China's Electric Power Industry and Its Trends

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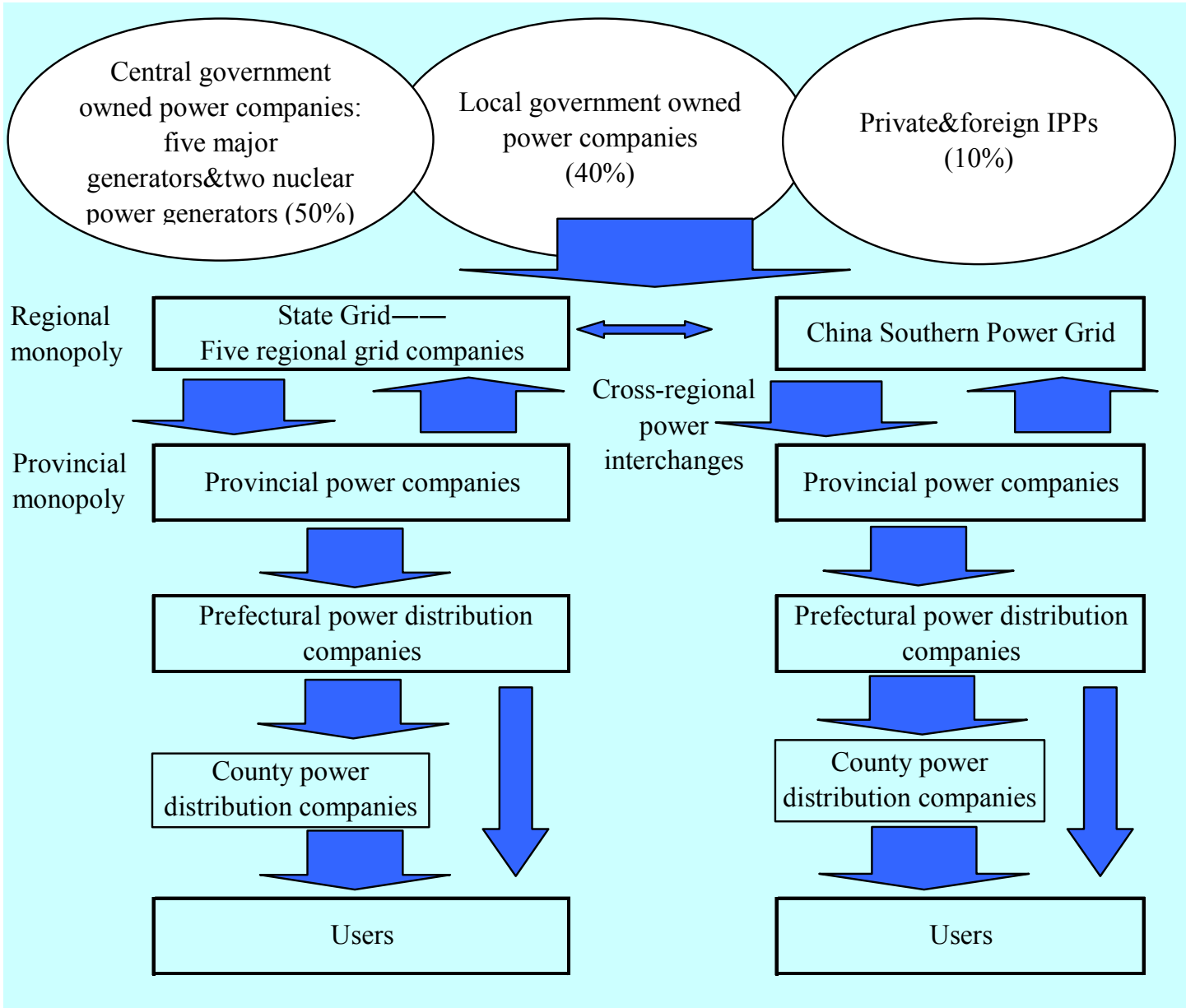
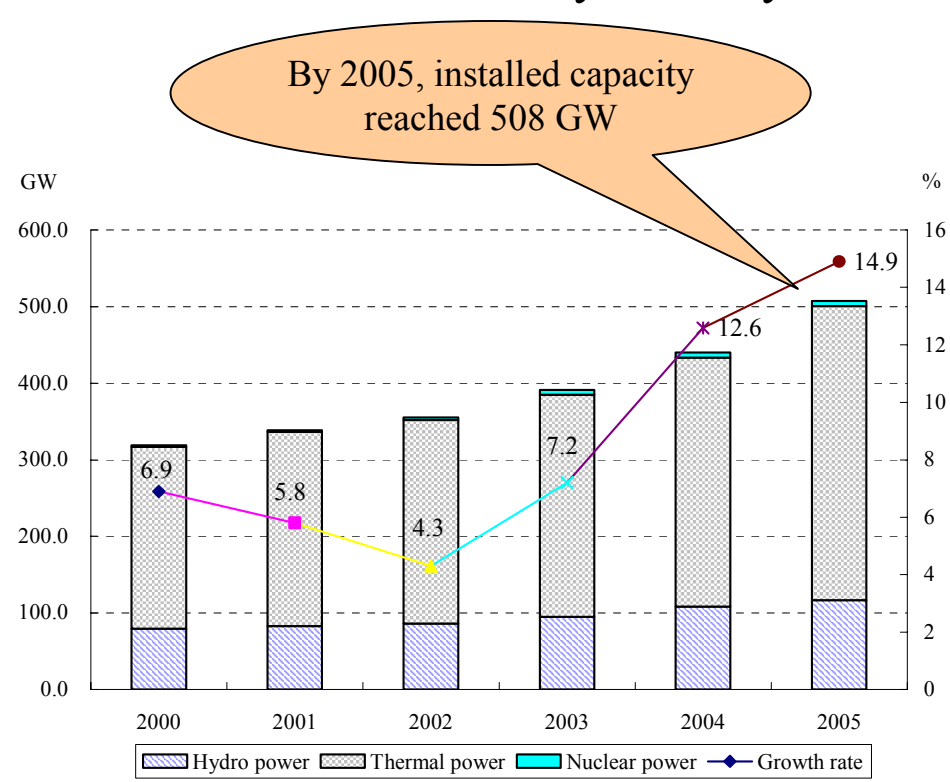
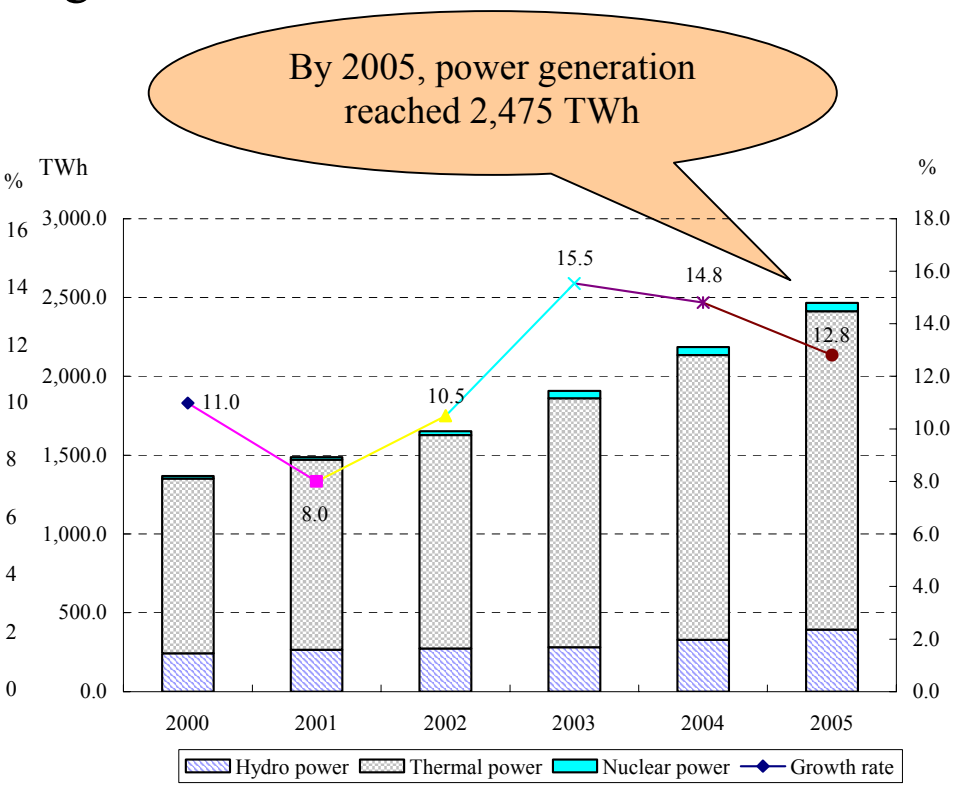
1. Structure of China's Electric Power Industry



