国务院发展研究中心

China: Regional Industrial Structure and Energy Intensity

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Note：The views expressed in the ppt are that of the author and should not be attributed to her affiliated institution.

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Outline

- China's energy supply & demand situation
- Causes for the high growth of energy demand
- Energy development strategy and policies
- Regional Development and Energy Intensity
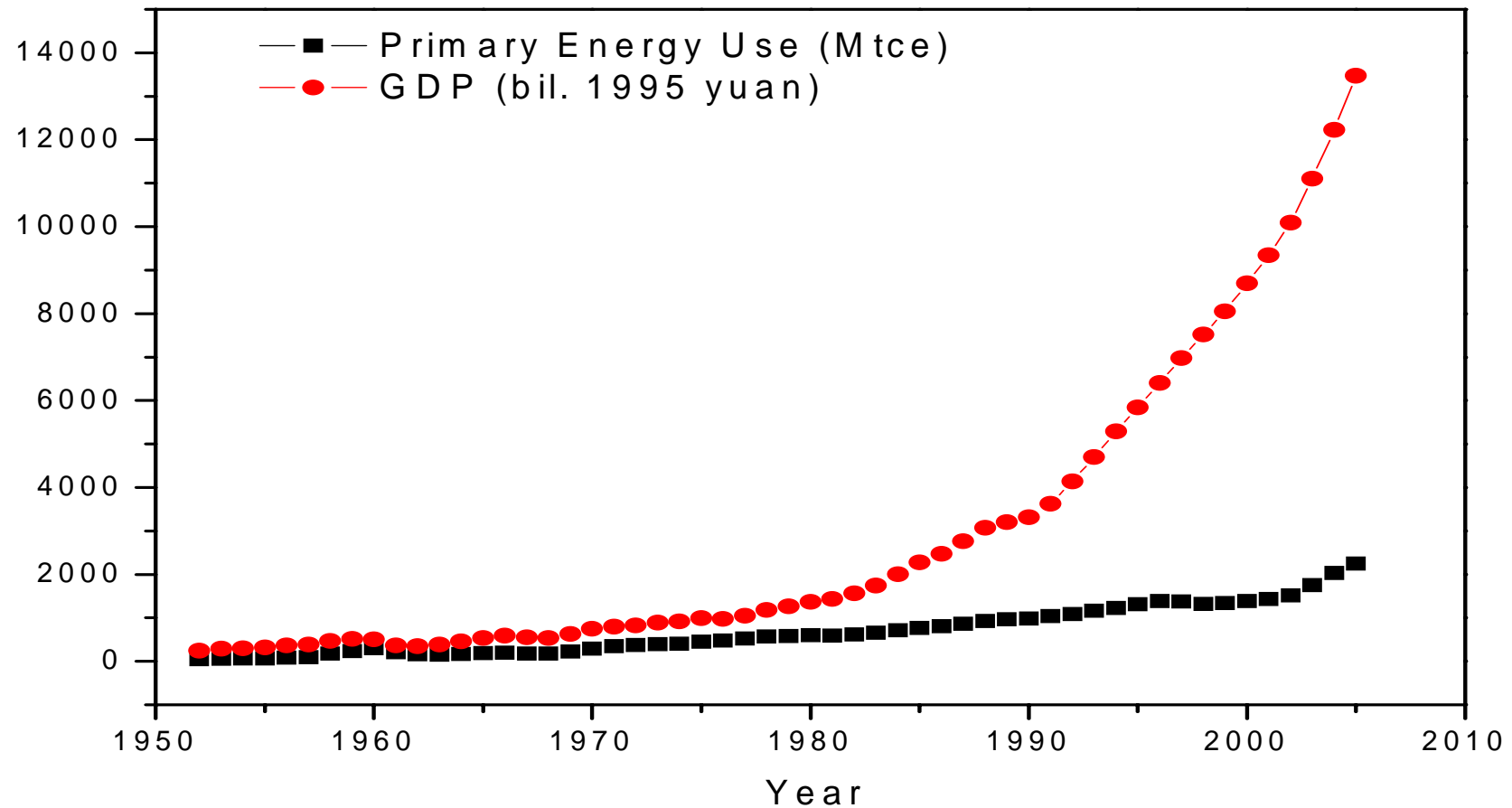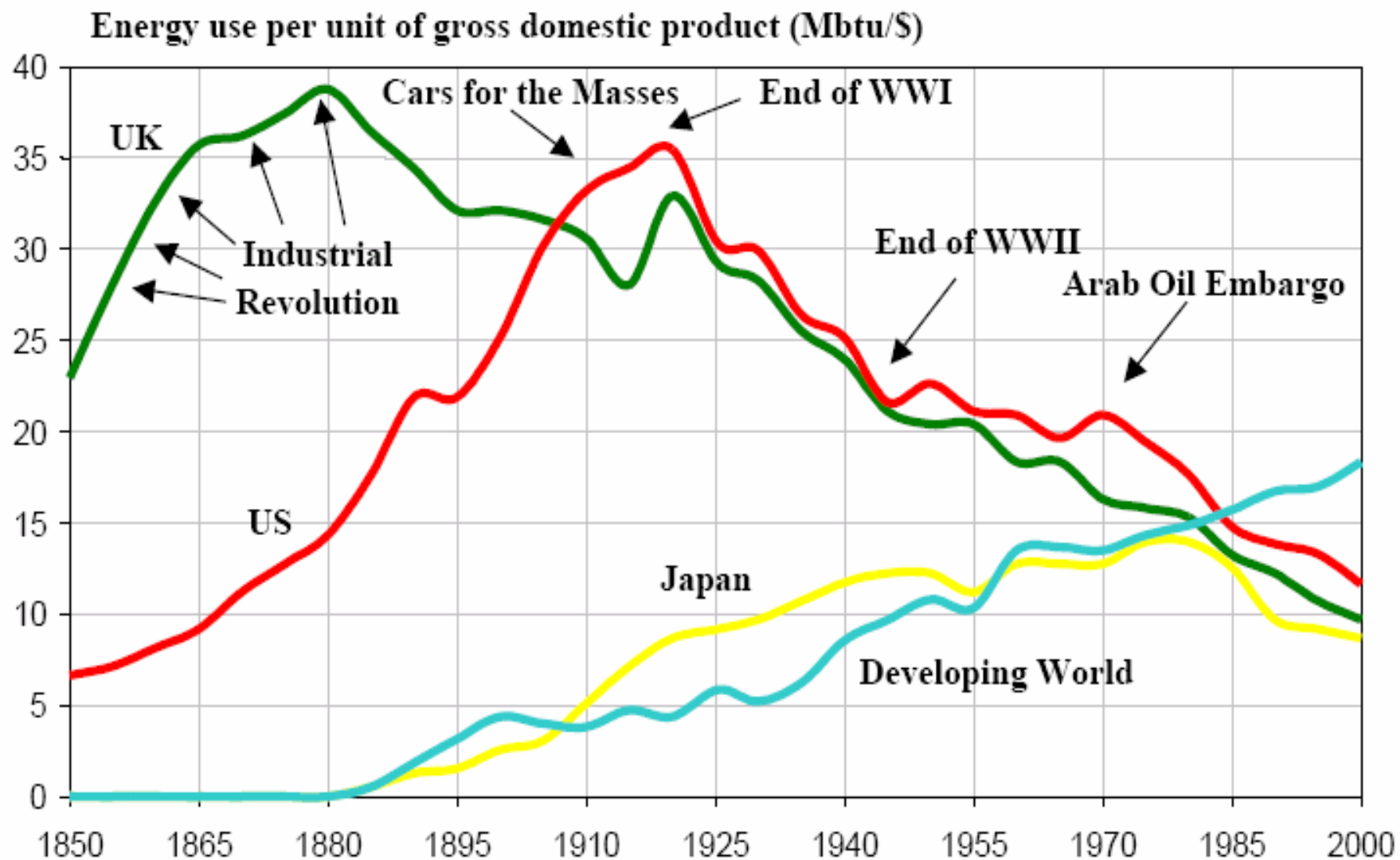- Option of Economic Development Mode

