China's Actions for Climate Change and Low Carbon Energy Developments

—PECC at 30: New Vision for APEC and Toward Further Regional Economic Cooperation

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Main points in my presentation:

[1]. China's socio-economic and energy profiles

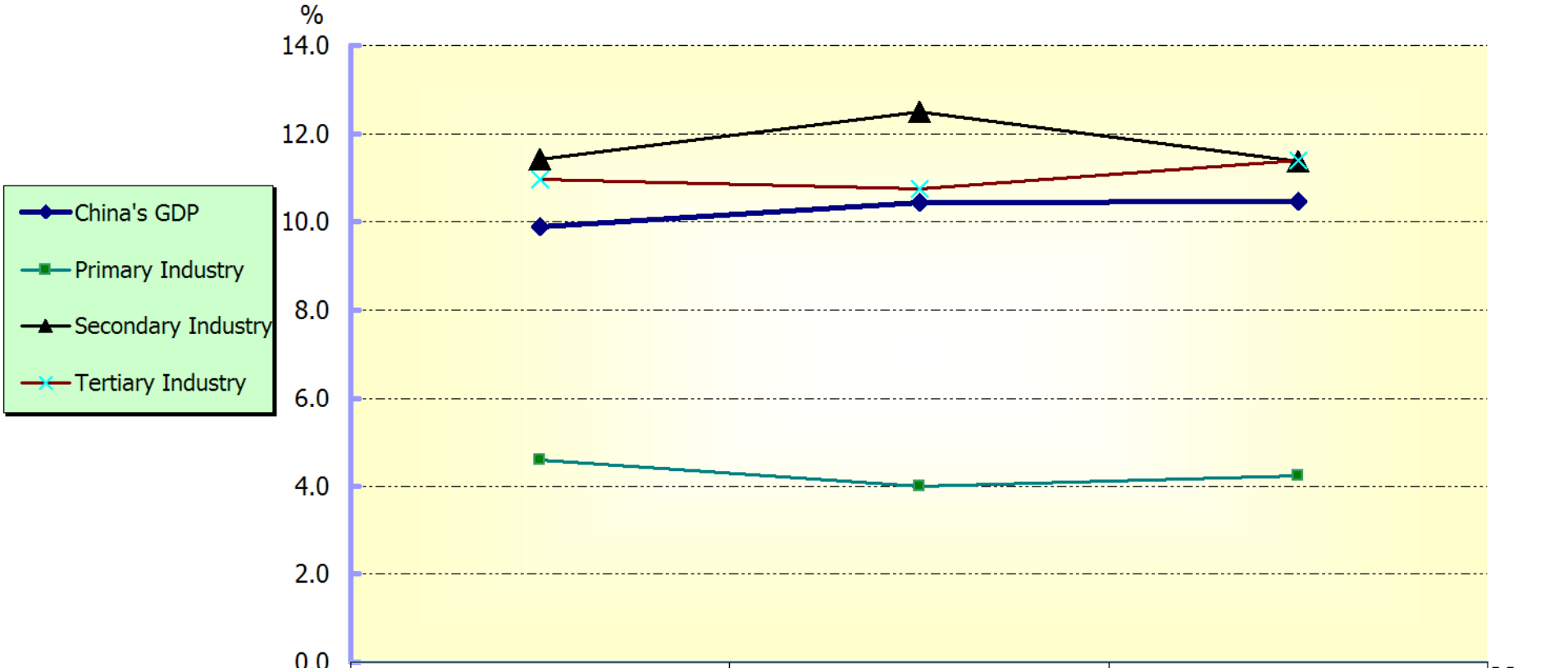
[2]. China's actions to respond to climate change and to take a low-carbon pathway forward

[3]. Regional/Global cooperation to meet common challenges ahead

[1]. China's socio-economic and energy profiles

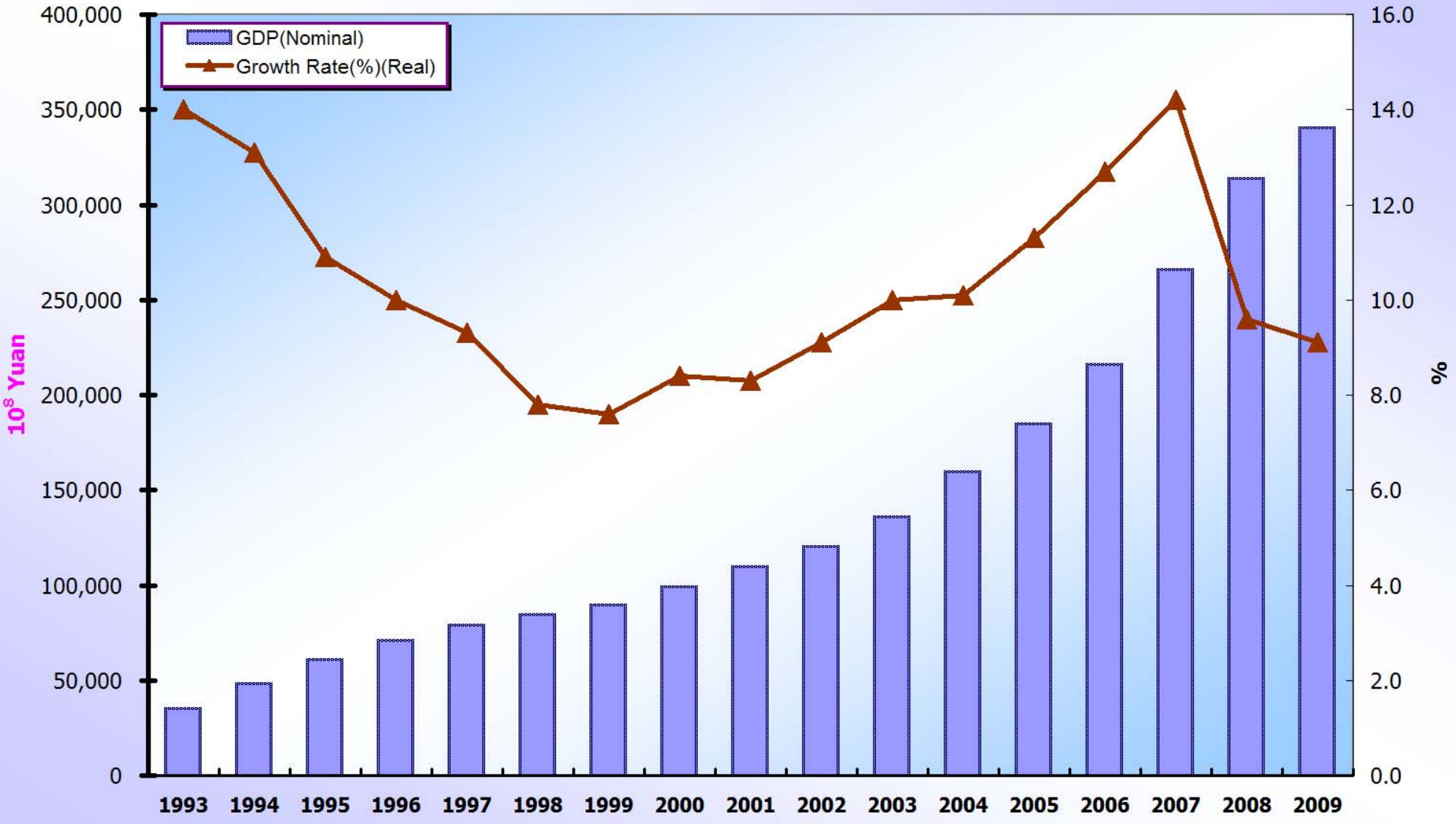
As part of the on-going three-step blueprints (almost over the span of 70 years) for socio-economic developments to enable the people to live a relatively comfortable life and to build the country into a well-off society, President Hu Jintao, in his report to the 17th National Congress of the CPC (Oct. 15, 2007), newly announced that China would work to quadruple its per capita GDP by the year 2020 against the level 2000, with less consumption of all resources and more stresses on the environmental protection.

Average Growth Rates for China's Economy and Structures



	1979-2009	1991-2009	2001-2009
China's GDP	9.9	10.5	10.5
Primary Industry	4.6	4.0	4.2
Secondary Industry	11.4	12.5	11.4
Tertiary Industry	11.0	10.7	11.4

China's GDP and Growth Rate over Past Two Decades(Officially Updated Data)



Year: 2009 (Nominal)

Country List for GDP Ranking by IMF

Rank	Country	GDP (millions of USD)
—	*World*	**57,843,376**
—	*European Union*	16,414,697
1	United States	14,119,050
2	Japan	5,068,894
3	People's Republic of China	4,984,731
4	Germany	3,338,675
5	France	2,656,378
6	United Kingdom	2,178,856
7	Italy	2,118,264
8	Brazil	1,574,039
9	Spain	1,467,889
10	Canada	1,336,066
11	India	1,236,943
12	Russia	1,231,892
13	Australia	994,246
14	Mexico	874,810
15	South Korea	832,512
16	Netherlands	796,651
17	Turkey	614,466
18	Indonesia	539,377
19	Switzerland	491,923
20	Belgium	472,103
21	Poland	430,736
22	Sweden	406,072

Country List for GDP Ranking by World Bank

Rank	Country	GDP (millions of USD)
—	*World*	**58,133,309**
1	United States	14,256,300
—	*Eurozone*	12,455,979
2	Japan	5,067,526
3	People's Republic of China	4,984,731
4	Germany	3,346,702
5	France	2,649,390
6	United Kingdom	2,174,530
7	Italy	2,112,780
8	Brazil	1,571,979
9	Spain	1,460,250
10	Canada	1,336,067
11	India	1,296,085
12	Russia	1,230,726
13	Australia	924,843
14	Mexico	874,902
15	South Korea	832,512
16	Netherlands	792,128
17	Turkey	617,099
18	Indonesia	540,277
19	Switzerland	500,260
20	Belgium	468,522
21	Poland	430,079
22	Sweden	406,072

Through the process of three-decade-long reforms and opening to the outside world, China has achieved significant social and economic developments, by the end of 2009, China has ranked the 3rd place in the world in terms of total GDP values based on the market exchange rate.

