APEIS Training Workshop

Initial output of AIM/CGE China Case

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Dec. 3, 2004, NIES, Tsukuba

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I-O table of China

- Published every 5 years;
- First I-O table was developed for 1992;
- Now 1997 I-O table is used for most cases
- 2002 I-O table would be available soon.
- Each sector is corresponding with one product

Sector and commodity classification

- 3 kinds of I-O table are available

Industry \ sector		sectors		
		6 sectors	40 sectors	124 sectors
Primary	Agriculture	1	1	5
Secondary	Industries	1	25	84
	Construction	1	1	1
Tertiary	Transport	1	2	9
	Commercial	1	2	2
	Other	1	9	23
Availability	U-matrix	No	Yes	No
	V-matrix	No	Yes	No

Final Consumption and value added

- Final Consumption
  - Household (rural, urban), government, fixed capital formation, stock change, export, import
- Value added
  - Capital income, labor income, net production tax and operating surplus

Reconstruction of I-O table

- Dis-aggregate: energy production sectors
- Dis-aggregate: energy intensive sectors
- Aggregate: sectors in which data is doubtable
- Aggregate: sectors less important for our study purpose
- Aggregation and dis-aggregation should be study-specific

Example of dis-aggregation

Original I-O table	AIM/CGE-CHINA
Crude Oil and gas production	Oil production
	Gas production
Petroleum processing and coking	Petroleum processing
	coking
Electricity and heat production	Electricity generation
	Heat production
Metal smelting and pressing	Steel production
	Non-ferrous metal production

Sector comparison

industry		original	revised
Primary	Agriculture	1	1
Secondary	Industries	25	22
	Construction	1	1
Tertiary	Freight Transport	2	1
	Commercial	2	2
	Other	9	2
Total		40	29

seven energy goods: coal, oil, gas, petroleum products as a whole, electricity, coke, town gas

Sector and commodity classification

Symbol	Description	Symbol	Description
AGR	Agriculture	MET	Metal production
M_C	Coal mining	OHI	Production of machinery equipment
M_O	Crude oil production	REP	Maintenance of machinery equipment
M_G	Gas production	OLI	Other manufacturing
MIN	Metal and non-metal mining	ELE	Electricity generation
FOD	Food and tobacco production	HET	Heat production
TEX	Textile	GAS	Gas production and supply
WOD	Wood and wood products	WTR	Water supply
PAP	Paper and paper products	CNS	Construction
OIL	Oil processing	T_F	Freight transport and warehousing
COL	Coking	COM	Commercial activity
CHM	Chemical industry	RES	Food and drinking
NMM	Non-metal mineral production	T_P	Passenger transport
STL	Steel production	OSR	Other services
NFR	Non-ferrous metal production		

FCF data

Commodity \ sector		Sector A	Sector B	Sector C	Total demand of FCF
commodity	a	I_A*I_a/INV	I_B*I_a/INV	I_C*I_a/INV	I_a
	b	I_A*I_b/INV	I_B*I_b/INV	I_C*I_b/INV	I_b
	c	I_A*I_c/INV	I_B*I_c/INV	I_C*I_c/INV	I_c
Total investment		I_A	I_B	I_C	INV

- FCF data by investment goods is provided by I-O table.
- FCF data by sector is provided by China Statistic Yearbook on Fixed Capital Investment
- FCF by goods and by sector is calculated in proportion to the FCF data by goods

Energy and emission data

- Energy consumption by type is provided by China Energy Statistic Yearbook;
- CO2 emission data is from Initial National Communication of China (INC);
- Price data is from AIM/LOCAL-China
- Share of energy used as feedstock is prepared by Dr.Yang. More accurate data could be provided by INC soon.