Energy Supply & Demand Situation

Since 2001, China's energy supply & demand situation has been significantly changed and the energy demand has been growing at unheard-of high speed

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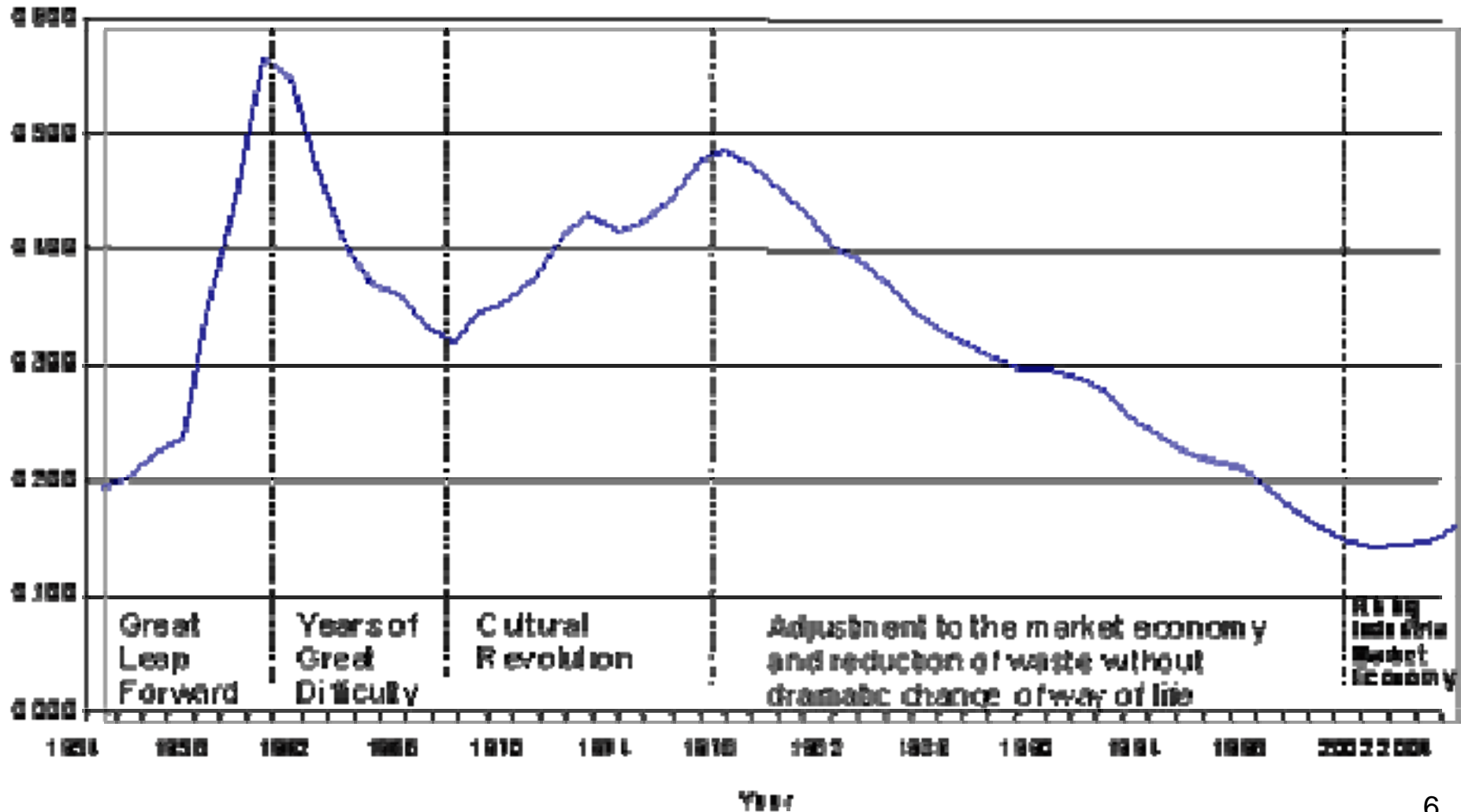# China's rapid economic growth is accompanied by rapid increase in energy use

The Energy Intensity is High

China's Energy Intensity (1978-2007)

Kgce/thousand 2005 *yuan*

China's Energy Intensity
(kgce/thousand 2005 yuan)

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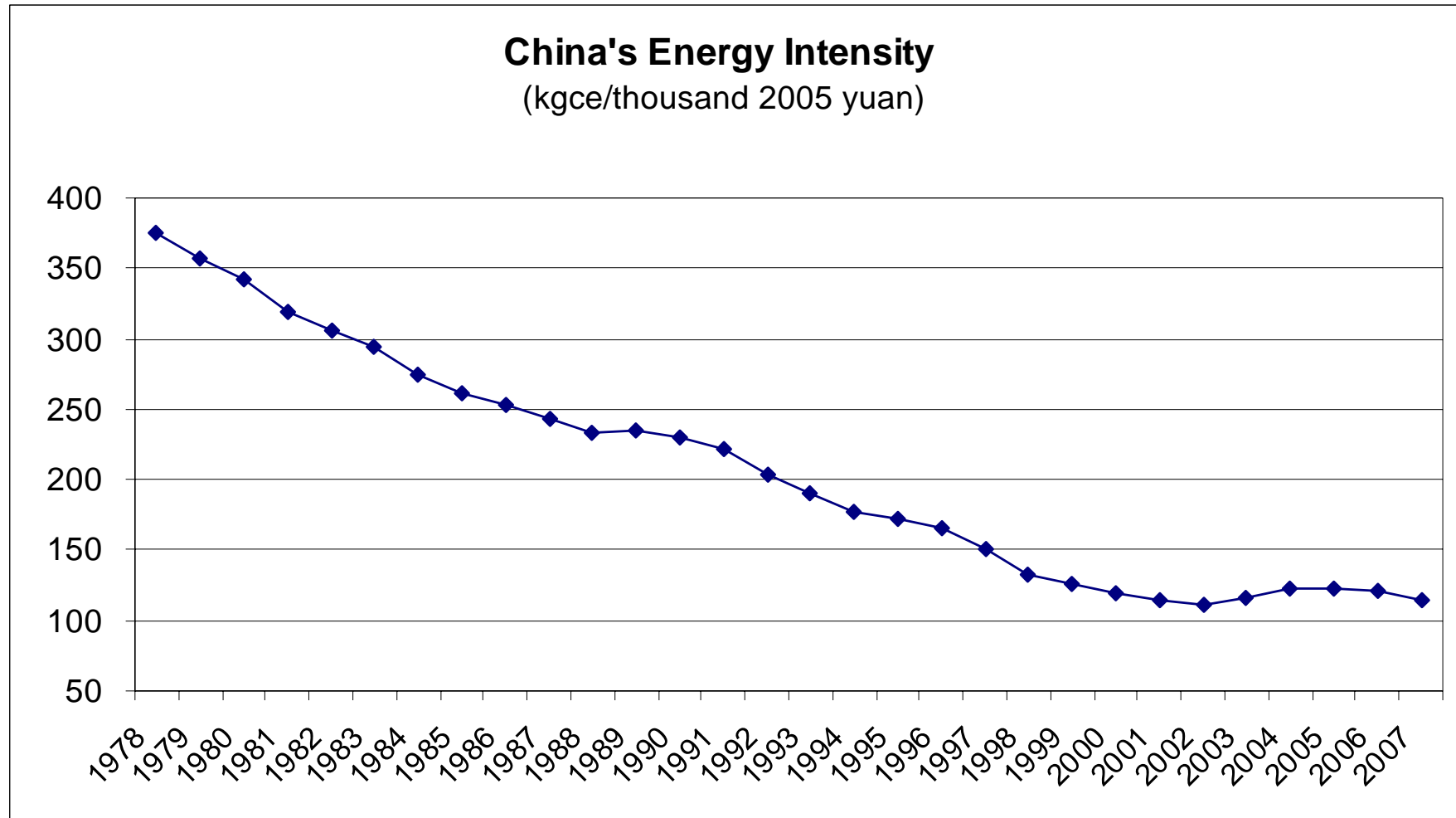
Since 2001 the annual average growth rate of the energy consumption is close to 10%, 2 times as the average growth rate of the first 20 years since 1978, and energy consumption elasticity is closed to 1

