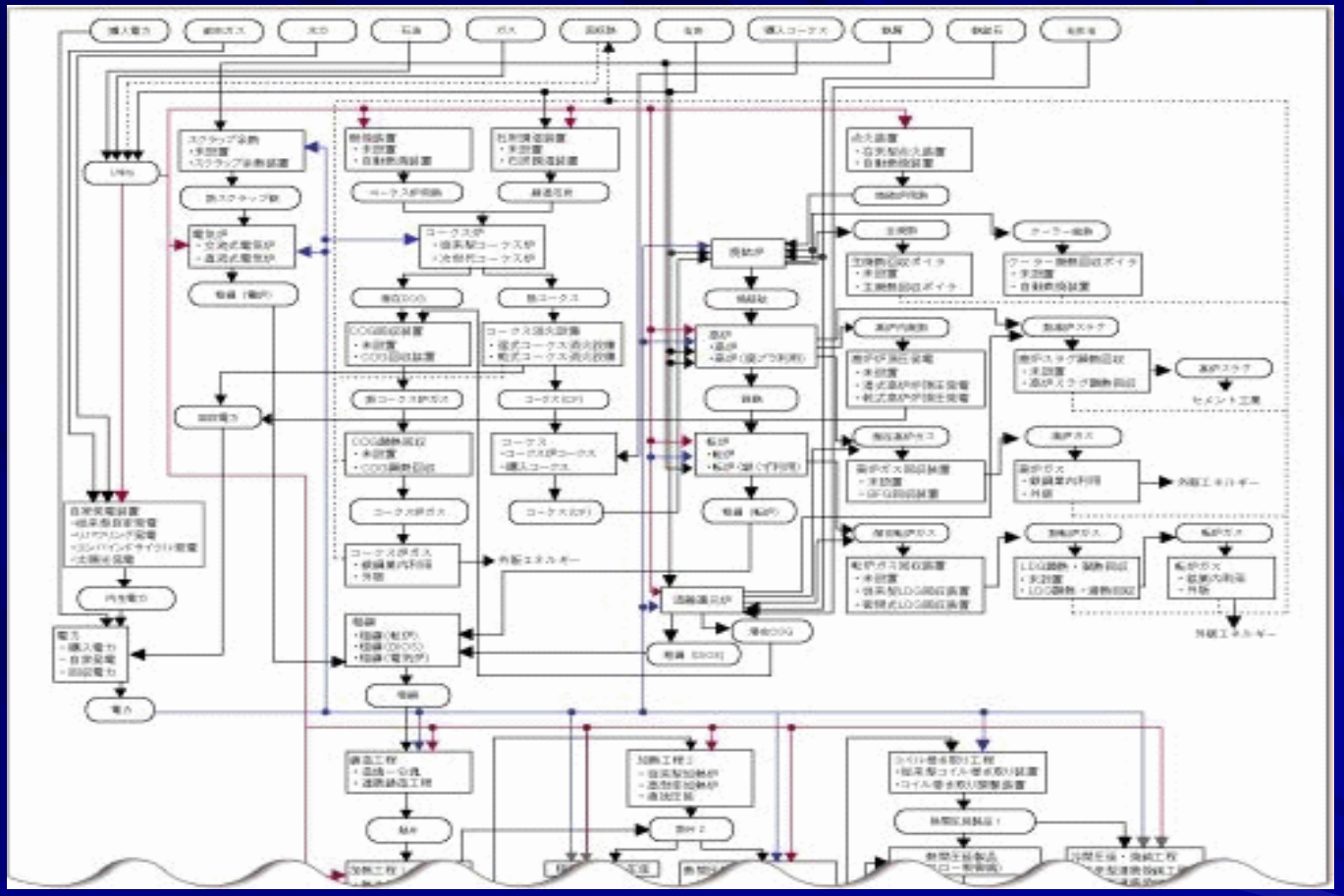
Brief history of AIM energy models with bottom-up approaches



