

Coal Consumption in China and its Impact on Environment

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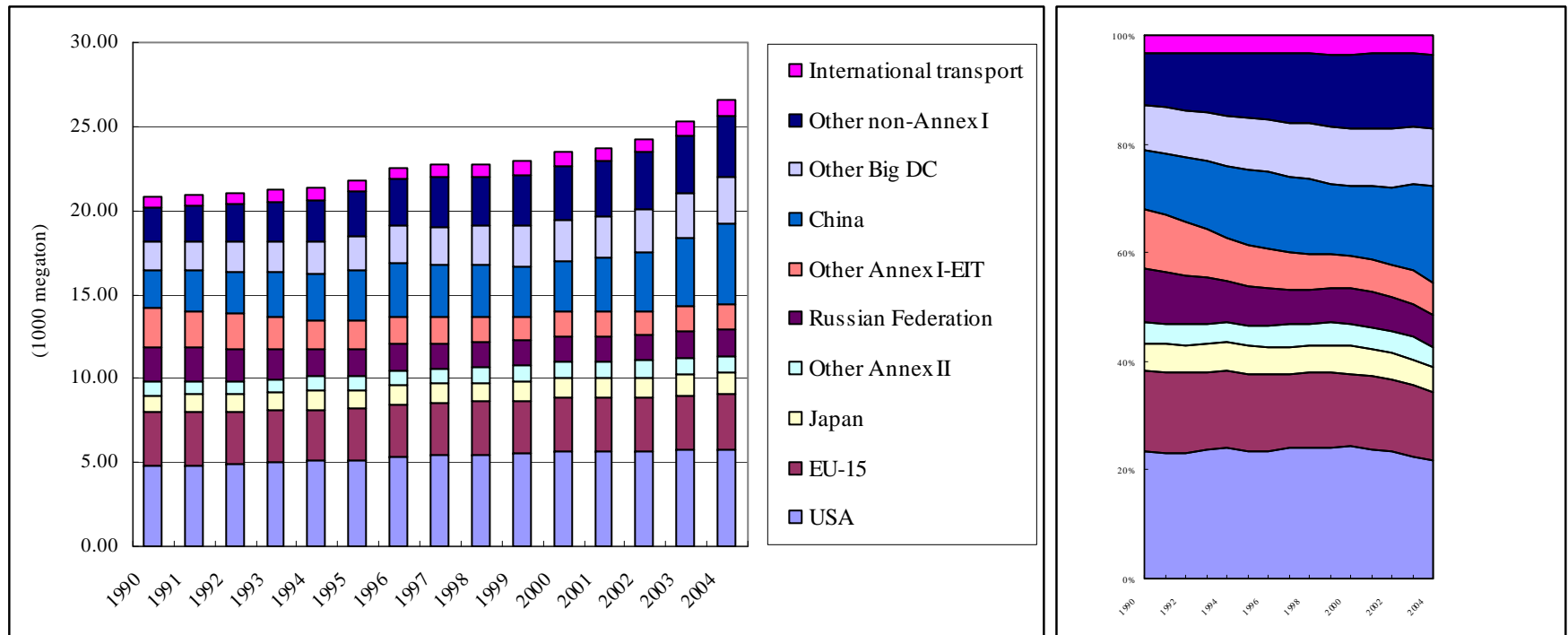
Topics

- China overtook US as the biggest CO₂ emitter (?)
- Rapid energy demand growth and high dependence on coal
- Basic situation of China's environmental (air pollution) problems
- Energy savings and SO₂ mitigation target in the 11th Five Year Plan
- Technology improvement solves environmental problem:
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- Conclusion: Implications for Japan-China cooperation

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China overtook US as the biggest CO₂ emitter (?)