	1980-2000	2000-2006	1980-2006
Economic Growth Rate	9.62	9.76	9.65
Energy Consumption Growth Rate	4.41	9.8	5.63
Energy Consumption Elasticity	0.45	1.003	0.58

Growth Rate

	GDP	Energy consumption	Industrial COD	Industrial SO_2
6th Five-year (1981-1985)	10.7	4.9		
7th Five-year (1986-1990)	7.9	5.2		
8th Five-year(1991-1995)	12.3	5.9	1.7	-1.4
9th Five-year(1996-2000)	8.6	1.1	-1.7	2.9
10th Five-year(2001-2005)	9.5	10.0	-4.7	6.1

Data source: China's Statistical Yearbook 2006, China environmental statistic bulletin

Primary energy structure- Coal is dominant energy resource

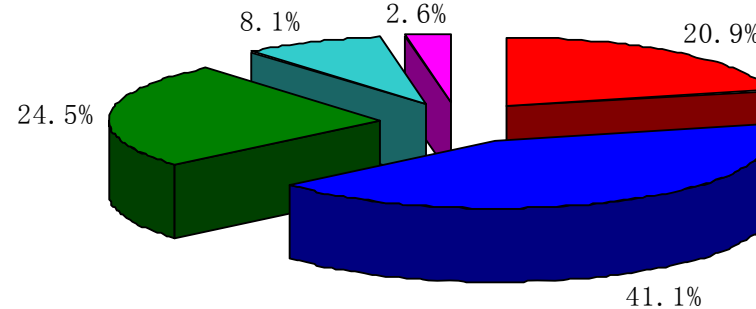China in 2006

World average in1998

0.80%
2.80%
21%
6.20% 0.10%
69.10%
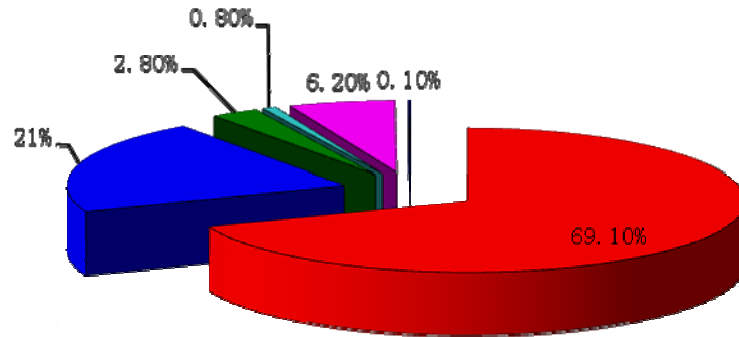
■煤炭 ■石油 ■天然气 ■核电 ■水电 ■其他可再生能源

Coal   petroleum   Natural gas   Nuclear electricity   hydropower
Other renewable energy resources

8.1%
24.5%
2.6%
20.9%
41.1%

■煤炭 ■石油 ■天然气 ■核电 ■水力

Coal   petroleum   Natural gas   Nuclear power   hydro power

source：Japanese Energy Economic Almanac, China Statistical Yearbook

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Energy consumption of main energy intensive products and its comparison with the advanced levels in the World

	China			Advanced level in the world	Gap from the advanced level in the world
	1990	2000	2004		
Coal consumption by thermal power plants/gce/kWh	427	392	379	312	+21.5%
Comparable energy consumption per ton of steel production/kgce/t (in medium/large- sized enterprises)	997	784	705	610	+15.6%
Overall energy consumption by cement production/kgce/t	201.1	181.0	157.0	127.3	+23.3%
Alternating current power consumption by electrolytic aluminum production/kWh/t	16,223	15,480	15,080*	14,100	+7.0%
Overall energy consumption by crude oil processing/kgce/t	102.5	118.4	112.0	73.0	+53.4%

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Causes for the high growth of energy demand

High economic growth rate

- **The economy grows continuously with high speed, the growth rate of GDP has been exceeded by 10% in recent four years** continuously.

- **The speed of growth of the secondary industry has exceeded that of GDP by 2 percentage points**

- **The secondary industry accelerates, while high energy intensive goods' growth rate is egregious**

  - The output of **crude steel** has been grown for more than one time from 0.1285 billion tons in 2000 to 0.423 billion tons in 2006

  - The output of **cement** has grown for more than one time to 1.24 billion tons in 2006

  - The annual average growth rate of the output of the ten species of **nonferrous metals** such as copper, aluminum, lead, zinc, etc has exceeded 10%

  - The annual average growth rate of main **chemical products** of sulfuric acid, soda ash, caustic soda, ethylene, etc is between 7% and 13%

  - The output of **automobile** has been grown nearly tripled, from 2500 thousand in2000 to 7279 thousand in 2006

  - The **building area** grows 1.8-2.0 billion square meters annually

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High energy intensive goods grow very fast since 2001

	2000	2001	2002	2003	2004	2005	2006	Average growth rate
Crude steel (粗钢) (10,000 tons)	12,850	15,163	18,237	22,234	28,291	35,324	42,266	21.95%
Automobile （汽车） (10,000 cars)	207	234	325	444	509	570	727	23.29%
Ethylene（乙烯） (10,000 tons)	470	481	543	612	630	756	940	12.25%
Fertilizer（化肥） (10,000 tons)	3,186	3,383	3,791	3,881	4,805	5,178	5,593	9.83%
Cement（水泥） (10,000 tons)	59,700	66,104	72,500	86,208	96,682	106,885	123,500	12.88%
Plate glasses （玻璃） (10,000 weight boxes)	18,352	20,964	23,446	27,703	37,026	40,210	40,499	14.10%
Electrolyzed Aluminum （电解铝） (10,000 tons)	279	337	432	554	669	779	935	22.33%

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Low efficiency and waste

- Electric power installed capacity with small unit capacity around 70 million kilowatts.