(1) AIM-Enduse model

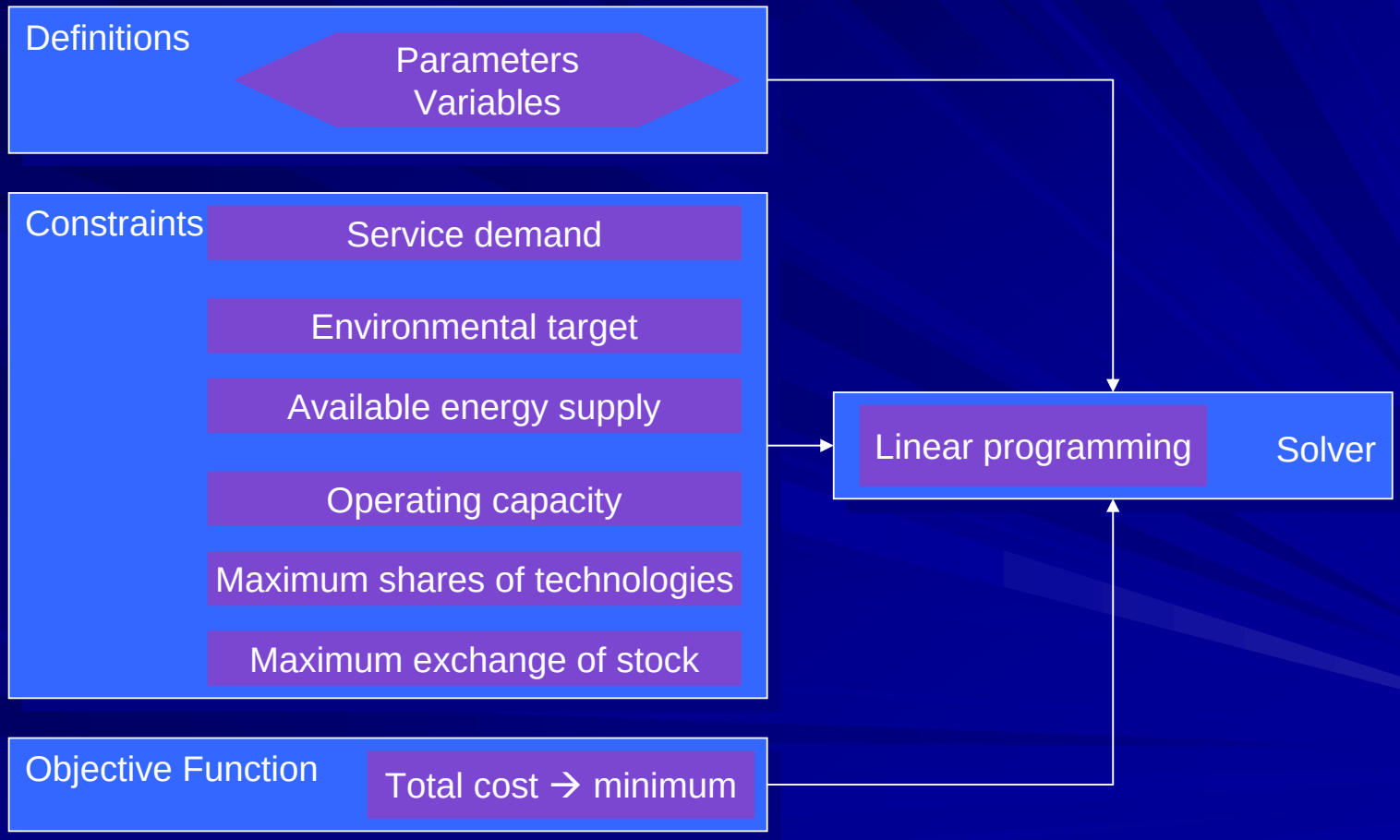


Source: AIM home page -- http://www-cger.nies.go.jp/ipcc/aim/

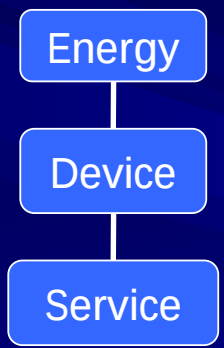


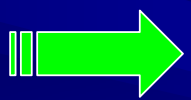
Source: 環境儀 No.2 地球温暖化の影響と対策 アジア太平洋地域における温暖化対策統合評価モデル- AIM

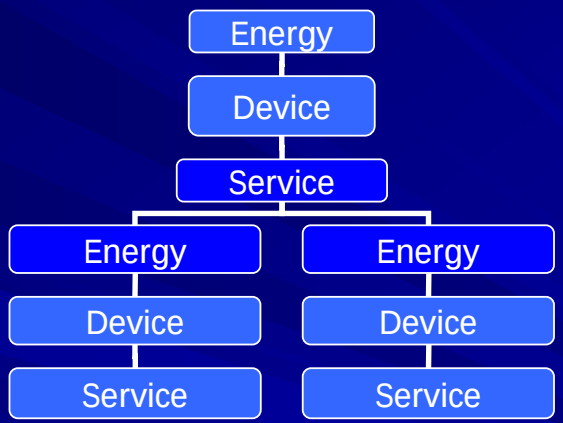
(2) AIM-Local-2001



(3) AIM-Local-2002







Version 2001

Version 2002

Features and Differences of the models

Model	Targeted Region	Calibration in the Base Year	Intermediate Process	Calculation of air pollutants emissions	LPS/AS	Link to GIS
AIM-Enduse	Country	Yes	Yes	Simplified	AS	No
AIM-Local 2001	Sub-country	Yes	No	Detailed	LPS/AS	Yes
AIM-Local 2002	Country Sub-country	Yes + Adjustment	Yes	Detailed	LPS/AS	Yes