【Regional CO₂ emissions from fossil fuel use, 1990-2004】

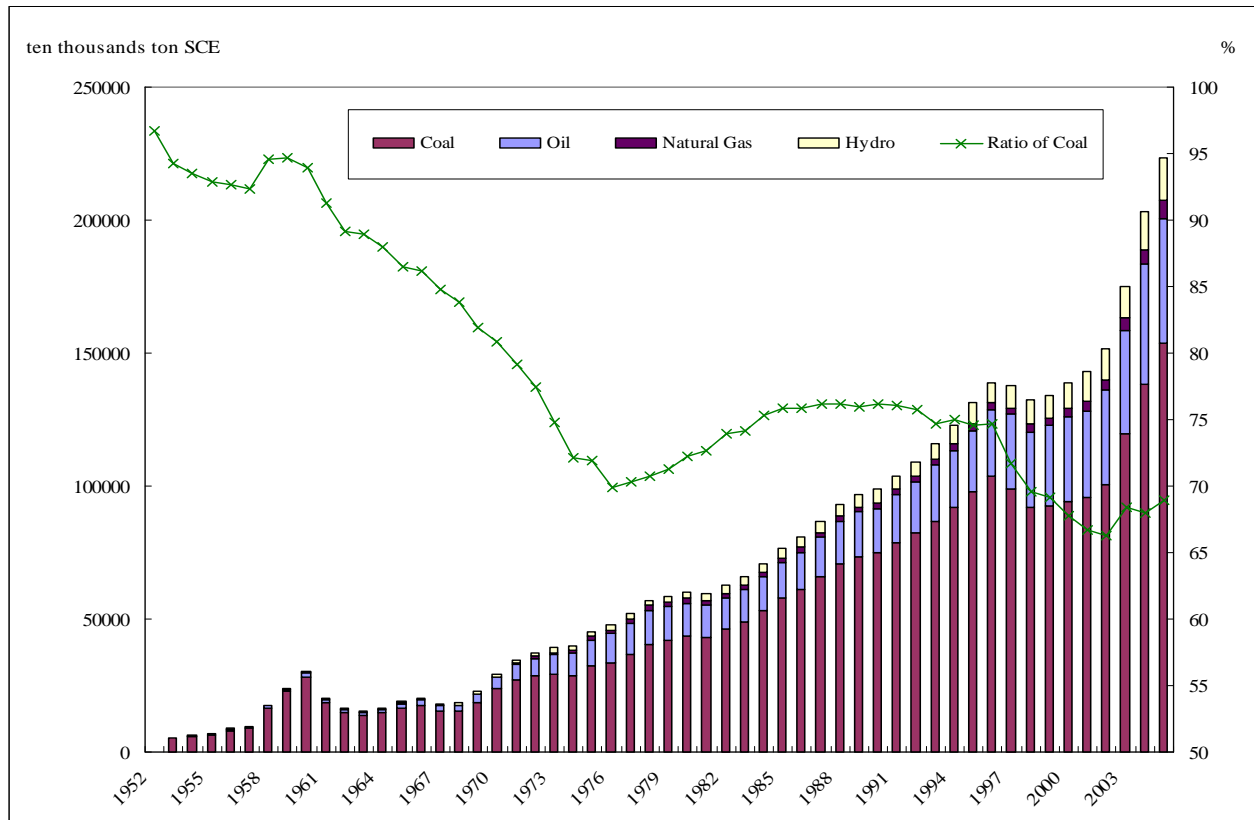


(Source) IEA, *CO₂ Emissions from Fuel Combustion 1971-2004*, IEA

In 2006, global CO₂ emissions from fossil fuel use increased by about 2.6%. This increase was mainly due to a 4.5% in global coal consumption, of which China contributed more than two-third. China's 2006 CO₂ emissions surpassed those of US by 8%. (estimated by Netherlands Environmental Assessment Agency, China denied).