However, China's per capita GDP level is still rather lower, even if compared with many other developing countries, due primarily to its so large a population size.

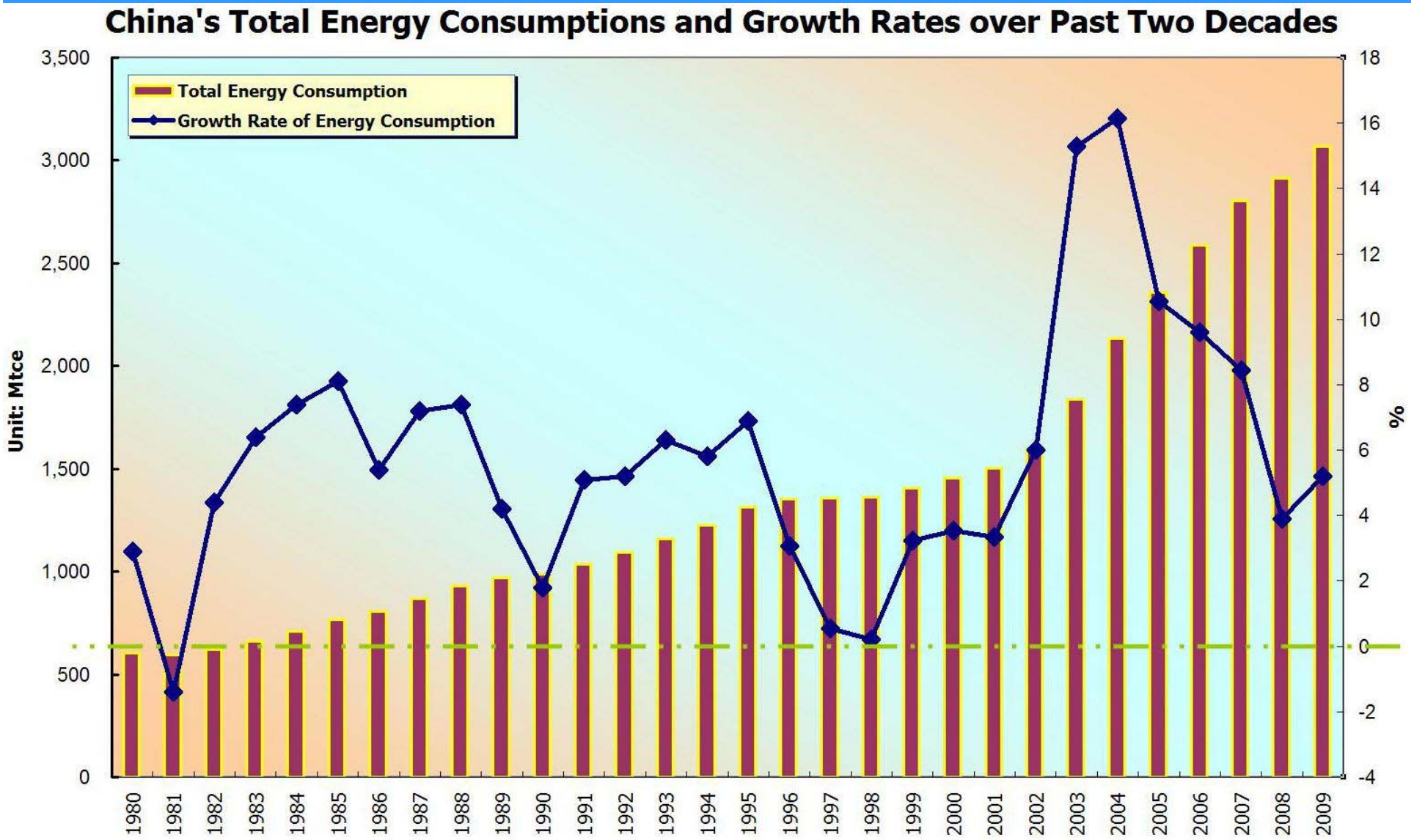
Year: 2009 per capita GDP (nominal)

Country List by IMF

Rank	Country	US$
1	Luxembourg	105,918
2	Norway	78,178
3	Switzerland	63,536
4	Qatar	59,990
5	Denmark	56,263
6	Ireland	49,863
7	Netherlands	48,209
8	United States	45,934
9	Austria	45,686
10	United Arab Emirates	45,615
11	Australia	45,285
12	Finland	44,581
13	Belgium	43,794
14	Sweden	43,668
15	France	42,413
16	Germany	40,832
17	Japan	39,740
96	Thailand	3,941
97	Ecuador	3,935
98	Albania	3,837
↓ 99	China, People's Republic of	3,735
100	El Salvador	3,623
101	Turkmenistan	3,451

Country List by WB

Rank	Country	US$
1	Luxembourg	105,350
2	Norway	79,089
3	Denmark	55,992
4	Ireland	51,049
5	Netherlands	47,917
6	United States	46,436
7	Austria	46,019
—	*Faroe Islands*	45,188
8	Finland	44,491
9	Sweden	43,654
10	Belgium	43,430
11	Australia	42,279
12	France	41,051
13	Germany	40,873
14	Japan	39,727
15	Canada	39,599
16	Iceland	38,029
83	Jordan	3,829
84	Tunisia	3,792
85	Albania	3,750
↓ 86	China, People's Republic of	3,744
87	Angola	3,734
88	El Salvador	3,598


China's Total Energy Consumptions and Growth Rates over Past Two Decades
Total Energy Consumption
Growth Rate of Energy Consumption
Unit: Mtce
%
3,500
3,000
2,500
2,000
1,500
1,000
500
0
18
16
14
12
10
8
6
4
2
0
-2
-4
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
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2001
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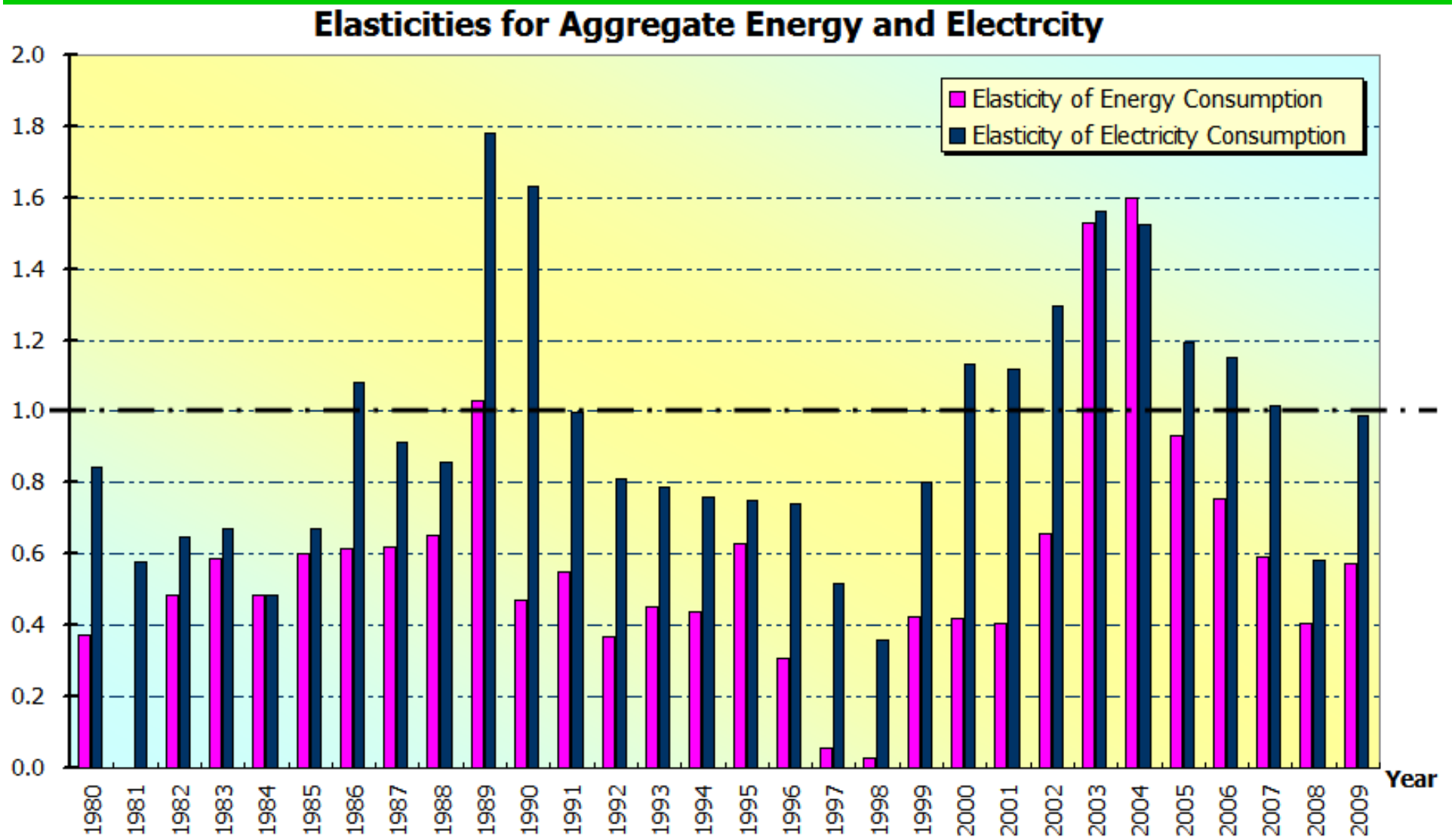
2003
2004
2005
2006
2007
2008
2009