2.1. Power supply and demand (1)

- Installed capacity and power generation output are both the second largest to the world's electricity industry following the United States



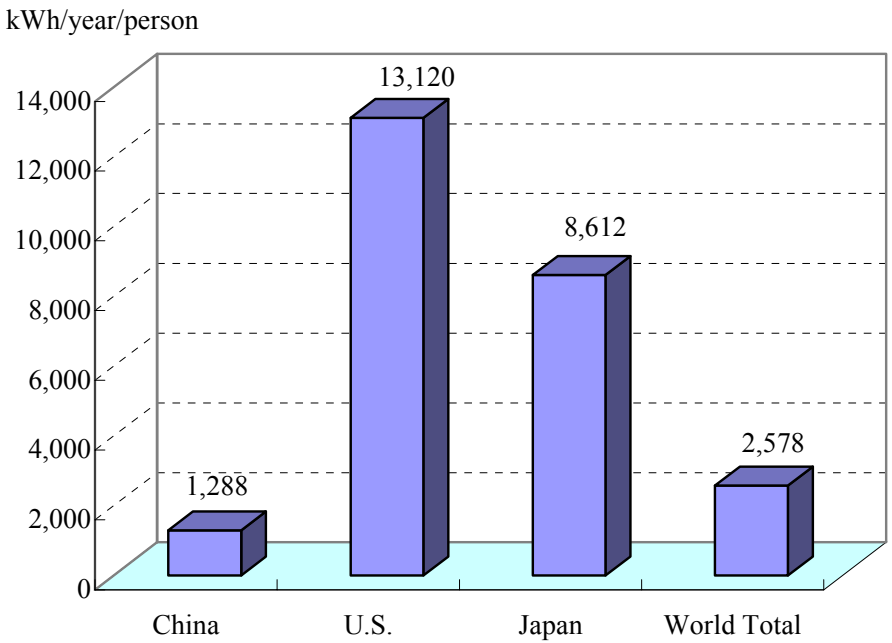


Source: China Electricity Council, (http://www.cec.org.cn/cec-en/index.htm).

2.1. Power supply and demand (2)

- Power generation per capita is one-tenth that of the United states, one-seventh of Japan and less than half of the world's average amount (2002 figures)

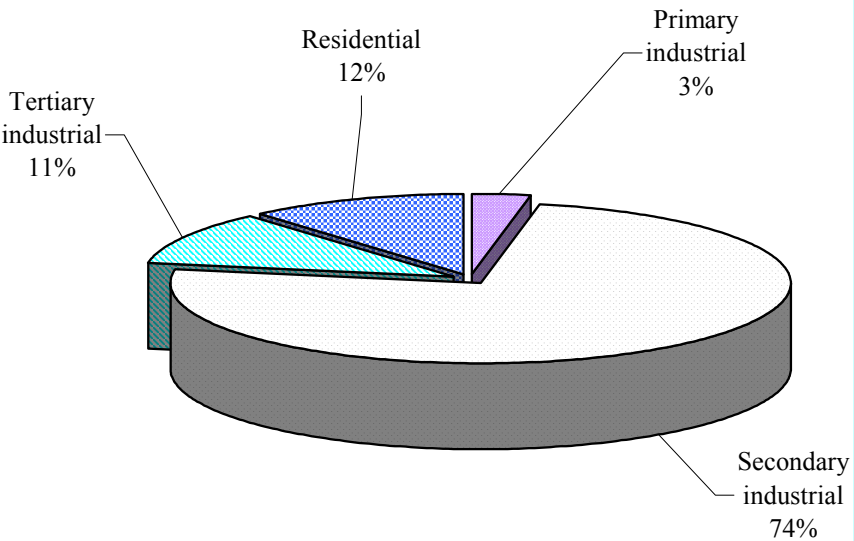
	China	U.S.	Japan	World Total
Installed capacity (GW)	356.6	979.6	266.1	3,372.8
(% of world total)	(9.6%)	(26.4%)	(7.2%)	(100%)
Power generation (TWh)	1,654.2	3,858.5	1,097.2	15,614.1
(% of world total)	(10.6%)	(24.7%)	(7.0%)	(100%)
Power generation per capita (kWh/person)	1,288	13,120	8,612	2,578



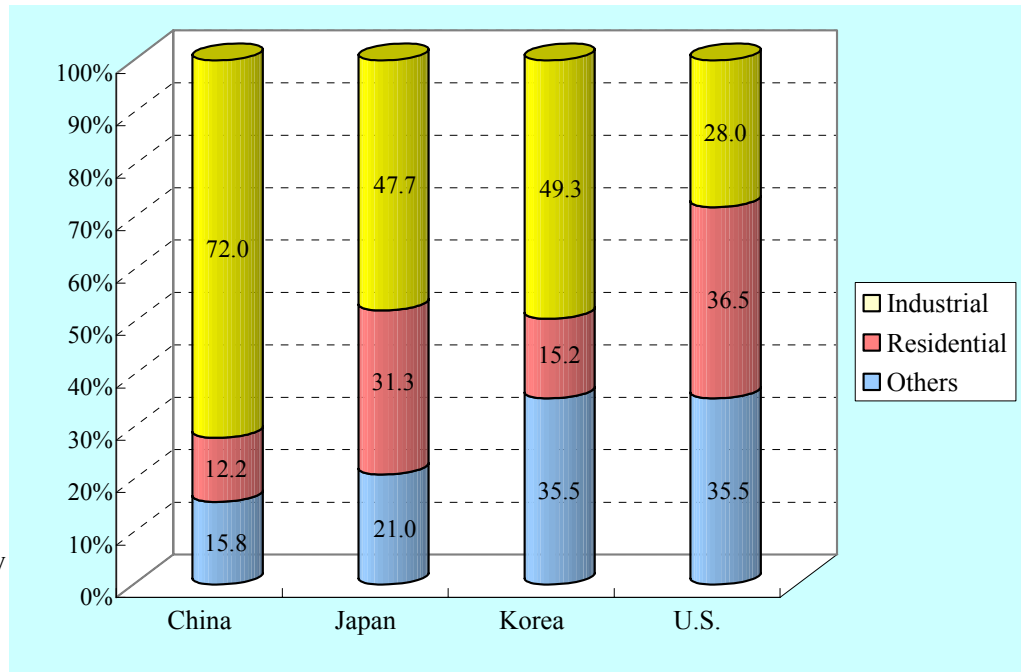
Source: Japan Electric Power Information Center (2005), *Overseas Electric Power Industry Statistics.*

