

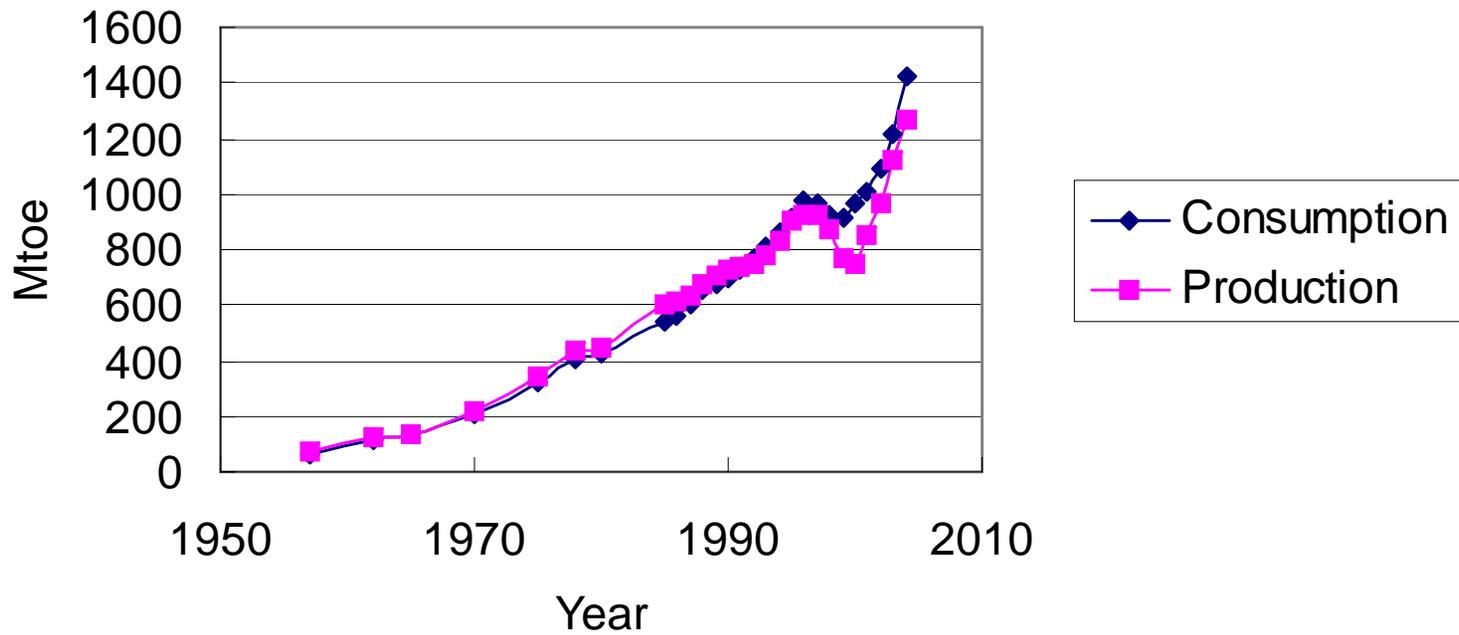
Energy Future and Policies: Recent IPAC Activities and Policy Perspective

Jiang Kejun

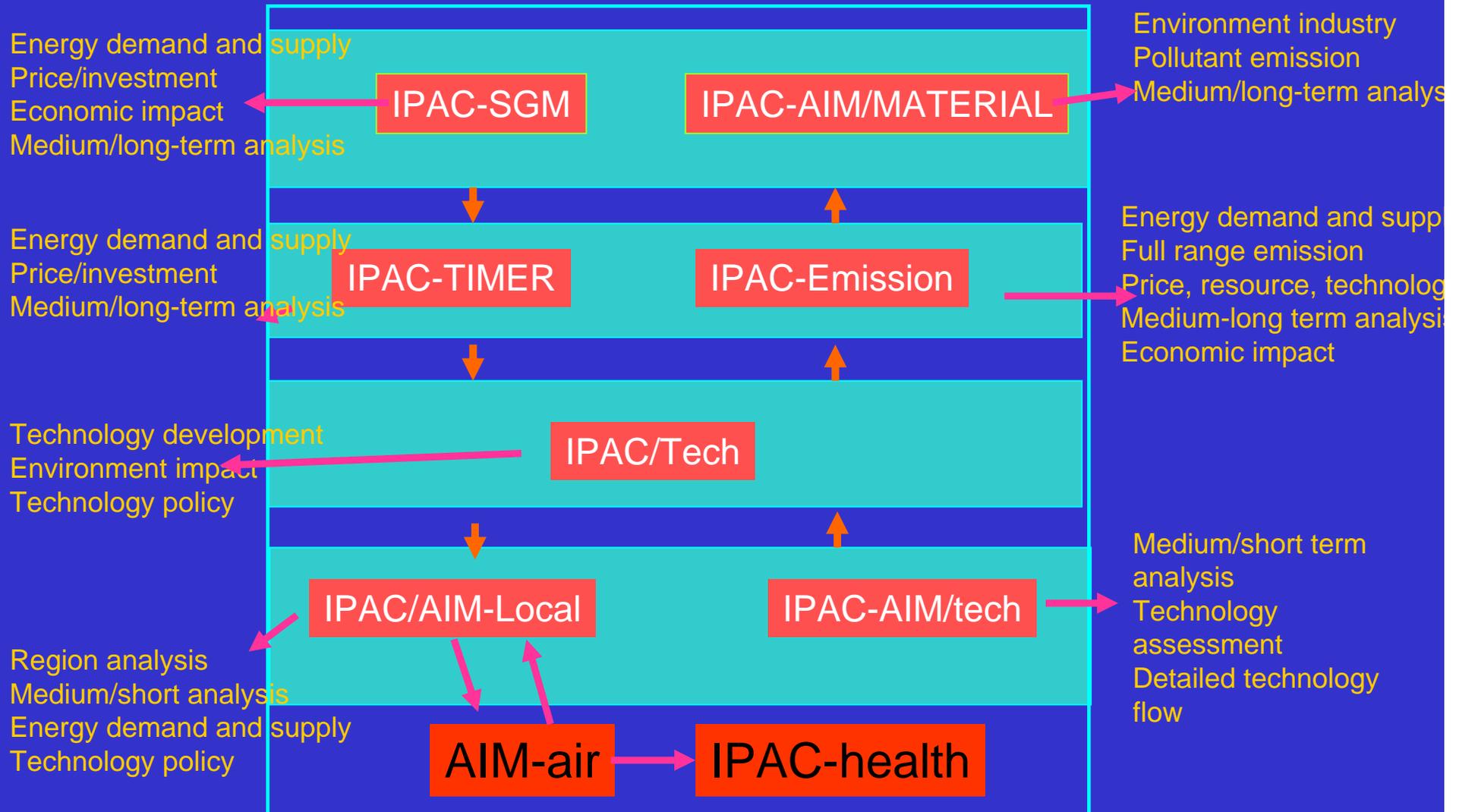
Energy System Analysis and Market Analysis Division
Energy Research Institute, China

China-Korea-U.S. Modeling Workshop, April 20-21, 2006

Energy Production and Consumption in China, 1957-2004



Framework of IPAC



Presentation content

- IPAC modeling activities in 2005-2006
- Policy discussion

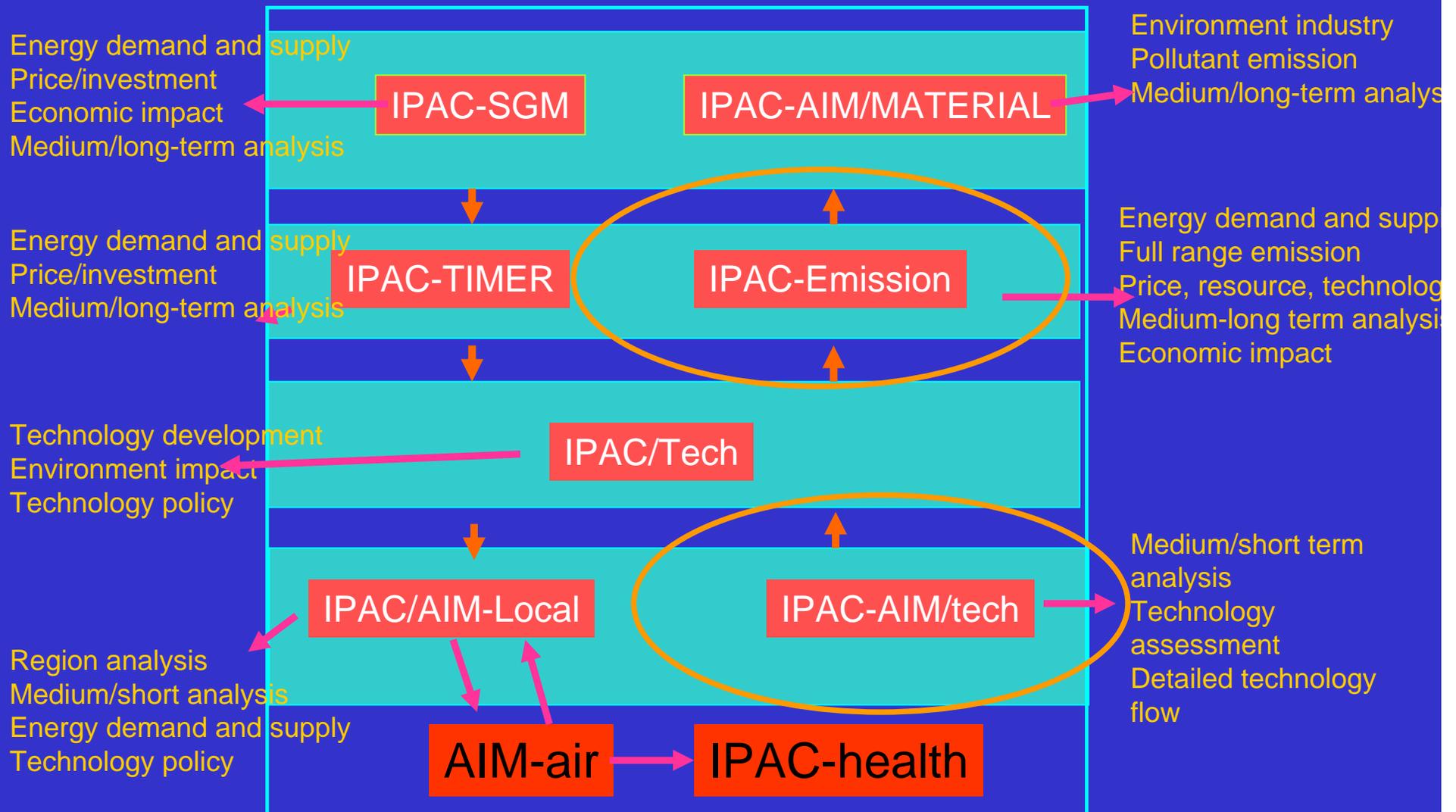
IPAC Modeling Activities: Progress in 2005-2006

- Energy and GHG Emission scenario up to 2030
- Urban Transport Development Study
- Energy Fiscal Policy Assessment
- Beijing Energy and Environment Analysis
- Climate and Development: Clean Coal Technology Assessment
- Long-term Emission Scenarios up to 2050 (Mrs. Hu XIulian's presentation)
- Regional Energy and Emission Analysis(Liu Qiang's Presentation)

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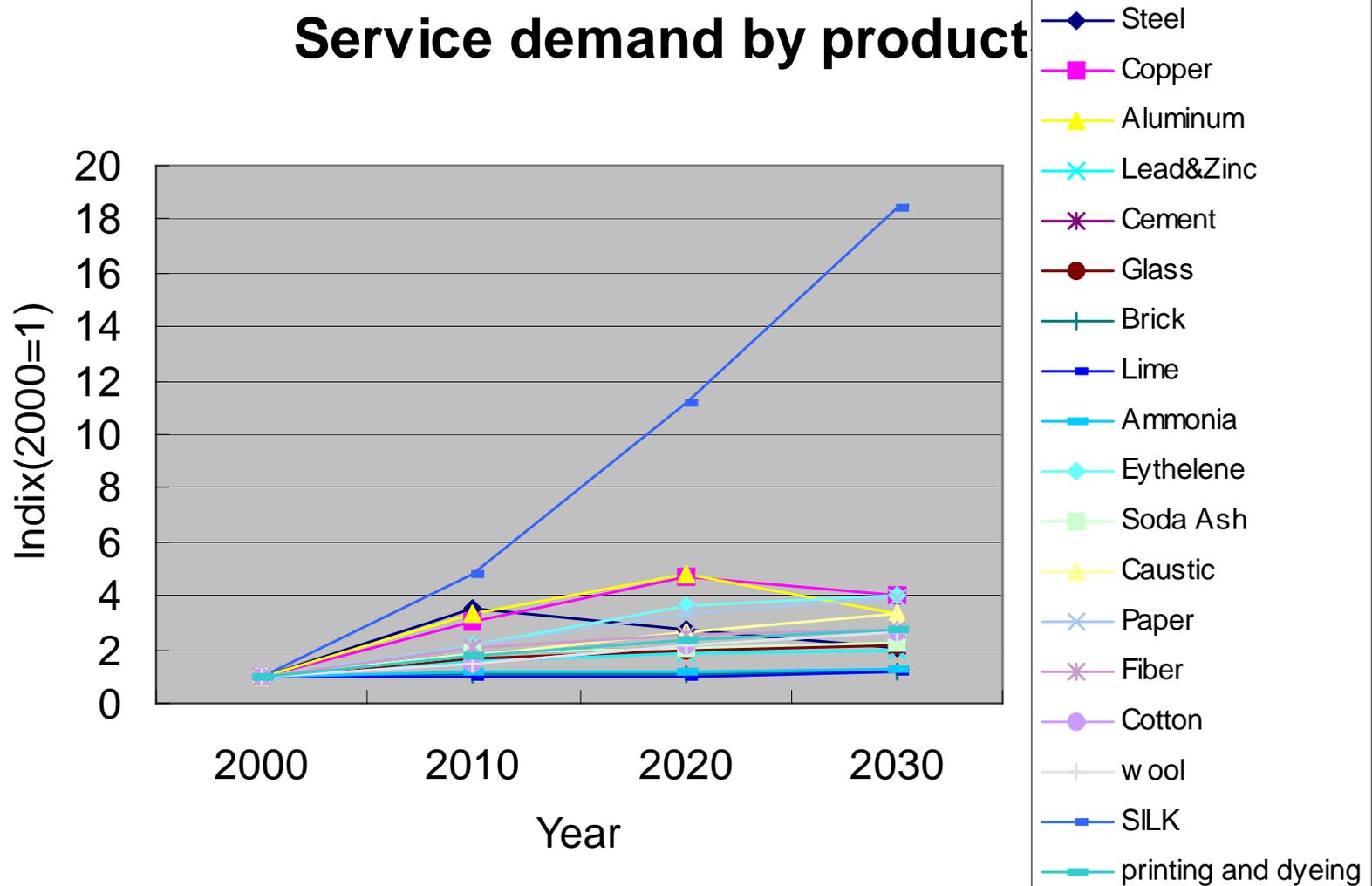
Energy and GHG Emission scenario up to 2030