Elasticities for Aggregate Energy and Electrcity
Elasticity of Energy Consumption
Elasticity of Electricity Consumption
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1980
1981
1982
1983
1984
1985
1986
1987
1988
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2006
2007
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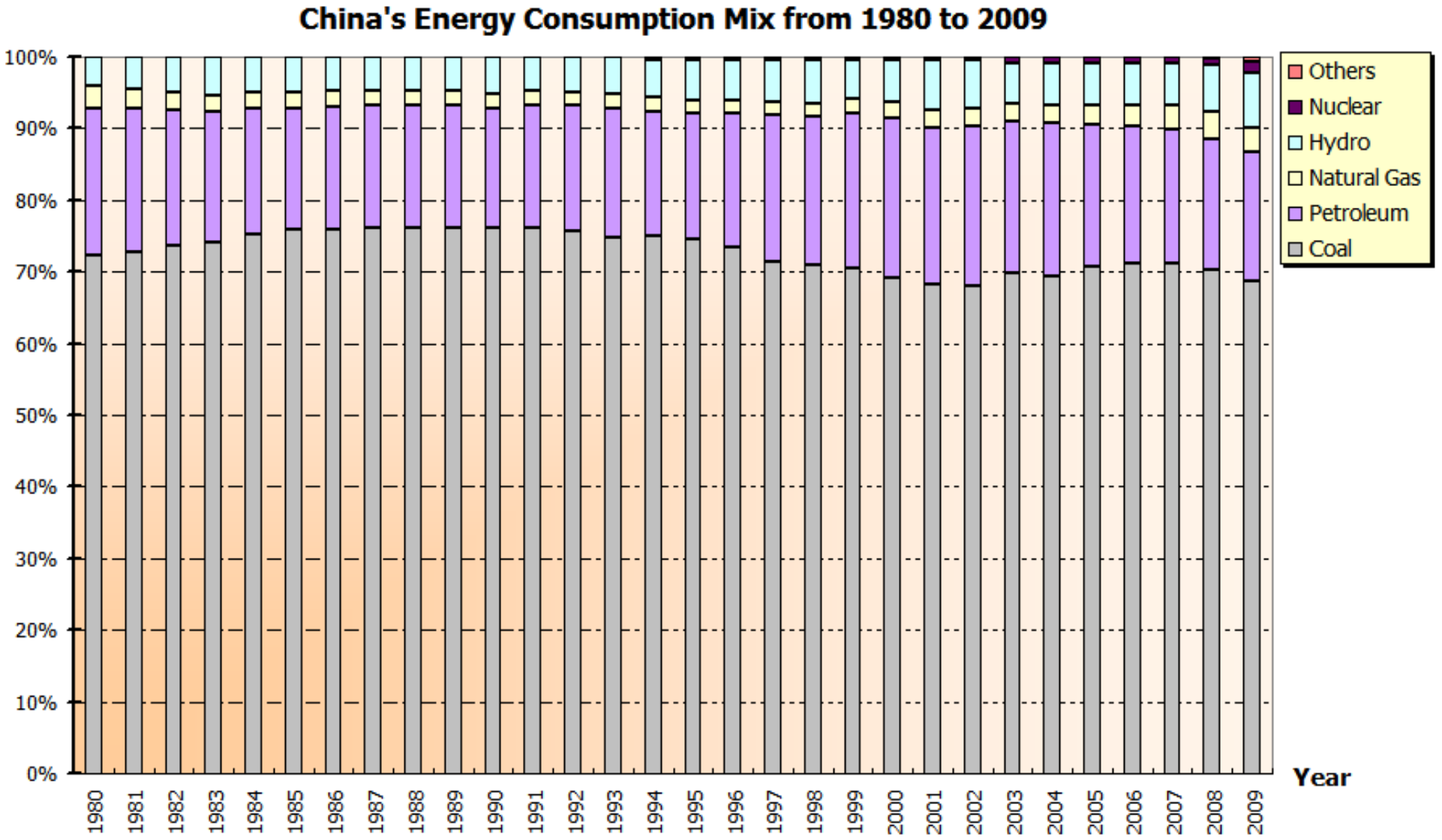
2009
Year


China's Energy Consumption Mix from 1980 to 2009
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Others
Nuclear
Hydro
Natural Gas
Petroleum
Coal
Year
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
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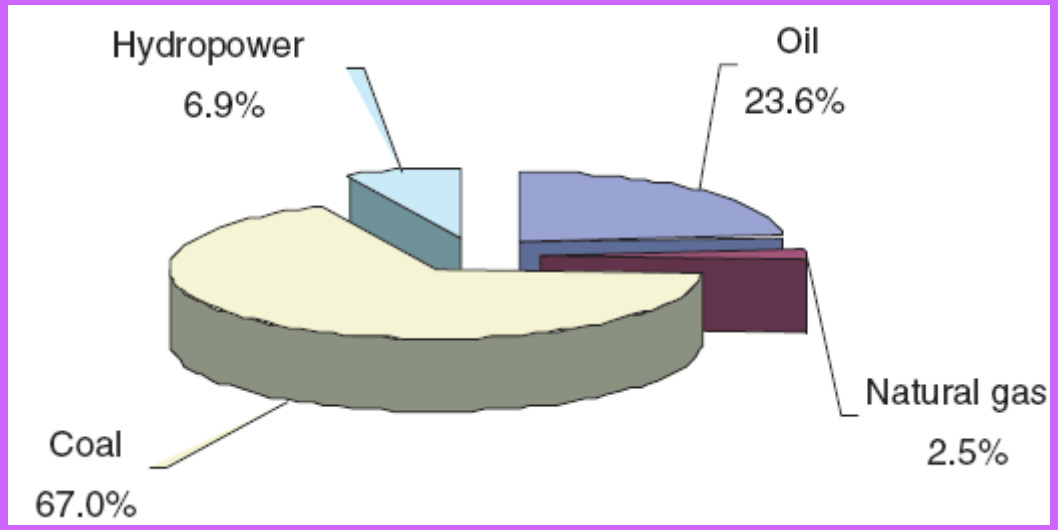
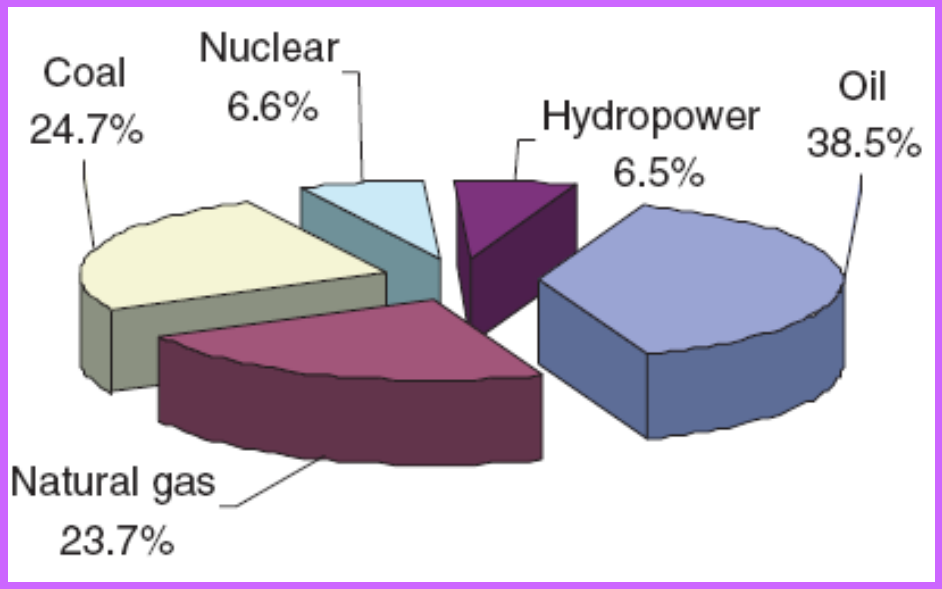
2006
2007
2008
2009