2.1. Power supply and demand (3)

- Secondary industrial accounts for approximately 70 percent, whereas residential only accounts for 10 percent of the total consumption

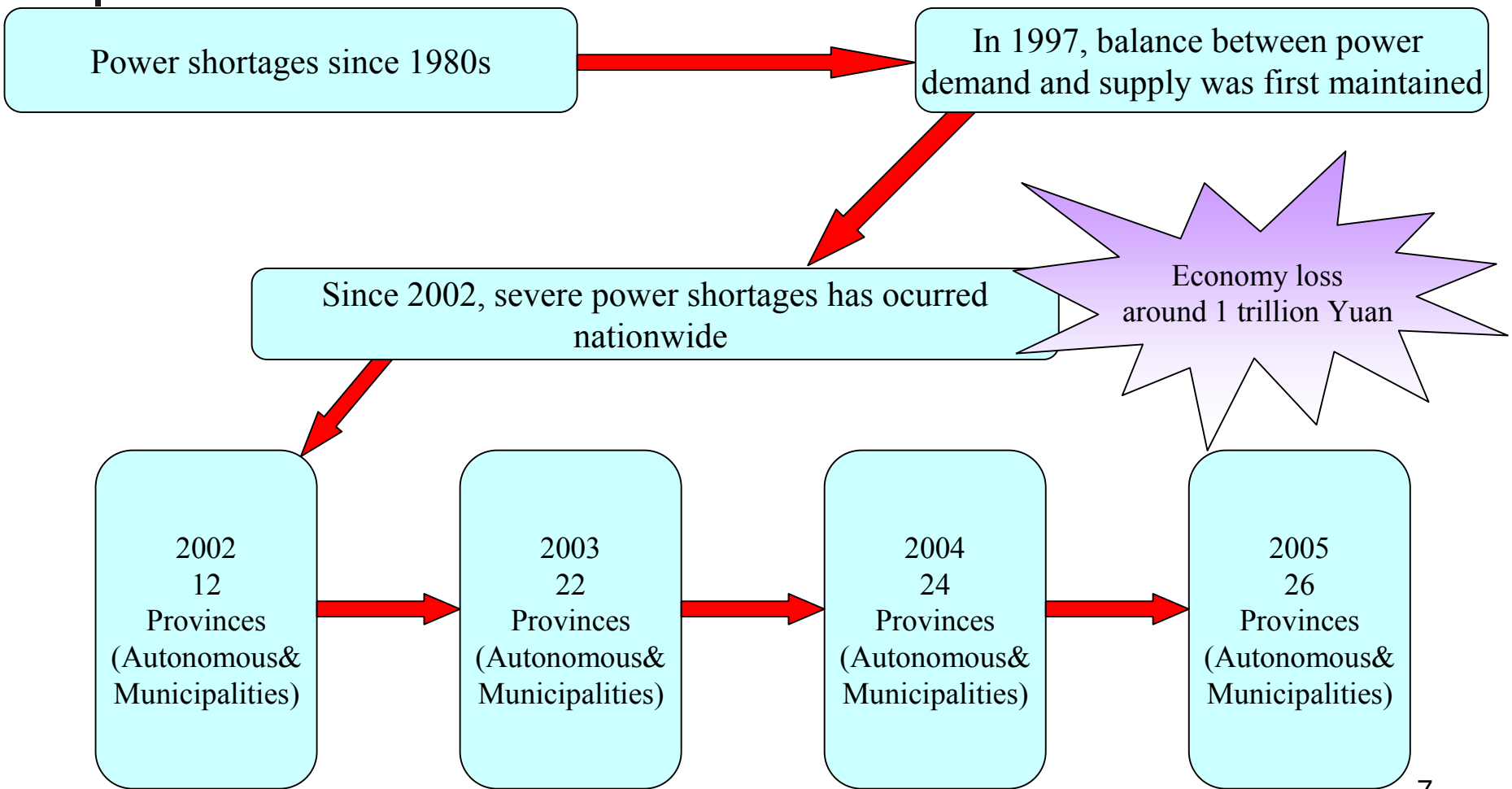


Note: 2005 figures.
Source: China Electricity Council,
(http://www.cec.org.cn/cec-en/index.htm).



Note: 2002 figures.
Source: Japan Electric Power Information Center (2005),
Overseas Electric Power Industry Statistics.

2.1. Power supply and demand (4)



(Appendix) Rolling Blackouts in China

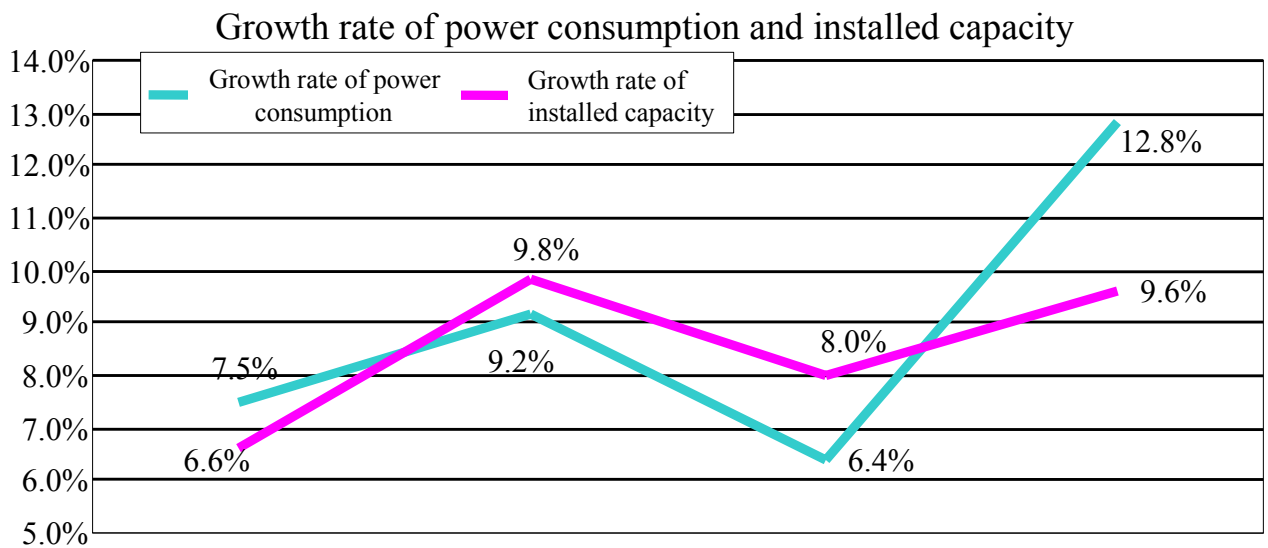
Rolling blackouts implemented in China (2002 – Aug. 2005)