- Including most recent energy data (up to 2004 and 2005)
- National plan (Economy growth, energy conservation plan, renewable energy plan)
- Circulating Economy Modeling (Process linkage within IPAC-AIM/technology model)

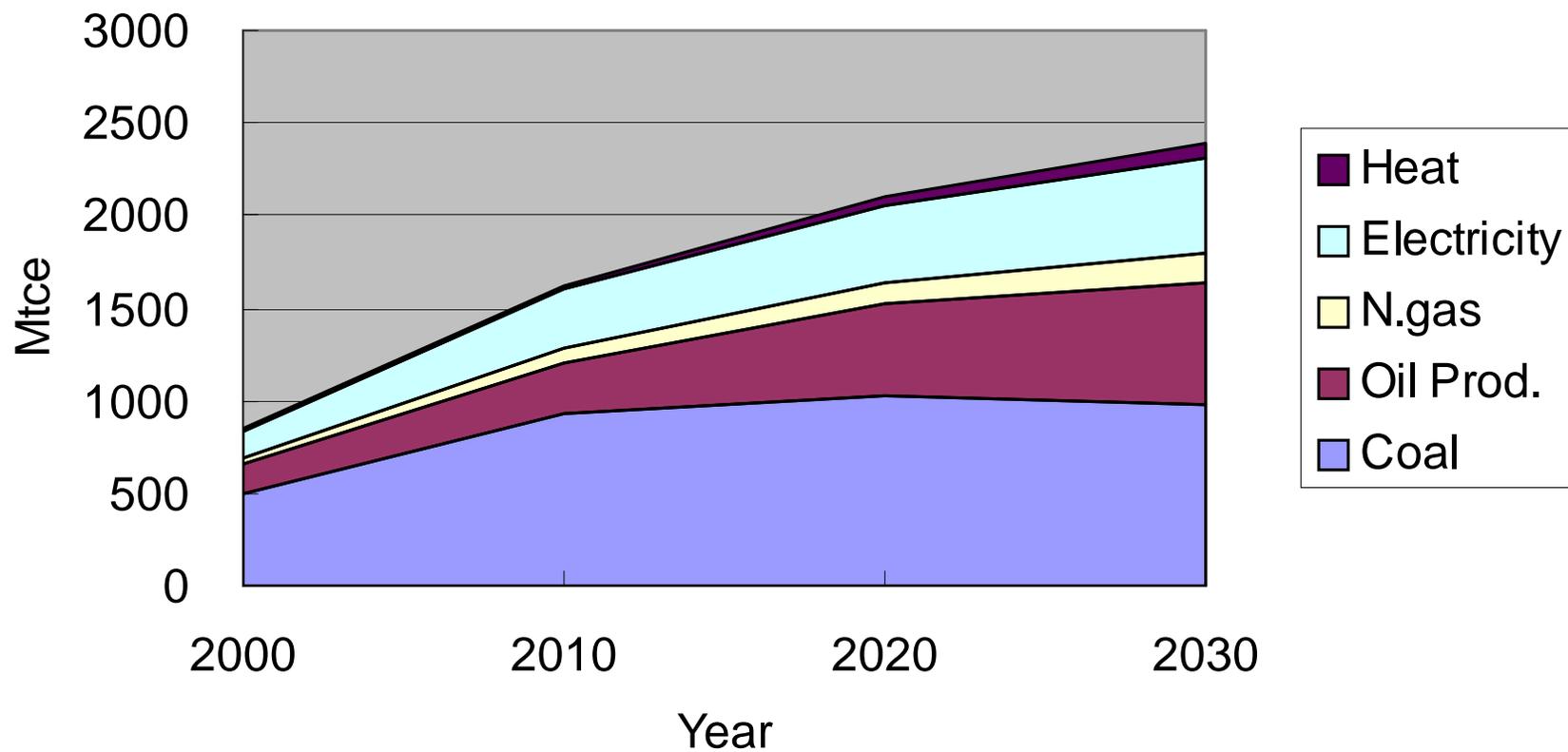
Energy and Emission Forecast in China: Population Scenario

		2000	2010	2020	2030
Total population	milliom	1267.43	1368.00	1445	1500
Share of City	%	0.36	0.48	0.57	0.66
Urban Pop	milliom	458.81	649.80	823.65	990.00
Rural Pop	milliom	808.62	718.20	621.35	510.00