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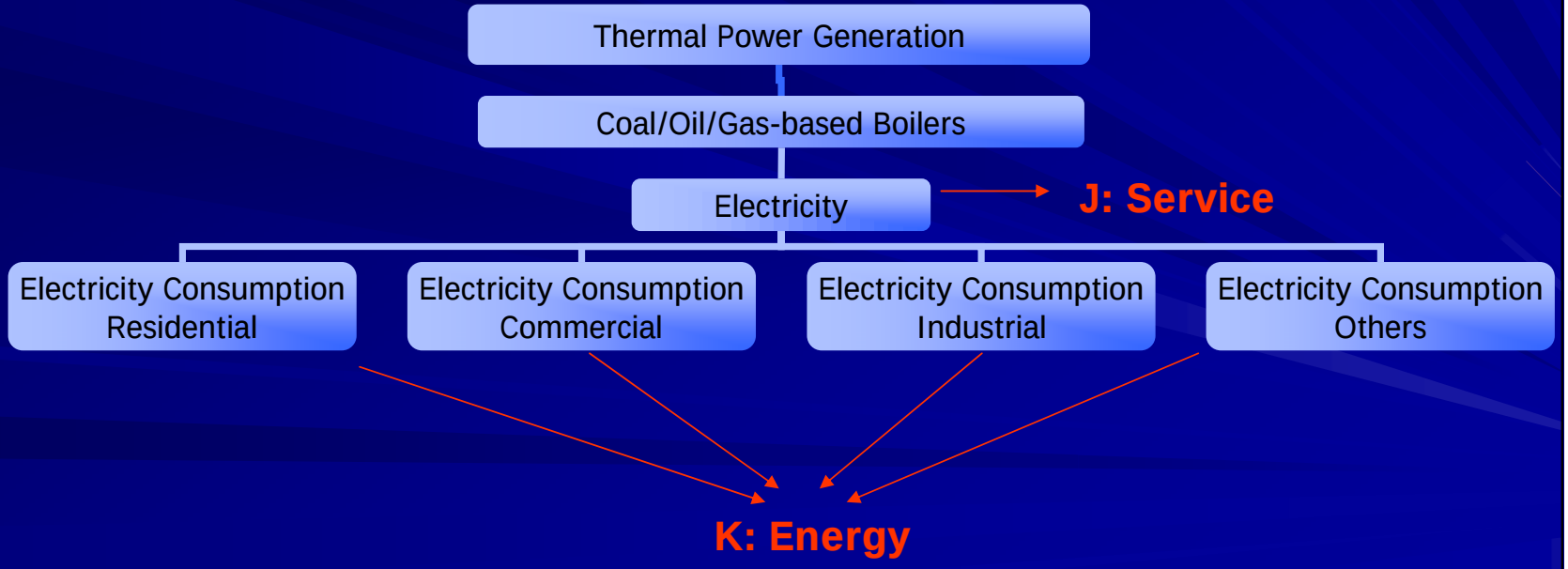
Major extension from AIM-Local-2001 to AIM-Local-2002

(1) Endogenous service and endogenous energy



(2) Automatic calibration and adjustment: automatically adjust service demand and technology stocks in the base year.

- Comparing energy demand data in the base year with the reported energy balance tables;
- Calculating adjust coefficients for service demand and technology stocks in terms of least calibration errors.

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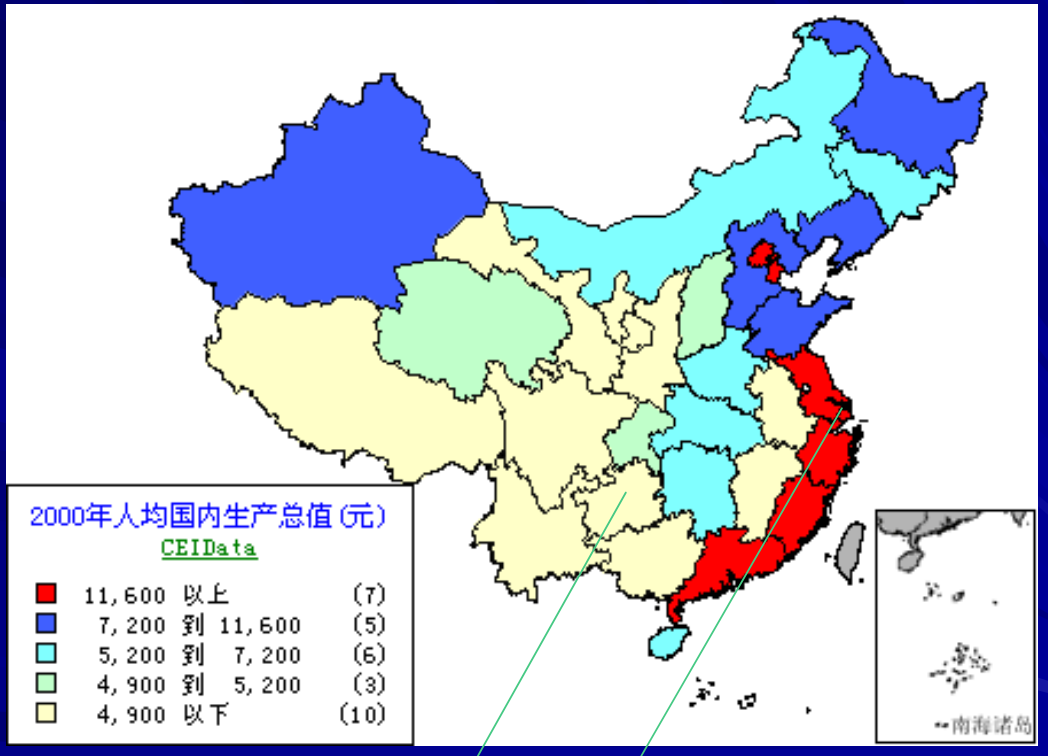
Applications of AIM-Local model in the case of China