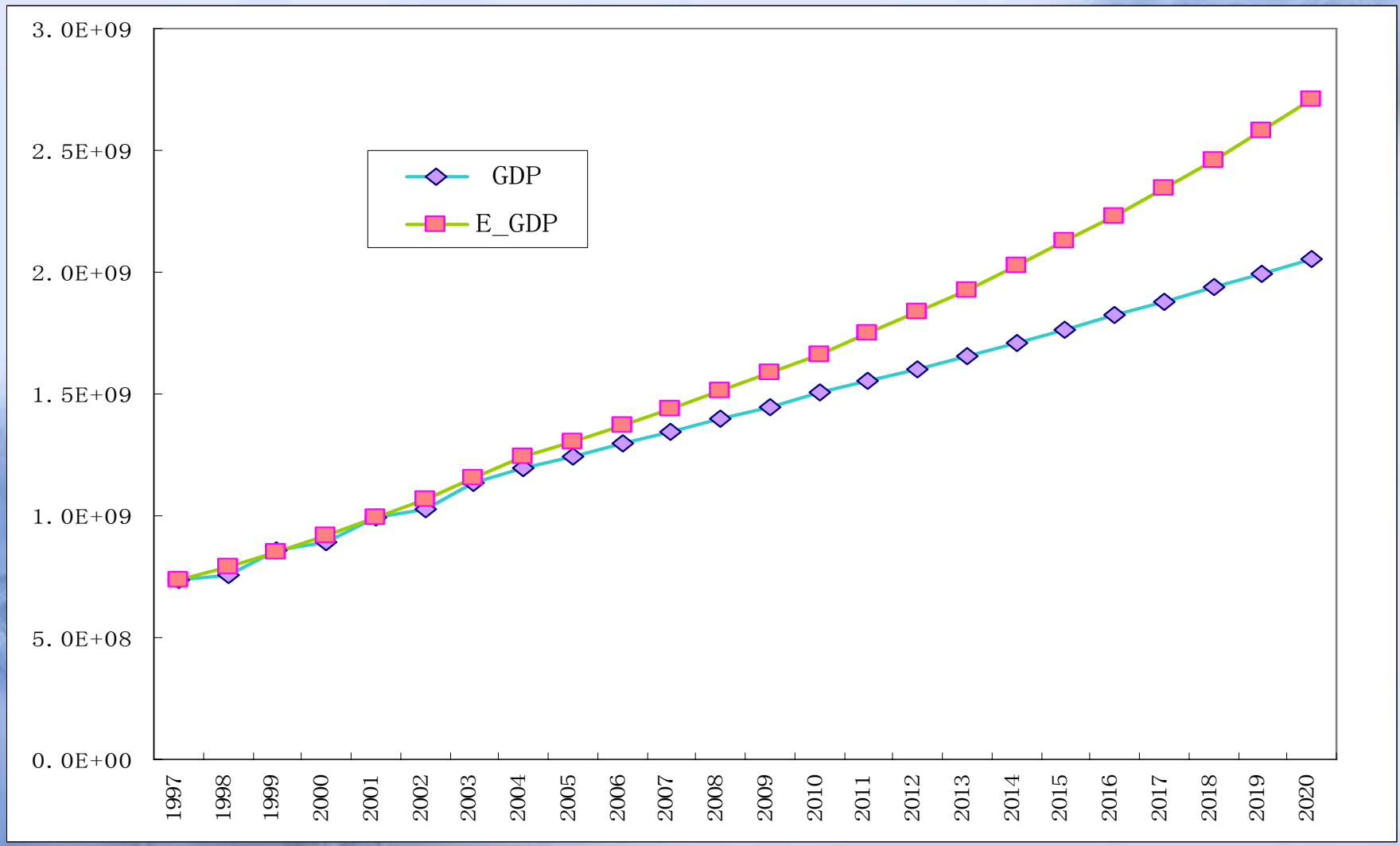
Modification of model for China

- Static model
  - Add SO_2 emission;
  - Add taxes: direct and indirect tax
- Dynamic model
  - Fix export of energy goods
  - Add SO_2 emission