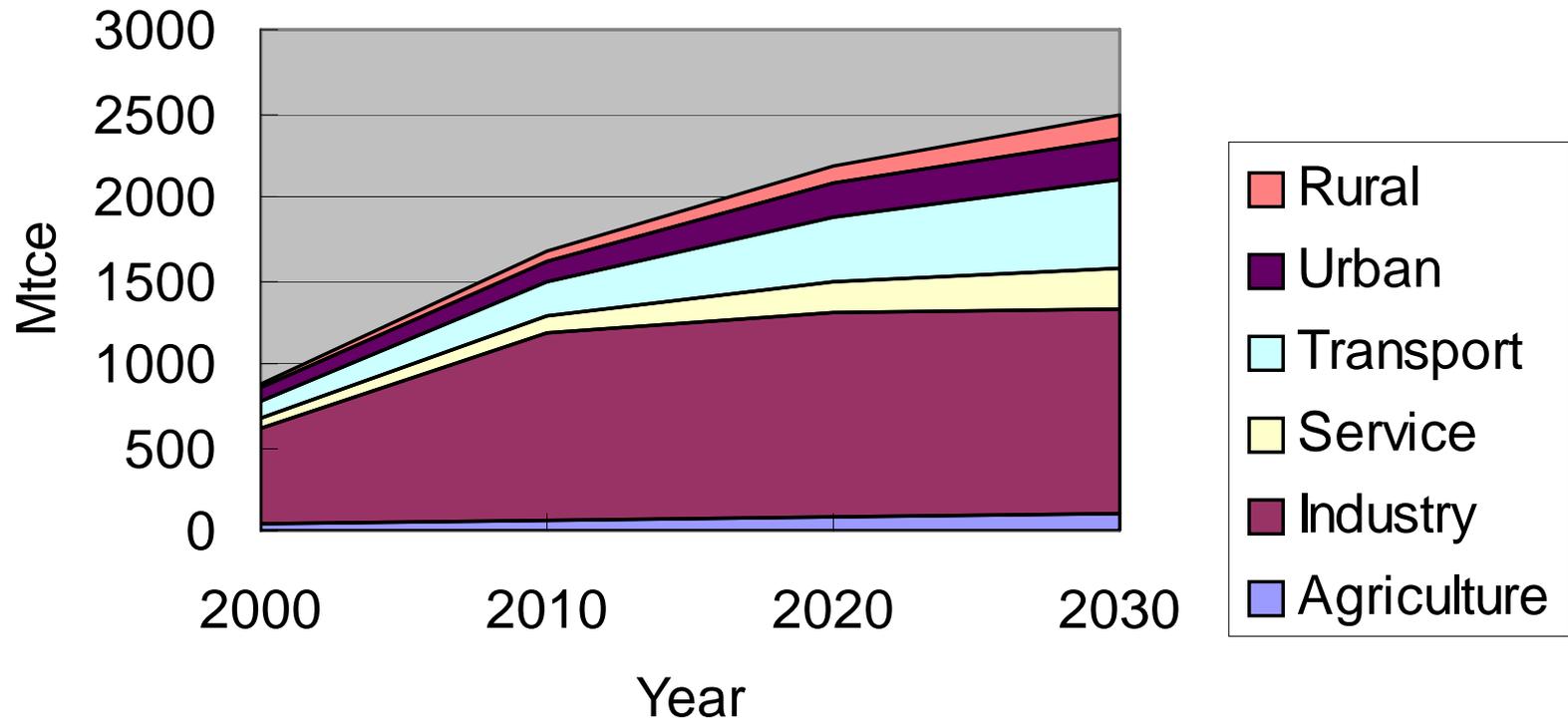
Service demand by product



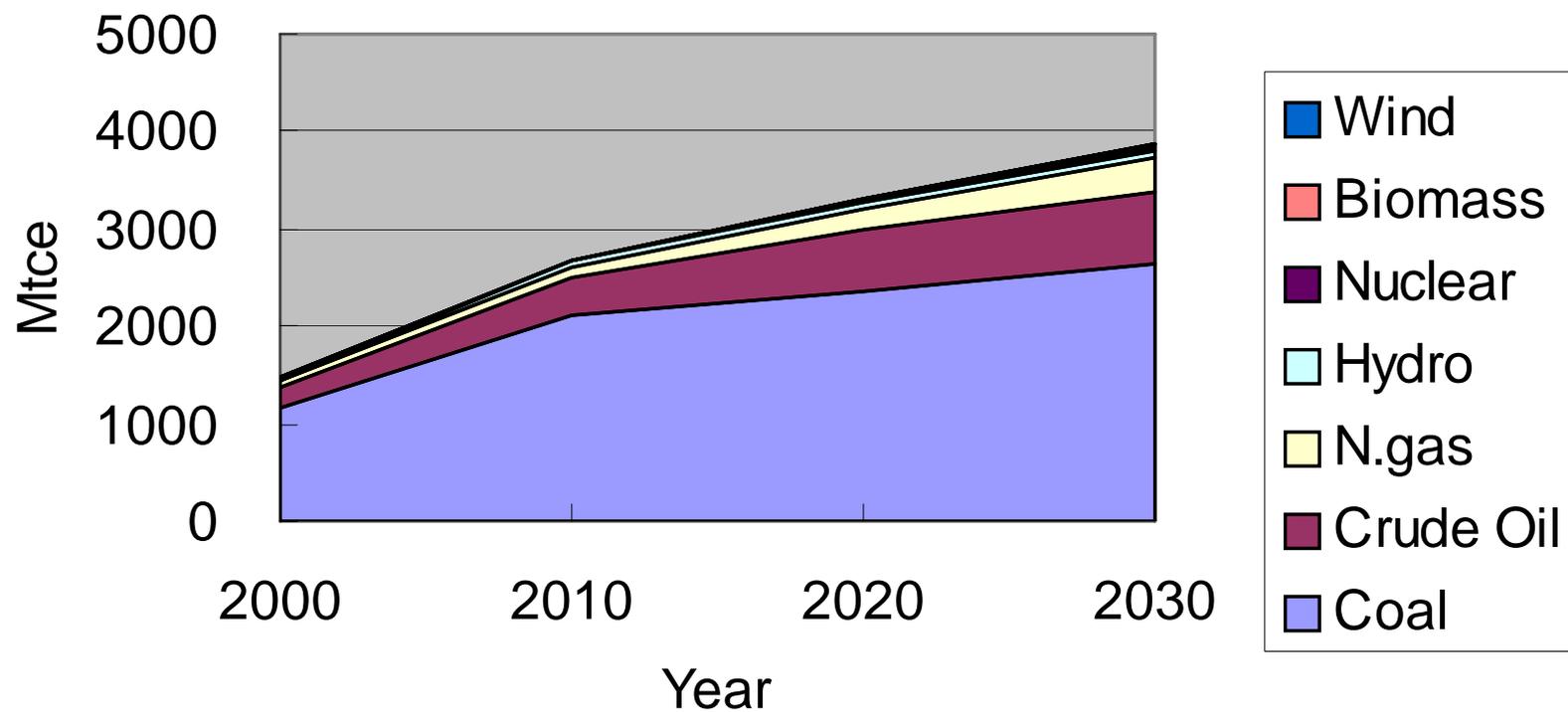
Final Energy Demand in China



Final energy demand by sector in China



Primary energy demand in China



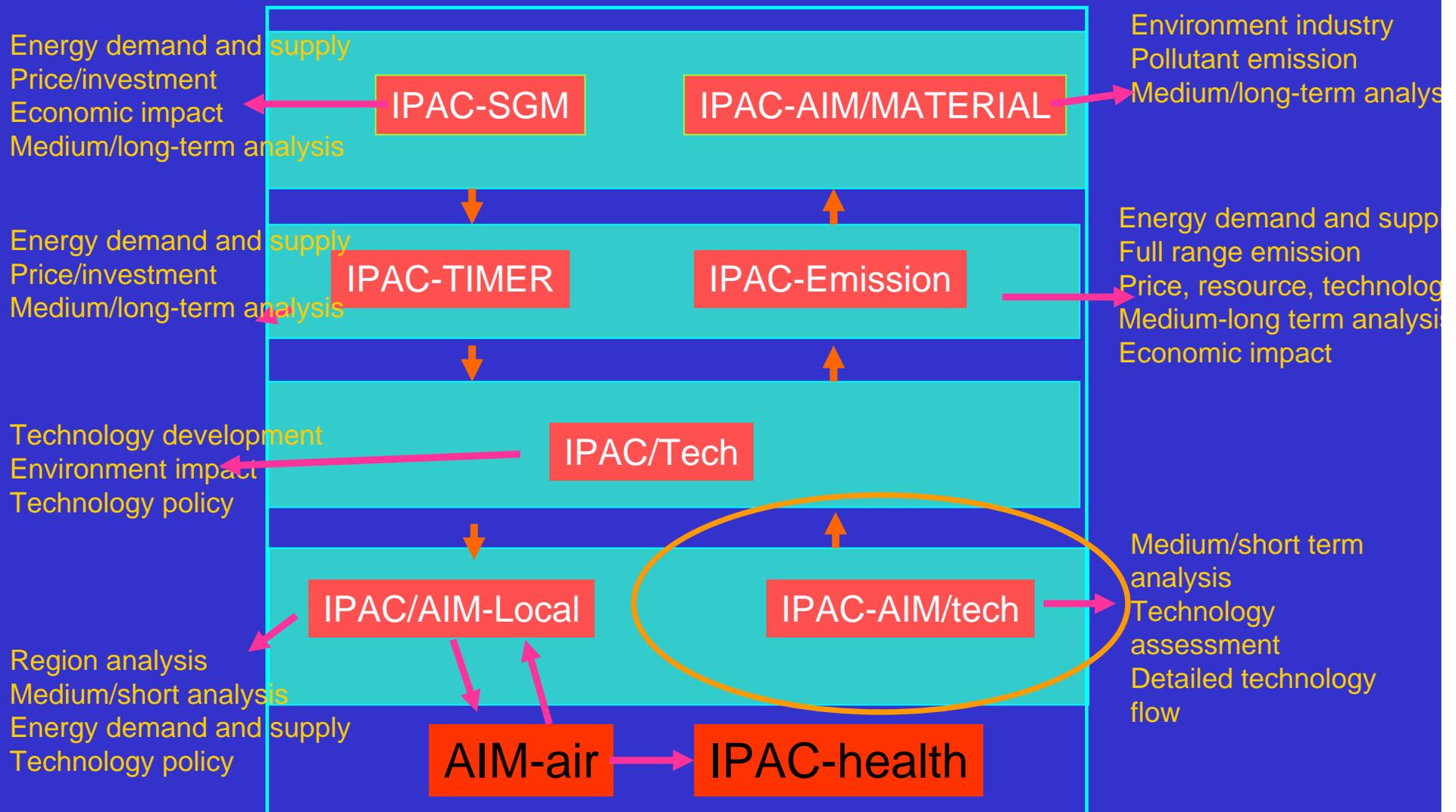
IPAC Modeling Activities: Progress in 2005-2006

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Urban Transport Development Study

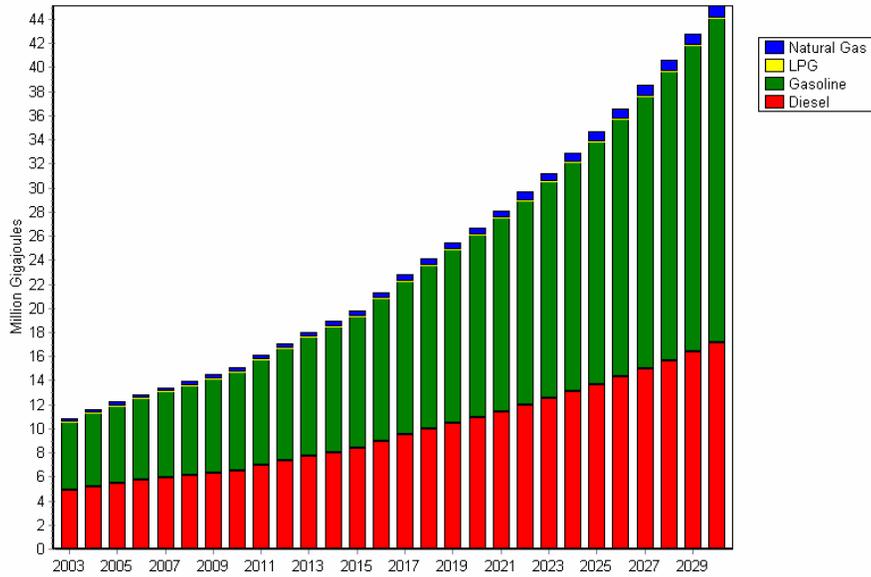
- Ultra-Large City: Beijing (Report available), Shanghai, Chong Qing
- Large Rich City: Hangzhou (Report available)
- Large Poor City: Taiyuan (?) (Report available), Yin chuan, Xining
- Small City: *Lang Fang*

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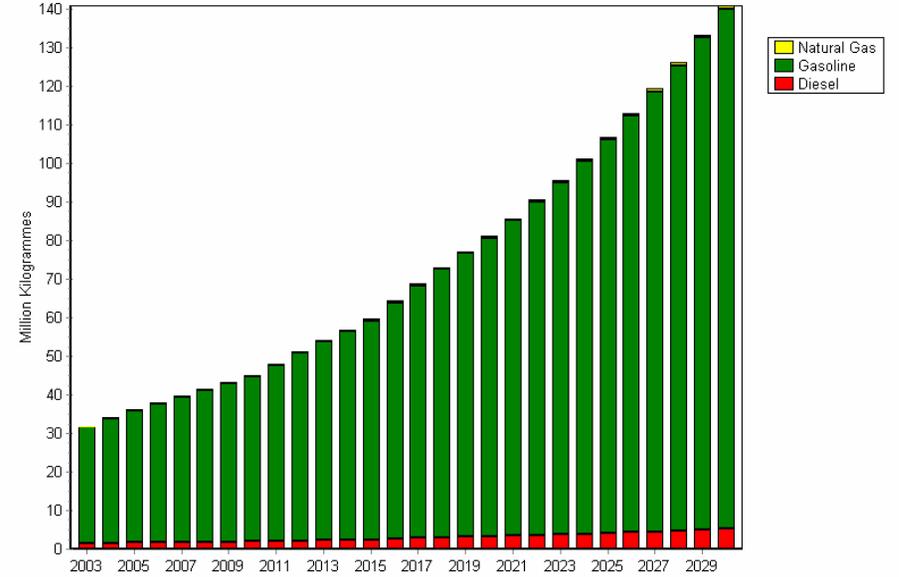
Demand: Energy demand (final units)

Scenario: BaU



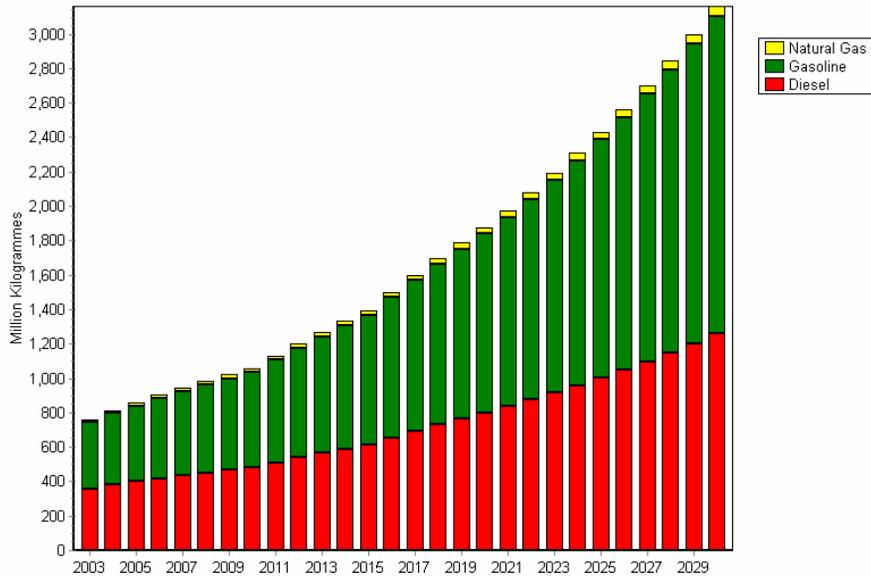
Environment: CO

Scenario: BaU



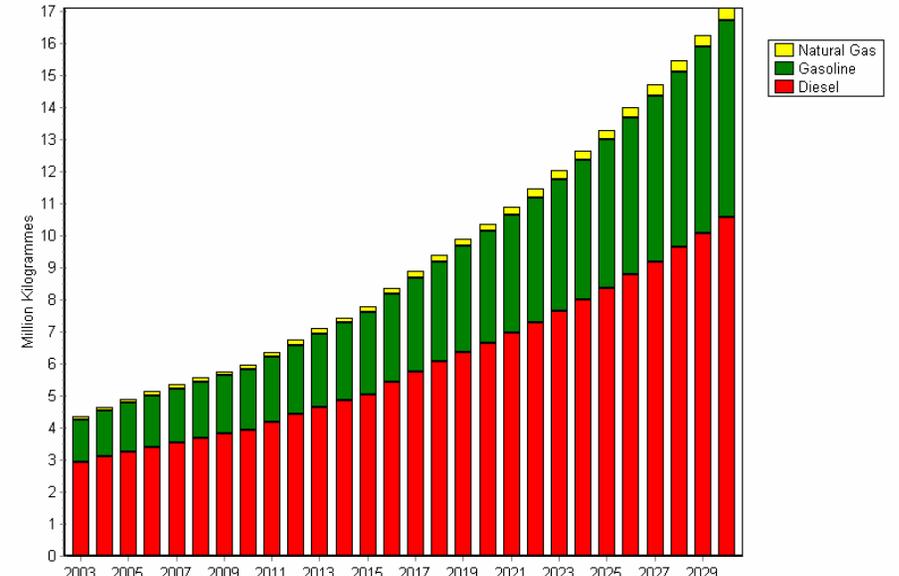
Environment: CO2 Emission

Scenario: BaU



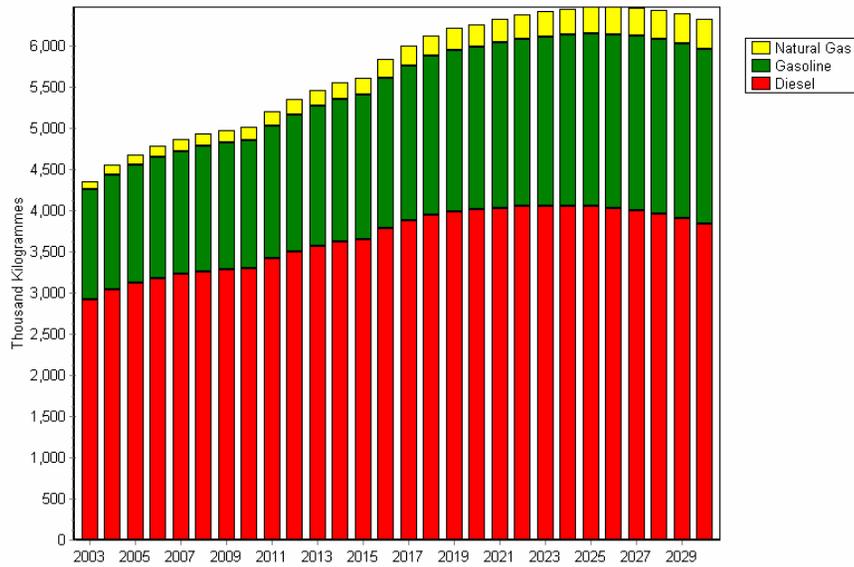
Environment: NOx Emission

Scenario: BaU



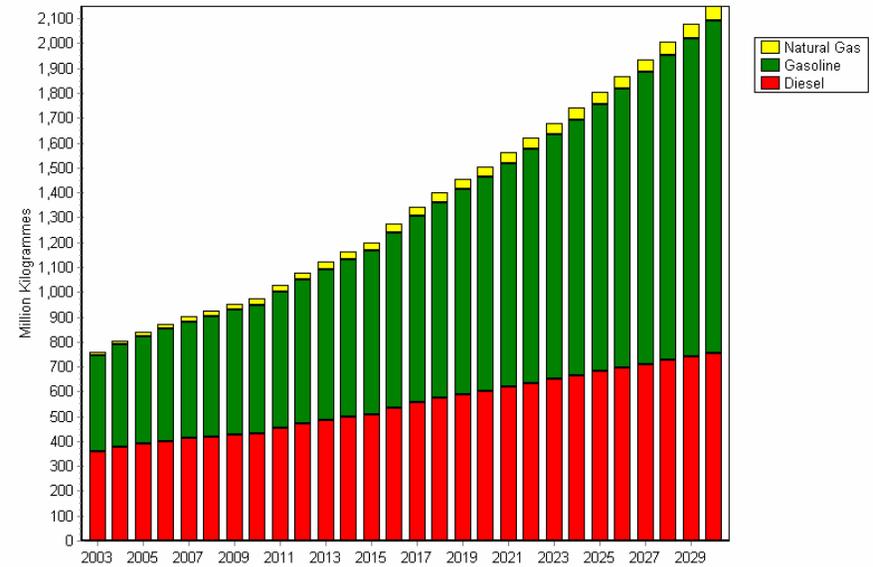
Environment: NOx Emission

Scenario: Policy Scenario



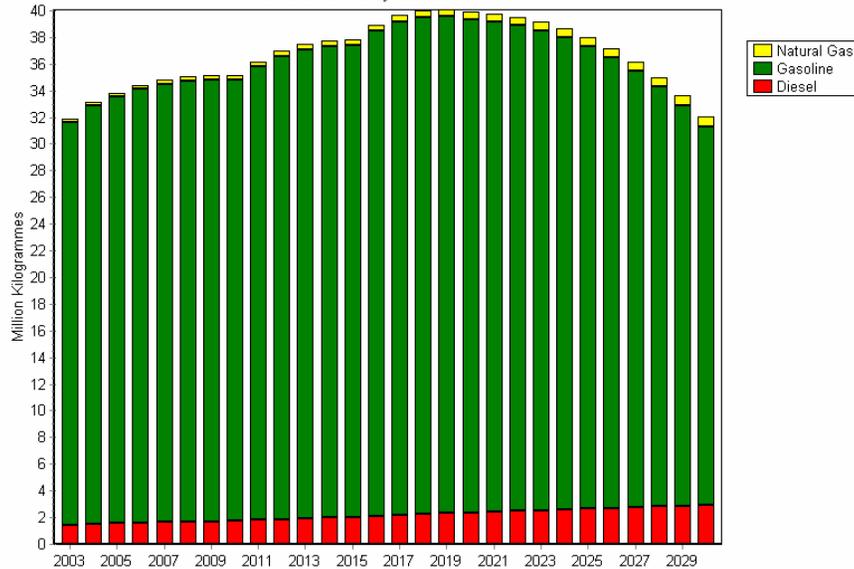
Environment: CO2 Emission

Scenario: Policy Scenario



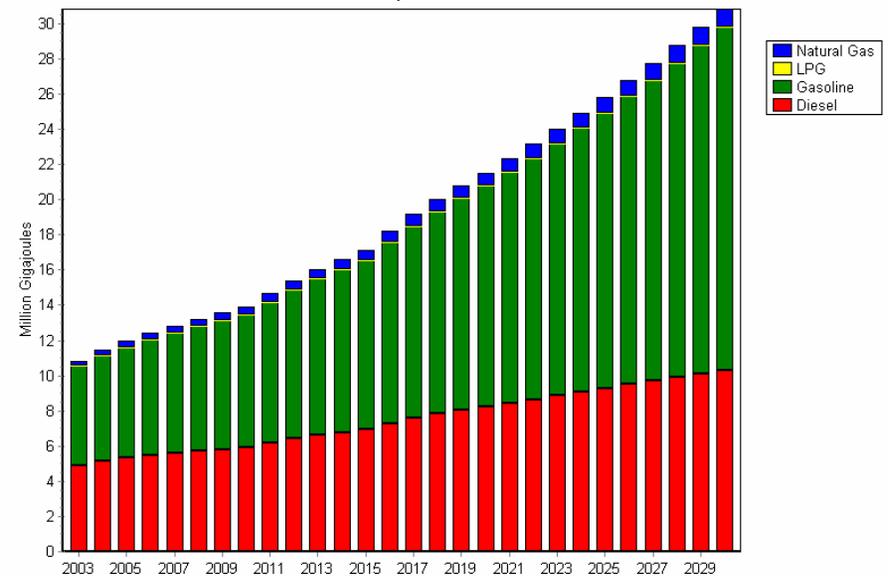
Environment: CO Emission

Scenario: Policy Scenario



Demand: Energy demand (final units)