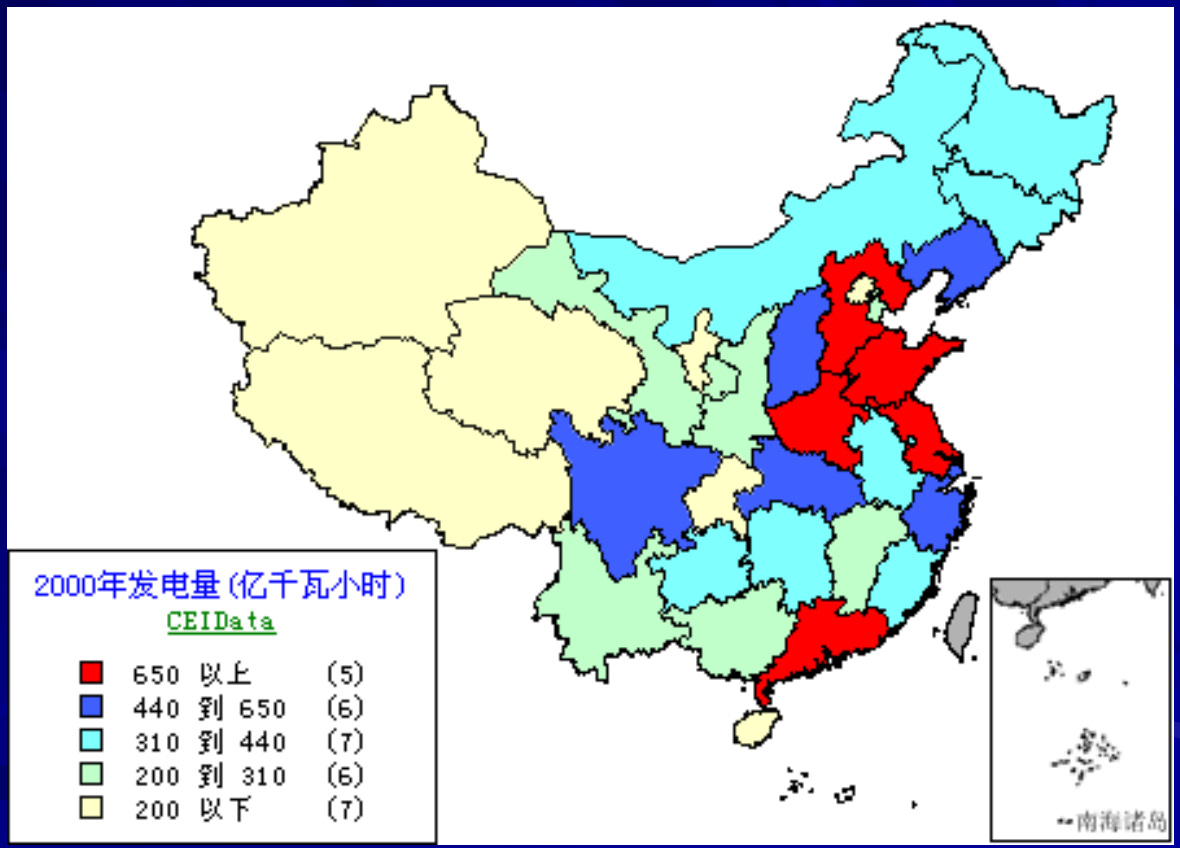
1. Necessity to go to provincial level

(1) Regional differences

economic development

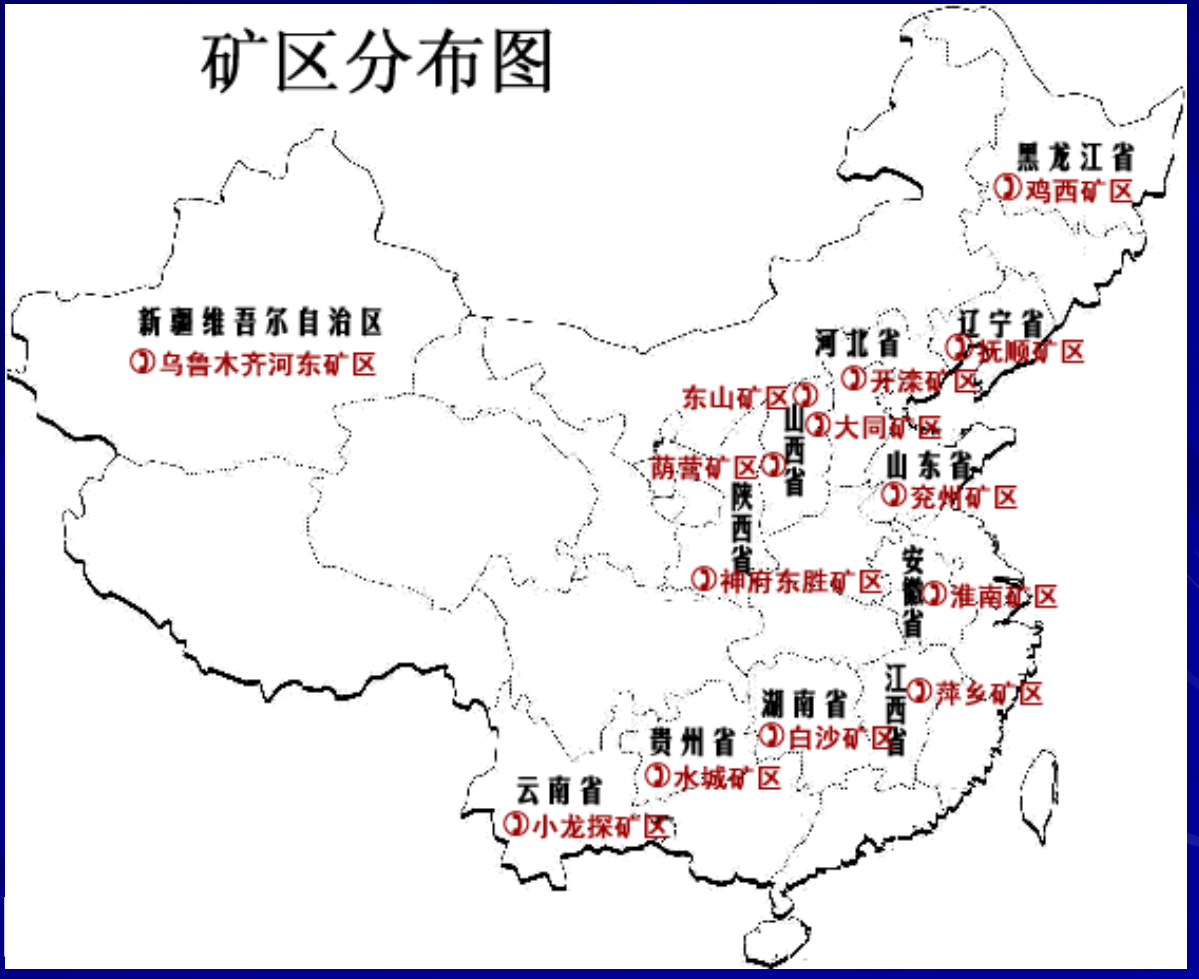


Example: Electricity supply



Example: Electricity supply

- Example: coal mines distribution



(2) Domestic policy needs

- "Great West Development" program and energy development

- Electricity transmission from west to east (Yunnan, Guizhou, Guangxi, Guangdong)

- Natural gas pipeline from west to east (Xinjiang, Gansu, Qinghai, Ningxia, Shaanxi, Henan, Anhui, jiansu, Shanghai)