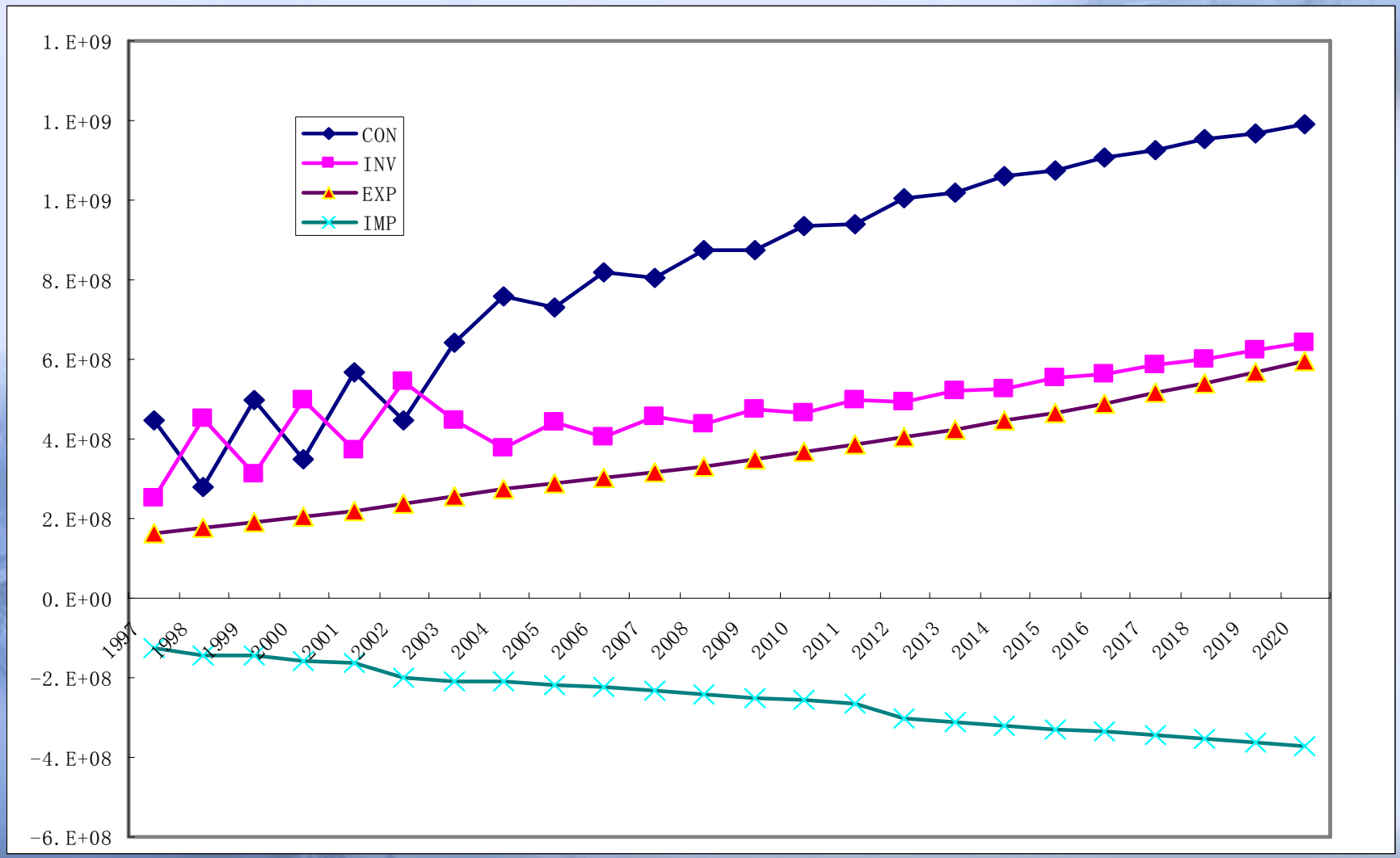
Scenario for simulation

- Planning horizon: 1997-2020
- Energy efficiency in initial year: 0.80
- Energy efficiency improvement in each year: 1%
- Labor efficiency in initial year: 0.5
- Labor efficiency improvement in each year: 5%
- GDP growth rate: conservative national plan
- Labor growth rate: UN data
- International price: 1
- Operation rate: 1
- Cost of mining: from Dr.Fujino