Region	2002 (12 provinces/municipalities /autonomies)	2003 (22 provinces/municipalities /autonomies)	2004 (24 provinces/municipalities /autonomies)	Jan.-Aug., 2005 (26 provinces/municipalities /autonomies)
North China	Hebei, Shanxi, Inner Mongolia	Hebei, Shanxi, Inner Mongolia	Tianjin, Hebei, Shanxi, Inner Mongolia, Shandong	Tianjin, Hebei, Shanxi, Inner Mongolia, Shandong, Beijing
Northeast China	-	-		Liaoning
East China	Shanghai, Jiangsu, Zhejiang	Shanghai, Jiangsu, Zhejiang, Anhui, Fujian	Shanghai, Jiangsu, Zhejiang, Anhui, Fujian	Shanghai, Jiangsu, Zhejiang, Anhui, Fujian
Central China	Henan, Hubei, Sichuan, Chongqing	Henan, Hubei, Sichuan, Chongqing, Jiangxi, Hunan	Henan, Hubei, Sichuan, Chongqing, Jiangxi, Hunan	Henan, Hubei, Sichuan, Chongqing, Jiangxi, Hunan
Northewest China	-	Gansu, Qinghai, Ningxia	Gansu, Qinghai, Ningxia, Shanxi	Gansu, Qinghai, Ningxia, Shanxi
South China	Guangdong, Guizhou	Guangdong, Guangxi, Guizhou, Yunnan, Hainan	Guangdong, Guangxi, Guizhou, Yunnan, Hainan	Guangdong, Guangxi, Guizhou, Yunnan, Hainan
Nation wide power shortages			35 GW	25-30 GW

Source: China Electricity Council, (http://www.cec.org.cn/cec-en/index.htm).

2.2. Causes of power shortages (1)

- ***Responsible entity***:
  - Central government: Power generation development plan was downwardly revised in the later of the "Ninth-Five Year Plan (1996-2000)" – "the construction of new thermal power plants is being suspended for the next three years"
- ***Others major factors***:
  - Rapid demand growth (driving by rapid economic growth, soaring demand from large electric power consumers, and the diffusion of household electrical appliances)



Source: State Power Information Network, (http://www.sp.com.cn/).

2.2. Causes of power shortages (2)

- ***Others major factors (continued):***
  - Issues based on coal industry:
    - imblance between coal supply and demand & transport bottlenecks
    - escalating coal prices and decreased quality of coal
  - Climatic influences (droughts and heat weaves):
    - power shortages in provinces such as Hunan, Fujian and Qinghai where there are many hydro power plants

History of coal price (Unit:Yuan/ton)

Type	2001	2002	2003	2004	2005
Planned price*	144.7 (-0.9%)	152.2 (5.2%)	155.8 (2.4%)	220.2 (41.3%)	240- less than 8% from Sept. 2004 base
Market price	141.9 (1.9%)	168.8 (18.3%)	173.8 (3.6%)	302.0 (73.8%)	

Note: planned price is the price only for generators.
Source: Japan Electric Power Information Center.

2.3. Countermeasures against power shortages

- ***Demand countermeasures***:
  - Peak shift: nighttime and weekend factory operations (expand TOU rate differentials and so on)
  - Peak cut: equipment inspections and load interrupts ("rolling shutdowns", and "three days on, four days off")

- ***Supply countermeasures***:
  - Moving up of power generation development (promotion of nuclear power generation)
  - Power network improvements

2.4. Outlook of power supply and demand (1)

- ***Short-term***:
  - Gradual decrease in growth of power demand (10% in 2006, 7% in 2007)
  - Net capacity increase is projected to reach 150 GW during 2006 and 2007 (80 GW in 2006 and 70 GW in 2007)
  - In 2006, power shortages will be limited to certain regions and time slots
  - In 2007, balance between supply and demand will be maintained

Outlook of power supply and demand in 2006

	2004	2005	2006
Installed capacity (GW)	442 (12.6%)	508 (14.9%)	591 (16.3%)
Net capacity increase (MW)	49,300	70,000	80,000
Power consumption (TWh)	2,176.1 (14.9%)	2,468.9 (13.5%)	2,668.0 (11.4%)
Max. power shortage (MW)	35,000	25,000-30,000	6,000-10,000

Source: State Power Information Center, (http://www.sp.com.cn/).

2.4. Outlook of power supply and demand (2)

- ***Long-term***:
  - At the end of 2010, installed capacity is projected to reach 560 GW and 950 GW by the end of 2020
  - At the end of 2010, power demand is projected to reach 3,000 TWh, and 4,600 TWh by the end of 2020

Outlook of generation component from 2010 to 2020 Unit: GW

	2010	2020
Total installed capacity	543-559 (100%)	865-947 (100%)
Coal	338-384 (62-69%)	509-661 (56-69%)
Oil	3-4 (1%)	1-6 (1%)
Natural gas	25-28 (5%)	43-46 (5%)
Hydro power	132-154 (24-28%)	191-240 (22-25%)
Nuclear power	9-15 (2-3%)	31-40 (3-4%)
Renewable sources	3-7 (1%)	11-30 (1-3%)

Source: Development Research Center of State Council R.R. China (2004), *China's Energy Development Strategy and Policy Study,* p.197.

Outlook of power demand from 2010 to 2020

	Unit	2000	2005	2010	2015	2020
Low case	TWh	1,350.8	2,222.2	2,917.9	3,558.2	4,324.4
Growth rate	%		10.5	5.1	3.2	2.6
Reference case	TWh	1,350.8	2,278.8	3,044.4	3,798.8	4,630.8
Growth rate	%		11.0	6.0	4.5	4.0
High case	TWh	1,350.8	2,336.6	3,246.9	4,219.9	5,152.4
Growth rate	%		11.6	7.3	6.7	6.3

Source: State Power Economic Research Center.

Power generation will continually be based on coal-fired thermal power!

2.4. Outlook of power supply and demand (3)

- In 2010, power consumption per capita will be approximately 2,130 kWh and daily power consumption per capita will reach 258 kWh
- In 2020, power consumption per capita will be approximately 3,200 kWh and daily power consumption per capita will reach 560 kWh

International Comparison

2010		2020	
Power consumption per capita	International Comparison	Power consumption per capita	International Comparison
2,130kWh	U.S. and Germany in the early of 1950s, Japan in the middle of 1960s	3,200kWh	U.S in the later of 1950s, Japan at the end of 1960s, Germany in the early of 1970s
Daily power consumption per capita	International Comparison	Daily power consumption per capita	International Comparison
258kWh	Japan in the early of 1960s, France in the middle of 1960s	560kWh	Germany in 1967, Japan in the early of 1970s, Korea in 1992

Source: State Power Economic Research Center.