- Economic development and energy consumption is a more provincial-specific issue.

* Energy transportation (provincial/inter-provincial) for coal, oil and gas;
* Development of renewable energy

  wind power (Xinjiang, InnerMongolia)

  geothermal (Tibet)

  hydro (Hubei, Hunan, Sichuan, Yunnan, Guangxi, Guizhou, Fujian, Guangdong)
* Nuclear power (Zhejiang, Guangdong, Jiangsu)

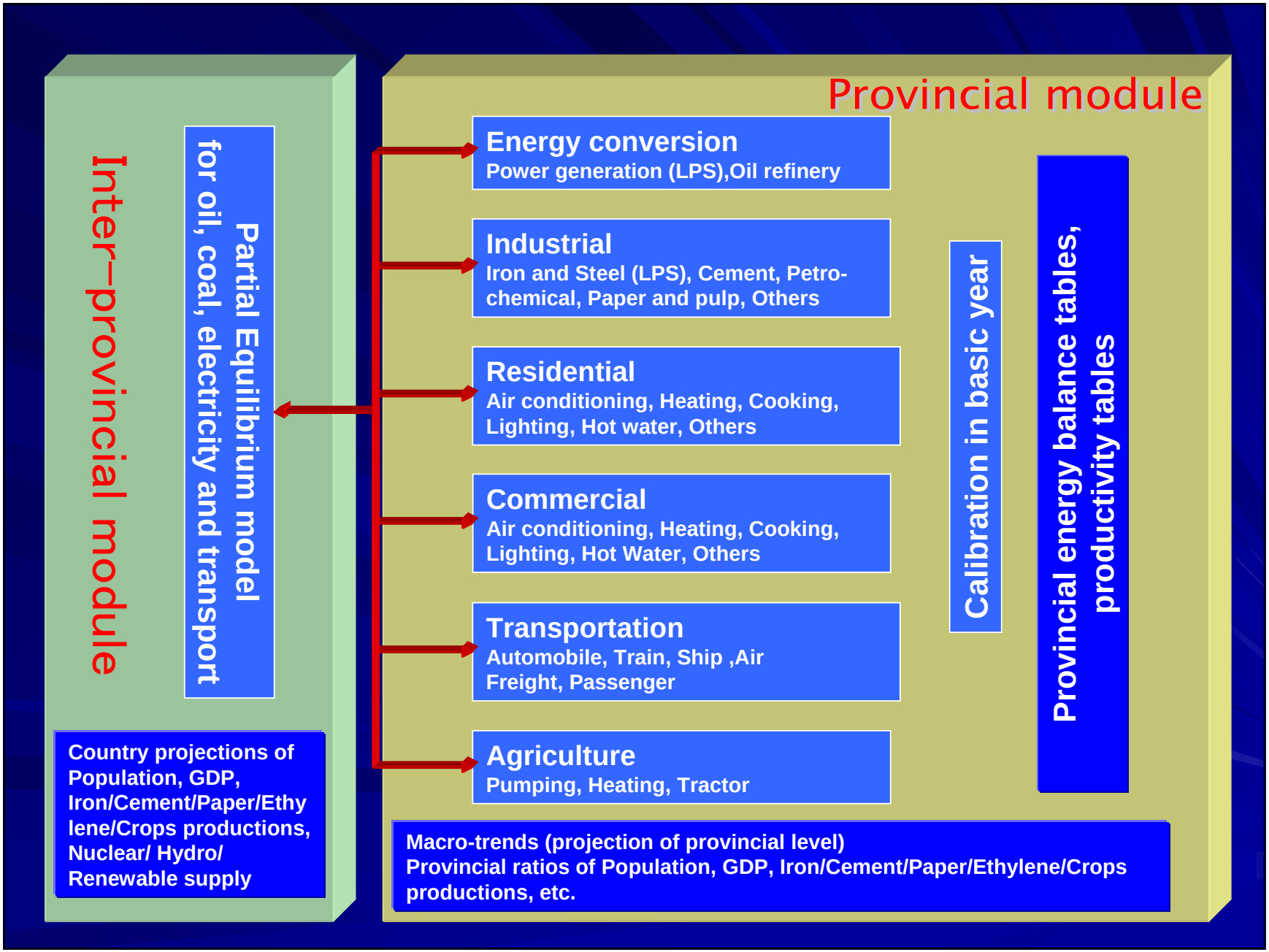
- Economic development and environment control is also a more provincial-specific issue.