Rapid energy demand growth and high dependence on coal

【China's energy consumption by each energy】

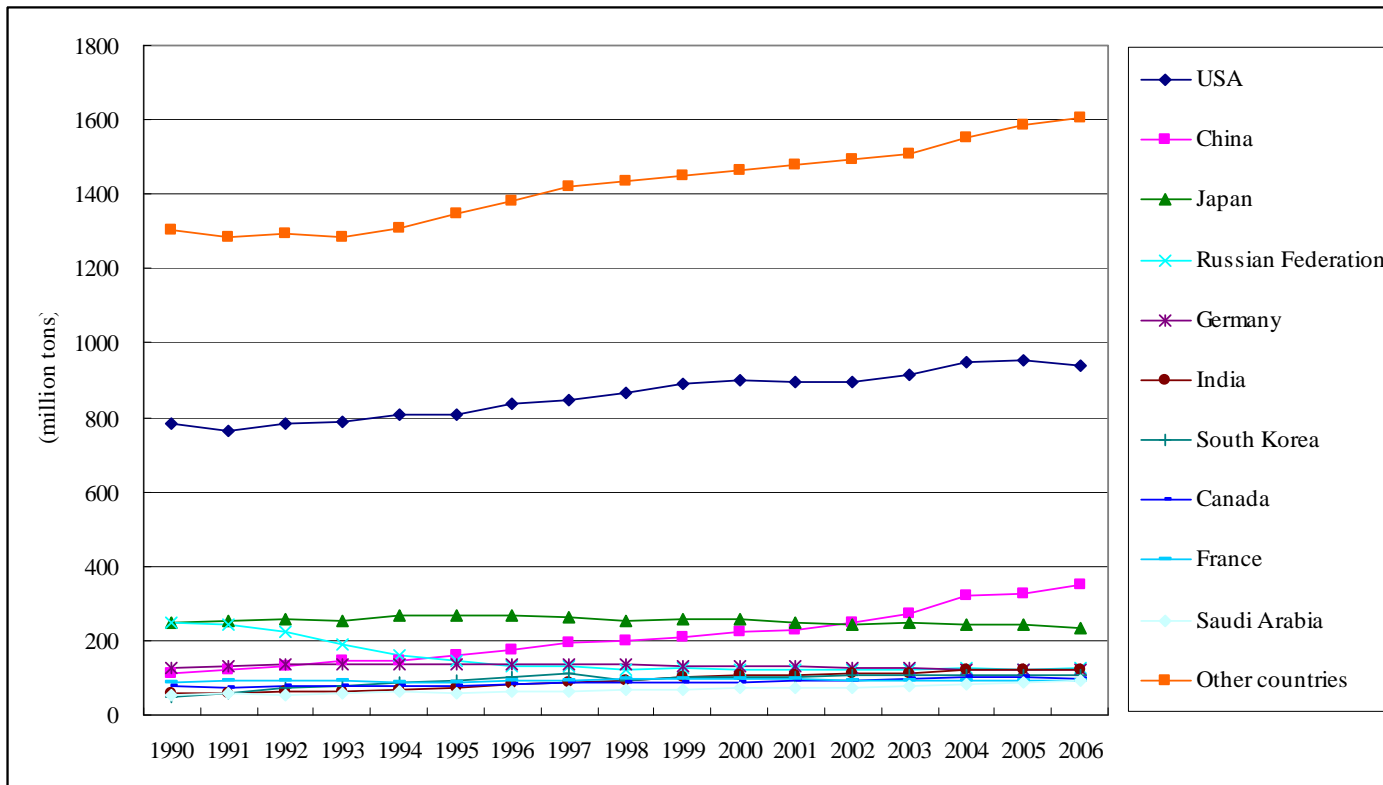


(Source) *China Statistical Yearbook*, each year

Coal supports basement of China's energy consumption, especially in demand's fast growing period.