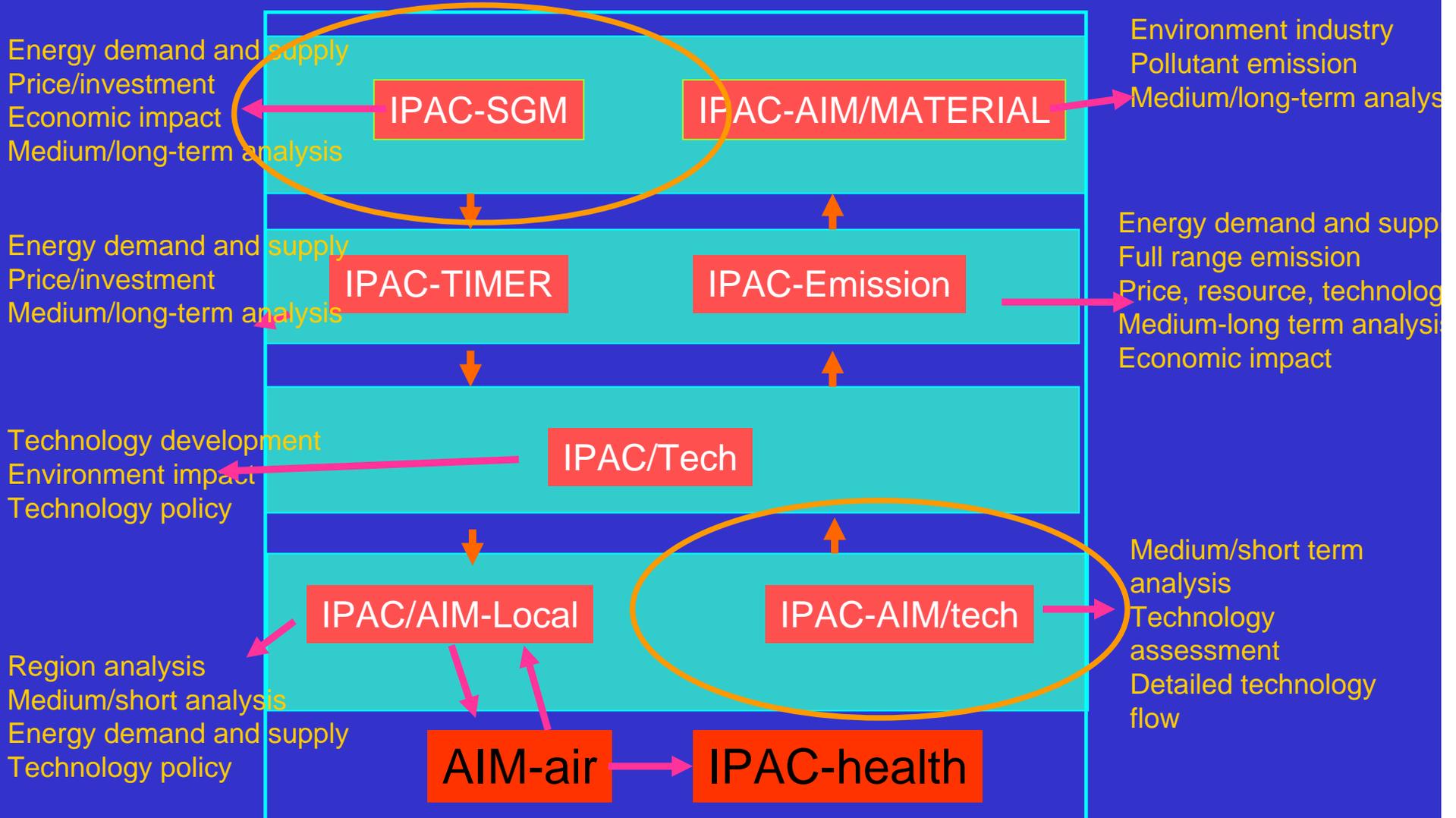
Scenario: Policy Scenario



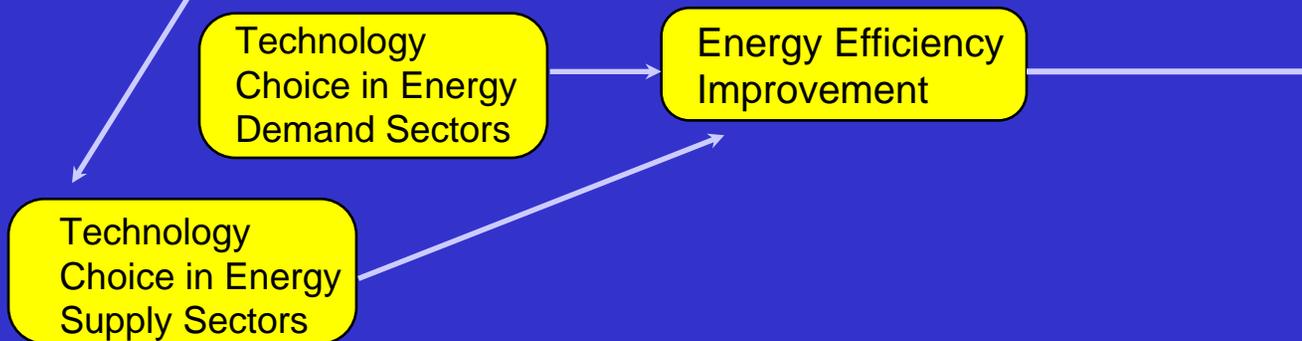
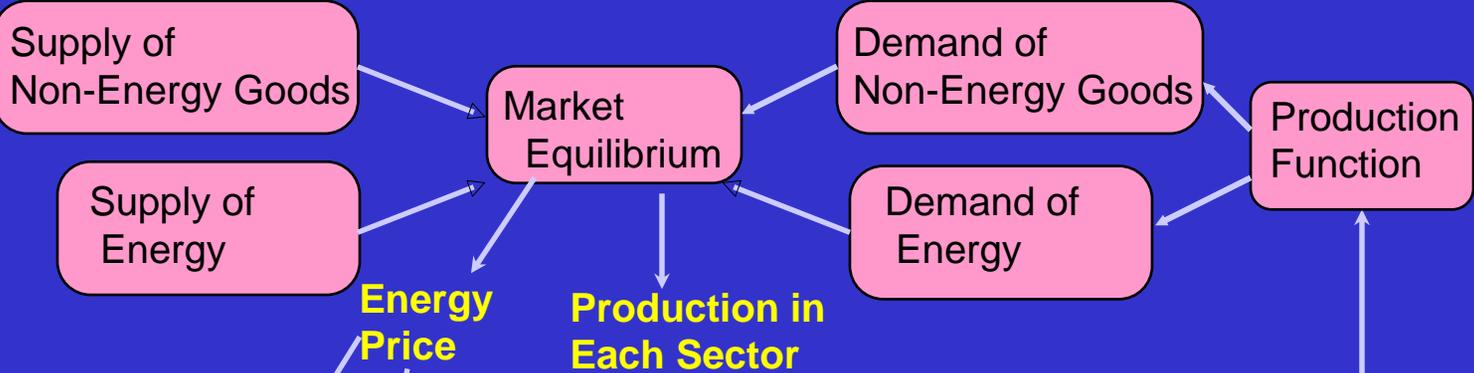
IPAC Modeling Activities: Progress in 2005-2006

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Framework of IPAC



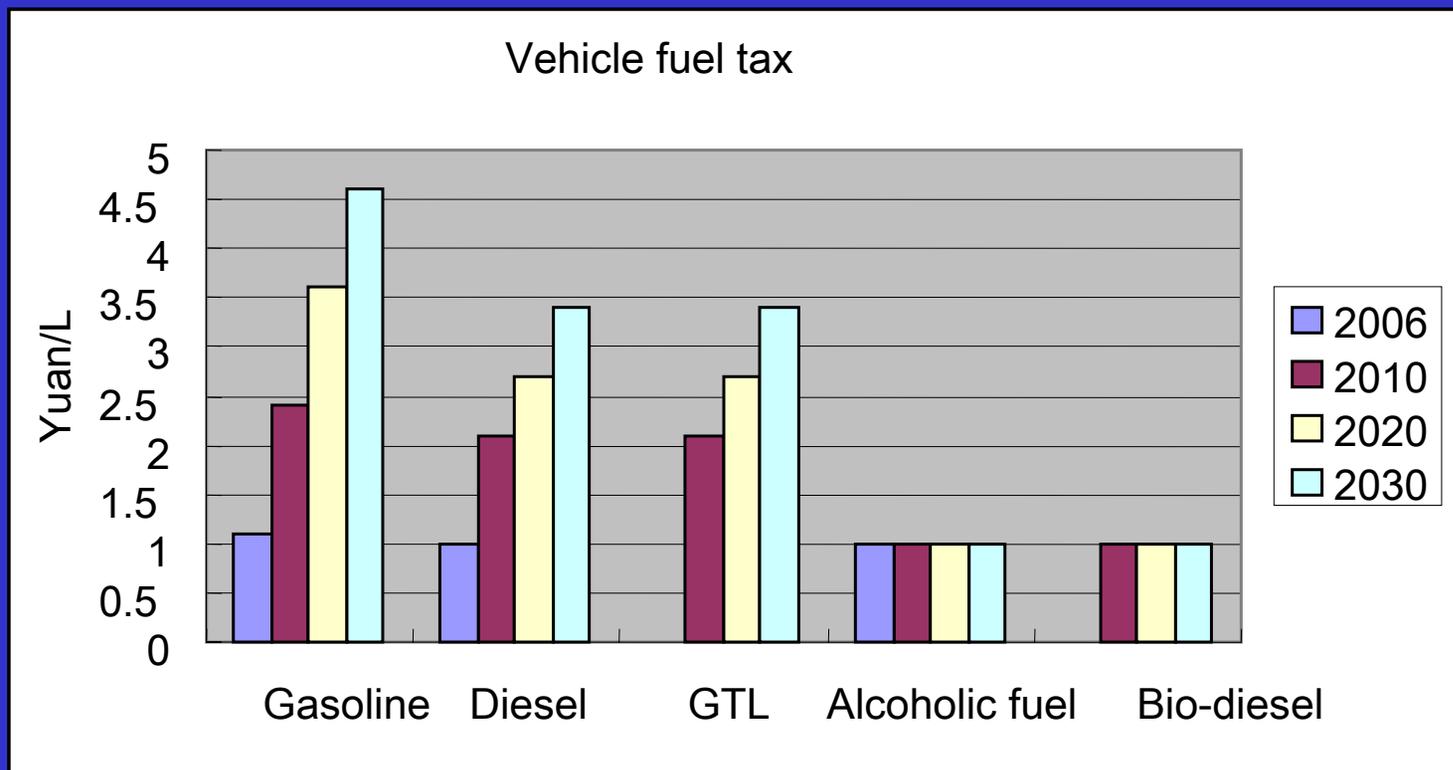
TOP-DOWN MODEL
IPAC-SGM



IPAC-AIM
BOTTOM-UP MODEL

Establishment of fiscal and taxation policies for energy sustainable development in China

1. Vehicle fuel tax (change fee to tax and vehicle fuel tax)

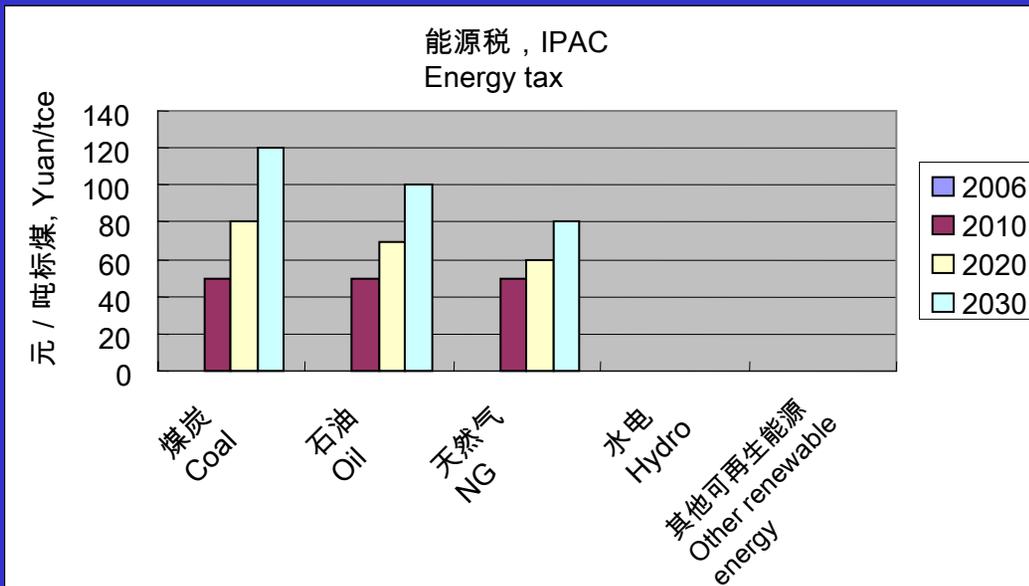


	2006	2010	2020	2030
汽油 Gasoline	1.1(费改税, change fee to tax)	2.4	3.6	4.6
柴油 Diesel	1(费改税, change fee to tax)	2.1	2.7	3.4
GTL		2.1	2.7	3.4
醇类燃料 Alcohol fuel	1	1	1	1
生物柴油 Bio-diesel		1	1	1