* "Two control zones" policy allocates SO_2 emissions into each province.
* Tax rates for air pollution control varies across provinces;
* There is a policy need to analyze air pollutants emission trading at provincial level;

(3) From the point of view of global environmental studies, the provincial approach helps

- to have more reasonable estimation for future greenhouse gas emissions in China;
- to carry out concrete policy countermeasures for greenhouse gas emission control and air pollutants emission reduction.

2. Demonstration of Provincial/Inter-Provincial Studies


Inter-provincial module
Partial Equilibrium model for oil, coal, electricity and transport
Country projections of Population, GDP, Iron/Cement/Paper/Ethylene/Crops productions, Nuclear/ Hydro/ Renewable supply
Provincial module
Energy conversion
Power generation (LPS),Oil refinery
Industrial
Iron and Steel (LPS), Cement, Petro-chemical, Paper and pulp, Others
Residential
Air conditioning, Heating, Cooking, Lighting, Hot water, Others
Commercial
Air conditioning, Heating, Cooking, Lighting, Hot Water, Others
Transportation
Automobile, Train, Ship ,Air Freight, Passenger
Agriculture
Pumping, Heating, Tractor
Calibration in basic year
Provincial energy balance tables, productivity tables
Macro-trends (projection of provincial level)
Provincial ratios of Population, GDP, Iron/Cement/Paper/Ethylene/Crops productions, etc.

(1) Beijing: all sectors (AIM-Local-2002)
(2) Shanxi: all sectors (AIM-Local-2002)

base year: 2000

simulation period: 2000-2030

emissions: CO_2, SO_2, NO_2

Stock allocation module

Energy consumption of thermal power generation

Fuel / Region	Coal	Fuel oil	Natural gas	Regional total (Sum by K)
Region i_1				
Region i_2				
… …	… …	… …	… …	… …
Region i_n				
National total (Sum by I)				

Simulation result

---- 202 VARIABLE S.L Provincial stock (l,i,j): Thermal power in GW

	Beijing	Tianjin	Hebei	Shanxi	InnerMong~
OILBLR.POWER	0.268	0.034	0.076		0.007
COLBLR.POWER	2.759	3.786	16.886	12.796	10.051
GASTBN.POWER		1.418078E-6			

+	Liaoning	Jilin	Heilongji~	Shanghai	Jiangsu
OILBLR.POWER	0.999	0.183	0.178	0.687	0.166
COLBLR.POWER	11.393	7.378	9.896	9.642	18.466
GASTBN.POWER		0.014	0.251		

+	Zhejiang	Anhui	Fujian	Jiangxi	Shandong
OILBLR.POWER	0.839	0.022	0.219	0.091	1.084
COLBLR.POWER	9.603	6.667	3.327	3.044	16.913
GASTBN.POWER					0.017

+	Henan	Hubei	Hunan	Guangdong	Guangxi
OILBLR.POWER	0.019	0.037	0.021	5.775	0.023
COLBLR.POWER	14.187	5.765	3.729	12.429	2.426
GASTBN.POWER				0.037	

+	Hainan	Chongqing	Sichuan	Guizhou	Yunnan
OILBLR.POWER	0.008	0.014	0.031	0.009	
COLBLR.POWER	0.485	2.206	6.204	4.557	4.035
GASTBN.POWER	0.105	0.051	0.217		

+	Tibet	Shaanxi	Gansu	Qinghai	Ningxia
OILBLR.POWER	3.959023E-5	0.030	0.033		
COLBLR.POWER		5.548	3.327	0.682	1.916