3. Future power development plans (2006-2010)

- ***Generation sector***:
  - Proactively work on the development of hydropower
  - Implement large-scale expansions of coal-fired thermal power, and upgrade technology
  - Proactive development of nuclear power
  - Appropriate introduction of natural gas power generation
  - Introduce renewable energy
  - Intensify energy conservation, and improve the efficiency of energy utilization
- ***Network sector***:
  - Pace of power generation construction and power grid construction (power generation, transmission and distribution investment ratio in 1990s was:1:0.2:0.2)
  - Realize nationwide interconnection based on “West-East Power Transmission” and “South-North Power Transmission”
  - Optimize power resources allocation based on renewal and construction of regional transmission and distribution networks

(Appendix) West-East Power Transmission Project

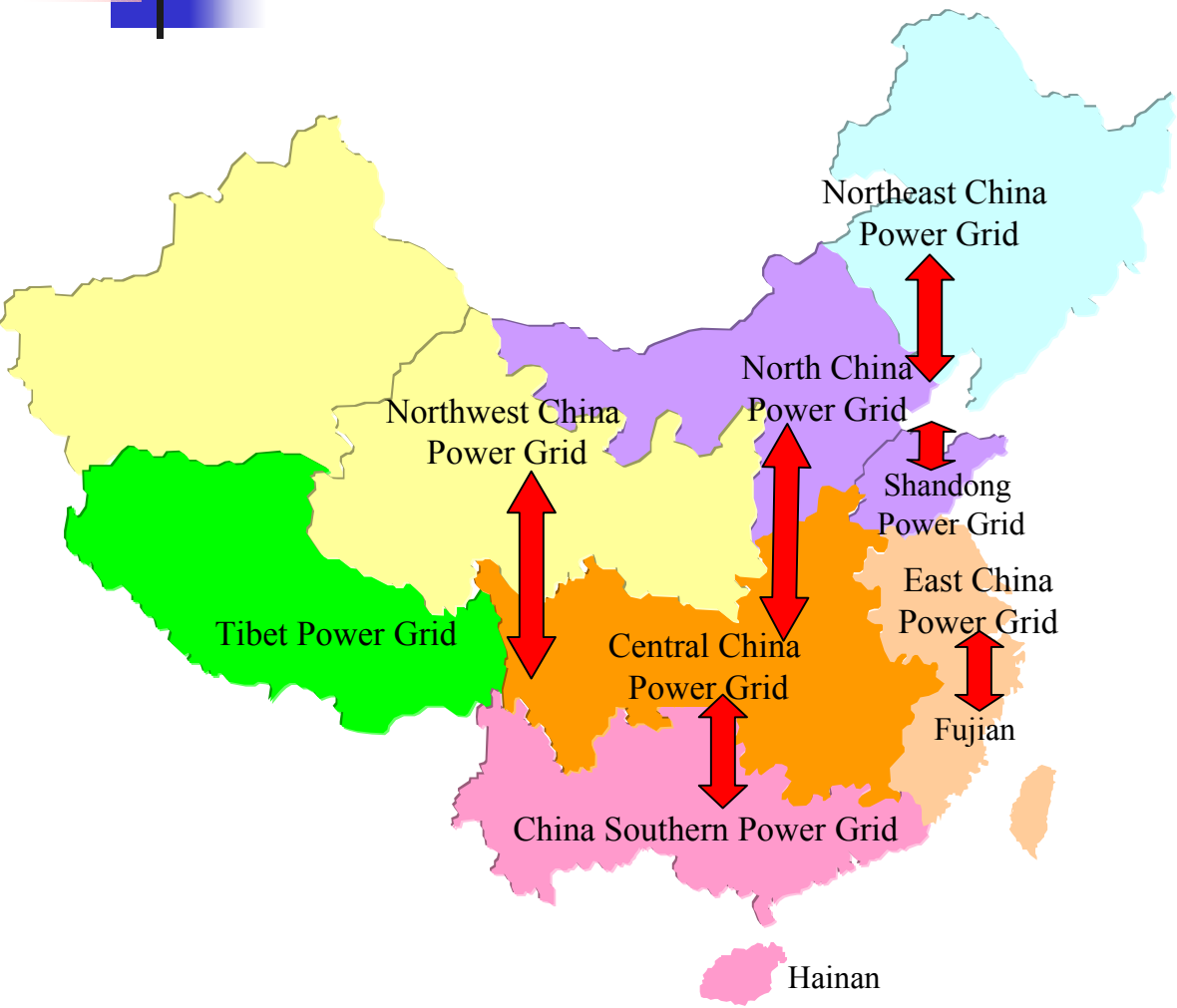
- West-East Power Transmission:

North Route:
7,000 MW by 2005
18 GW by 2010
40 GW by 2020

Middle Route:
7,000 MW by 2005
21.8 GW by 2010
40 – 45 GW by 2020

South Route:
11 GW by 2005
15 GW by 2010
20 – 25 GW by 2020

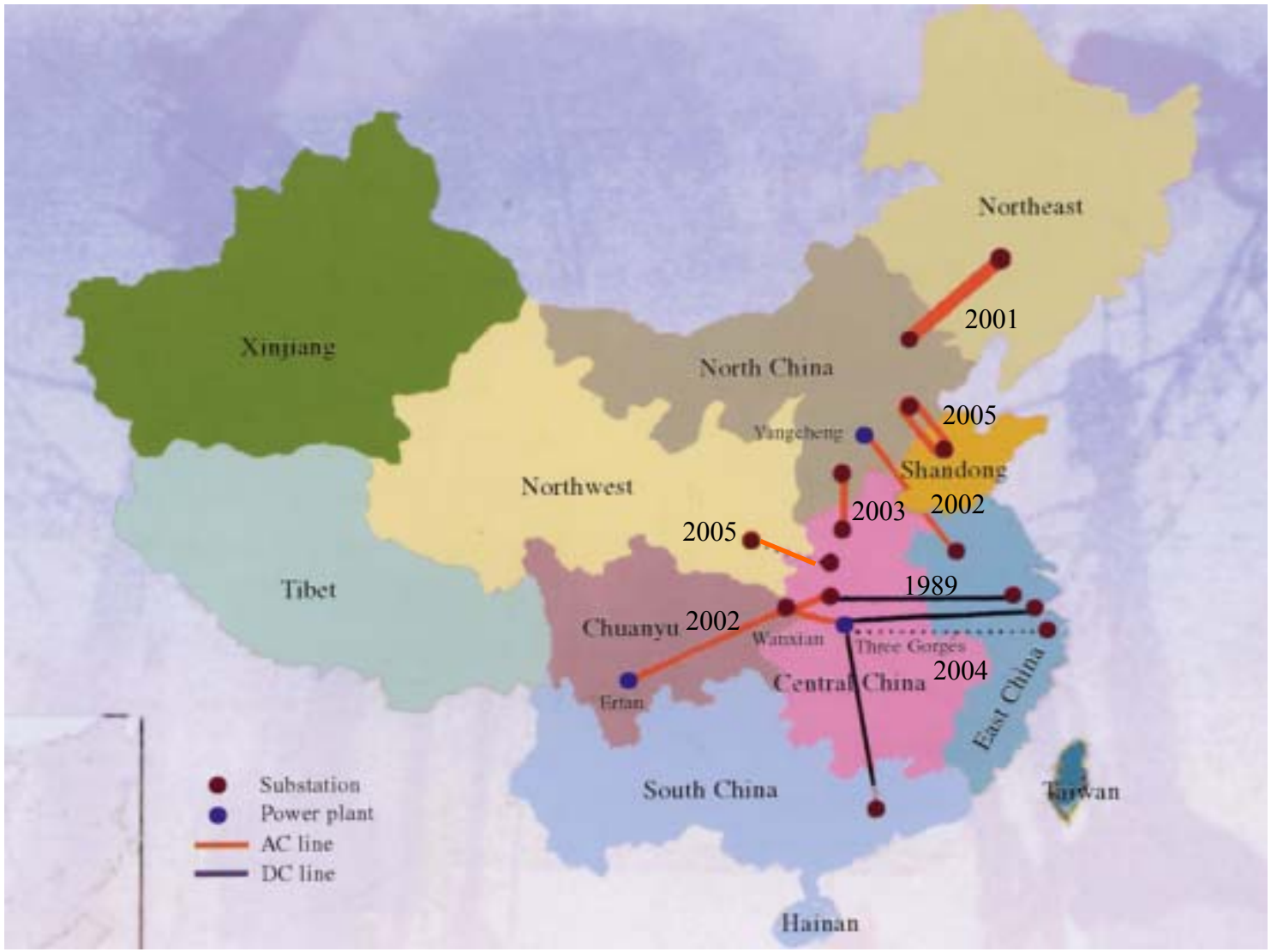
(Appendix) South-North Power Transmission