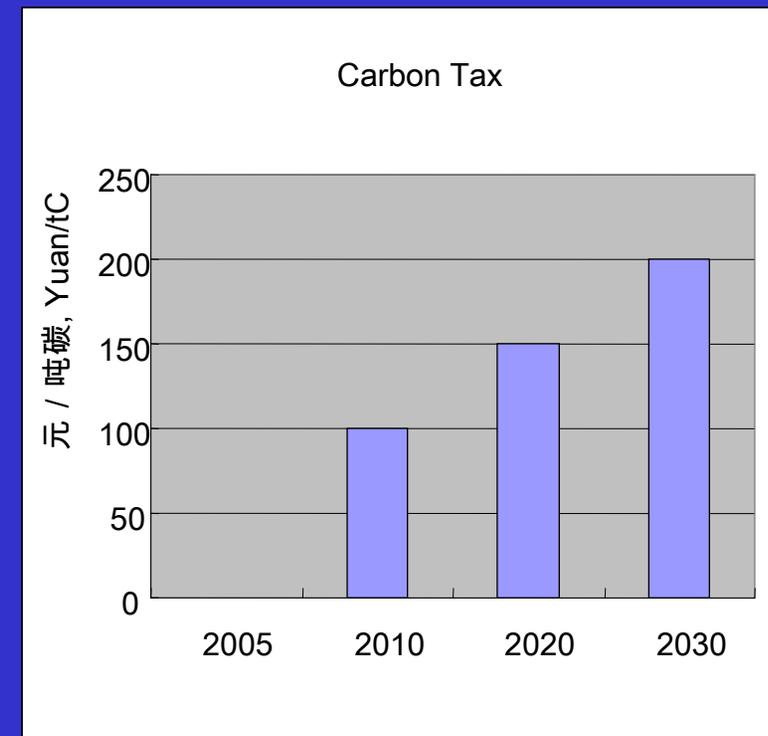
Establishment of fiscal and taxation policies for energy sustainable development in China (Cont.)

2. Energy tax (based on heat value and encourage clean energy)

	2006	2010	2020	2030
煤炭 Coal	0	50	80	120
石油 Oil	0	50	70	100
天然气 Natural Gas	0	50	60	80



3. Carbon tax



Establishment of fiscal and taxation policies for energy sustainable development in China (Cont.)

4. End-use energy price

		2005	2010	2020	2030
石油制品 Oil product	Yuan/Ton	2822	3116	3912	4430
天然气 Natural Gas	Yuan/m ³	1.61	1.6	1.67	1.76
煤炭 Coal	Yuan/Ton	495	496	500	489
电力 Electricity	Yuan/KWh	0.45	0.46	0.47	0.47
醇类染料 Alcoholic Fuel	Yuan/Ton	2900	2900	2900	2900
生物柴油 Bio-diesel	Yuan/Ton	5300	4300	3900	3800

5. Utilization of tax revenue

In modeling:

70% goes to government revenue, as common expense for government

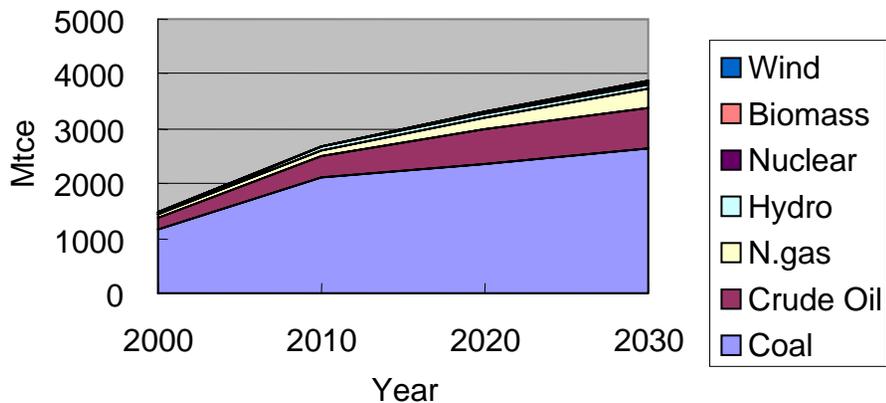
30% goes to expense for energy conservation and new energy development

Indicators for policy assessment

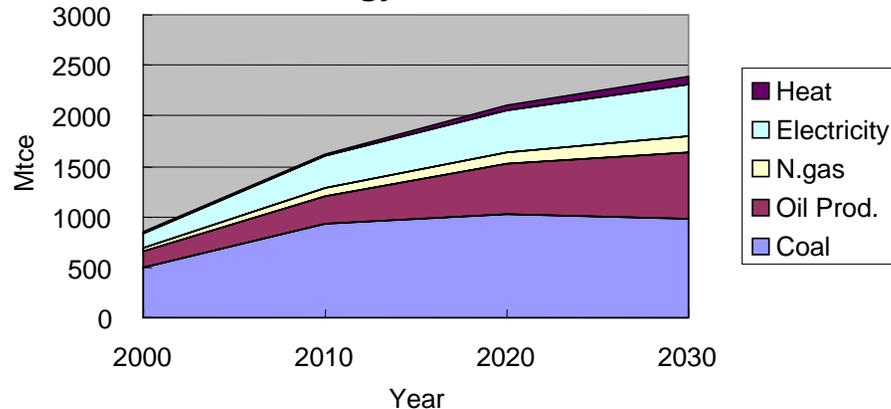
- Cost and benefit
- Energy security
- Rural energy supply
- Poverty
- Production safety
- Emission mitigation
- Water and land damage
- Institutional arrangement
- Economy promotion
- Employment
- Multiple development objectives

Modeling analysis result: Baseline scenario

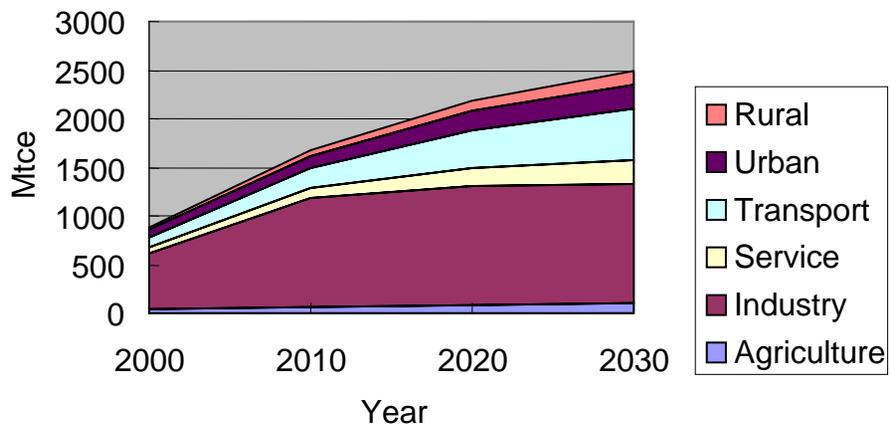
中国一次能源需求
Primary energy demand in China



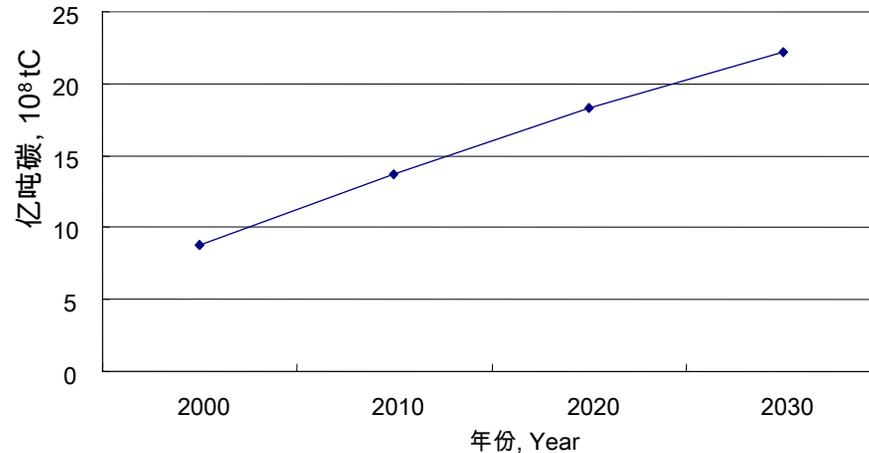
中国终端能源需求
Final Energy Demand in China



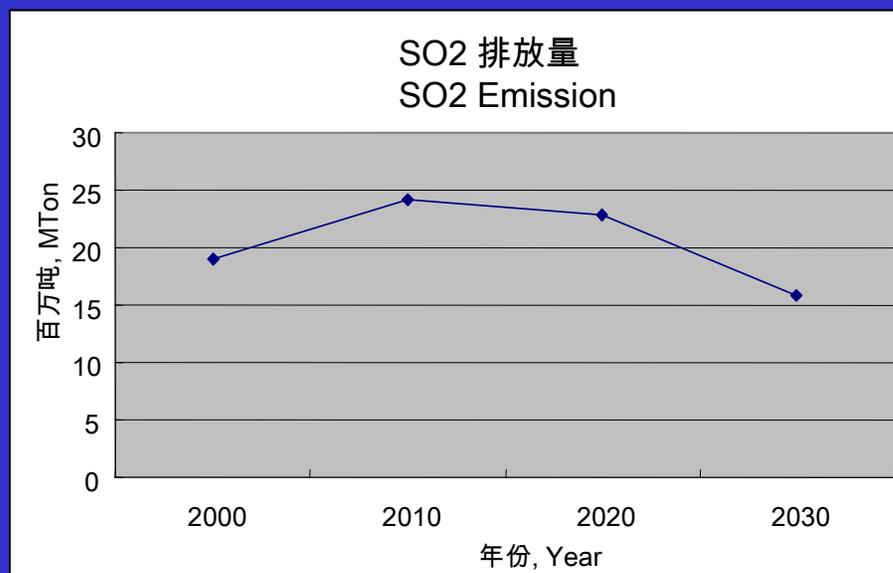
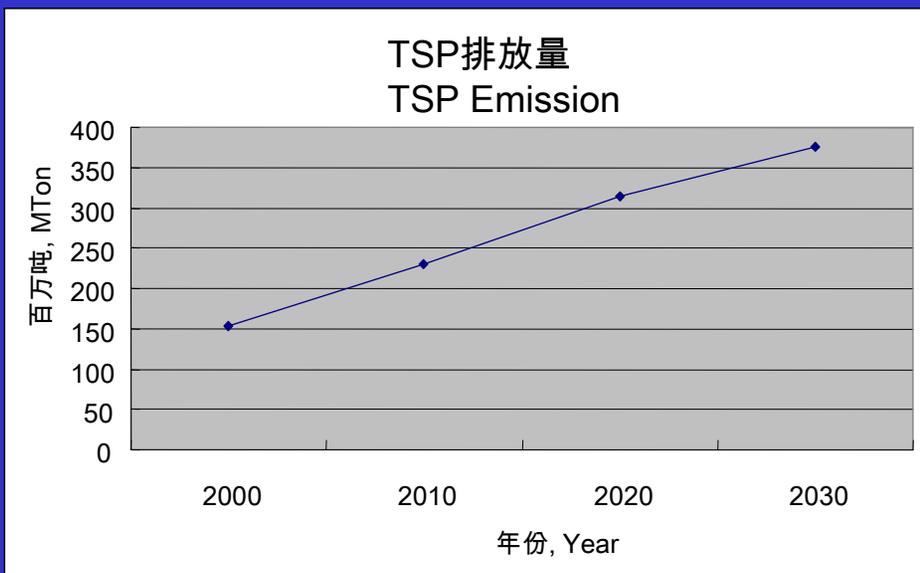
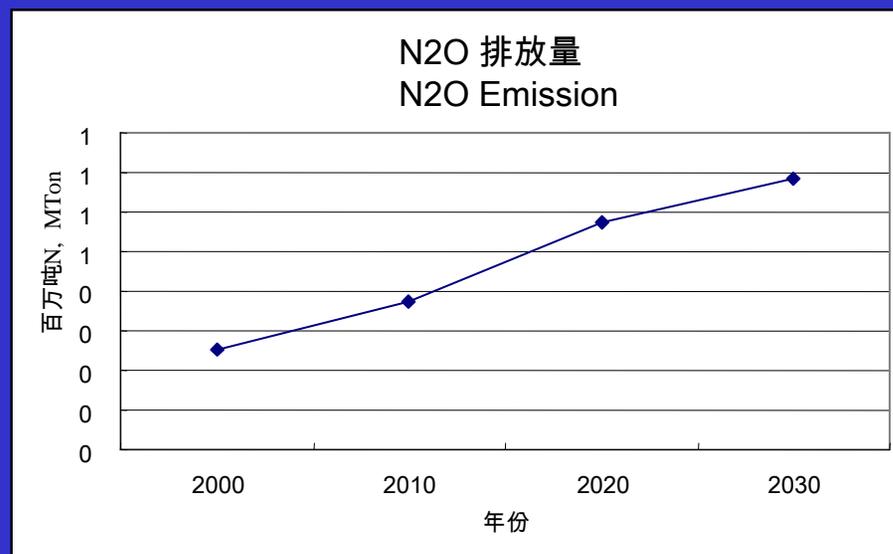
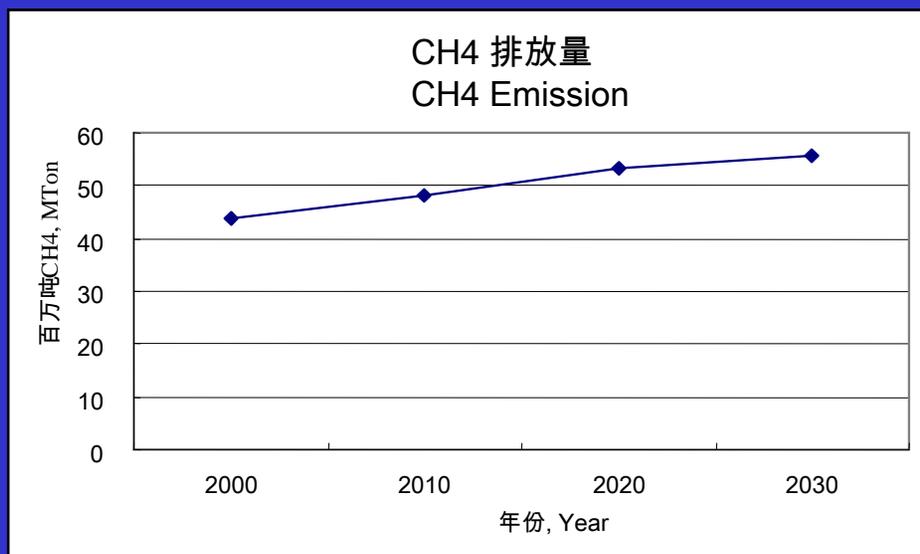
中国终端分部门能源需求
Final energy demand by sector in China