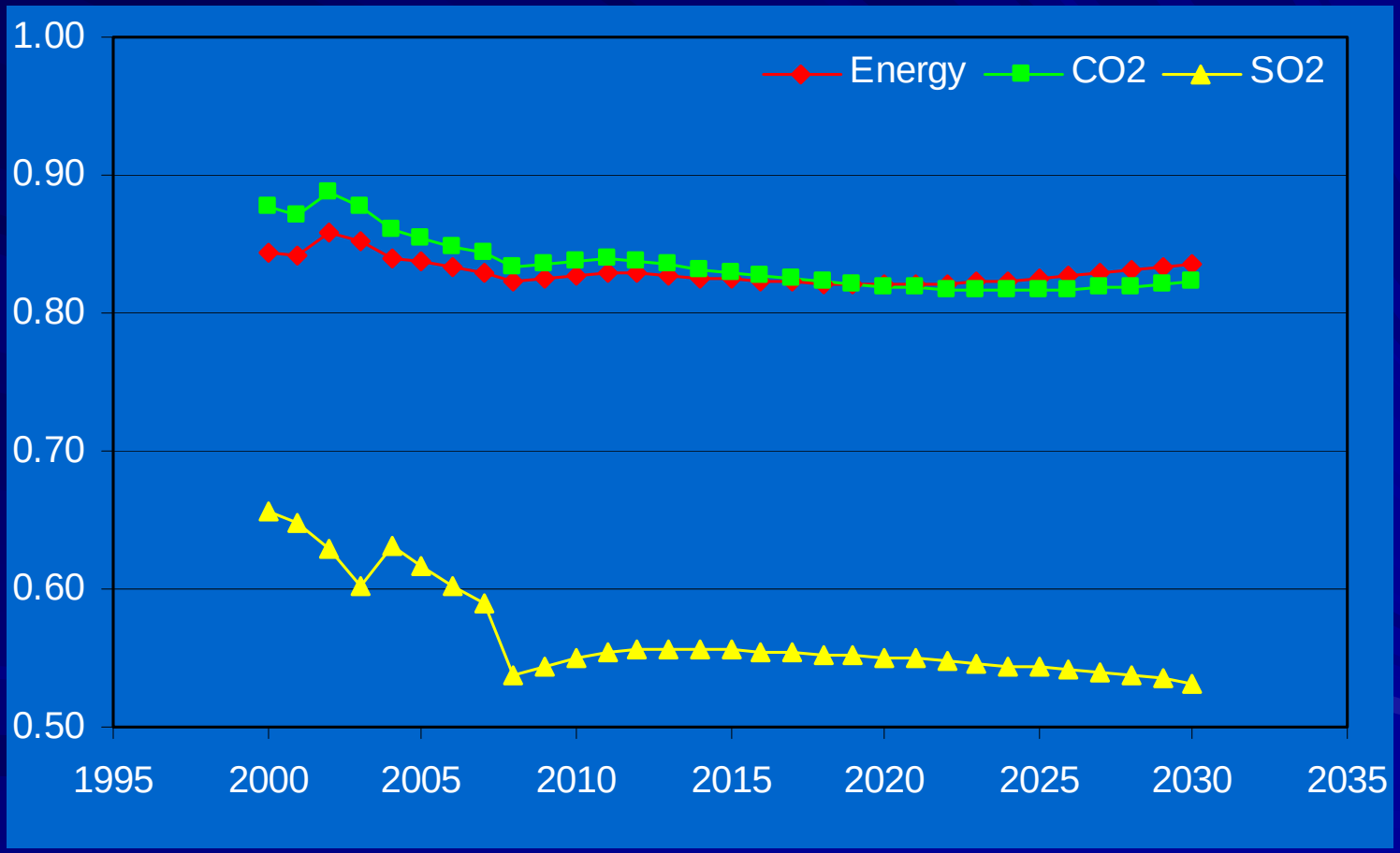
+	Xinjiang
OILBLR.POWER	0.023
COLBLR.POWER	3.249
GASTBN.POWER	0.478

(3) Inter-provincial module

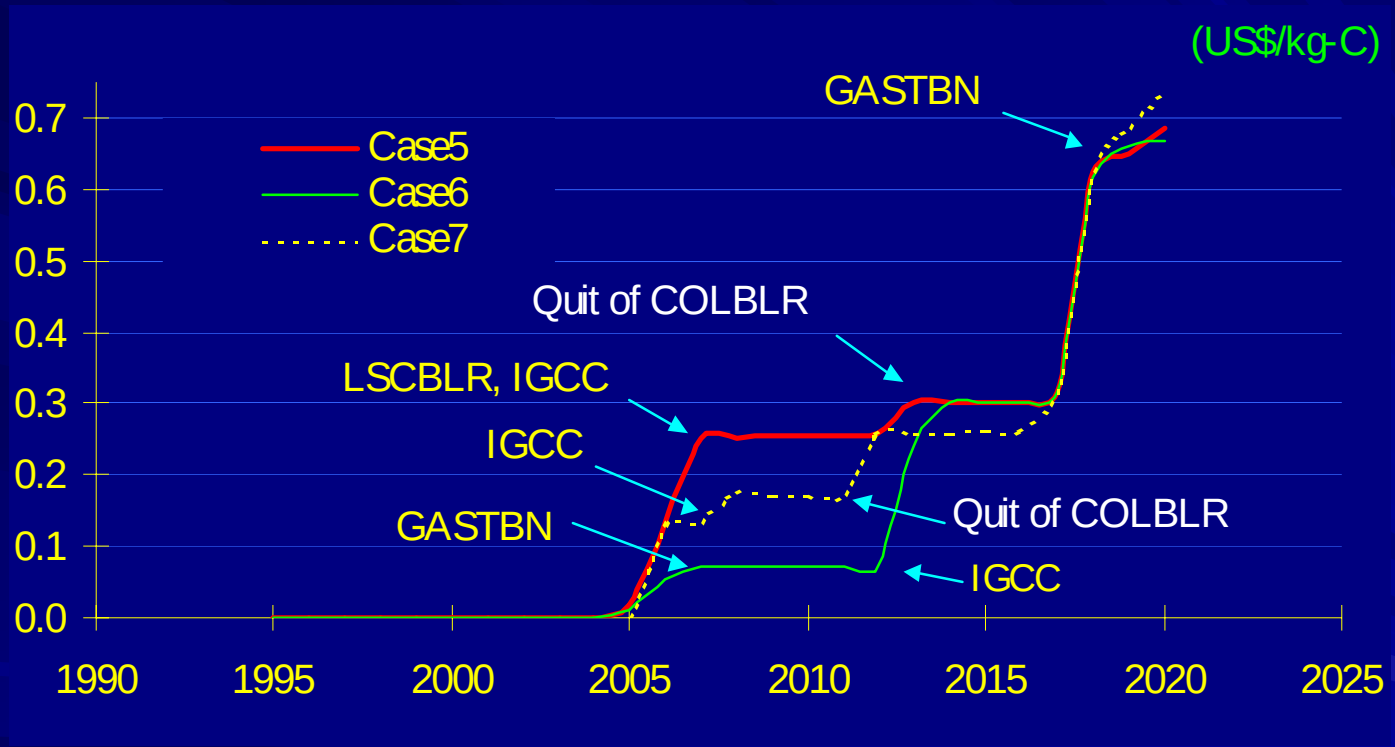
- Coal transportation from Shanxi to Beijing