Rapid energy demand growth and high dependence on coal

【Oil consumption of major countries, 1990-2006】

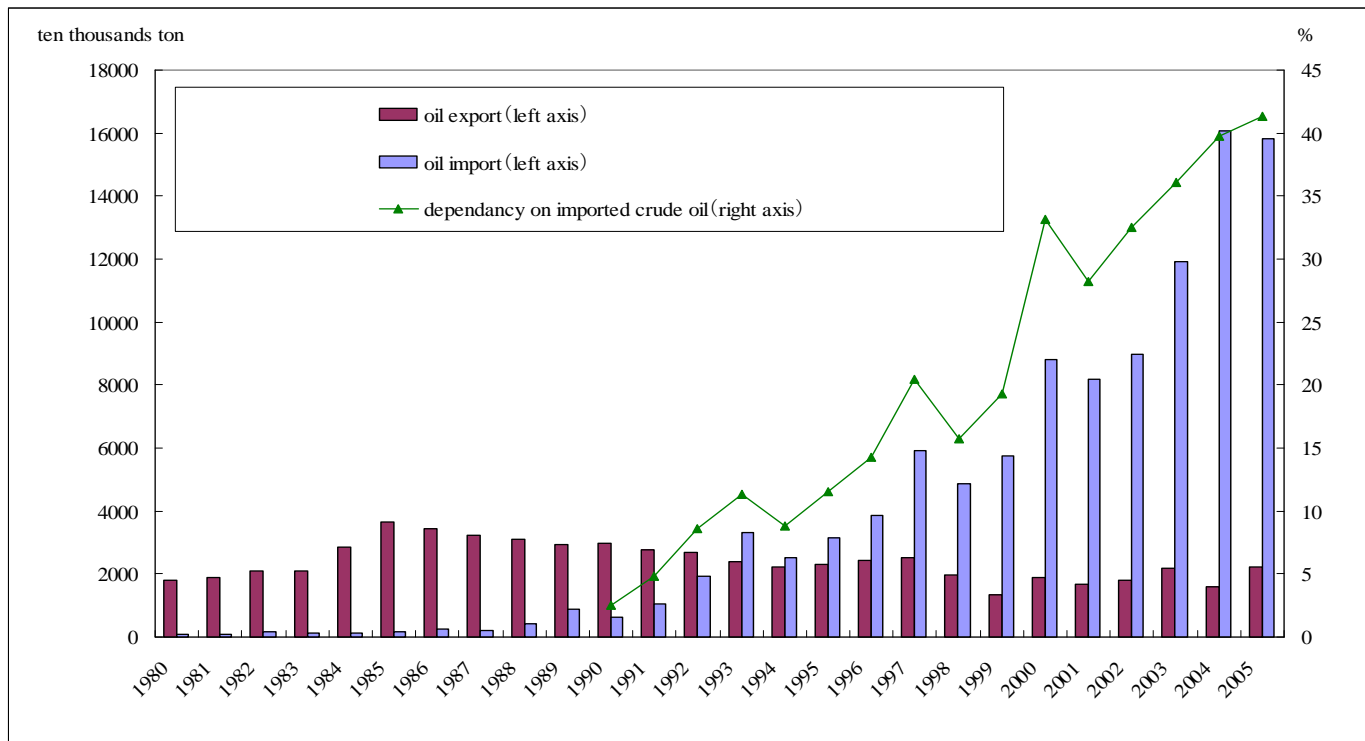


(Source) BP, BP
Statistical Review 2007

China ranks the second in major oil consuming countries, surpassing Japan in 2003. In recent years, consumption is rocketing because of “My car boom”.

Rapid energy demand growth and high dependence on coal

【China's oil export, import, and dependence on imported crude oil】



Due to resource limitation, domestic oil production slows down rapidly, especially in major in-land oil production base. Therefore, the gap between production and consumption increase dramatically, which results in oil import expansion.