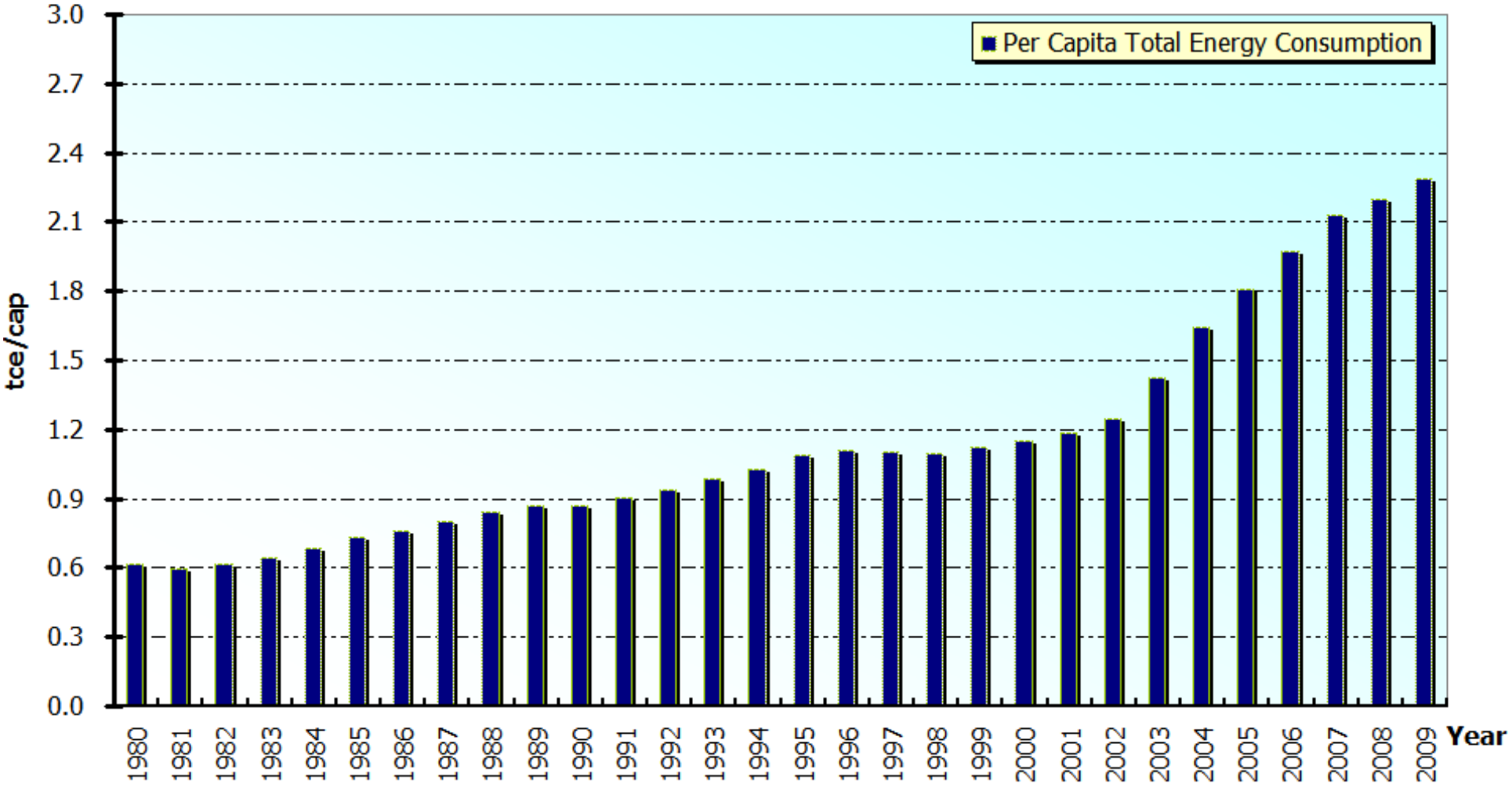


Consumption mix of China's primary energy

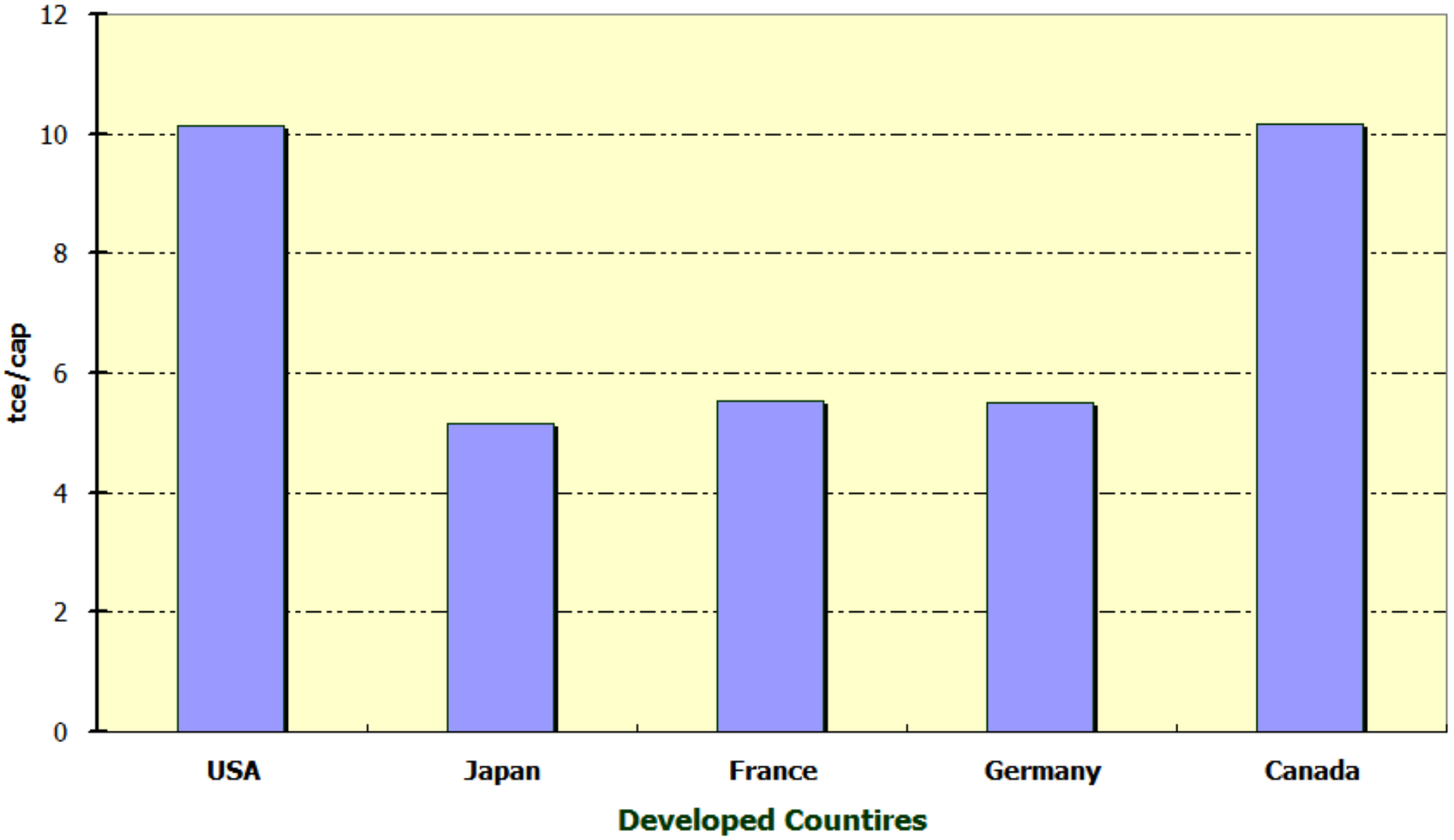


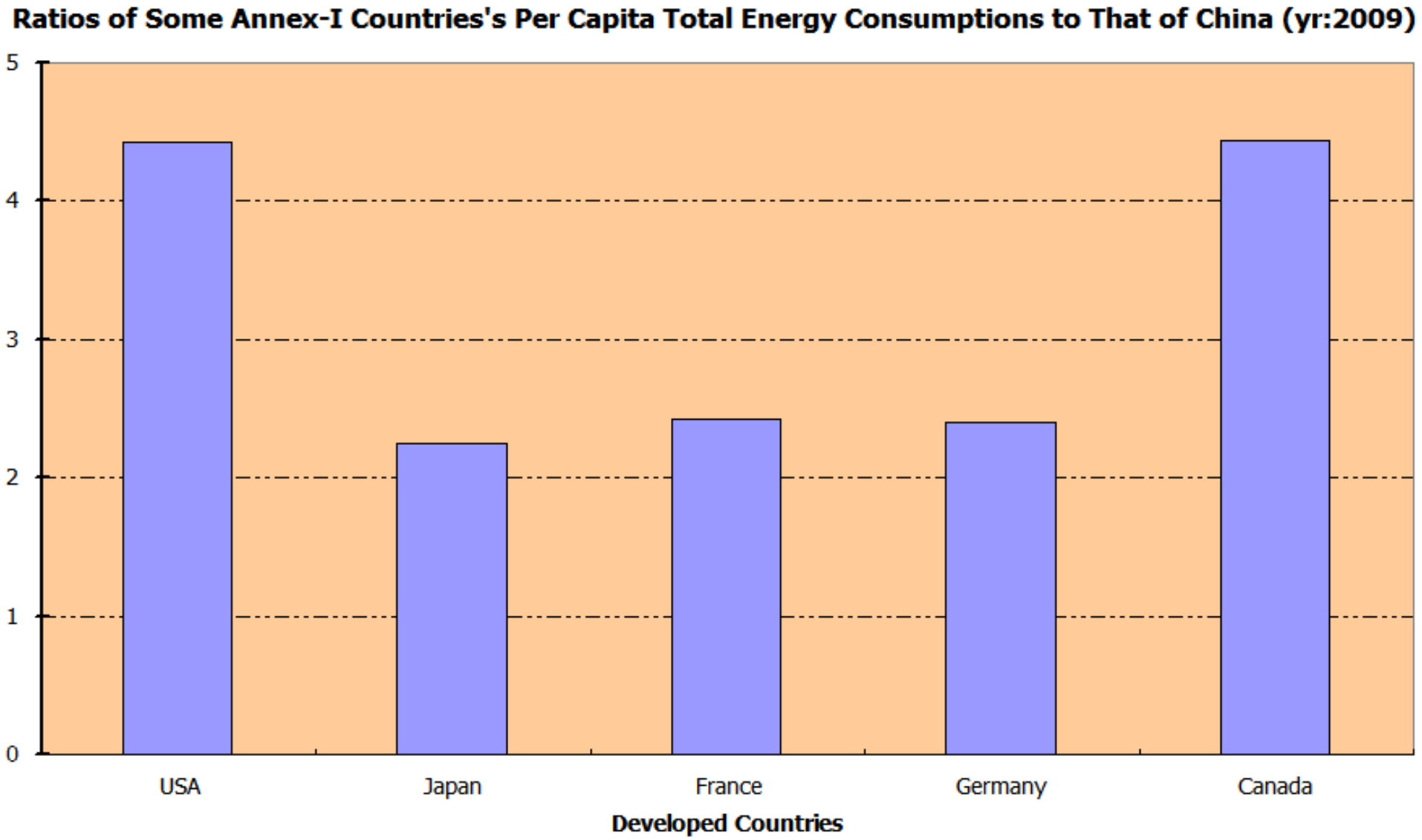
Consumption mix of the world's primary energy