Railway:
Datong-Qinhuangdao
Baotou-Beijing

Ratio of Beijing/Shanxi for energy, CO_2 and SO_2



3. Estimation of the effects of Clean Development Mechanism at provincial and sectoral levels in China



Provincial level: (Beijing study) CDM fund used as subsidies to technologies can help to reduce the marginal costs of Gas turbine and IGCC.

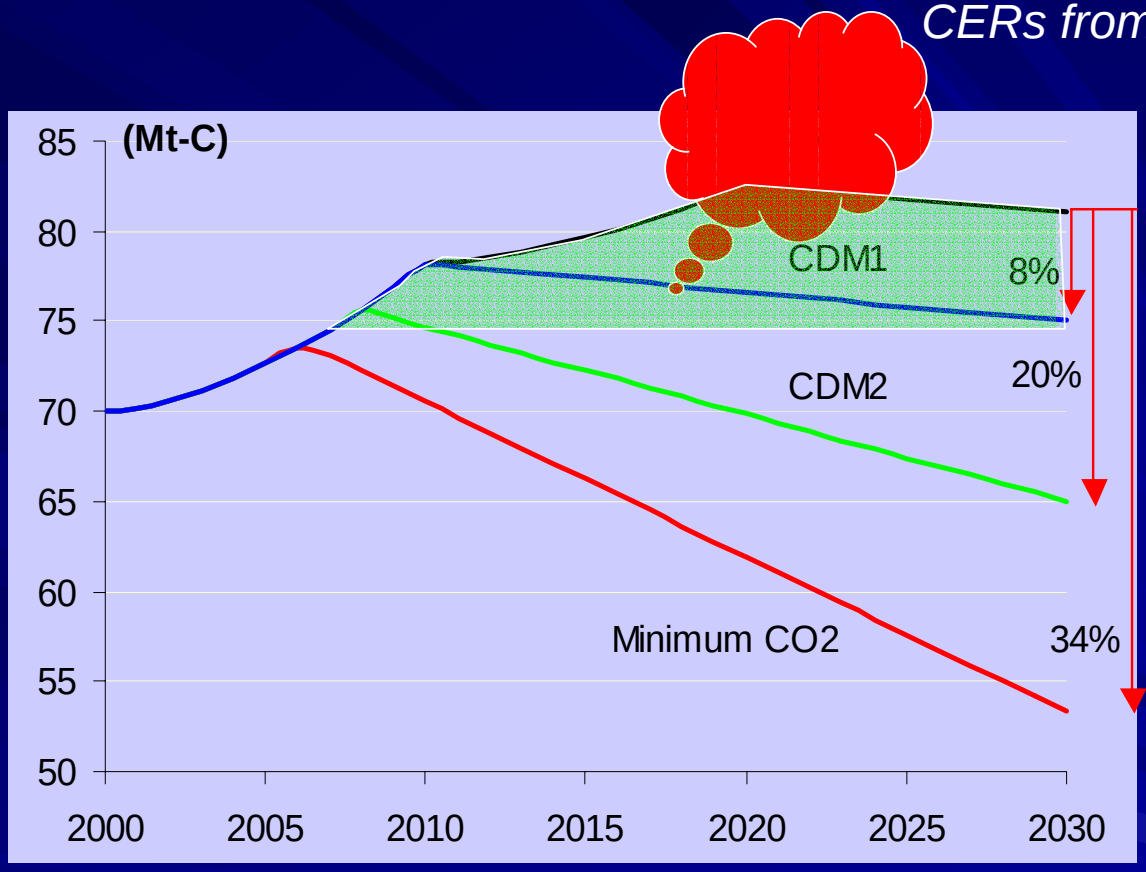
Projection of future emissions from iron and steel industry with/without CDM

Shares of the accumulated production by technologies under different scenarios (%)
Period: 2000-2030

Scenario	Open-hearth	Oxygen	AC Electric	DC Electric	Heat Recovery	DIOS	Total
Market	0.4	81.3	18.3	0.0	0.0	0.0	100
CDM1	0.4	73.7	19.4	1.4	5.2	0.0	100
CDM2	0.4	58.2	24.5	11.0	5.9	0.0	100
Min CO_2	0.4	42.6	24.3	30.7	2.1	0.0	100

Present technologies in China

Advanced technologies from Japan



Reasonable scale of CDM opportunities for Japan's technologies in China's iron and steel industry

- Possible application areas of AIM-Local model?
- Specific needs and requirements to the model?