- Concerning steel production capacity, blast furnace below 400 cubic meters amounts to 0.1 billion tons

- The wasted energy of the nation amounts to 0.4 billion tons standard coal equivalent

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insufficient Energy resource, National resource is difficult to support social economic development

Output of fossil energy of 2005 and proved workable reserves at the end of the year

	Consumption		Output		Reserve		
	Consumption	Rank	Output	Rank	Workable Reserve at end of year	Rank	Reserve/production
Coal (0.1billion tons)	21.4	1	21.9	1	1145	3	52.2
Petroleum (0.1billion tons)	3.0	2	1.8	5	23	11	12.8
Natural Gas (0.1billion m^3)	450	18	450	16	22300	21	49.5

- **Fossil resource reserve per capita**
  - ❖ Coal-- 60% of world's average per capita;
  - ❖ Petroleum--10% of world's average per capita; natural
  - ❖ Gas--only 10% of world's average per capita

- **Renewable energies,**
  - ❖ Hydropower energy resource technical development capacity is 378.5GW, economic development capacity is 294GW.

  - ❖ Wind energy resource: ashore and offshore technical development capacity are respectively 250GW and 750GW

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External dependence of petroleum is increasingly higher, energy safety issue becomes outstanding

- **Crude oil consumption for 1990 was 0.118 billion tons and that grew to 0.3 billion tons in 2005**

- **The scope of output growth is small, maintained at about 0.18 billion tons and imports grows swiftly**

- **In 1996, China has become the crude oil net importer country; during the 10 years, external dependence had increased to 50%**

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Environmental pollution caused by energy consumption has brought heavy burden to the environment

- SO_2 and dust discharge caused by energy consumption has exceeded 80% of the gross discharge amount
- SO_2 discharge of 2005 exceeded 25 million tons
- Acid rain area occupies above one third of the country area
- More than 90% of the coal burning plant are not equipped with desulphurization facility.
- Coal exploitation has caused add up to 0.4 million hectare land collapse
- Annual sewage discharge of coal exploitation amounts to 3 billion cubic meters
- Mine exhaust emission amount (main basis is CH_4) is 9-12 billion cubic meters

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Major indicators of economic and social development in the 11th five-year plan period

Category	Indicators	Yr. 2005	Yr. 2010	Annual growth rate (%)	Attribute
Economic Growth	GDP (Trillion Yuan)	18.2	26.1	7.5	Anticipated
	Per Capita GDP (Yuan)	13985	19270	6.6	Anticipated
Economic Structure	Ratio of Added Value of Service Industry (%)	40.3	43.3	[3]	Anticipated
	Employment Ratio of Service Industry (%)	31.3	35.3	[4]	Anticipated
	Ratio of Expenditures on R & D to GDP (%)	1.3	2	[0.7]	Anticipated
	Urbanization Rate (%)	43	47	[4]	Anticipated
Population, Resources and Environment	Total Population (10,000 people)	130756	136000	< 8‰	Obligatory
	Reduction of Energy Consumption per Unit GDP (%)			[20]	Obligatory
	Reduction of Water Consumption per Unit Industrial Added Value (%)			[30]	Obligatory
	Efficient Utilization Coefficient of Agricultural Irrigation Water	0.45	0.5	[0.05]	Anticipated
	Comprehensive Utilization Rate of Industrial Solid Wastes (%)	55.8	60	[4.2]	Anticipated
	Total Cultivated Land (100 million ha.)	1.22	1.2	−0.3	Obligatory
	Reduction of Total Major Pollutants Emission Volume (%)			[10]	Obligatory
	Forest Coverage (%)	18.2	20	[1.8]	Obligatory
Public Services and Life Quality	Average Schooling Years of Citizens (Yr.)	8.5	9	[0.5]	Anticipated
	Population Covered by Basic Pension in Urban Areas (billion people)	1.74	2.23	5.1	Obligatory
	Coverage of the New Rural Cooperative Healthcare System (%)	23.5	> 80	>[56.5]	Obligatory
	Newly Increased Urban Employment in Five Years (10,000 people)			[4500]	Anticipated
	Rural Labor Force Transferred in Five Years (10,000 people)			[4500]	Anticipated
	Registered Urban Unemployment Rate (%)	4.2	5		Anticipated
	Per Capita Disposable Income of Urban Households (Yuan)	10493	13390	5	Anticipated
	Per Capita Net Income of Rural Households (Yuan)	3255	4150	5	Anticipated

Note: Figures of GDP and urban resident income are of 2005 price; those in [] are accumulative figures in five years; major pollutants refers to sulfur dioxide and COD.

Object of Development

Total amount of consumption and its structure

- By the year 2010, the target of control of total amount of consumption of primary energy is around 2.7 billion tons standard coal Equivalent (SCE), with average annual growth rate of 4%. Coal, petroleum, natural gas, nuclear electricity, hydro-electricity and other renewable energy resources will have a share of 66.1%, 20.5%, 5.3%, 0.9%, 6.8% and 0.4% respectively of total amount of consumption of energy. Compared with the year of 2005, the share of coal and petroleum is declined 3.0 and 0.5 percentage points, while the share of natural gas, nuclear electricity, hydro-electricity and other renewable energy resources have been increased by 2.5, 0.1, 0.6 and 0.3 percentage points respectively

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31 Provinces: Population (million)

Henan	93.71	Yunnan	44.42	Inner Mongolia	23.86
Shandong	92.39	Jiangxi	43.07	Xinjiang	20.08
Guangdong	91.85	Liaoning	42.20	Shanghai	17.78
Sichuan	82.08	Heilongjiang	38.18	Beijing	15.36
Jiangsu	74.68	Guizhou	37.25	Tianjin	10.43
Hebei	68.44	Shaanxi	37.18	Hainan	8.26
Hunan	63.20	Fujian	35.32	Ningxia	5.95
Anhui	61.14	Shanxi	33.52	Qinghai	5.43
Hubei	57.07	Chongqing	27.97	Tibet	2.76
Zhejiang	48.94	Jilin	27.15		
Guangxi	46.55	Gansu	25.92		

31 Provinces: Area (km²)

Xinjiang	1,660,000	Hebei	190,000	Fujian	121,400
Tibet	1,228,400	Jilin	187,400	Jiangsu	102,600
Inner Mongolia	1,183,000	Hubei	185,900	Zhejiang	101,800
Qinghai	722,000	Guangdong	179,800	Chongqing	82,400
Sichuan	485,000	Guizhou	176,100	Ningxia	66,400
Gansu	455,000	Henan	167,000	Hainan	35,000
Heilongjiang	454,000	Jiangxi	166,947	Beijing	16,807
Yunnan	394,000	Shandong	157,100	Tianjin	11,305
Guangxi	236,300	Shanxi	156,000	Shanghai	6,341
Hunan	211,875	Liaoning	145,700		
Shaanxi	205,600	Anhui	139,600		