China's Per Capita Total Energy Consumptions (1980~2009)

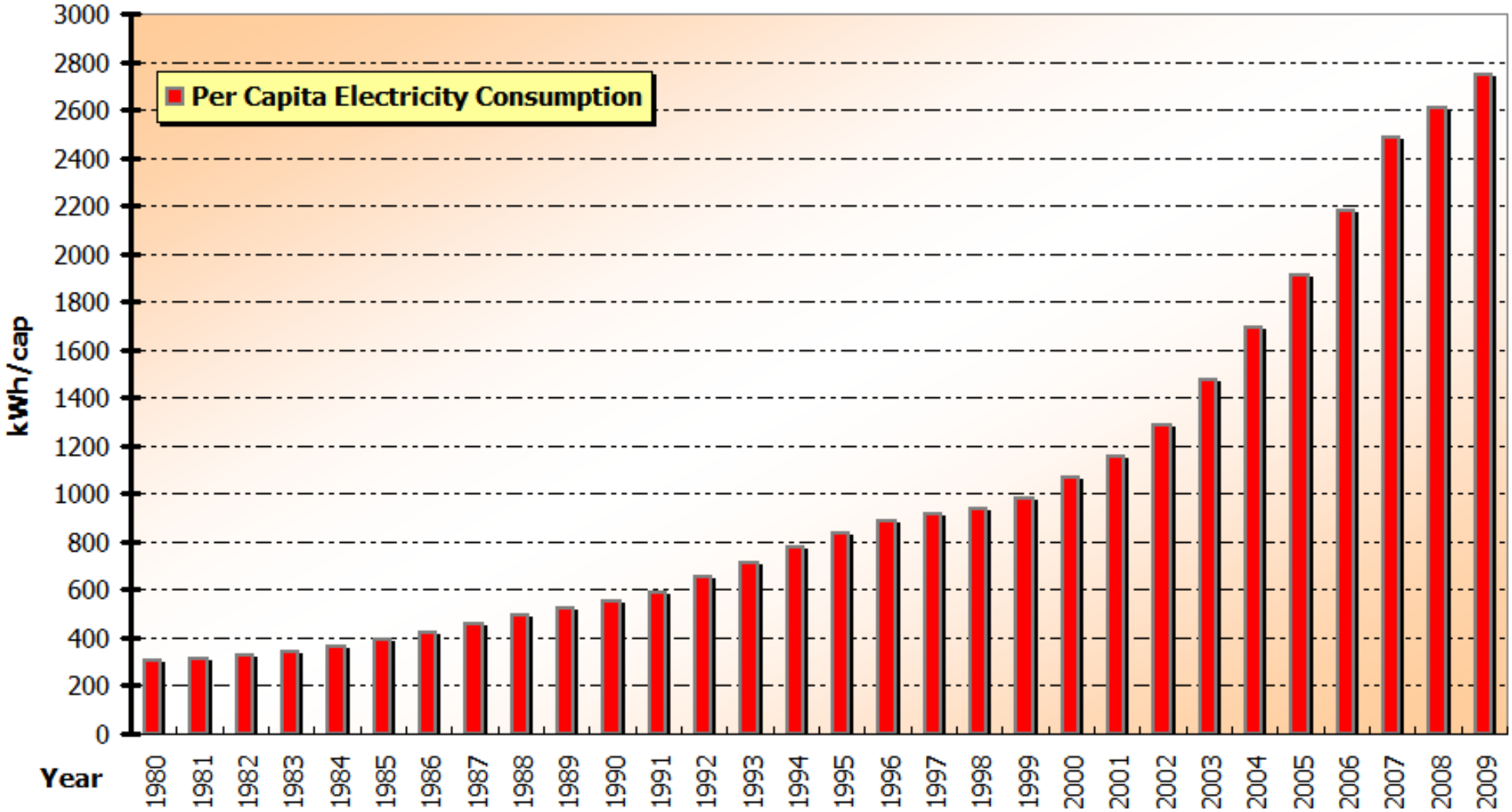


Per Capita Total Energy Consumptions of Some Annex-I Countries (Yr:2009)