Rapid energy demand growth and high dependence on coal

【Price difference among various energy sources】

	Price	Caloric value	Efficiency	Caloric value used in combustion	Price in same caloric value (yuan/GJ)	Ratio of price difference
Raw coal	262 (yuan/ton)	22.13 (MJ/kg)	60%	13.27 (MJ/kg)	19.74	1
Washed coal	340 (yuan/ton)	23.00 (MJ/kg)	60%	13.8 (MJ/kg)	24.64	1.25
CWM	430 (yuan/ton)	18.82 (MJ/kg)	95%	17.89 (MJ/kg)	24.03	1.22
Heavy oil	2300 (yuan/ton)	40.17 (MJ/kg)	98%	39.37 (MJ/kg)	58.42	2.96
Natural gas	1.8 (yuan/m ³)	35.98 (MJ/m ³)	98%	35.26 (MJ/m ³)	49.93	2.53

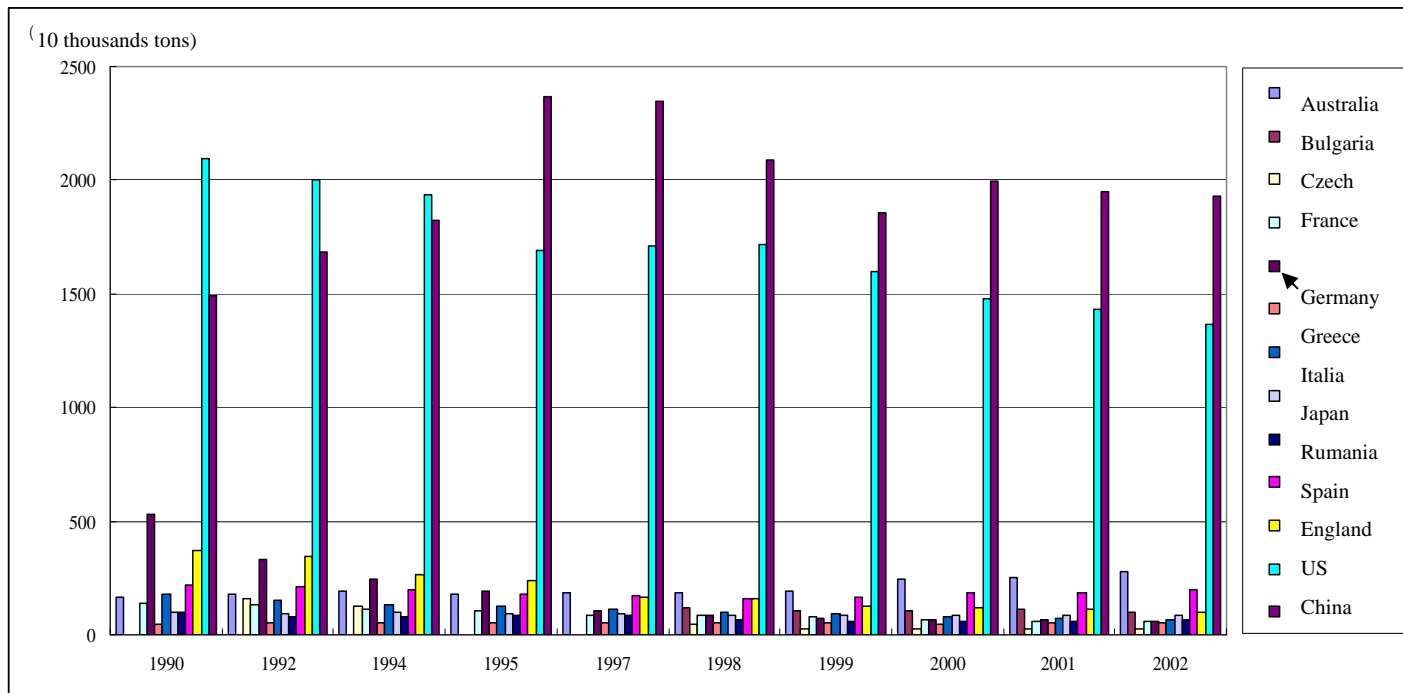
(Note) Data are for Changsha, Hunan province, in 2003.