- South-North Power Transmission:

Northeast & North China interconnection
Shandong & North China interconnection
Central China & North China AV/BTB interconnection
Central China & Northwest China BTB interconnection
Fujian & East China interconnection
Three Gorges Dam & Guangdong DC interconnection

(Appendix) Nationwide interconnection by Dec. 2005

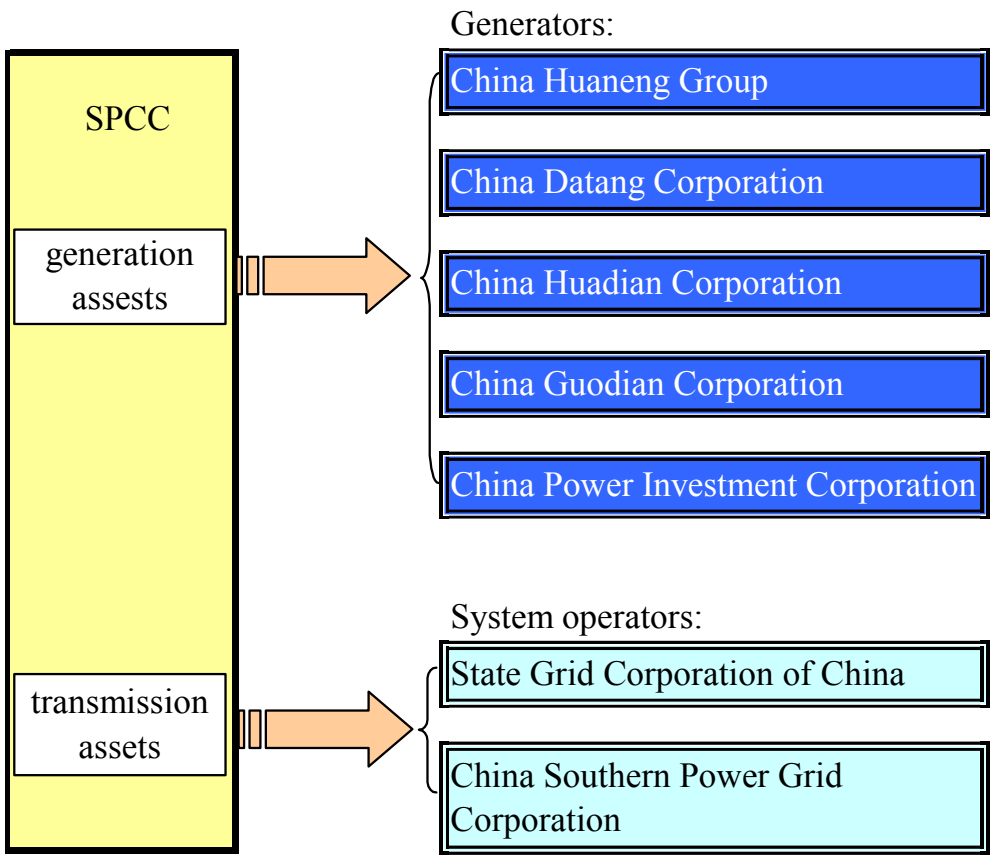


Source: State Grid Corporation of China, *Electric Power In China, 2005*.

4. Regulation reform trends (1)

- "***introduce competition and break the market monopoly***"- separation of generation and transmission sectors

Restructuring of the ***State Power Corporation of China***
December 2002



4. Regulation reform trends (2)

- ***Generation sector***:

1. Power Grids

(in the purpose of ancillary service and funding for network construction)

By Dec. 2002

State Grid Corporation of China				
Northeast China Grid Company	North China Grid Company	East China Grid Company	Central China Grid Company	Northwest China Grid Company
40,500 MW	74,700 MW	76,000 MW	74,300 MW	27,000 MW
China Southern Power Grid Corporation 63,500 MW				

2. Five major power generators

Five major generators	Installed capacity	Power components			Assets
		Hydro	Thermal	Nuclear power	Billion Yuan
Huaneng	38.0GW	18%	82%	-	126.5
Datang	32.5GW	21%	79%	-	71.6
Huadian	31.3GW	19%	81%	-	71.2
Guodian	30.8GW	15%	85%	-	73.3
Chian Power Investment	30.2GW	26%	70%	3.8%	76.9

Note: Each company's market share is less than 20% in each region and less than 10% in nationwide.

4. Regulation reform trends (3)

- ***Transmission Sector***:

  State Grid Corporation of China (SGCC) & China Southern Power Grid (CSPG)

SGCC:

Northeast China Power Grid:Heilongjiang, Jilin, Liaoning, East Inner Mongolia

North China Power Grid: Beijing, Tianjin,Hebei, Shanxi, Shandong, West Inner Mongolia