Inter-Provinces– Max/Min

Max/Min

per capita GDP　per capita consumption (current price)
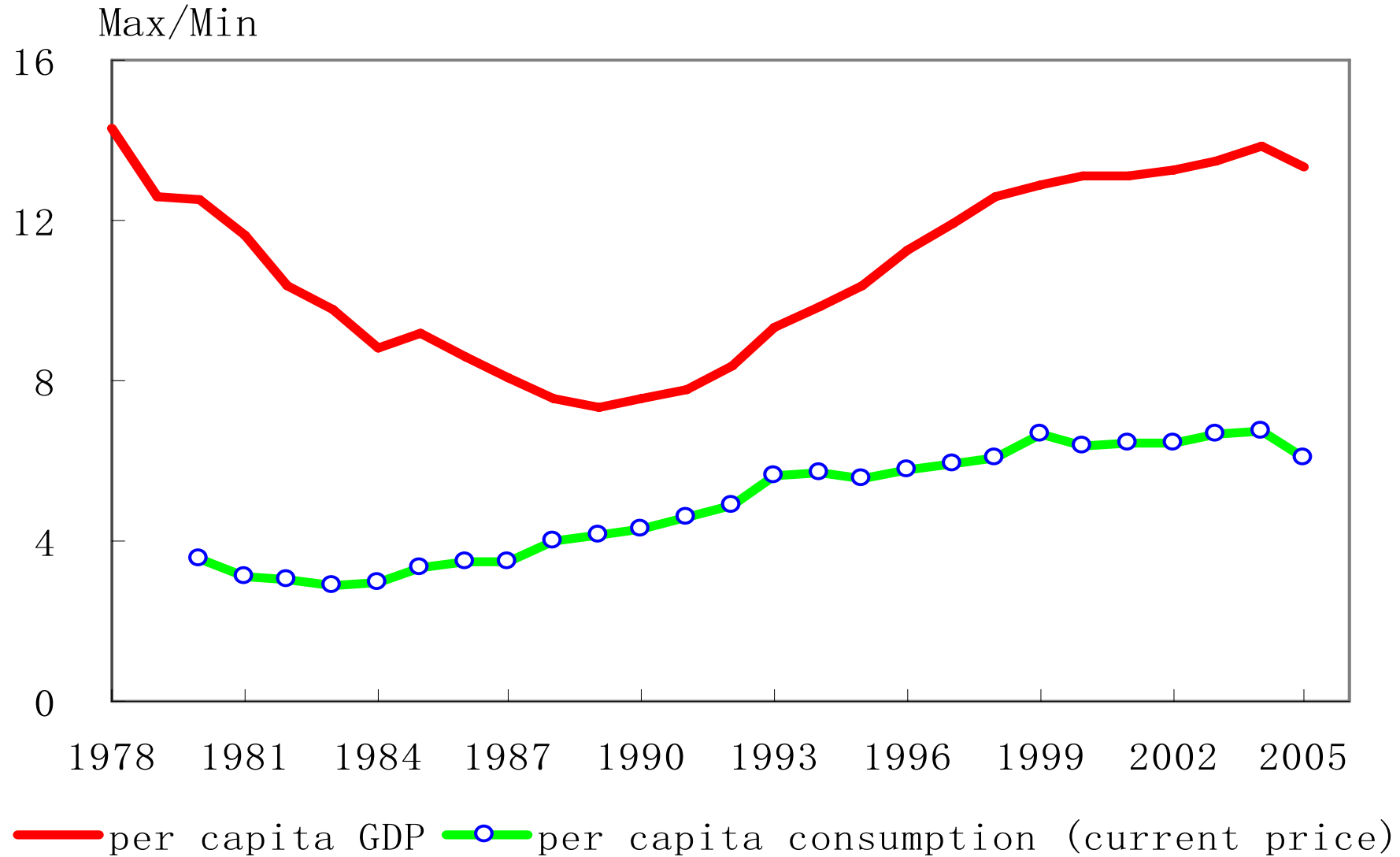
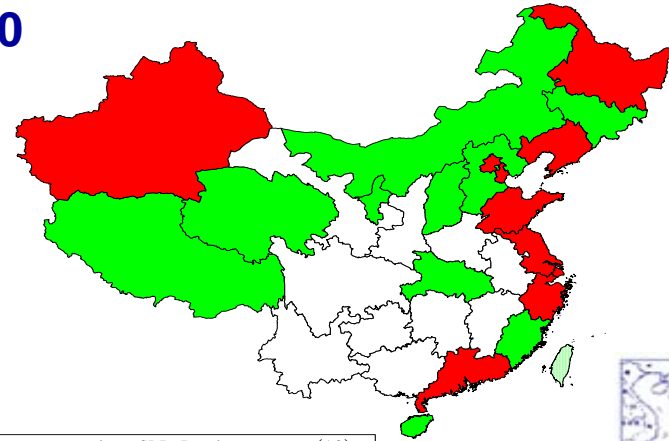# Inter-Provinces– Gini and Theil index (at current price)
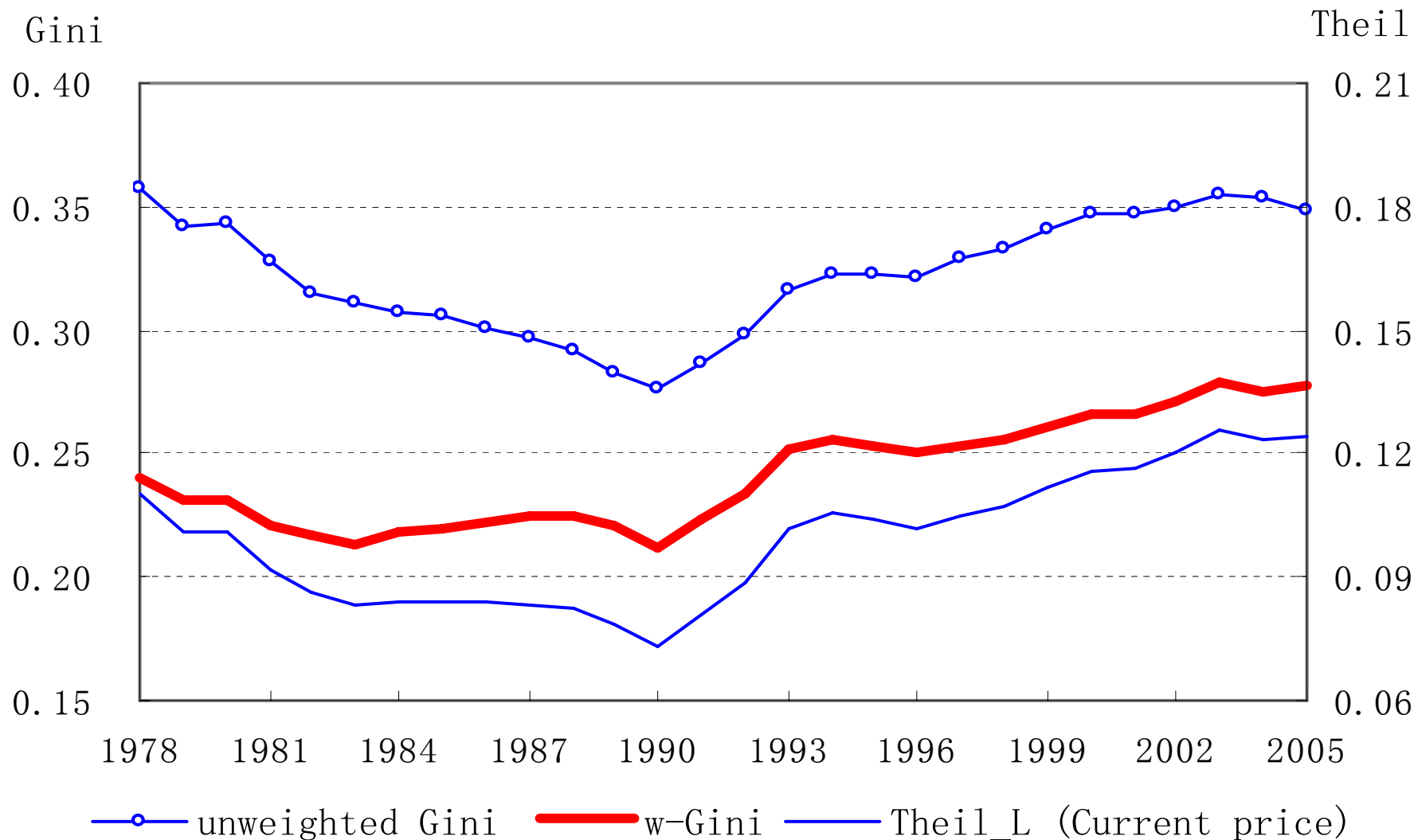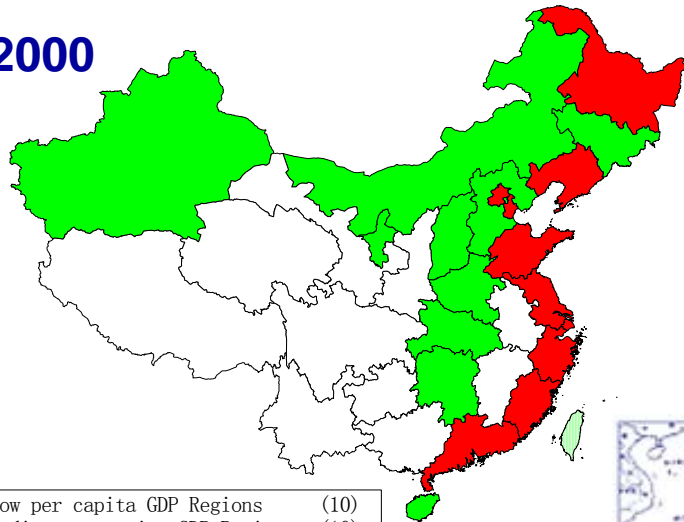
Provincial per capita GDP