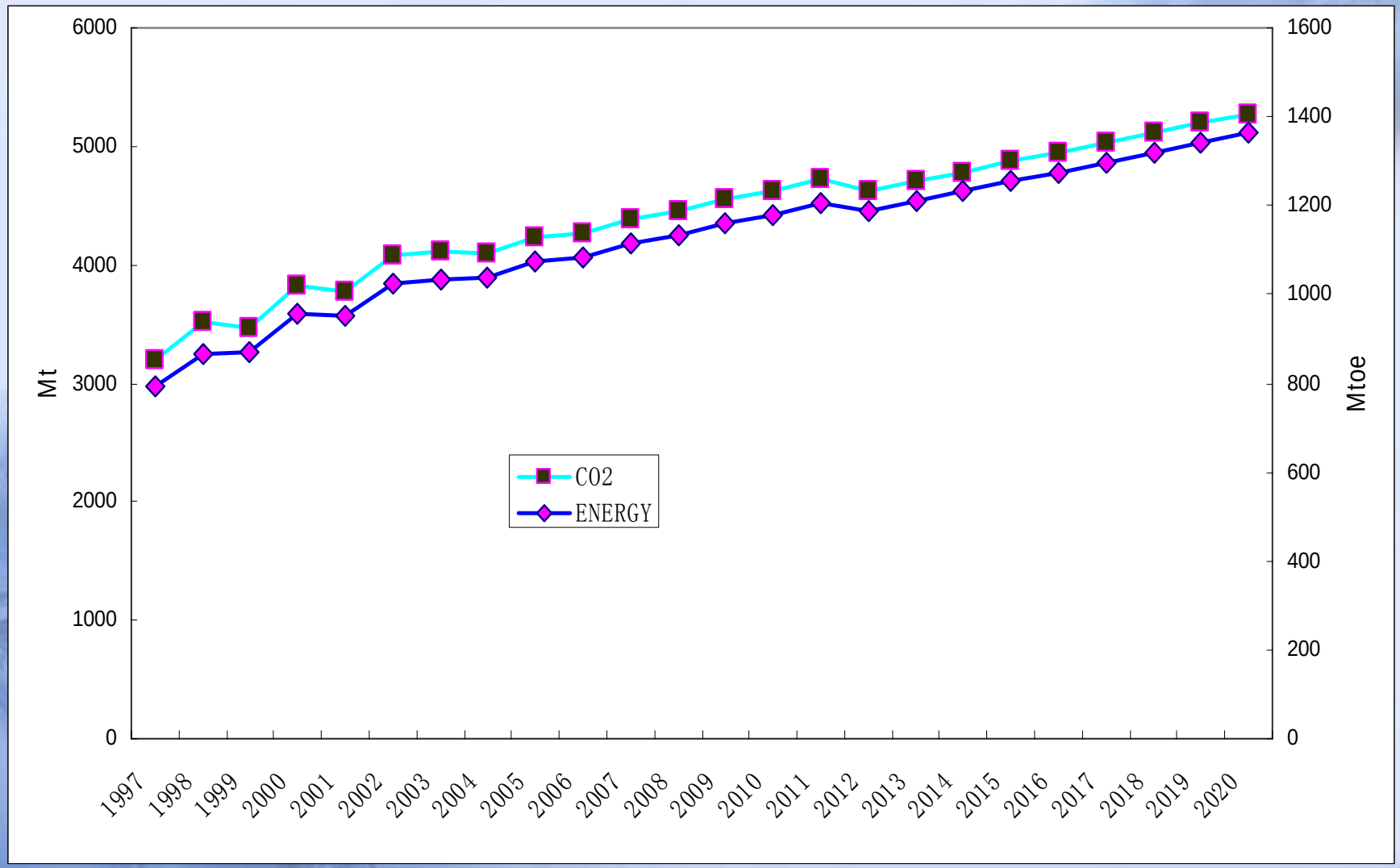
Result on reference scenario-GDP



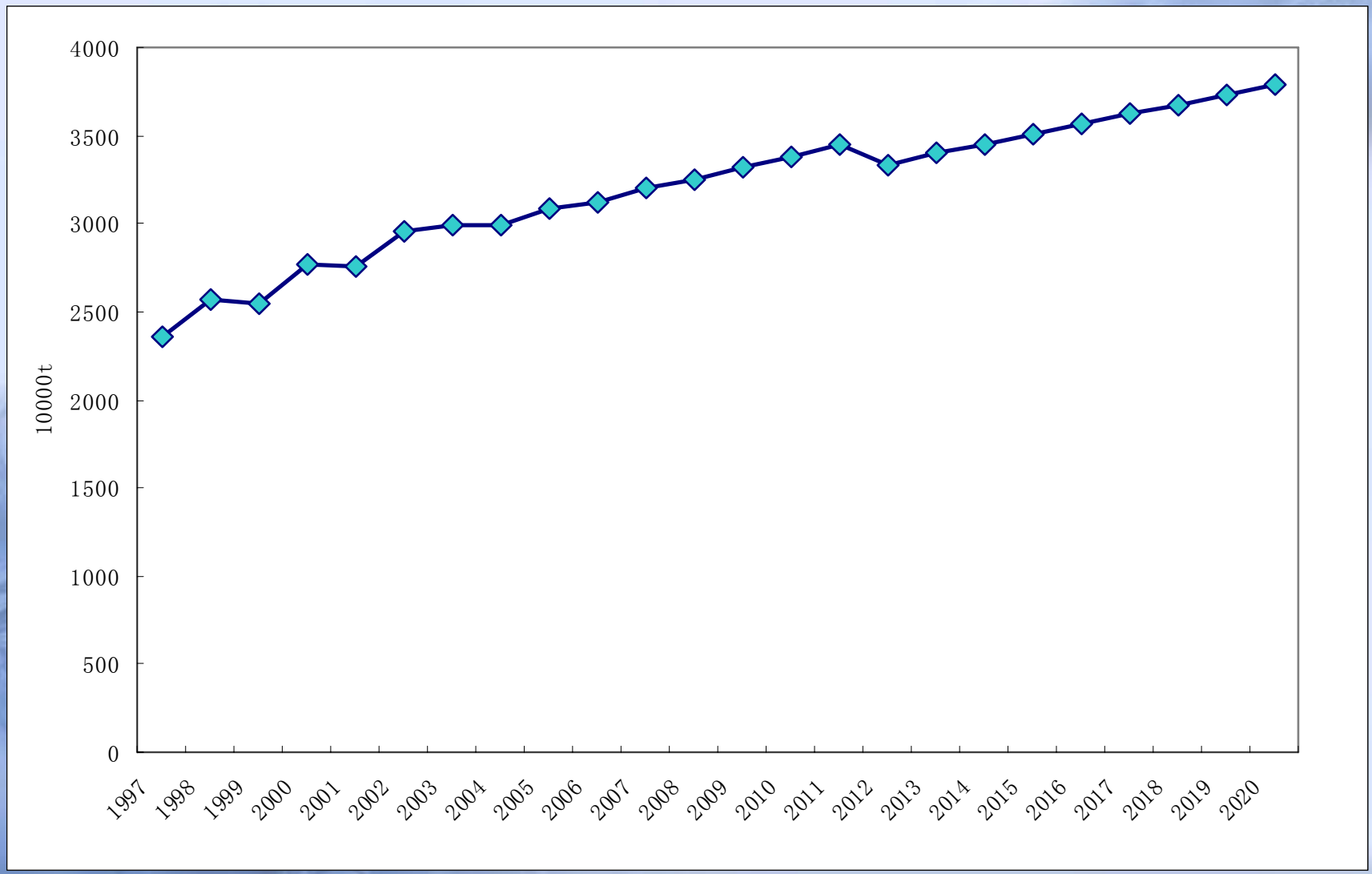
Result on reference scenario - component of GDP