(Source) prepared by author, based on various sources

Coal also has been playing role in supporting China's economic growth by supplying stable and cheap energy. Through market competition, coal is chosen because of its low price.

Basic situation of China's environmental (air pollution) problems

【SO₂ emissions of major countries, 1990-2002】

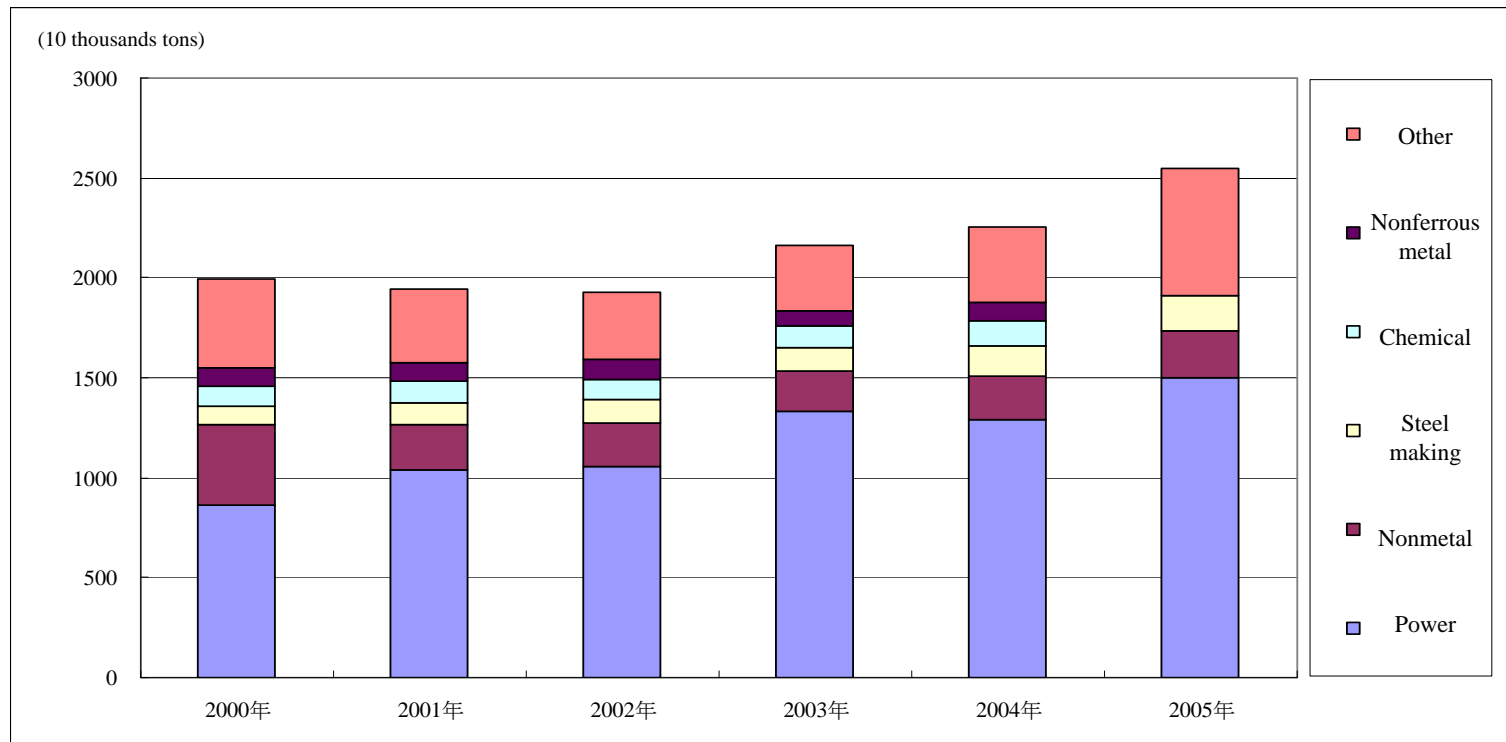


(Source) China SEPA, *China Environmental Statistics Report 2004*, China Environmental Science Publishing Company.