1978
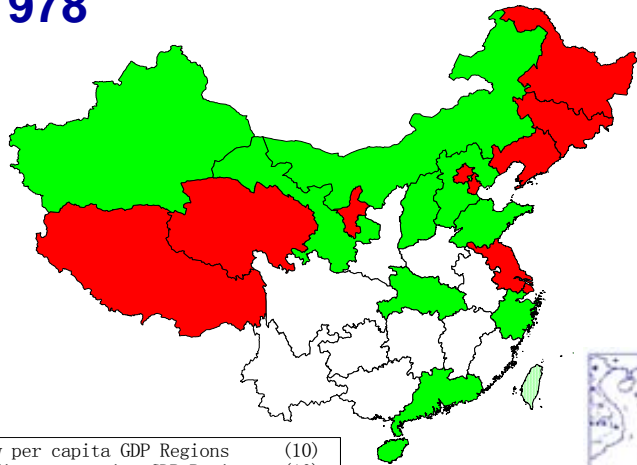
Low per capita GDP Regions (10)
medium per capita GDP Regions (10)
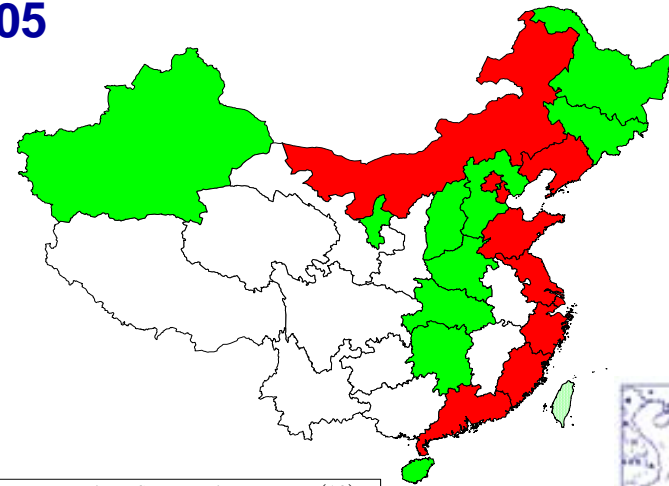high per capita GDP Regions (10)

1990

Low per capita GDP Regions (10)
Medium per capita GDP Regions (10)
High per capita GDP Regions (10)

2000

Low per capita GDP Regions (10)
Medium per capita GDP Regions (10)
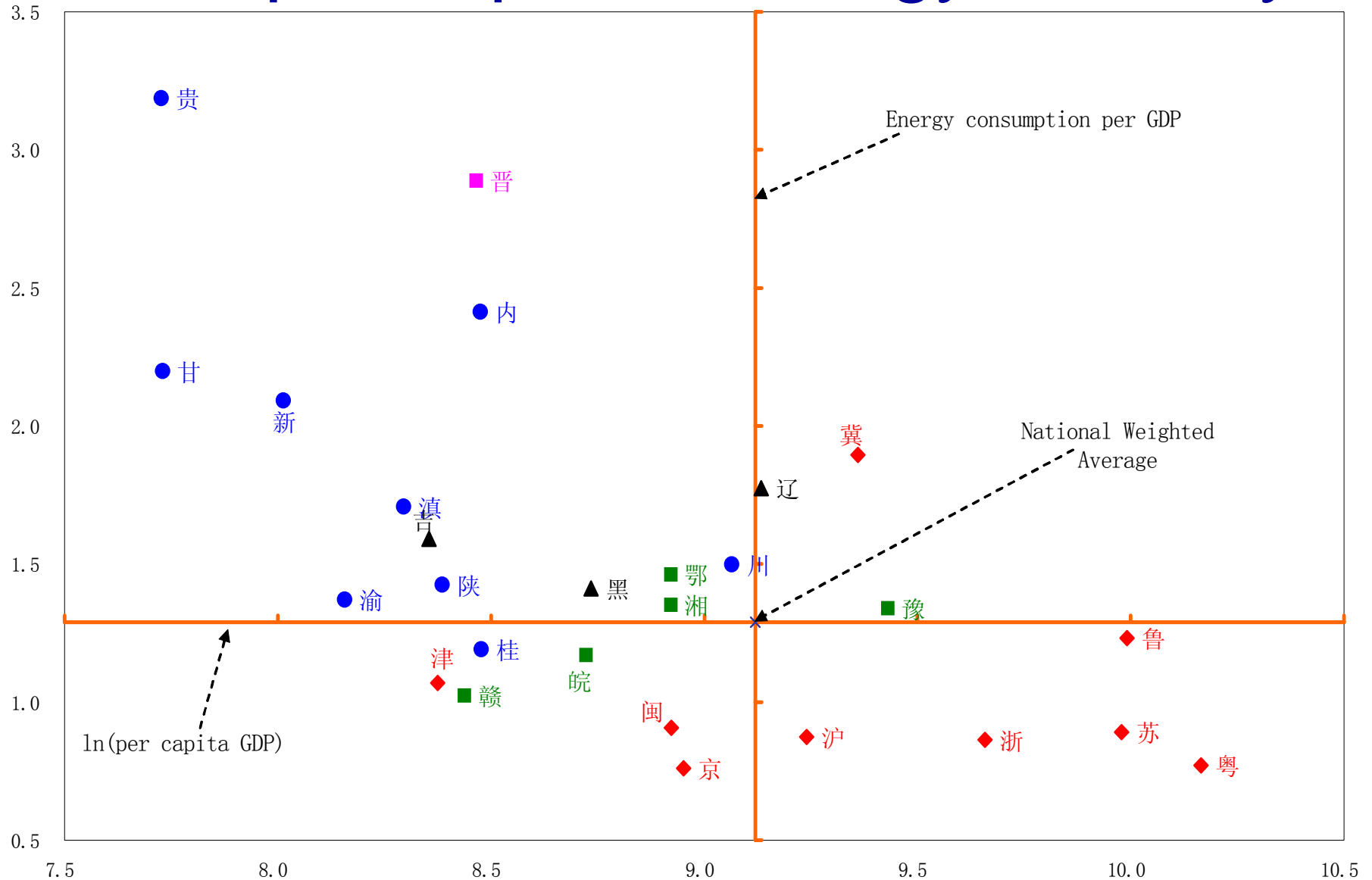High per capita GDP Regions (10)