CO2排放量
CO2 Emission



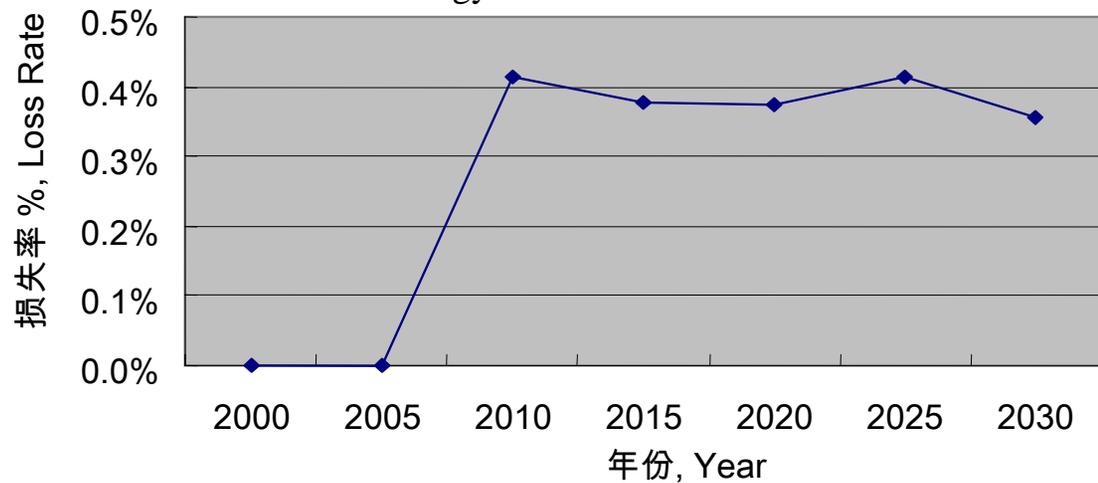
Modeling analysis result: Baseline scenario (Cont.)