China is also the biggest emitter of SO₂, surpassing US in 1995. The emissions of other countries are vanishingly small, compared with those two countries.

Basic situation of China's environmental (air pollution) problems

【China's SO₂ emissions of each sector, 2000-2005】



(Source) China SEPA, *China Environmental Statistics Report 2006*, China Environmental Science Publishing Company.

Power sector is the biggest emitter of SO₂, accounting for more than half of total emissions.

Basic situation of China's environmental (air pollution) problems

【Number and installed capacity of coal-fired power units by each scale】

	1988			1998			2003		
	number of units	installed capacity (MW)	%	number of units	installed capacity (MW)	%	number of units	installed capacity (MW)	%
above 300MW	32	10,340	14.2	206	69,240	37.1	339	119,940	45.1
100MW-less than 300MW	257	36,090	49.4	476	70,560	37.8	605	90,170	33.9
50MW-less than 100MW	211	10,780	14.8	354	18,120	9.7	397	20,710	7.8
less than 50MW	1,172	15,820	21.7	2,377	28,600	15.3	2,924	34,900	13.1
total	—	73,020	100.0	—	186,510	100.0	—	265,730	100.0

(Note) Data are for Changsha, Hunan province, in 2003.

(Source) prepared by author, based on various sources

In China's power industry, there still exists considerable number of small scaled units. The average scale of a unit of China's coal-fired plants was only 60.9MW in 2006, much smaller than that of Japan's 487.6MW.

Basic situation of China's environmental (air pollution) problems

【Industrial and residential boilers】

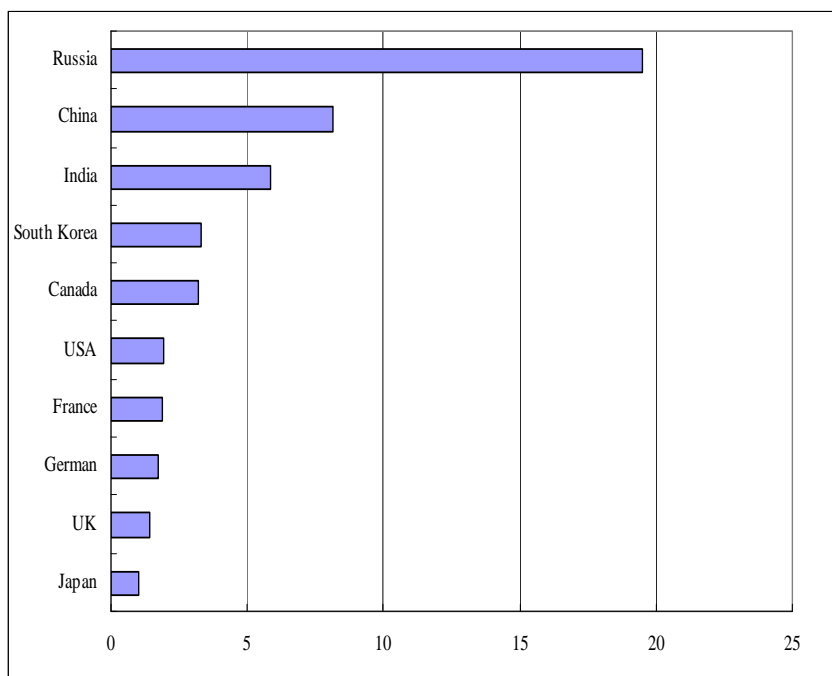
	before 1980's		the end of 1998
number of units	about 200 thousands	→→→→	about 500 thousands
installed capacity	370 thousands t/h	→→→→	1210 thousands t/h
average capacity	1.85 t/h	→→→→	2.42 t/h

(Source) prepared by author, based on various sources

Coal consumption by industrial and residential boilers, supplying steam and heat, accounts around 30% in whole consumption. Most of those boilers are also small scaled, only 700 tons coal consumed by each unit on average. Now Chinese government is promoting the deployment of regional central heating system to substitute dispersed small scaled boilers.