Result on reference scenario- energy & CO_2



Result on reference scenario - SO_2



Proposed policy options

- Total amount constrain on SO_2 emission
  - SO_2 emission in 2005 should be 10% lower than that in 2000;
  - 10% lower in 2010 compared with 2005;
  - 25% lower in 2020 compared with 2010;
- Desulfuration rate of coal combustion would increase gradually.
  - By 2020, 75% of coal-fired power plants should install desulfurating devices

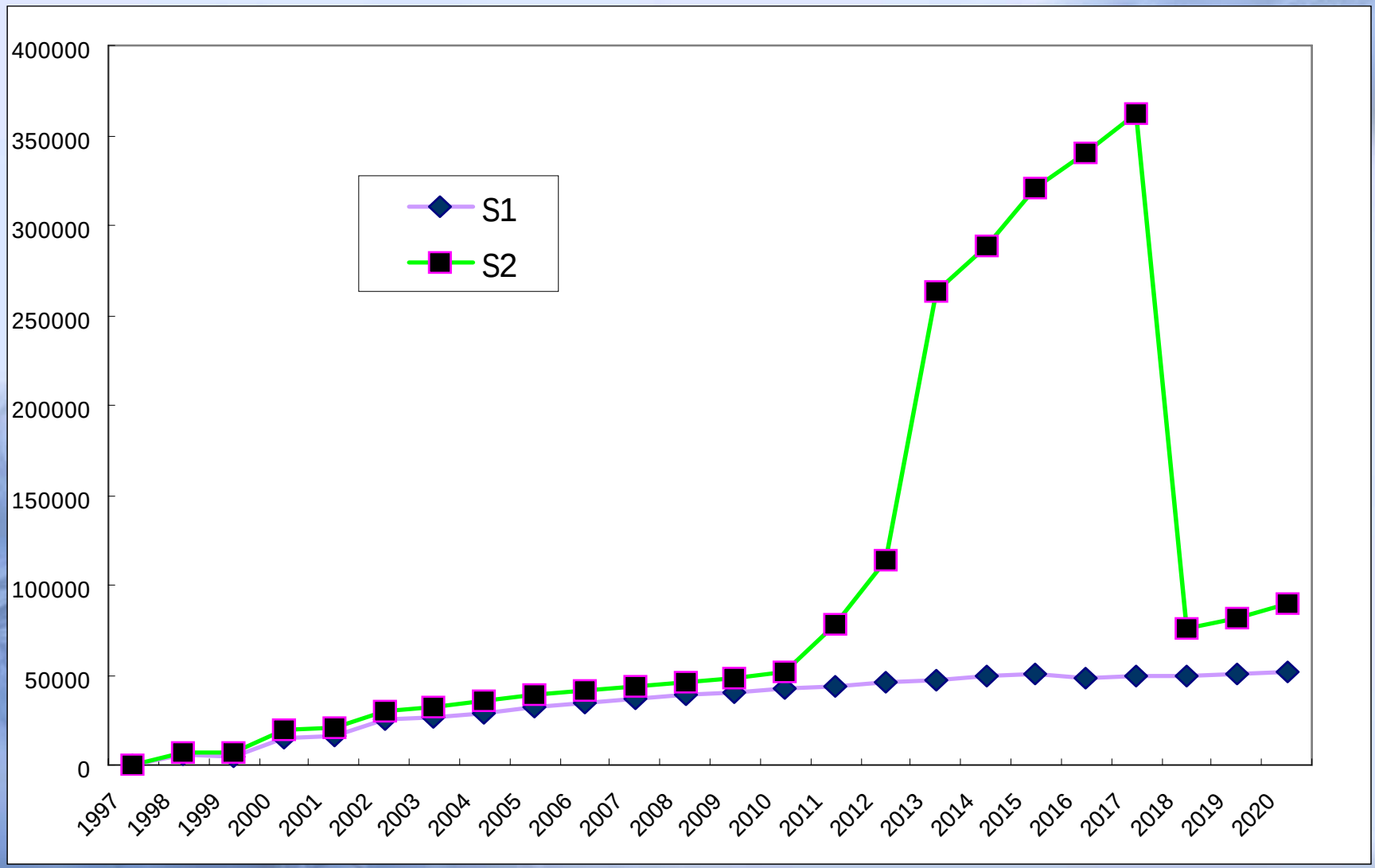
Scenario Creation

- Scenario 1
  - keep SO_2 emission stable;
  - Desulfurization rate of coal combustion: 35% in 2020;
- Scenario 2
  - Annual SO_2 reduction rate: 2%;
  - Desulfurization rate: 70% in 2020;

Hypothesis about selected policy option

- SO2 would be charged.
- CO2 emission would also drop
- Energy mix would have to be optimized, less coal, more oil and gas;
- GDP growth would be negatively influenced.
- Output of coal-dominant sectors and commodities would be heavily influenced.