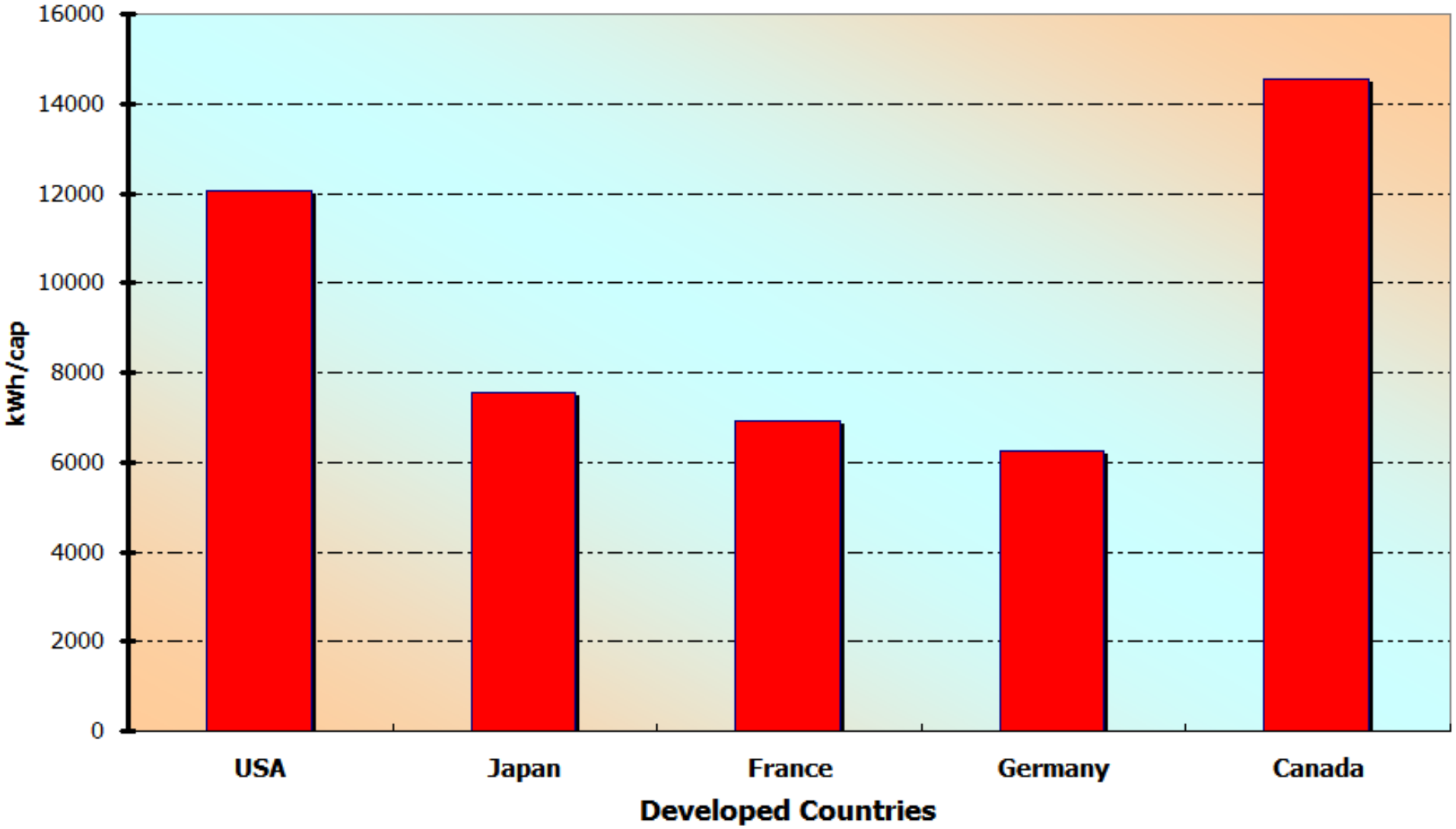


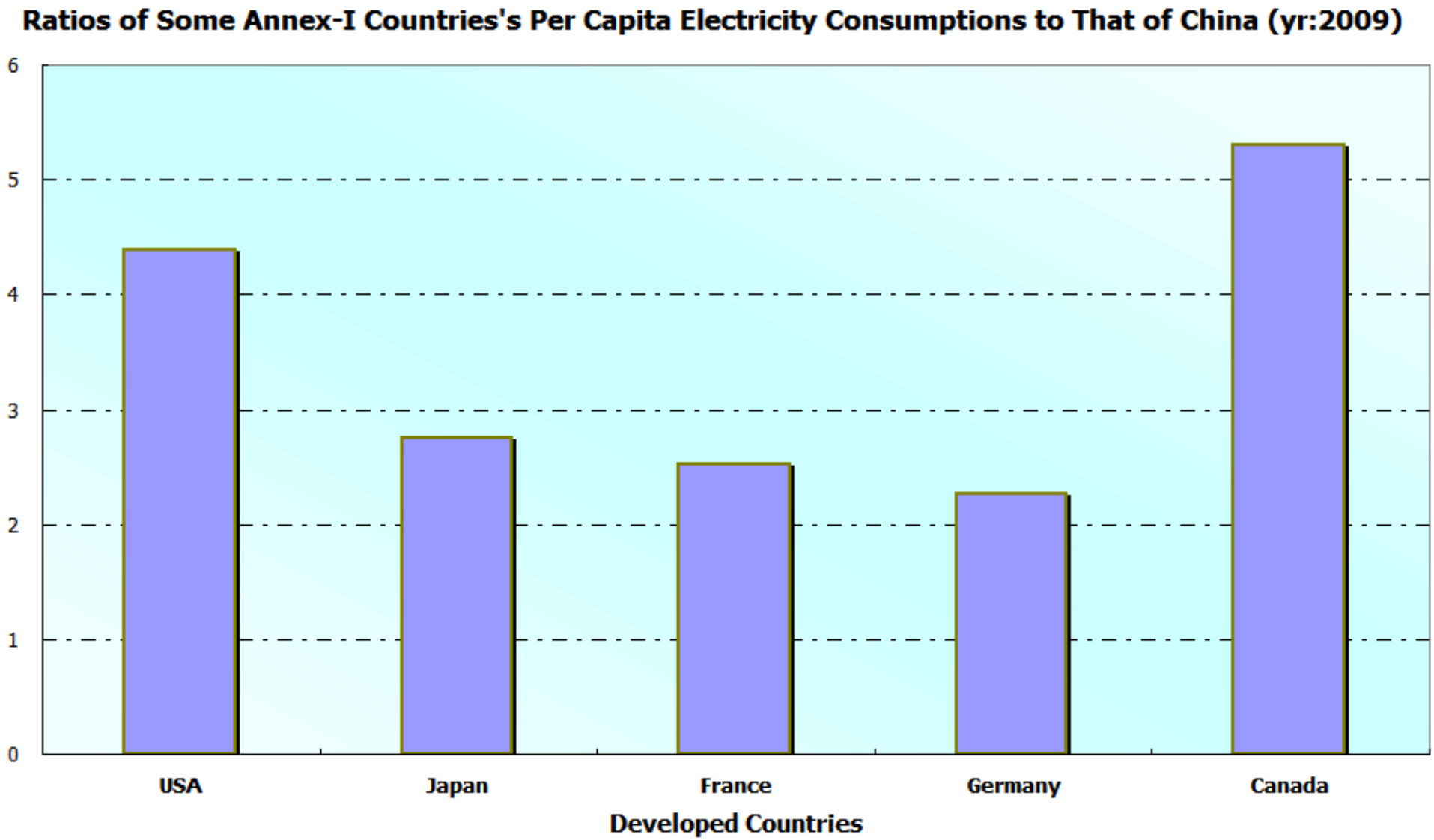

Ratios of Some Annex-I Countries's Per Capita Total Energy Consumptions to That of China (yr:2009)
5
4
3
2
1
0
USA
Japan
France
Germany
Canada
Developed Countries

China's Per Capita Electricity Consumption (1980~2009)



Per Capita Electricity Consumption of Some Annex-I Countries (Yr:2009)




Ratios of Some Annex-I Countries's Per Capita Electricity Consumptions to That of China (yr:2009)
6
5
4
3
2
1
0
USA
Japan
France
Germany
Canada
Developed Countries

China’s electric power has experienced a fast-paced period, along with the rapid social and economic growth ever since 1980s. Some important milestones are chronicled as follows

Some important milestones for China's electric power development

♦ December,1987, China's installed capacity hit 100GW, an important milestone for the development of China's power industry

♦ March,1995, China's installed capacity reached 200GW

♦ April, 2000, China's installed capacity reached 300GW

♦ May, 2004, China's installed capacity reached 400GW

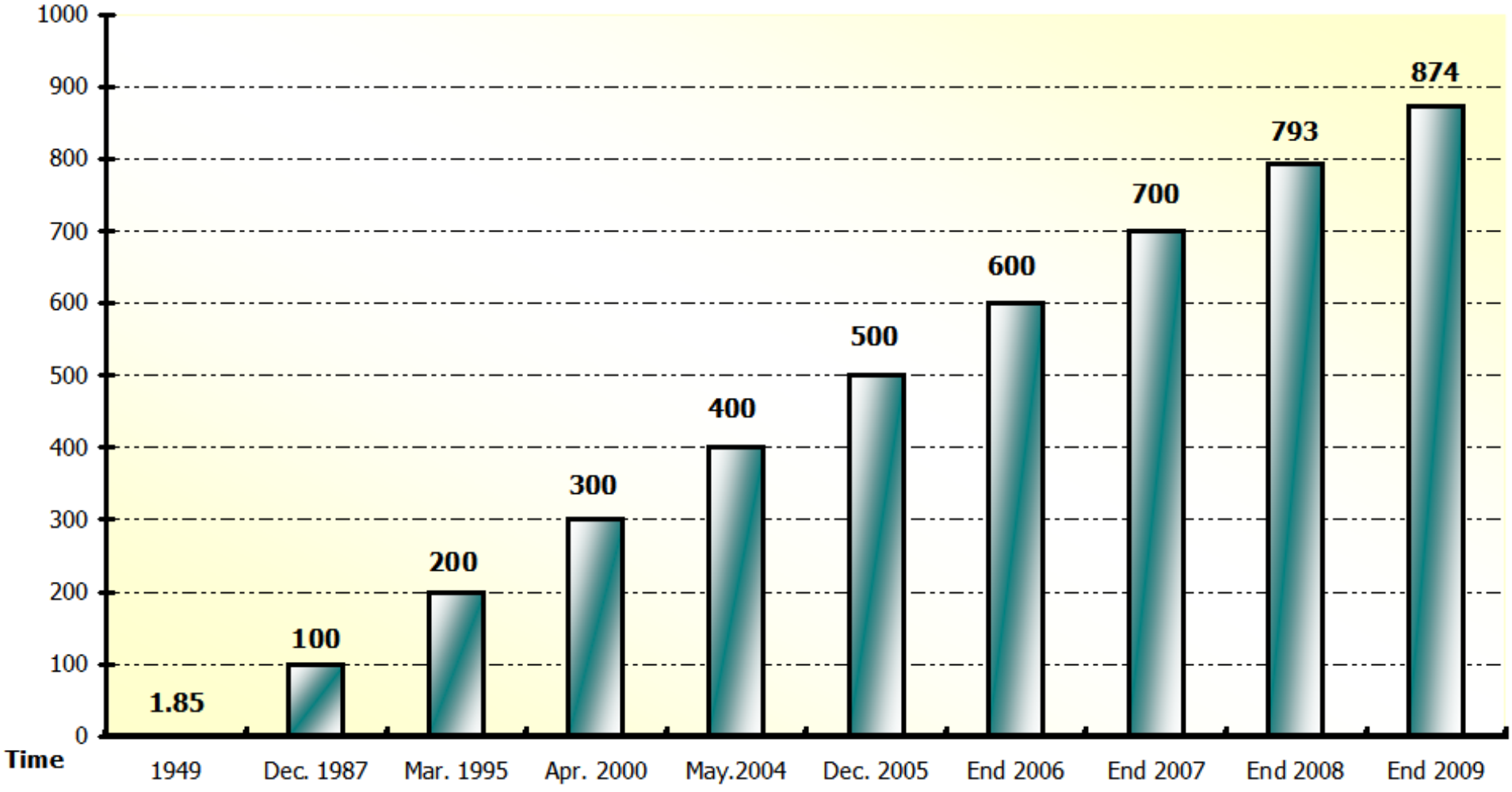
♦ December, 2005, China's installed capacity reached 500GW