Energy savings and SO₂ mitigation target in the 11th Five Year Plan

【Energy Consumption for 1\$ GDP of Major Energy Consuming Countries】



(Source) UN statistics

【China's Energy Consumption for Production of Major Products】

	unit	China	advanced technology	gap (%)
ethylene	kgce/t	1,210	870	39.1
coal-fired power	gce/kWh	408	324	25.8
crude steel	kgce/t	976	656	48.8
copper	kgce/t	1,352	820	64.9
cement	kgce/t	181	125	45.5
ammonia	kgce/t	1,399	970	44.2
paper making	tcet/t	1.57	0.70	124.3

(Source) *China Energy 50 Years*, China Power Publisher, 2002

The target for energy savings in the 11th FY plan, 20% reduction of energy consumption for unit GDP, is very challenging but guarantees the slow down of energy consumption increase in the next 5-10 years.

Energy savings and SO₂ mitigation target in the 11th Five Year Plan

【SO₂ mitigation target in the 10th Five Year Plan】

- 10% reduction of SO₂ in 2005, compared with emissions in 2000
- SO₂ target: 18 million tons
- particulate: 20 million tons

However, in reality, in 2005,

- SO₂ emission: 25.49 million tons
- particulate emission: 20.94 million tons

【SO₂ mitigation target in the 11th Five Year Plan】

- Again, 10% reduction of SO₂ in 2010, compared with emissions in 2005

Technology improvement solves environmental problem: Case study on deployment of FGD

【Outstanding expansion of deployment of FGD】

at the end of 2000

6.95 million kW (2.9%)

at the end of 2004

16.07 million kW (4.9%)

at the end of 2006

45 million kW (including under construction units)



178 million kW capacities are planned to be installed before 2010 in the 11th Five Year Plan.

This policy is thought to reduce around 30% of SO₂ emissions.

Technology improvement solves environmental problem: Case study on deployment of FGD

【Dramatic growth of FGD makers and sharp price down】

- The number of FGD makers
at the middle of 2003 7-8 companies
↓
at the beginning of 2005 46 companies
→at the end of 2006 more than 100 companies
- Unit investment cost of FGD per kW
at the year 2000 800-1300yuan/kW
↓
at the year 2005 150-250yuan/kW
↓
at the year 2006 less than 200yuan/kW

Conclusion: Implications for Japan-China cooperation

■China cannot help but continue dependence on coal for her major energy source in future. Therefore, sustainable coal utilization system should be built up, in which energy saving and environmental technologies (CCT: Clean Coal Technology) are key component.

■The critical factor in rapid deployment of FGD in recent years was sharp reduction of installment cost, resulting from domestic production and localization.

■Japanese makers are not enough competitive in Chinese FGD market, although their technology is one of the most advanced in the world. The reason is that Japanese makers stick to their own technology and products, which miss the market needs, that is, in other words, 80% performance but low cost.

■On the other hand, Europe and US makers transferred their technology to Chinese companies by only patent royalty, which enabled Chinese companies to develop their own products, suitable to Chinese market needs.

Conclusion: Implications for Japan-China cooperation

- China's energy utilization system is very different from Japan's. Consequently, it is very important for Japan's technology to be modified to fit China's needs. Technology modification might be important rather than innovation in introducing to developing countries---Implication (1)
- Japanese advanced environmental technology might not be necessarily competitive in developing countries.--- Implication (2)
- In not only FGD technology but also other environmental technologies for global warming, such as energy saving technology, carbon capture and storage (CCS) technology, Chinese companies might be able to make breakthrough in reducing installment cost.---Implication (3)
- The world has benefited from Chinese manufacturing industry in supply of low price and high quality products. We also should make use of "made in China" to overcome the barriers in dissemination of environmental technologies into market .---Implication (4)