SO2 price


400000
350000
300000
250000
200000
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100000
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1999
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2018
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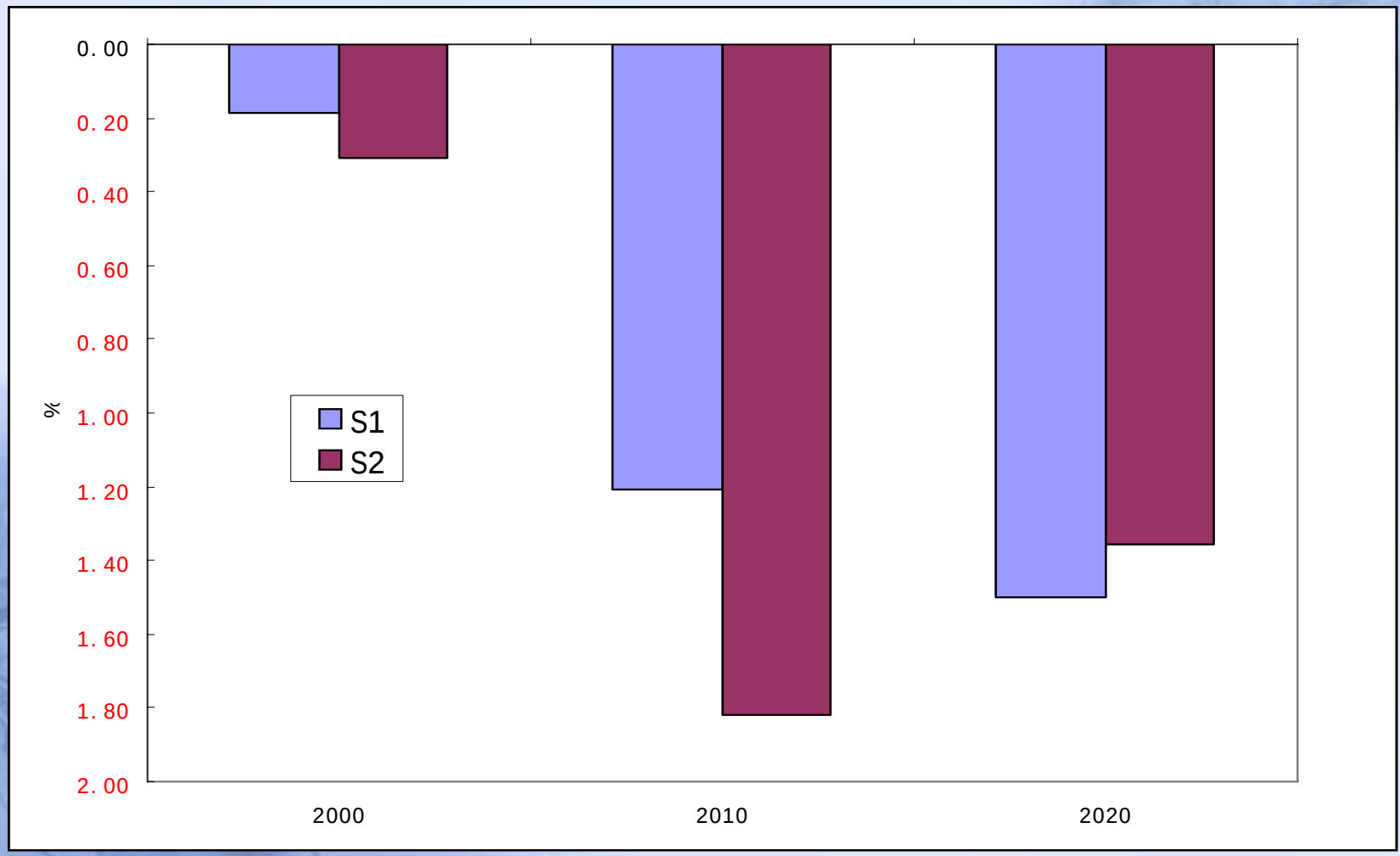
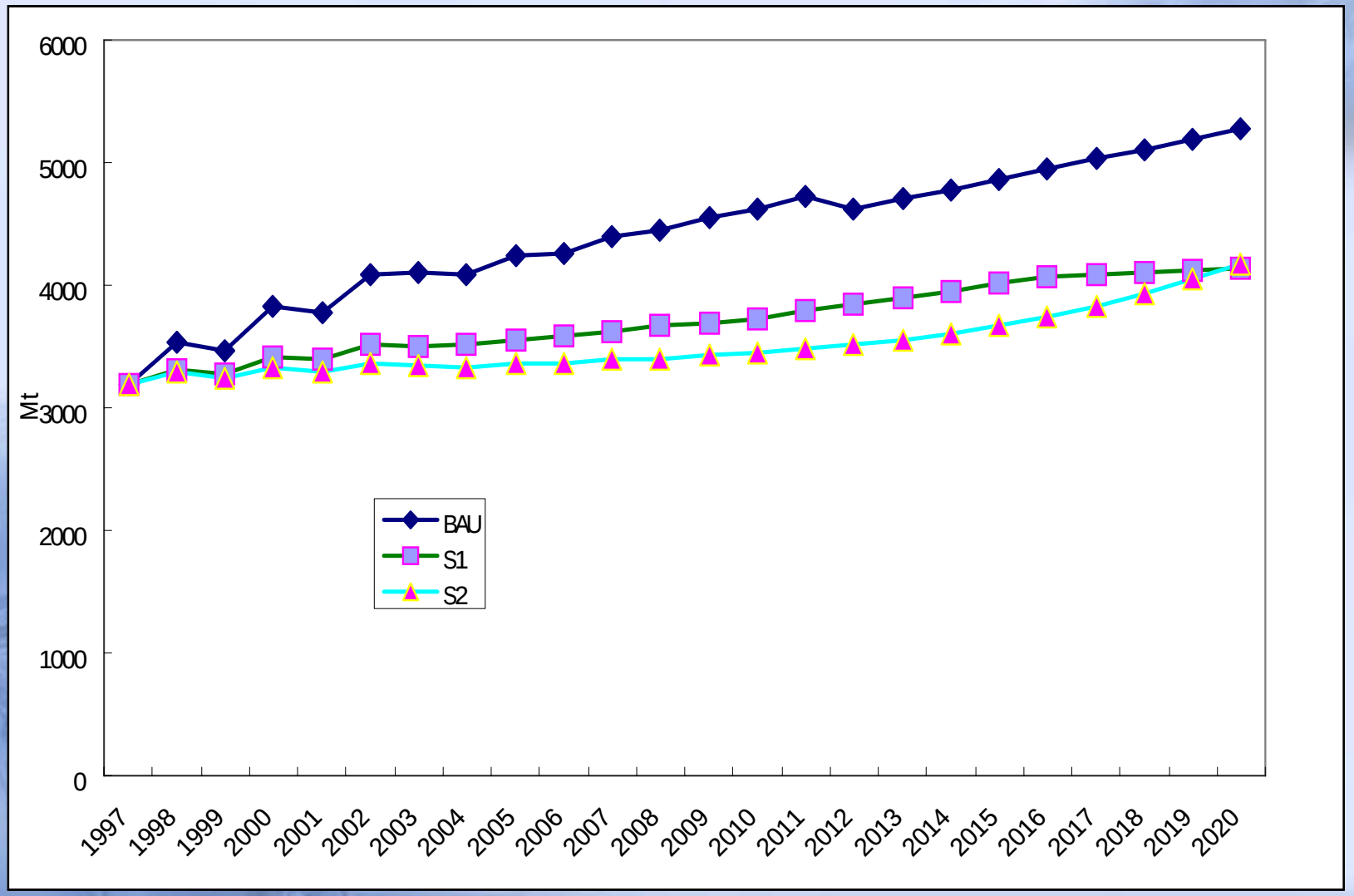
2020