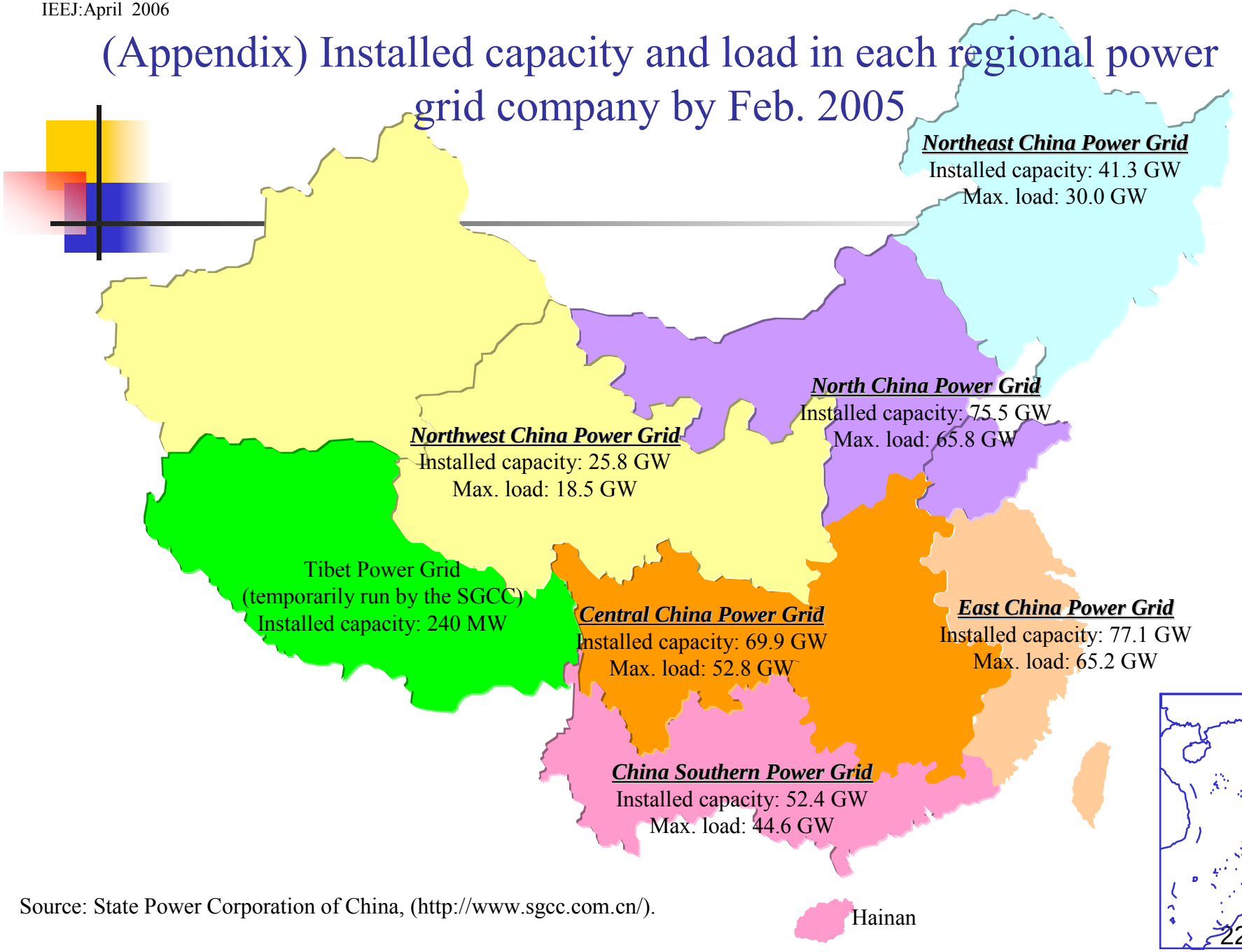
East China Power Grid: Shanghai, Zhejiang, Anhui, Jiangsu, Fujian

Central China Power Grid: Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan

Northwest China Power Grid: Shanxi, Gansu, Qinghai, Ningxia, Xinjiang

China Southern Power Grid: Guangdong, Guangxi, Yunnan, Guizhou, Hainan

(Appendix) Installed capacity and load in each regional power grid company by Feb. 2005

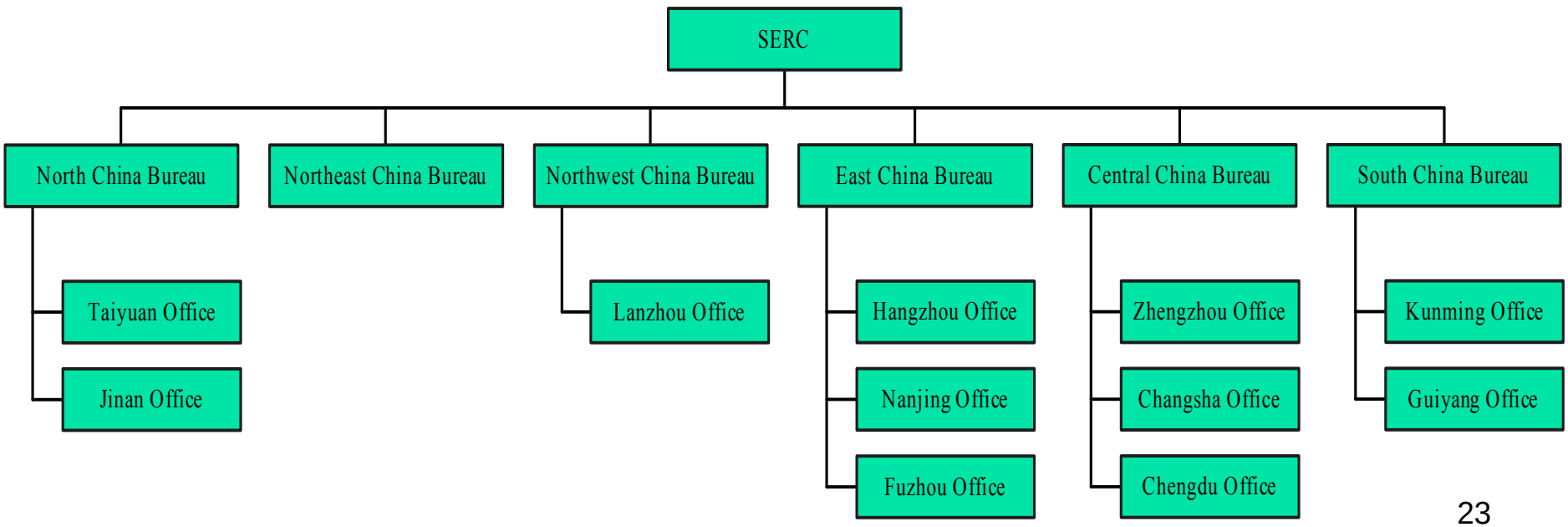


Source: State Power Corporation of China, (http://www.sgcc.com.cn/).