2005

Low per capita GDP Regions (10)
Medium per capita GDP Regions (10)
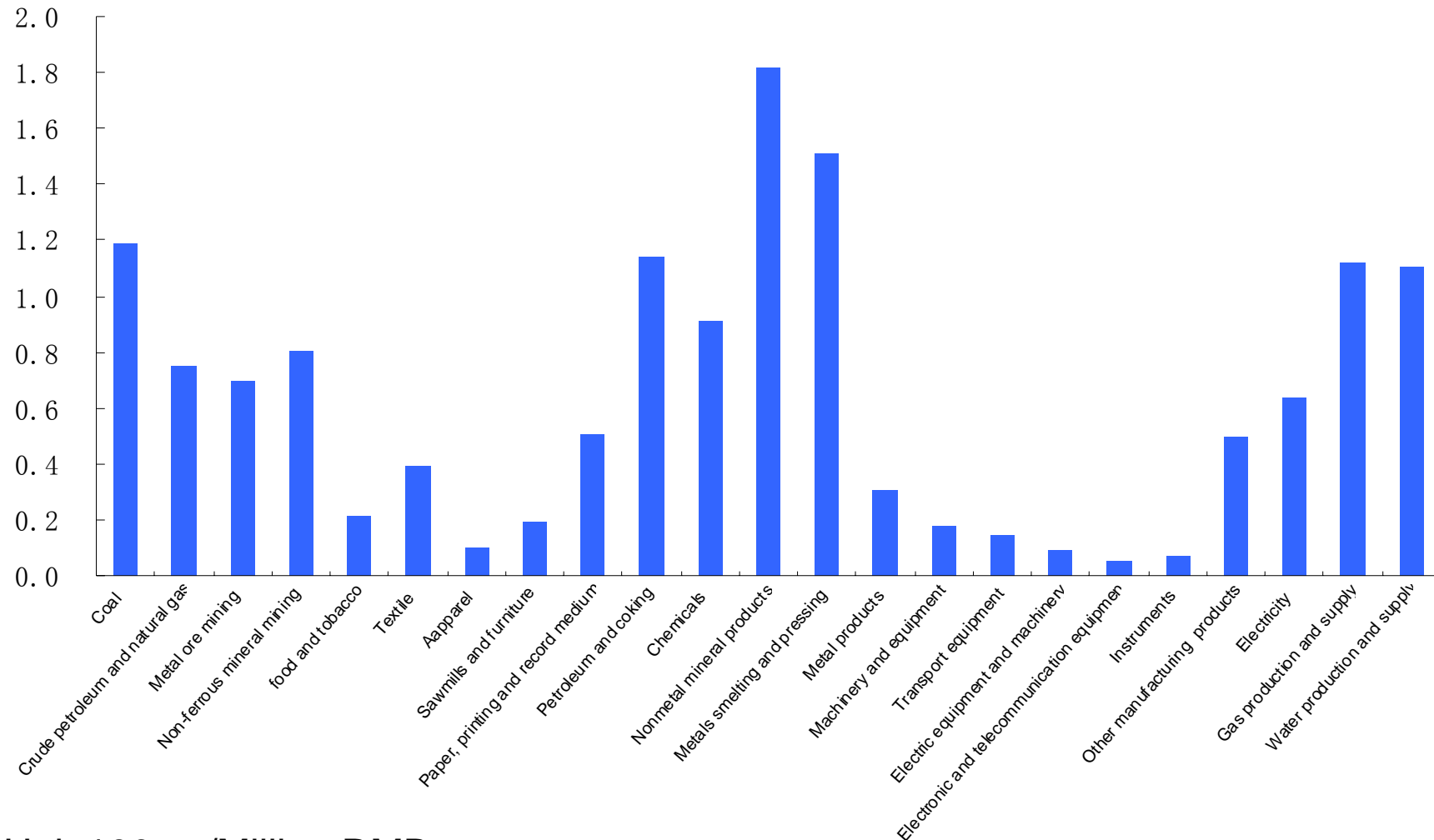High per capita GDP Regions (10)
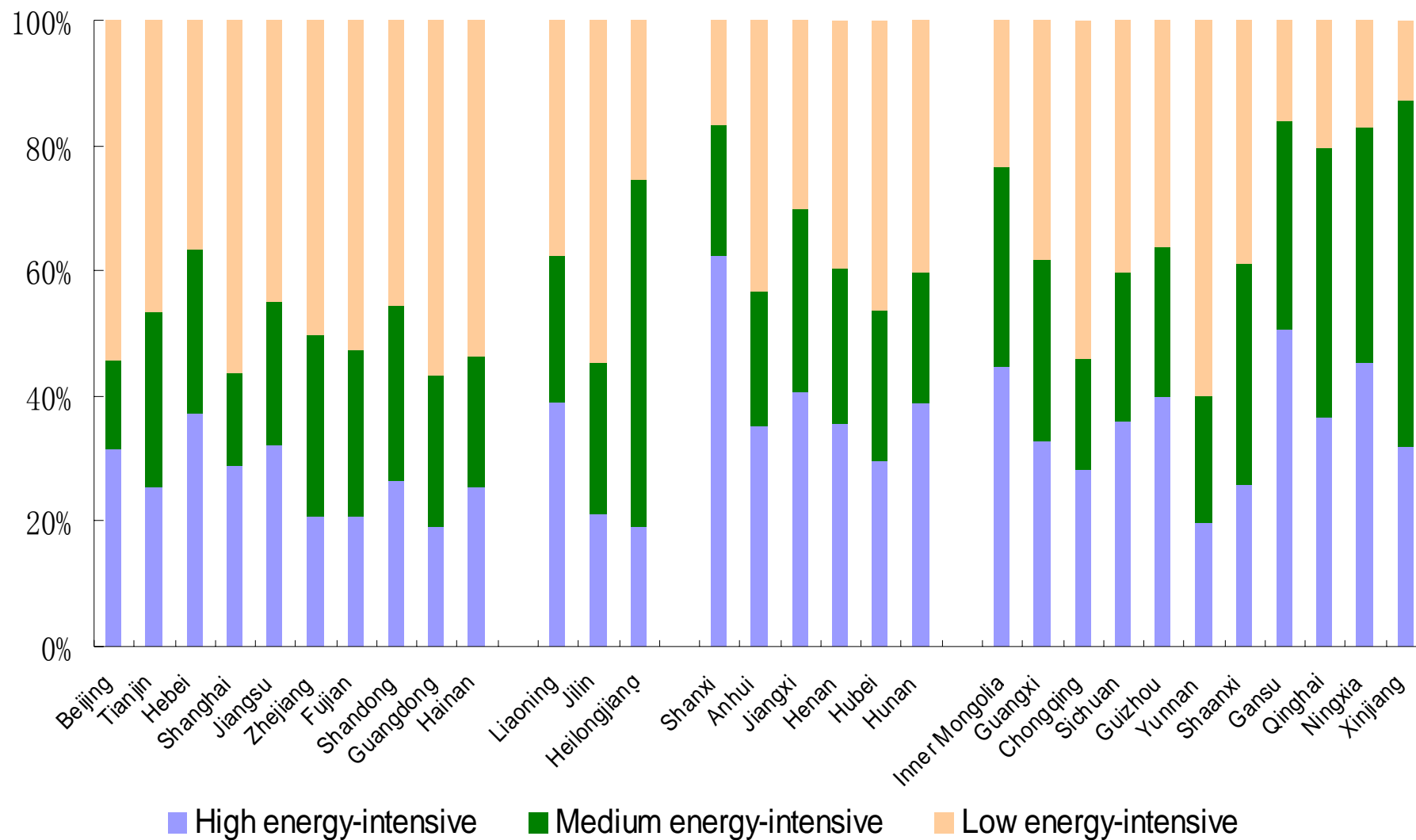
GDP per capita & Energy Intensity