♦Year end of 2006, China's total installed capacity has reached 622GW

♦Year end of 2007, China's total installed capacity has reached 700GW

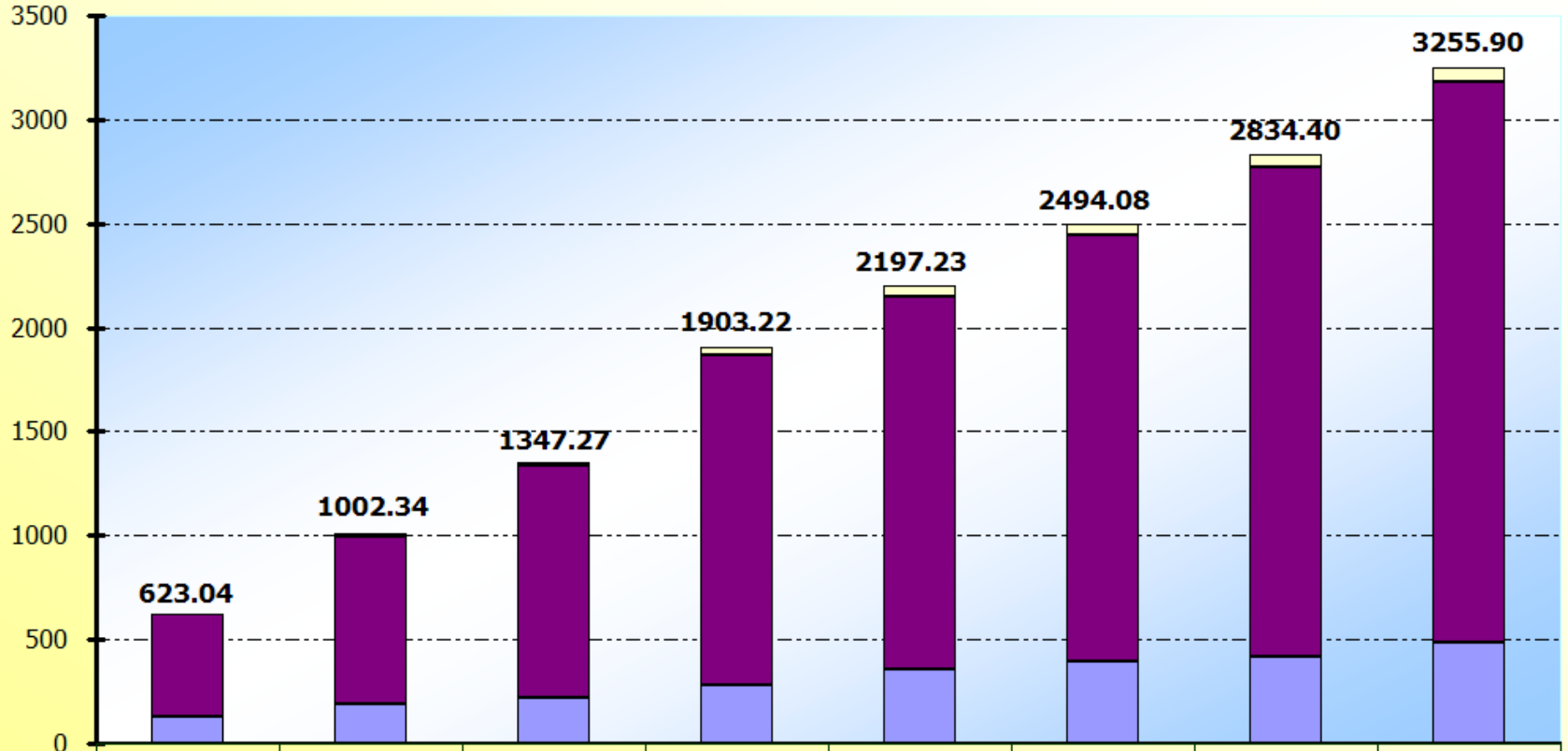
♦ Year end of 2009, China's total installed capacity has reached 874GW

Important Milestones of China's Electric Power Capacity Developments



China's Electricity Production

Unit: TWh



	1990	1995	2000	2003	2004	2005	2006	2007
Nuclear		12.83	16.74	43.34	50.47	53.09	54.30	62.60
Thermal	494.48	804.32	1114.19	1580.36	1795.59	2047.34	2357.30	2698.00
Hydro	126.72	190.58	222.41	283.68	353.54	397.02	416.70	486.70

China's Power Capacity Installation-2006

Unit: GW

	Capacity	Share	Year-on-year increase
China's Total Power Capacity	622		20.3%
—Thermal	484	77.82%	23.7%
—Hydro	129	20.67%	9.5%
—Nuclear	6.85	1.10%	-
—Wind	2.60	0.30%	76.7%
—Others	0.28		

- **This year saw a record-high annual increase: 122GW !**
- **Annual increase of hydro power >10GW, less than the planned level.**
- **Annual increase of Thermal power > 90GW, well over the planned level.**
- **Coal intensity for electricity generation was 366g/kWh, reduced by 4g/kWh compared with the previous level.**

China's Power Capacity Installation-2007

Unit: GW

	Capacity	Share	Year-on-year increase
China's Total Power Capacity	713		14.36%
—Thermal	554	77.72%	14.59%
—Hydro	145	20.33%	11.49%
—Nuclear	8.85	1.24%	29%
—Wind	5.5~5.9	0.74%	115%
—Others			

This year saw a fast annual increase: 100GW !

China's Electricity Generation-2007

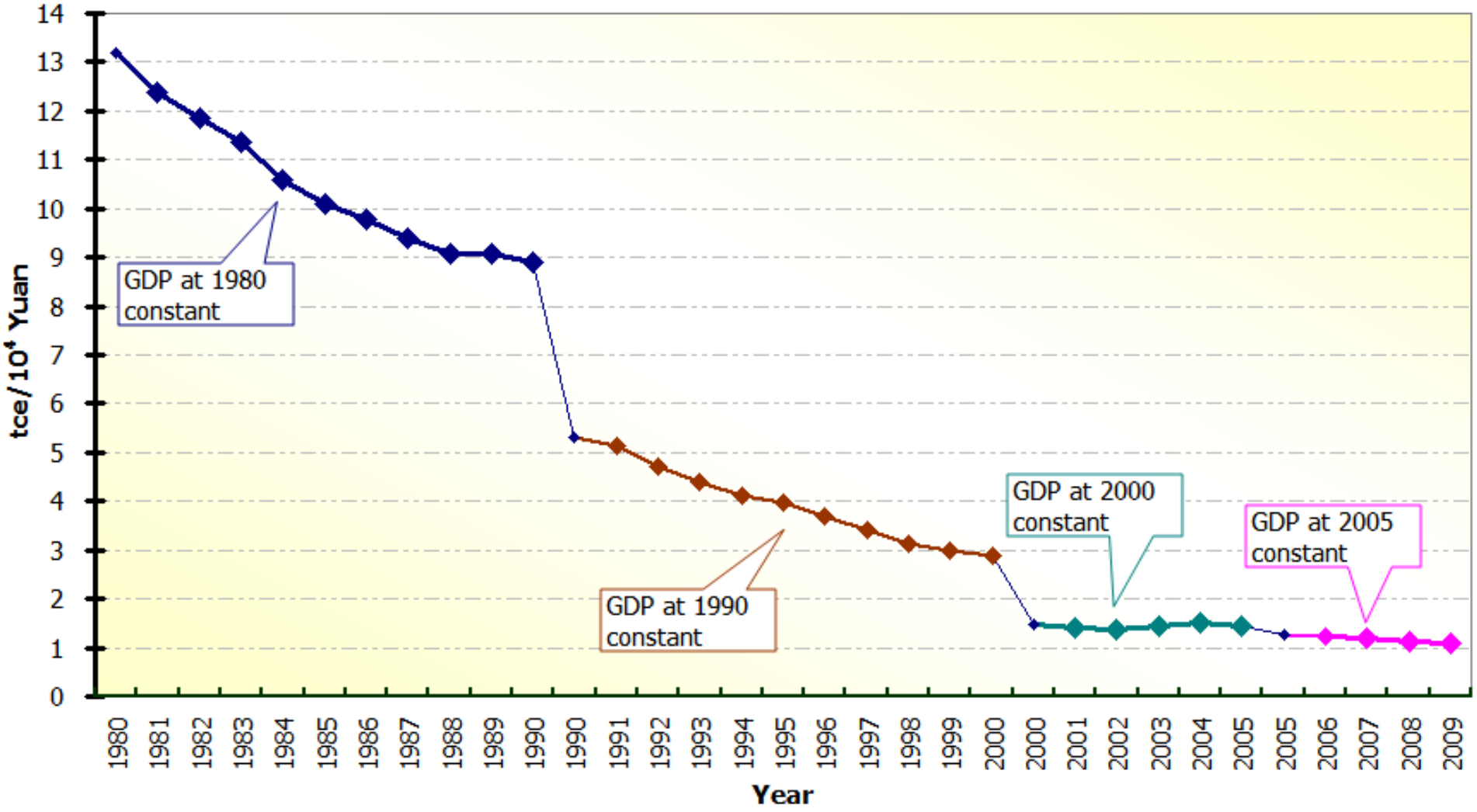
Unit: TWh

	Electricity	Share	Year-on-year increase
China's Electricity Generation	3255.9		14.44%
—Thermal	2698.0	82.86%	13.82%
—Hydro	486.7	14.95%	17.61%
—Nuclear	62.6	1.92%	14.05%
—Wind	5.2	(Grid-connected)	