4. Regulation reform trends (4)

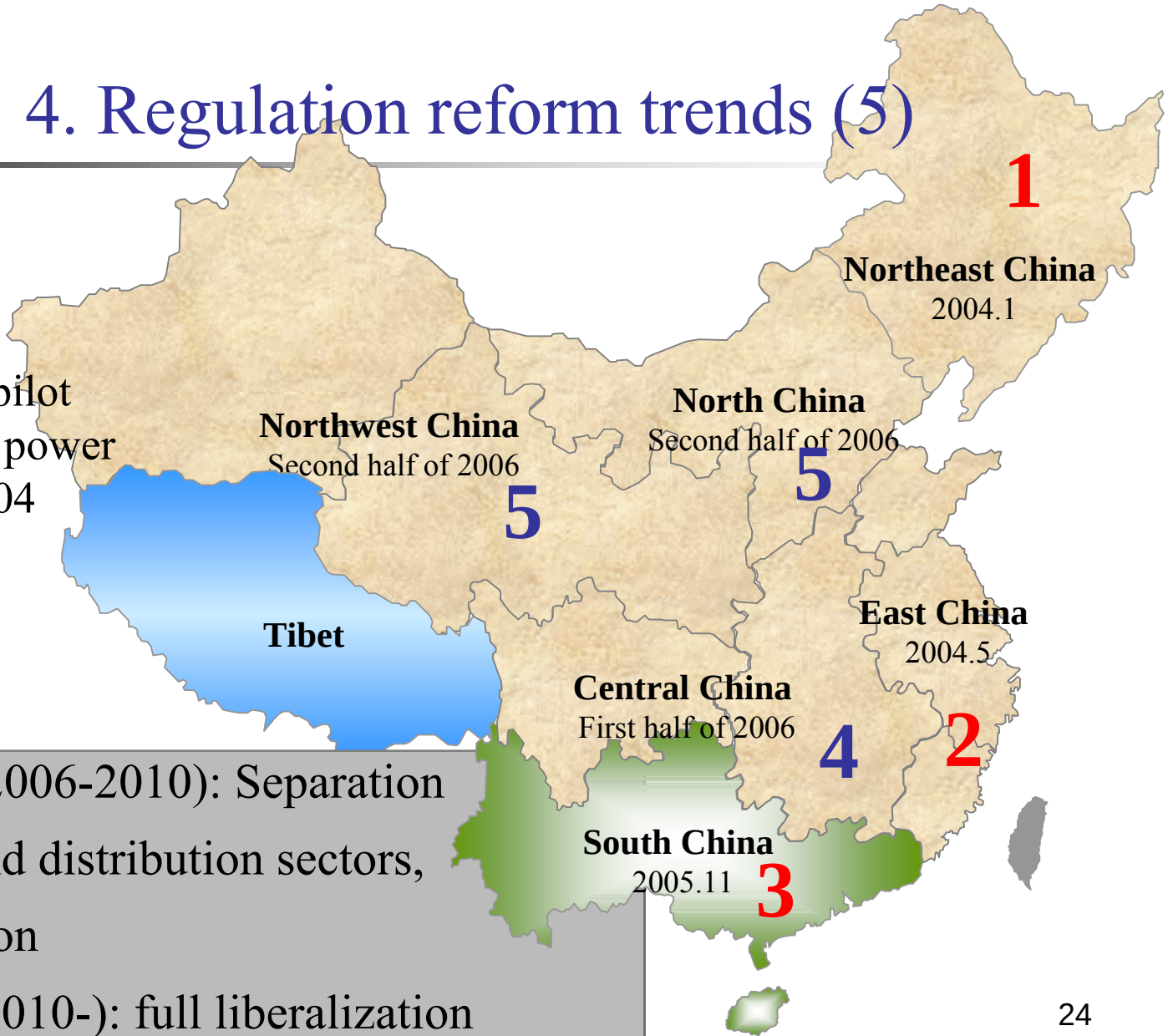
- Establishment of the State Electricity Regulatory Commission (SERC) in March 2003
- Major responsibilities:

  - Develop laws and regulations; - Monitor electricity operations, - Propose tariff and adjustments to governmental pricing authority, - Investigate any possible violations of laws and regulations, - Supervise the implementation of universal service provisions, etc.



4. Regulation reform trends (5)

- Implementation of pilot program of wholesale power market since April 2004



- Short-term goal (2006-2010): Separation of transmission and distribution sectors, partial liberalization
- Long-term goal (2010-): full liberalization

5. Retail electricity rate trends

- ***History of retail electricity rates***:
  - In January 2004, whole sale prices were uniformly raised 0.007 Yuan/kWh, and industrial rates were uniformly raised 0.008 Yuan/kWh
  - In June 2004, industrial power rates were raised an average of 0.022 Yuan/kWh in China's Northern, Eastern, Central and Southern regions
  - In May 2005, national average retail prices were raised 0.0252 Yuan/kWh due to the introduction of the fuel costs adjustment system

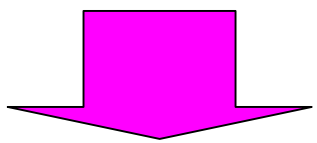
6.1. Issues

Fuel sector:		
Negotiation between coal suppliers and generators for coal price has became onerous since 2004	→	security and stablity of coal supply?
Generation		
In 2004, unauthorized construction/project totaled to 120 GW	→	control of excess investment in generation sector?
At the end of 2004, power generating facilities with desulfurizing apparatuses totaled a mere 6% of facilities	→	promotion of desulfurization system?
Transmission		
Debt percentages for power network companies ranged from 70% – 80%	→	promotion of investments in power networks?
Retail sector:		
Industrial power rates are high in comparison to household rates	→	create a rational electricity rates system?
Regualtion		
Transmission operators hold their own generation capacities	→	equity, fairness and transparency of network operators?

6.2. Points to be checked (1)

- Generation sector:

During the 11th Five-year Plan: 300 MW and above thermal plants will account for 50% of the total; only 600 MW and above new thermal plants will be allowed to be built; the building of supercritical and ultra-supercritical power units will be encouraged; by 2020, nuclear power will be 40 GW

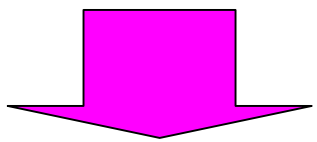


International ordering & bidding for supercritical, ultra-supercritical and large-scale gas-turbine plants, nuclear power plants will be expanded

6.2. Points to be checked (2)

- Generation sector:

During the 11th Five-year plan: 3,000 MW new wind power plants will be installed; more than 70% of the wind power units will be domestically produced

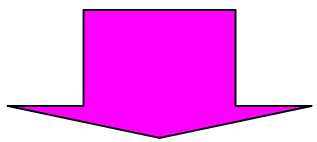


Domestic production of wind power plants will be accelerated

6.2. Points to be checked (3)

- Generation sector:

"Regulated power rate system" and introduction of wholesale power market



The withdrawal of foreign IPPs will accelerate (for example: Siemens, Vattenfall, American Electric Power, Alston, etc.)

6.2. Points to be checked (4)

- Generation sector:

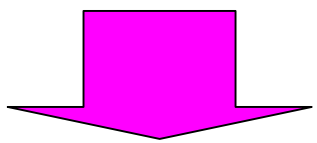
During the 11th Five-year plan: SO2 emission:12 million-13 million tons/year (10% reduction from 2005); soot emission: 3 million tons/year (more than 25% reduction from 2005); coal consumption/kWh: less than 360 g; transmission loss rate: less than 7 %; consolidated usage rate of particulates: 70%, etc.

The latent potential of energy conservation and environmental countermeasures in power generation sector is quite great, consequently in the future, increased international (governmental and private sector) activity can be anticipated in concerned sectors

6.2. Points to be checked (5)

- Transmission sector:

During the 11th Five-year plan: construction of 330 kV and above power grids will reach 75,00 km; transformer capacity will reach 360 million kVA; investment scale will be around1.5 trillion Yuan

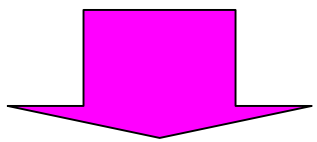


Overseas orders of medium, high and ultra-high voltage transmission (1,000 kV) and transformer facilities will be expanded; technological collaborations (private sector) will be invigorated in regards to network security and stable operations

6.2. Points to be checked (6)

- Retail sector:

Introduction of Renewable Energy Law & revision of electricity rate system

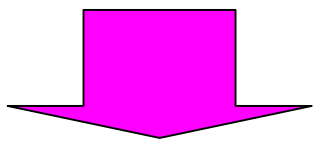


Retail prices tend to continually increased

6.2. Points to be checked (7)

- Market liberalization:

Power supply and demand is projected to be maintained in 2007



Implementation of regional power market will be accelerated and it is anticipated that small generators will exit and major generators will concentrate on the market due to fierce market competition