Energy intensity by sectors, 2004

Unit:100tce/Million RMB

Composition of Industrial Output by energy intensity

Legend: ■ High energy-intensive ■ Medium energy-intensive ■ Low energy-intensive

Decomposition of Energy intensity

$$\frac{E_2}{GDP_2} - \frac{E_1}{GDP_1} = \frac{A_2'X_2}{GDP_2} - \frac{A_1'X_1}{GDP_1}$$

$$= \underbrace{\left(A_2' - A_1'\right)S_1}_{} + \underbrace{A_1'\left(S_2 - S_1\right)}_{} + \left(A_2' - A_1'\right)\left(S_2 - S_1\right)$$

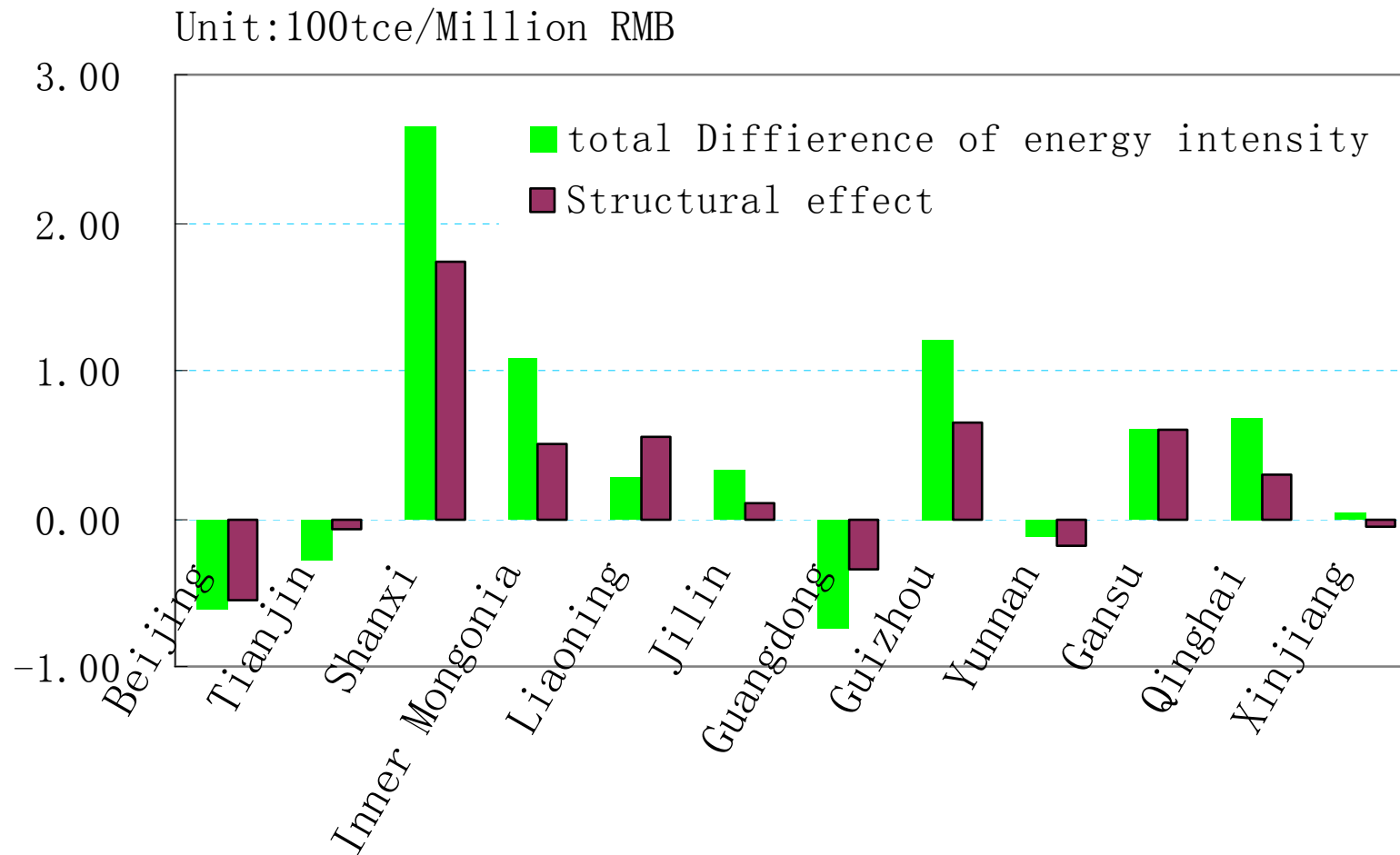Sectoral Efficiency   Structural effect   Residua

$$A_i = \left(\frac{E_{i1}}{TVA_{i1}}, \frac{E_{i2}}{TVA_{i2}}, \ldots\ldots, \frac{E_{i24}}{TVA_{i24}}\right) \qquad S_i = \begin{pmatrix} \dfrac{TVA_{i1}}{GDP_i} \\ \dfrac{TVA_{i2}}{GDP_i} \\ \ldots \\ \dfrac{TVA_{i24}}{GDP_i} \end{pmatrix} \qquad E_i = \sum_{j=1}^{24} E_{ij}$$

Contributions to the difference of regional energy intensity

Unit:100tce/Million RMB

- total Diffierence of energy intensity
- Structural effect

Option of Mode of Economic Development

Sustainable Production, Consumption, and Trade energy saving can be achieved through three aspects:

- Structural saving
- Technical saving
- Institutional saving

Structural saving

- **Structure of primary, secondary and tertiary industries,**

- **Structure of industry**

- **Division of Labor structure of industries among countries**

- **Structure of urban Development**

  ❖ The admixture of and relations among small-sized, medium-sized and large-sized cities

  ❖ To optimize the functions and layout of cities, advocating "compact cities" and "expansion in a smart way"

  ❖ To establish a transportation system conducive to energy saving.

- **Structure of transportation modes**

- **Consumption structure**

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Institutional saving

- **Law**

  ❖ **Conservation Law**

- **Standards**

- **Governance**

- **Public participation**

- **Tax**

- **Incentive System**

Thank you very much!