Modeling analysis result: Energy tax scenario

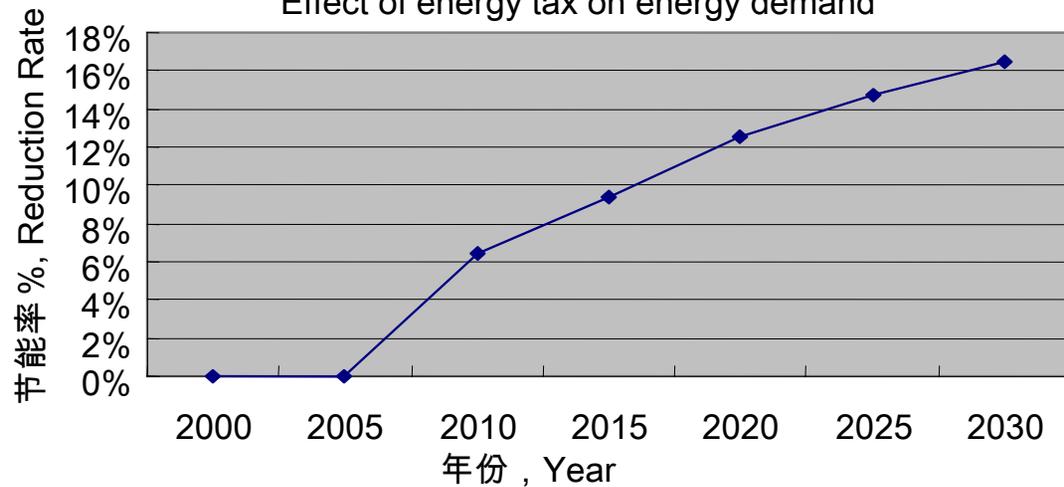
能源税对中国GDP的影响

Effect of energy tax on GDP of China



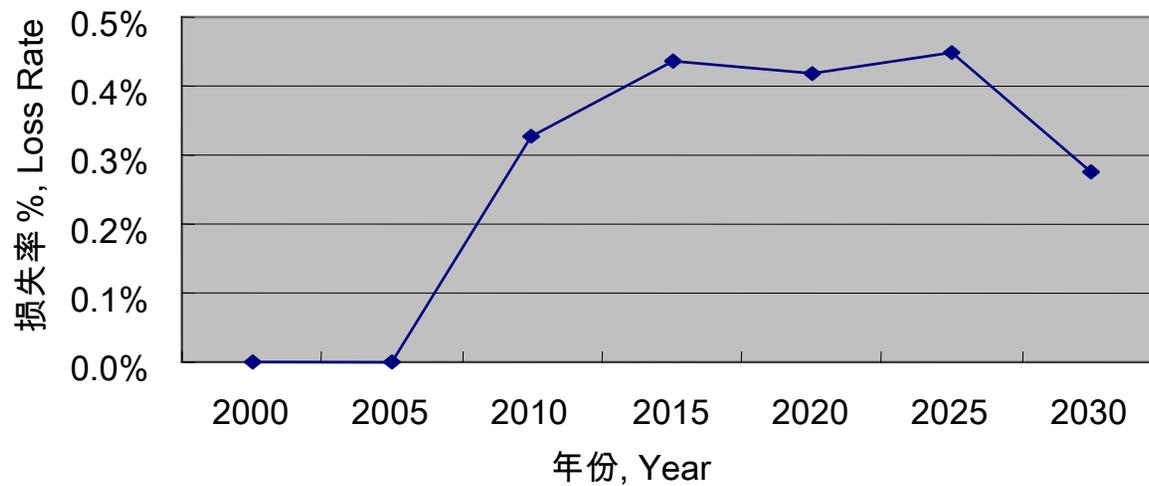
能源税对能源需求的影响

Effect of energy tax on energy demand

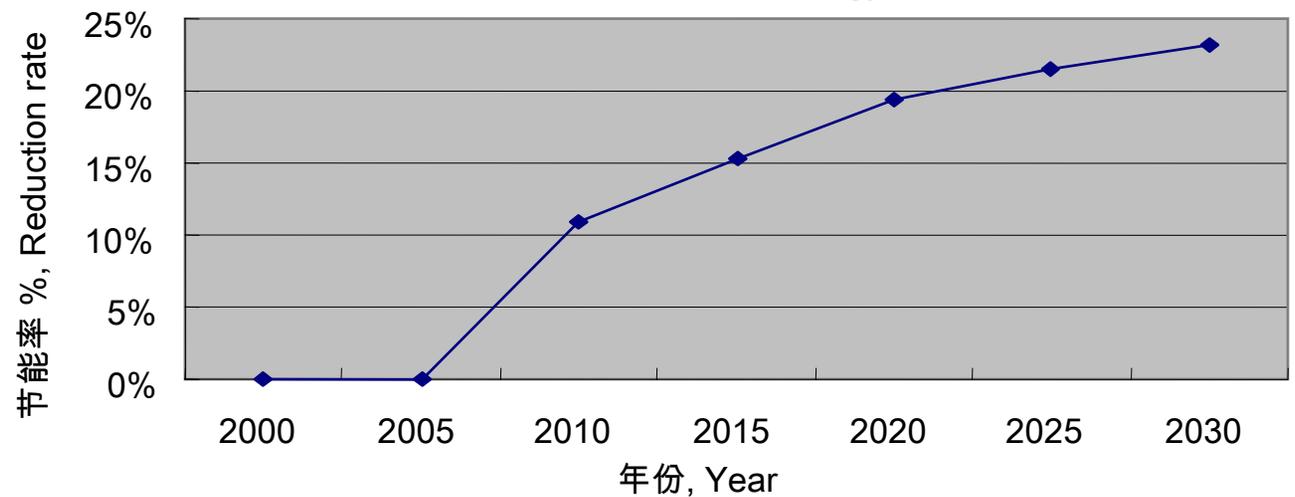


Modeling analysis result: Carbon tax scenario

碳税对GDP的影响
Effect of carbon tax on GDP

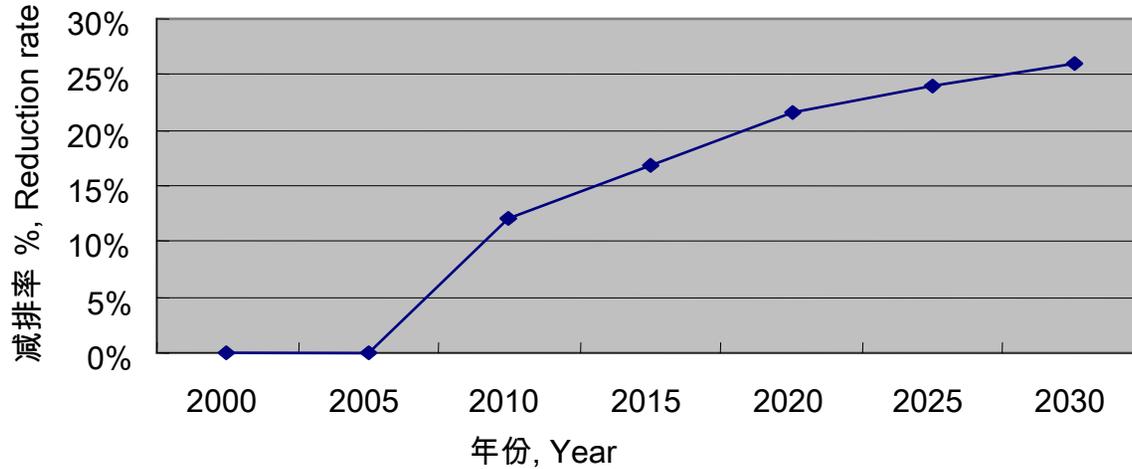


碳税对能源需求的影响
Effect of carbon tax on energy demand

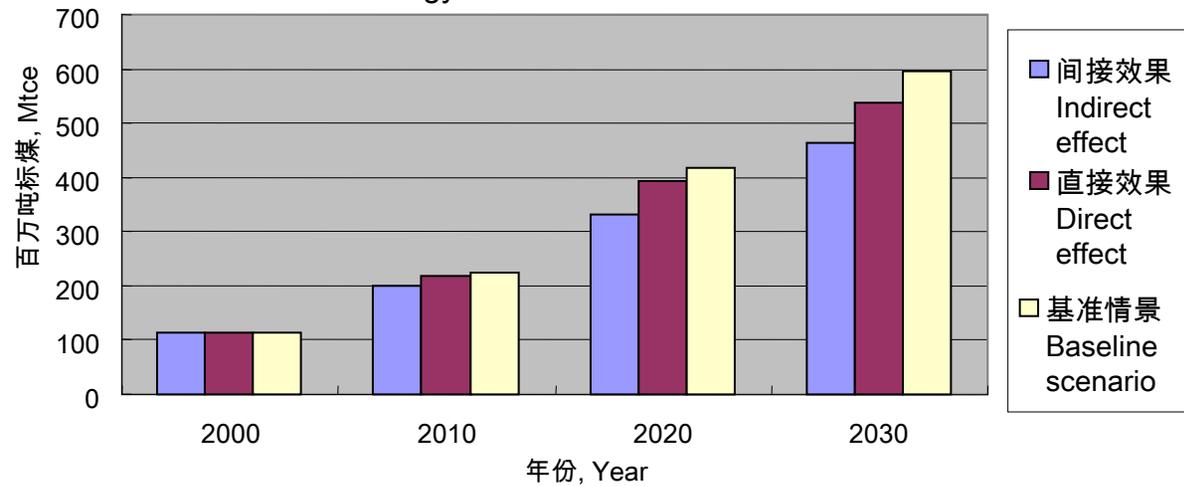


Modeling analysis result: Fuel tax scenario

碳税对CO2排放的影响
Effect of carbon tax on CO2 emission



采用机动车燃料税的能源效果
Energy effect of fuel tax



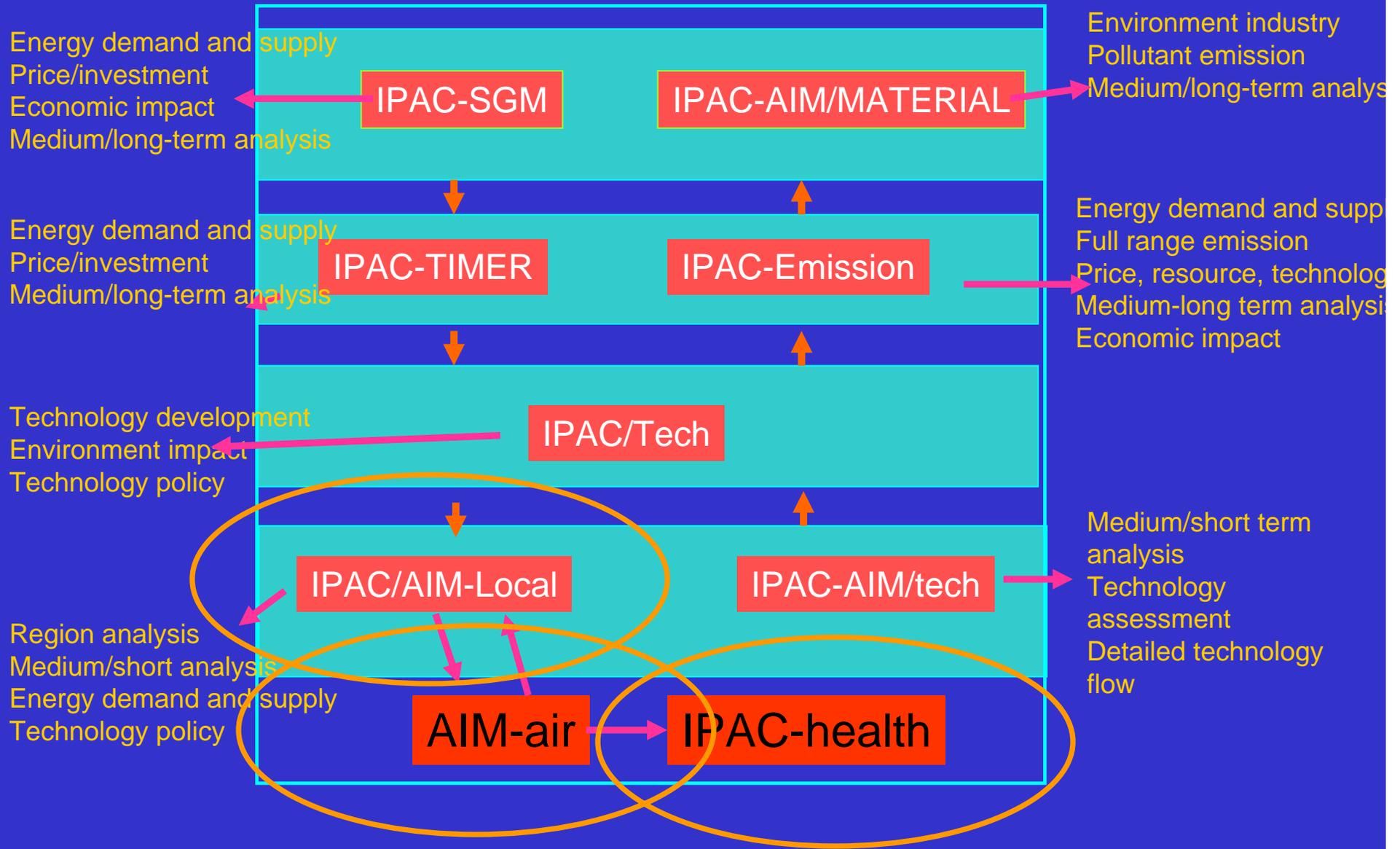
Work in 2006

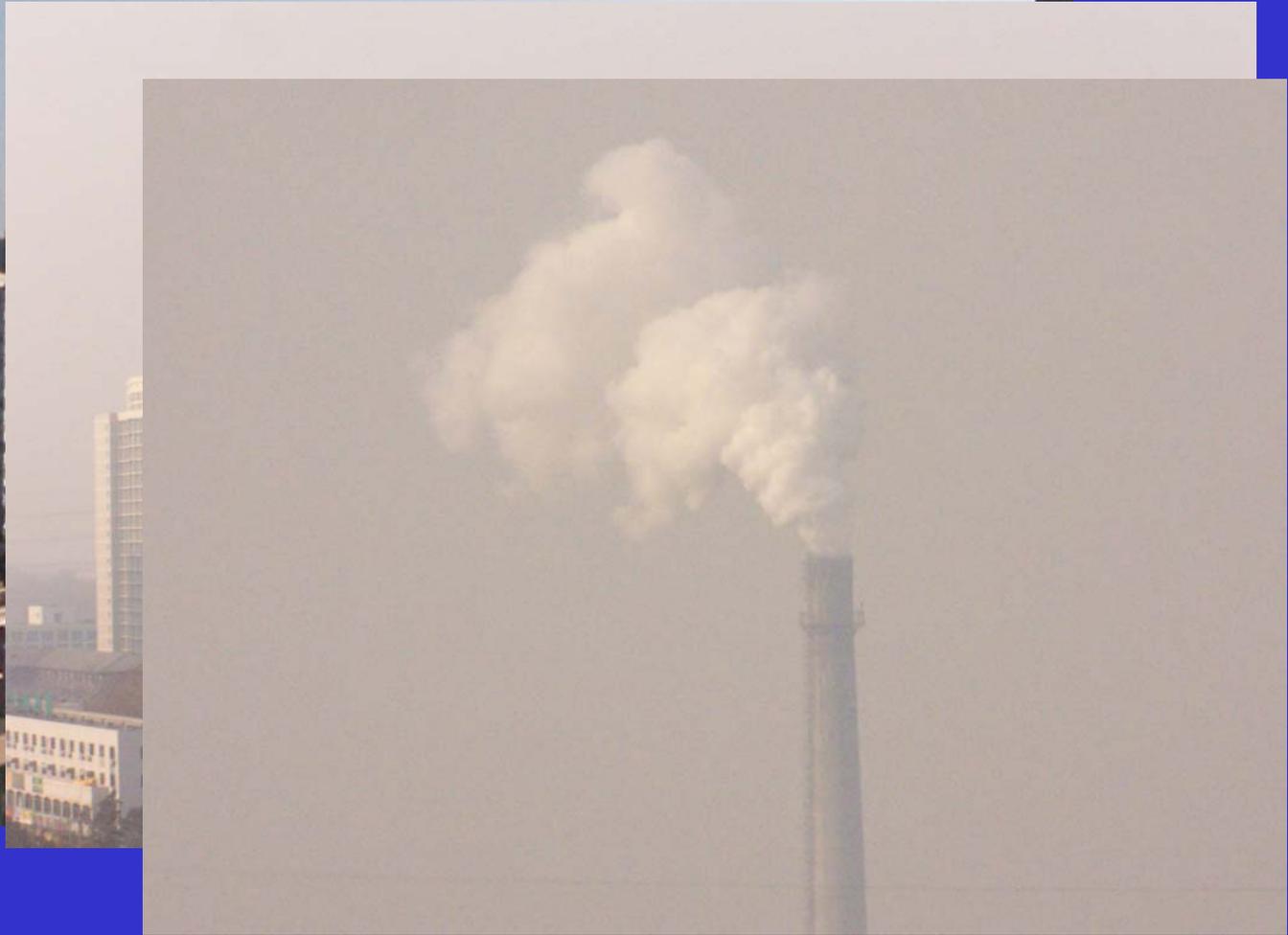
- Design energy tax system
- Assessment of the energy tax system
- Presentation to government, congress and public

IPAC Modeling Activities: Progress in 2005-2006

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Regions in the model

Regional 2	Regional	Regional	Regional 1	Code	GIS Code
1	BJ	BEI JI NG	BJ		1
2	HD	HAI DI AN	HD		2
3	CY	CHAOYANG	CY	}	3
4	FT	FENGTAI	FT		4
5	SJS	SHI JI NG	SJS		5
16	CW	CHONGWEN	CW		16
17	XW	XUANWU	XW		17
18	DC	DONGCHEN	DC		18
19	XC	XI CHENG	XC		19
6	MTG	MENTOU	MTG		6
7	TZ	TONGZHOU	TZ	}	7
8	CP	CHANGPIN	CP		8
9	FS	FANGSHAN	FS		9
10	SY	SHUNYI	SY		10
11	MY	M YUN	MY		11
12	HR	HUAI ROU	HR		12
13	YQ	YANQI NG	YQ		13
14	DX	DAXI NG	DX		14
15	PG	PI NGGU	PG	15	

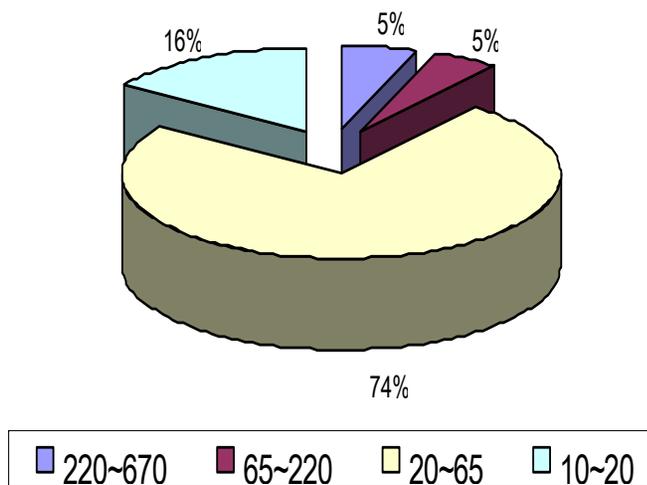
8
districts
in urban

Suburb

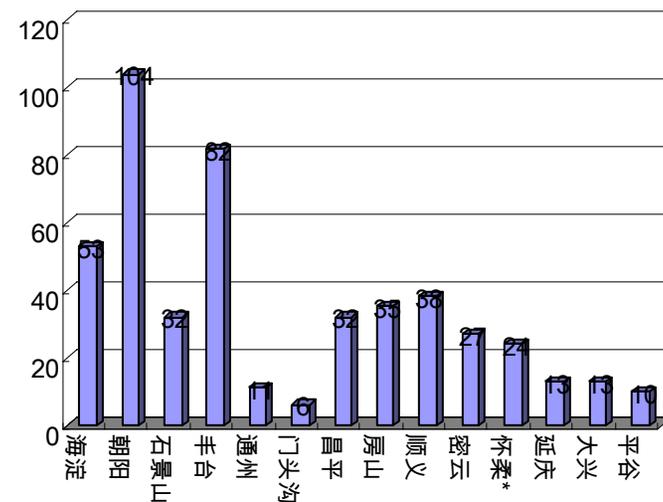
Select of LPS

Base one data survey, 480 boilers with capacity between 10t/h - 670t/h: 112 for hot water, 360 for heating

Distribution of LPS with Capacity



Distribution of LPS by county



LPS in the model: example

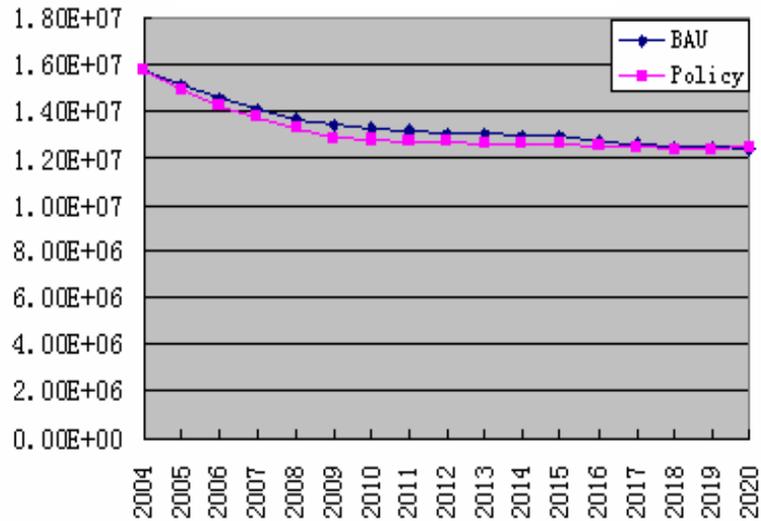
LPS Num	LPS Code	LPS Name	GLS Code	Region2	Operation	Longitude	Latitude	Stack He
289	BJCP01	beii nashouchuanalunt ai - com	7	CP	0.32	116.3058	39.0389	75
290	BJCP02	beii nashouchuanalunt ai - com	7	CP	0.32	116.3058	39.0389	75
291	BJCP03	beii nashouchuanalunt ai - com	7	CP	0.32	116.3058	39.0389	75
292	BJCP04	beiji ngbi shui wuye- company	7	CP	1	116.2914	39.0503	50
293	BJCP05	huabei dianli - university	7	CP	1	116.3047	39.0297	50
294	BJCP06	beii nashuntiantonawive- com	7	CP	1	116.3686	39.0397	75
295	BJCP07	beii nashuntiantonawive- com	7	CP	1	116.3686	39.0397	75
296	BJCP08	beii nashuntiantonawive- com	7	CP	1	116.3686	39.0397	75
297	BJCP09	beii nashuntiantonawive- com	7	CP	1	116.3686	39.04	75
298	BJCP10	beii nashuntiantonawive- com	7	CP	1	116.3686	39.04	75
299	BJCP11	beii nashuntiantonawive- com	7	CP	1	116.3686	39.04	75
300	BJCP12	beii nashuntiantonawive- com	7	CP	1	116.3686	39.04	75
301	BJCP13	beii nanakouichecheliana- f	7	CP	0.32	116.1772	39.1778	75
302	BJCP14	beii nanakouichecheliana- f	7	CP	0.32	116.1772	39.1778	75
303	BJCP15	beii nanakouichecheliana- f	7	CP	0.32	116.1772	39.1778	75
304	BJCP16	beii nanakouichecheliana- f	7	CP	0.32	116.1772	39.1778	75
305	BJCP17	chenani nakei vuan- heati na- c	7	CP	1	116.1811	39.1778	75
306	BJCP18	chenani nakei vuan- heati na- c	7	CP	1	116.1811	39.1797	75
307	BJCP19	chenani nakei vuan- heati na- c	7	CP	1	116.1811	39.1797	75
308	BJCP20	chenani nakei vuan- heati na- c	7	CP	1	116.1811	39.1797	75
309	BJCP21	chenani nakei vuan- heati na- c	7	CP	1	116.1811	39.1797	75
310	BJCP22	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
311	BJCP23	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
312	BJCP24	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
313	BJCP25	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
314	BJCP26	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
315	BJCP27	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
316	BJCP28	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
317	BJCP29	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
318	BJCP30	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
319	BJCP31	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
320	BJCP32	chenani nakei vuan- heati na- c	7	CP	1	116.2306	39.185	100
54	BJCY01	xiaovi na- heati na- factory	2	CY	1	116.3839	39.9706	100