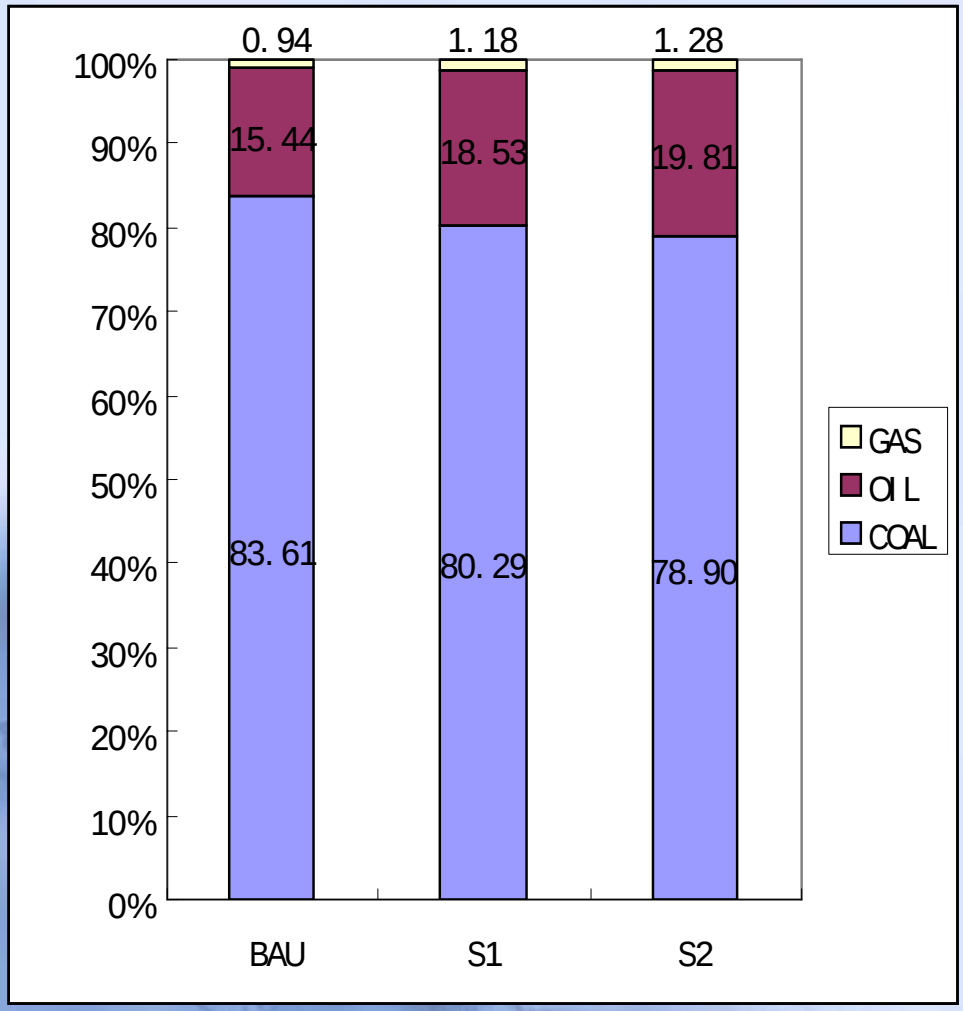
GDP loss



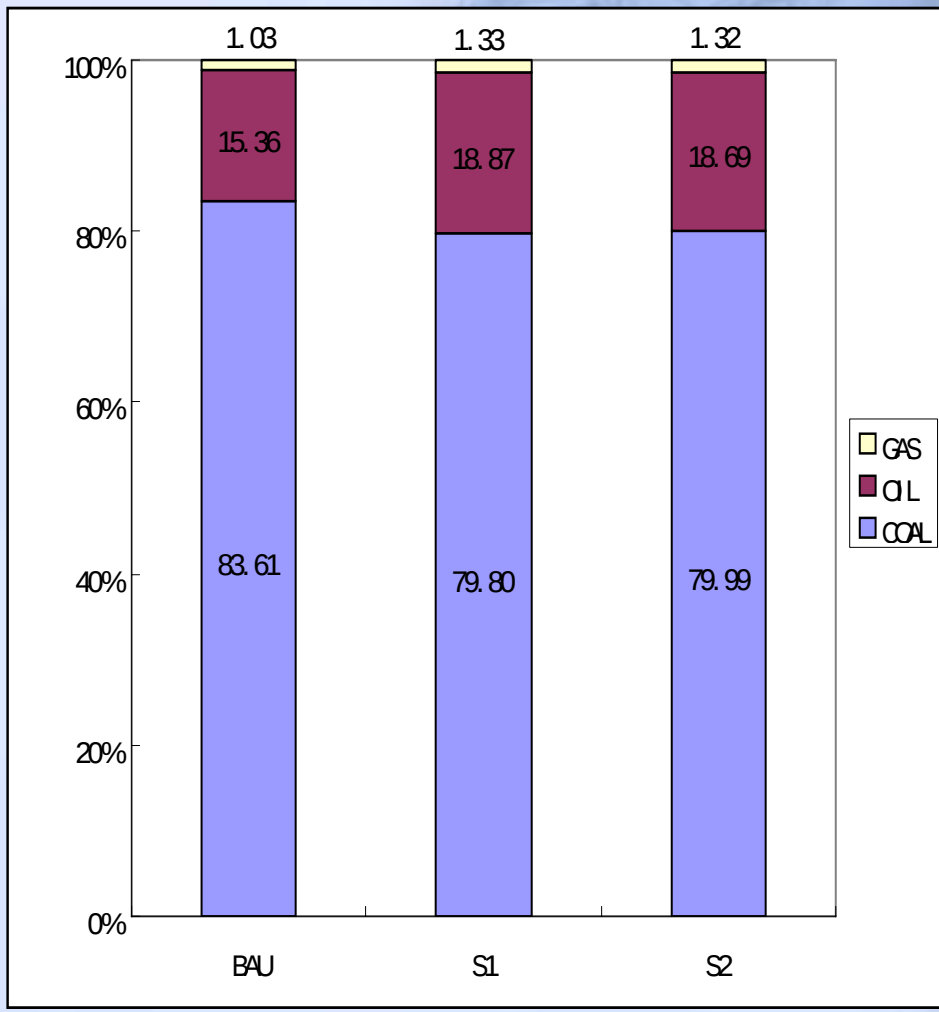
CO2 emission



Energy mix



2010



2020

Share of output value of “ELE”

		“ELE” (SECTOR)	“ELE”(commodity)
1997	Base year	1.84	1.89
2010	BAU	1.5	1.55
	S1	0.52	0.57
	S2	0.06	0.12
2020	BAU	1.35	1.38
	S1	0.11	0.16
	S2	0.17	0.23

Why energy mix does not change much

- From 2002, all oil is imported; from 2010, all gas is imported.

Finding

- **SO2 emission reduction seems an impossible task under the current assumption;**

Future tasks

- Prepare more accurate country-specific data
- Modify model to get more reasonable output
- Giving more concern on local pollutant emission
- One more policy option: Introduction of fuel tax (oil tax)

thank you!