China's Electric Power Capacity Development in 2009

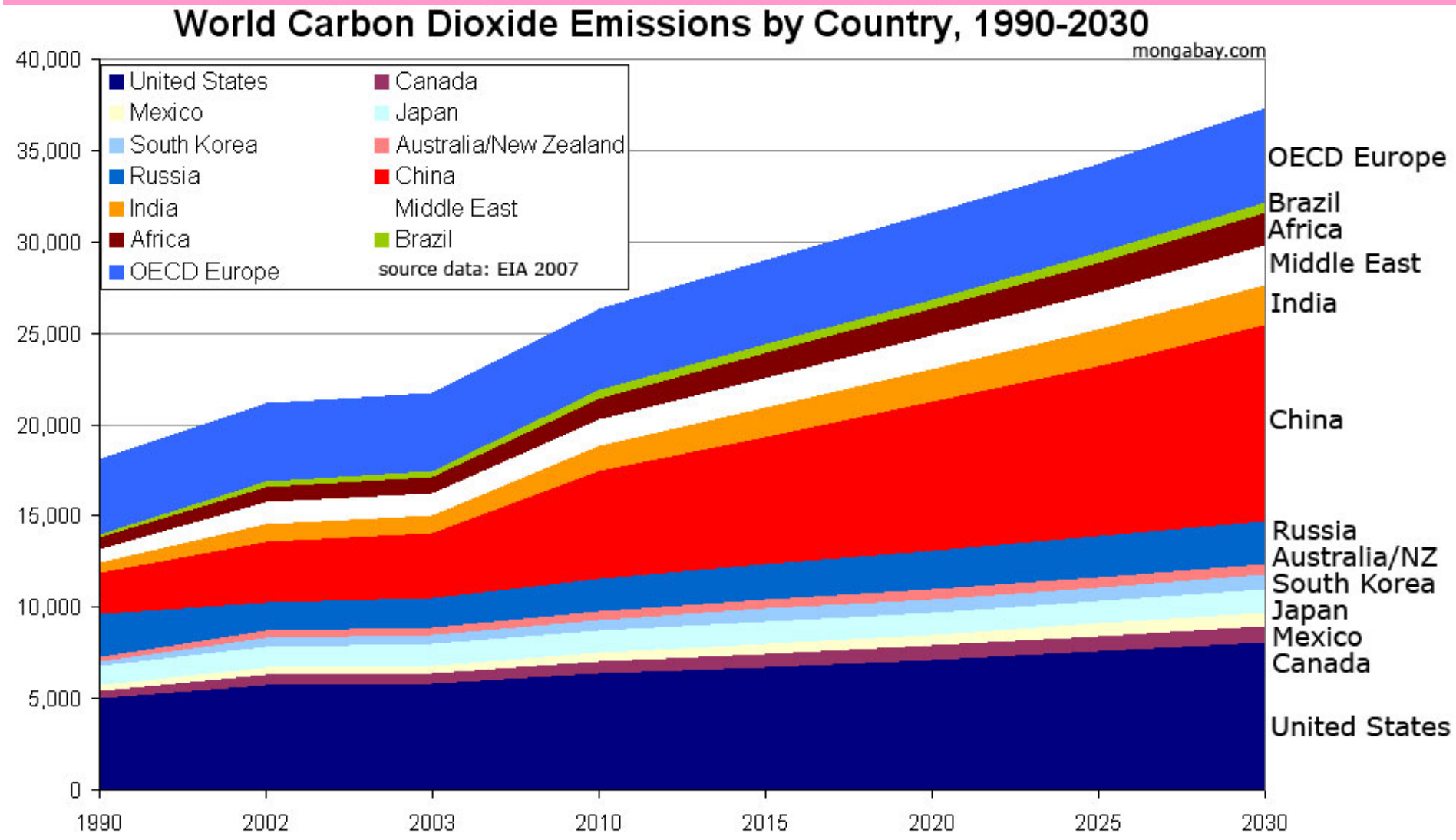
	Unit: GW	% in total capacity
Total capacity:	874.1	
——Thermal	651.08	74.49
——Hydro	196.29	22.46
——Wind	17.6	2.01
——Nuclear	9.08	1.04

Energy Consumption per 10^4 Yuan of GDP



From 1990 up to 2009, China's energy intensity per unit of GDP has achieved a remarkable reduction by 53%, with its associated CO_2 intensity cut down by 55% over the same period, while developed countries have only seen a reduction of CO_2 intensity by 25%, with the world average reduction being 14%, over the same period.

From 1990 up to 2009, China's GDP has increased by 6.6 times, CO_2 emissions increased by 3 times. In 1970 China's per capita CO_2 emission was only ¼ of the world average level, in 1990 amounted to half of that, while at present has exceeded the world average level. With the socio-economic developments, which entail still huge energy consumptions, China's CO_2 emissions may peak beyond 2030.


World Carbon Dioxide Emissions by Country, 1990-2030
mongabay.com
United States
Canada
Mexico
Japan
South Korea
Australia/New Zealand
Russia
China
India
Middle East
Africa
Brazil
OECD Europe
source data: EIA 2007
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1990
2002
2003
2010
2015
2020
2025
2030
OECD Europe
Brazil
Africa
Middle East
India
China
Russia
Australia/NZ
South Korea
Japan
Mexico
Canada
United States

[2]. China's actions to respond to climate change and to take a low-carbon pathway forward

❶. Some High-Profile National Policies and Measures

1). Targets for reducing energy intensity(20%) and major pollutants (10%) has been specifically set out for the country during the 11th Five-Year Plan period(2006-2010).

2). "China's National Climate Change Program" was officially announced by the central government last June to help build a resource-efficient and environmentally sound low carbon society.

3).White paper: China's reactions to climate change" has been made public.

4). 40~45% target of reducing CO_2 emission intensity by 2020 was announced before the Copenhagen COP-15.

❷. Institutional rearrangements and capacity building

1). China's National Leading Group on Climate Change (the prime minister heads this group)
2). A new department responsible for climate change affaires in the NDRC has be set up to strengthen domestic actions.
3). Local competent authorities to coordinate climate change efforts and CDM project implementation at the provincial levels

❸. Mid- and long-term planning for energy developments

1). China's energy development strategies
2). China's nuclear power development program
3). China's renewable energy development program
4). China's power industry development program
5). China's coal development program
.....

❹. China's efforts to improve the energy mix

By the year 2020, the total energy consumption is predicted to amount to 4.5 Gtce, while the share of non-fossil fuels is expected to reach 15% in total primary energy consumptions, of which:

— Hydro: 9%

— Nuclear: 4%

— Wind and other renewables/biomass: 2%

For the target in 2020, electricity from the sources of non-fossil fuels will see a significant growth.

❶. Hydro power: 350GW;

❷. Nuclear power(both in operation and under construction): 100GW;

❸. Wind power: 100~150GW;

❹. Solar power: 10~20GW;

❺. Biomass power: 30GW.

China's nuclear industry has seen a strong development trends over the recent period. By September 20, 2010, the State Council has approved 34 nuclear power units, with the total capacity of 36.92GW, in which 25 units(27.73GW) have been already under construction. Right now China is also supposed to be a country with the largest number of nuclear power plants under construction in the world.

According to the latest information announced the other day this month, China's total nuclear power capacity has reached 11GW, with the recent completion of Ling'ao(2nd phase) project in Guangzhou.

Since coal will continue to dominate China's energy mix over the coming decades, it is really important and necessary to further explore and deploy clean coal technology (CCT) in a large scale and cost-effective manner. Some useful and feasible options to apply CCT for electric power generation include:

❶. SC/USC

❷. CFBC/PFBC

❸. PC+FGD+SCR

❹. USC+$CFB_{600MW/1000MW}$

❺. IGCC

❻. NGCC

❼. Pre-combustion decarburization treatment

❽. Post-combustion capture (+CCS)

❾. Other technical combination schemes of CCT like polygeneration, etc.

❺. China's industrial restructuring for a more balanced development of economy and environment

1). To increase the share of tertiary industry
2). To phase out the inefficient and outdated technological processes
3). To shut down small-sized polluting producers of raw materials
4). To develop new products with high value-added profits
5). To introduce clean production system
……

❻. China's strong actions to close those small-capacity and heavy-polluting generating sets

Small sized power generating sets have been shut down, cumulative amount reached 14.38GW in 2007. By small capacity units, it here means
1). Unit capacity ≤ 50MW;
2). Unit set ≤ 200MW if its life time expires
3). Unit set ≤ 100MW with a 20-year operation
4). Unit sets with coal intensity higher than the provincial average level by 10% or national average by 15%
5).Those units which fail to meet relevant environmental requirements.

The Chinese government has imposed even stronger enforcements to shut down or phase out those small-capacity coal-fired generating sets, and in some cases, by putting teeth into law to remove heavy polluters.

Shut-down capacity

In 2006: 4.42GW
In 2007: 23.38GW
In 2008: 18.93 GW
In 2009: 18.13GW

The cumulative capacity that has been shut down and decommissioned from 2006 to 2009 has amounted to 64.84 GW !

❼. Some good practices since 1980s are being renewed up to now and beyond

1). Total energy saved through the conservation programs in China has amounted to 800 Mtce, equivalent to 1.8 Gtce emission reduction of CO2 between 1991 and 2005.

2).Coal has dropped to 69.1% in China's primary energy mix in 2005 from 76.2% in 1990.

3).Carbon sinks also contribute significantly to the carbon absorption between 1980 and 2005:

- Forestation: 3.06 Gt
- Forest management: 1.62 Gt
- Prevention against emissions from deforestation: 430 Mt

4). China's population has been reduced by at least 300 million due to the birth control policy implemented since 1970s, about an emission reduction by 1.2 Gt CO_2-eq.

5). Amelioration of grassland 24 Mha, reclamation of alkaline and degraded land 52 Mha.

6). About 90% typical forest system and national key animals and plants have been well under protection, the protection zone area accounts for 16% of the country’s total.

7).About 22 Mha desertified land has been well reclaimed through ecosystem recovery programs

⑧. Elimination of the inefficient or backward/obsolete production capacity for the following energy-intensive product types:

Production capacity phase-out for the year 2008

Unit: Mt

—Cement	50
—Steel	6
—Iron	14
—Electrolytic aluminum	0.15
—Ferrous alloy	0.8
—Small coke	15
—Plate glass	6 million box(heavy)
—Paper making	1.06

China has so far set up prohibitively high standards for engaging in the production in those 8 energy-intensive sectors.

[3]. Regional/Global cooperation to meet common challenges ahead

To enhance the national actions, according to the decision (FCCC/CP/2007/L.7/Rev.1) in COP-13:

“Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner”.

As the largest developing or emerging country, China is still facing enormous challenges ahead, while doing its utmost to achieve the sustainable development and pledged volutary targets(40~45%) on its own initiative and commensurate with its capability.

For the future efforts to combat global climate change, the following key points should be further stressed:

1). Upholding the main principles enshrined in both the UNFCCC and the framework of Kyoto Protocol.

2). Following the roadmap charted in the Bali action plan.

3). Continuing the two-tiered negotiation tracks going on under the framework of AWG-LCA and AWG-KP.

Conclusions:

To address the issue of climate change and help the world move onto a successful low-carbon pathway forward, every country/person is a stakeholder, it is really the time to further strengthen both regional and global collaborations through multiple forms or patterns.

Thanks for your attention

Thanks for JANCPEC and JIIA