Energy Balance Table 2003

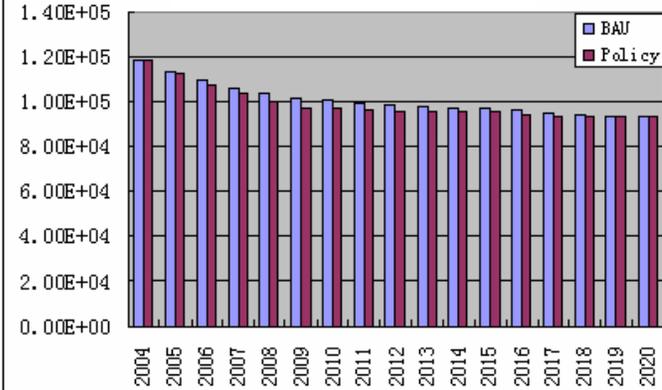
	Coal (10000 tce)	Coal (10000 tons)
Total Primary Energy Supply	1532. 24493	2145. 1
Indigenous Production		
Recovery of Energy		
Moving In from Other Provinces		
Import		
Chinese Airplane&Ships In Refueling Abroad		
Sending Out to Other Provinces(-)		
Export(-)		
Foreign Airplane&Ships In Refueling Abroad		
Stock Change		
Input(-)& Output(+) of Transformation	- 722. 000154	- 1010. 78
Thermal Power	- 510. 531639	- 714. 73
Heating Supply	- 209. 539905	- 293. 35
Coal Washing		
Coking		
Petroleum Refines		
Gas Works		
Coke Input(-)		
Briquettes		
Loss		
Total Final Consumption	819. 23067	1146. 9
Farming,Forestry,Animal husbandry,Fishery&water Conservancy	31. 936353	44. 71
Second Industry	423. 901335	593. 45
Industry	418. 044075	585. 25
Non-Energy Use	6. 578703	9. 21
Construction	5. 85726	8. 2
Tertiary Industry	174. 532002	240. 14
Residential Consumption	191. 86098	268. 6
Urban	46. 64379	65. 3
Rural	145. 21719	203. 3
Statistical Difference	- 8. 978751	- 12. 57
Total Energy Consumption	1548. 366681	2167. 67

3. Model Results

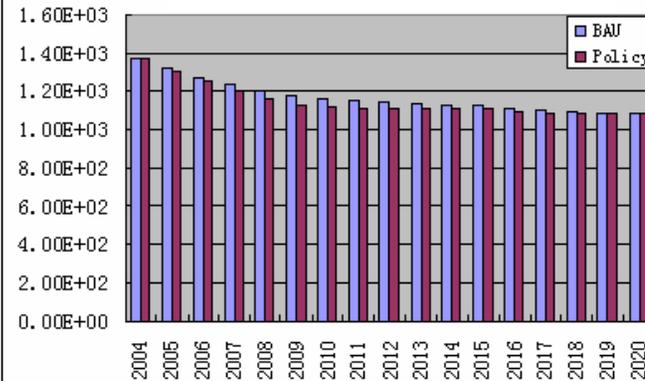
Coal Demand, tce



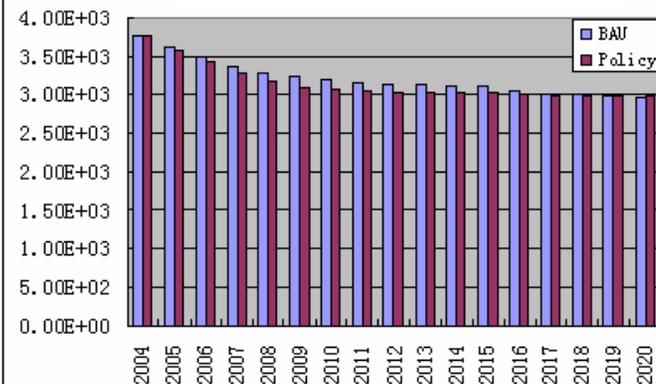
CO2 Emission, t-C



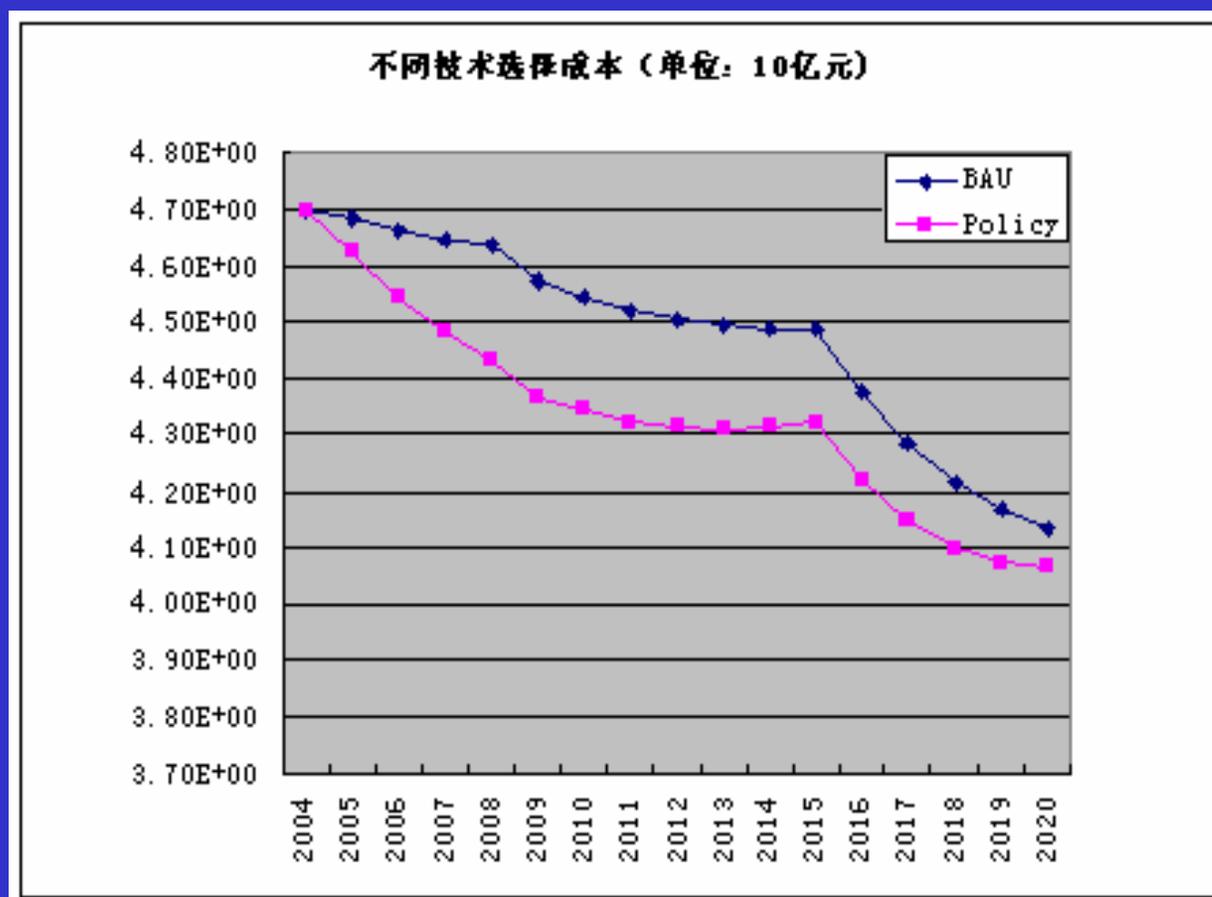
NOx Emission, t-NOx



SO2 Emission, t-SO2



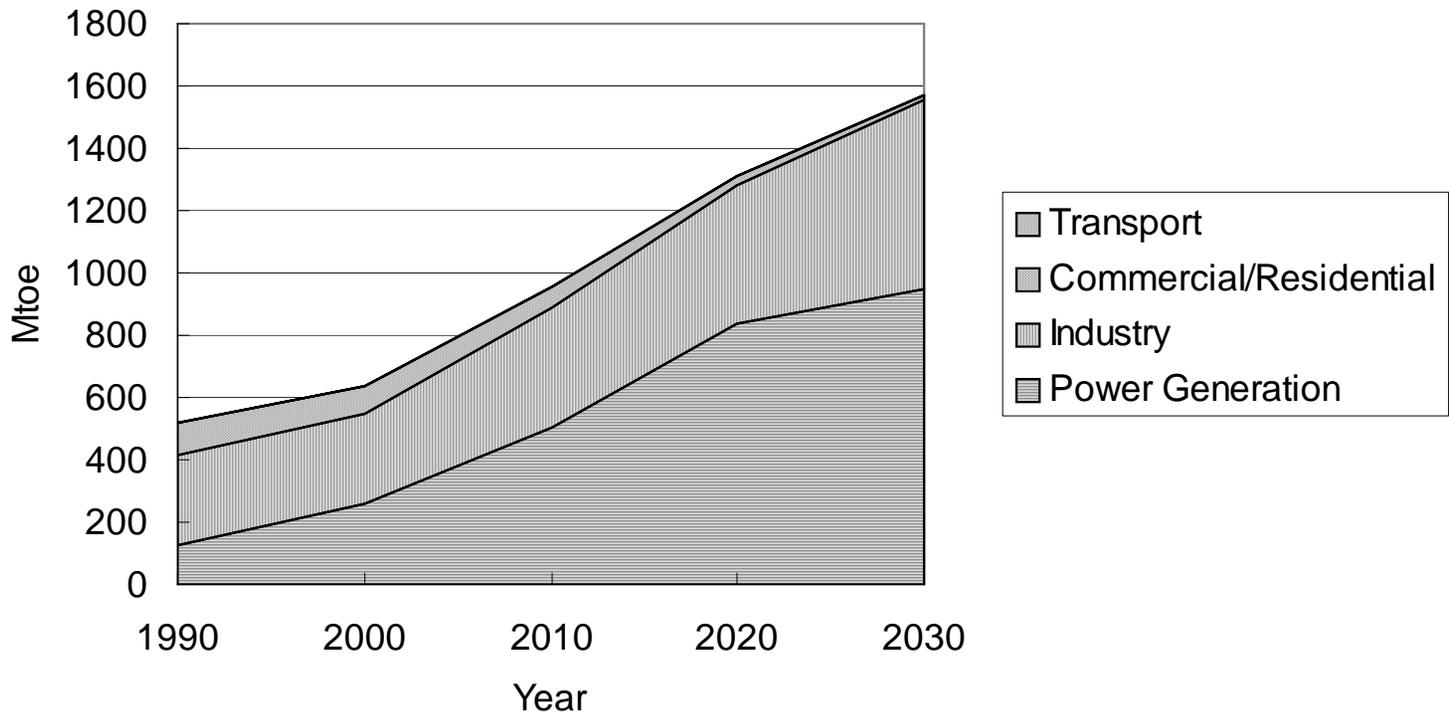
Cost Curve



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- 2050 Energy and Emission Scenario in China
- Regional Energy and Emission Scenarios
- *Climate and Development: Clean Coal Technology Assessment*

Coal use by sectors in China



Clean coal technologies in baseline scenario

Sector	Technology	Share in 2030
Power generation	Super Critical	25%
	IGCC	4%
Industry/Boiler	Advanced boiler	45%
Industry/Kiln	Advanced kiln	38%
Coal processing	Coal liquefaction	2% of total coal
Desulfurazation in power plants		58% of total coal fired power plants

Clean coal technologies in policy scenario

Sector/Process	Technology	Share in 2030
Power generation	Super Critical	25%
	IGCC	30%
Industry/Boiler	Advanced boiler	75%
Industry/Kiln	Advanced kiln	70%
Coal processing	Coal liquefaction	10% of total coal
Desulphurisation in power plants		80% of total coal fired power plants

IPAC Contribution to international study

- New IPCC scenario database
- Input for New GCM run
- IPCC New Emission Scenario discussion
- EMF-22
- IEA WEO-2006

Recent Energy Policies

- 20% energy intensity reduction in 2010 comparing with that in 2005, announced by government at beginning of 2006
- Medium and Long-term Energy Conservation Planning
- 11th Five Year Plan on Energy
- Energy reporting system

Recent Energy Policies: Projects and Programs

- Energy conservation projects under the energy conservation planning (detailed energy conservation projects)
- 1000 Enterprise Energy Monitoring Program

Recent Energy Policies: measure under decision

- Fuel taxes (gasoline and diesel), implementing within 11th Five Year Planning period
- Second vehicle fuel efficiency standard

Laws and Regulation

- Start to revise energy conservation law
- Drafting Energy Law
- Drafting Oil, Natural Gas Law

International Activities on Climate Change

- APP: Asia-Pacific Partnership on Clean Development and Climate
Move fast, and focus on technologies
- Post Kyoto Negotiation
- China-EU Partnership on Climate Change
- G8 Summit

For China: some personal ideas

- Domestic energy activities on energy conservation, renewable energy, unclear, technology R&D
- APP: more extensively support, by presenting ideas and working group
- Post Kyoto Negotiation: join the game, taking some commitment. Domestic 20% energy intensity target could be guidance for the commitment, considering the difficulty to reach the target
- China-EU Partnership on Climate Change: start to move

Our next study: Energy

- Energy tax system: finish by end of this year and ready to report to government and public
- Quantification analysis for 20% energy intensity target
- Early Warning System: A few days to 2 years
- Energy Scenarios
- Energy Technology R&D Assessment
- Energy Intensive Products Forecast
- Circulating Economy Modeling
- Regional Energy Future

Our next study: Climate Change

- 2050 Emission Scenario: together with other country team, focusing on the common target in 2050
- EMF-22
- Modeling extension for new IPCC scenarios
- Study on collaboration of APP, what is Chinese demand
- Study on China-EU Partnership: what should we do
- Post-Kyoto Commitment