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ANNEX 7

DATA ANNEX: CHINA

FROM IDEAS TO ACTION: CLEAN ENERGY SOLUTIONS FOR ASIA TO ADDRESS CLIMATE CHANGE

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China country profile – Quantitative data

NOTE: This compilation is mostly based on regional datasets and to a limited extent on country-level primary data. While regional datasets offer the advantage of data consistency (definitions and units) and higher data quality, they are often outdated relative to national country data sets. Further, the assumptions made by regional research institutes to model future trends may vary from those adopted by national government institutes. As such, the data presented here is best used to evaluate broad differences between countries and obtain an overview of future trends, rather than provide specific information at a particular point in time.

Section 1. Introduction

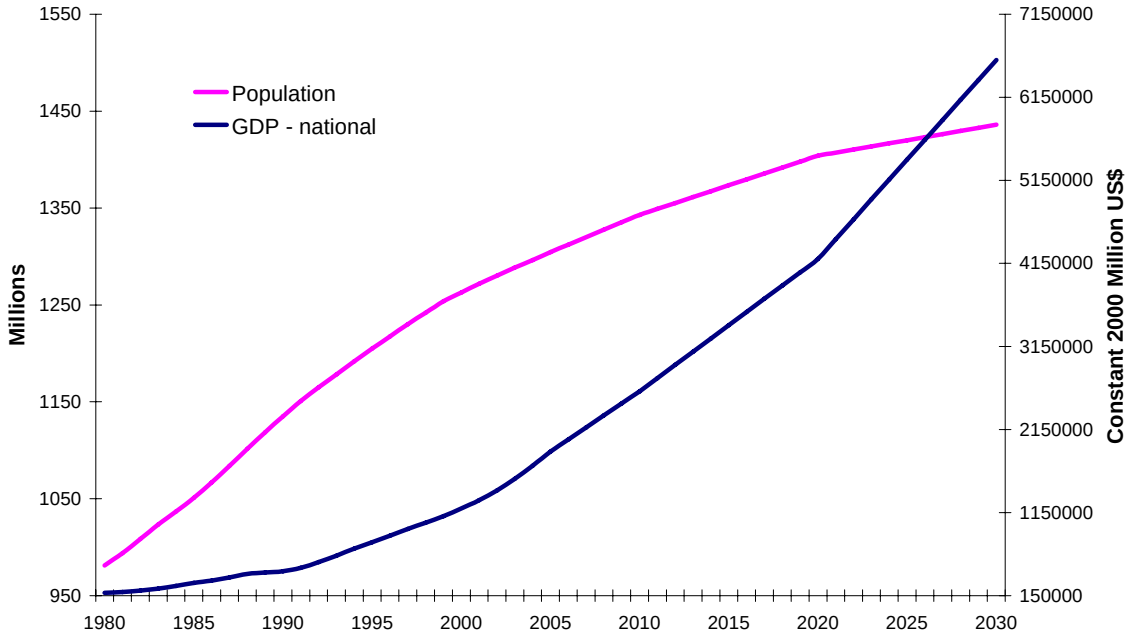
a) General data

Population (2005) [#]	1306313812
Country area (km²) [#]	9806391
GDP - per capita (constant 2000 US$) [2005] [##]	1445
Percentage of total people living in urban areas (%) [#]	37.7
Percentage of people connected to the grid (electricity) [%] [#]	99

* Urbanization level is expected to reach 60% by 2030 [*#].

Source: [#] RECIPES (2006), [##] WDI (2006), [*#] APERC (2006).

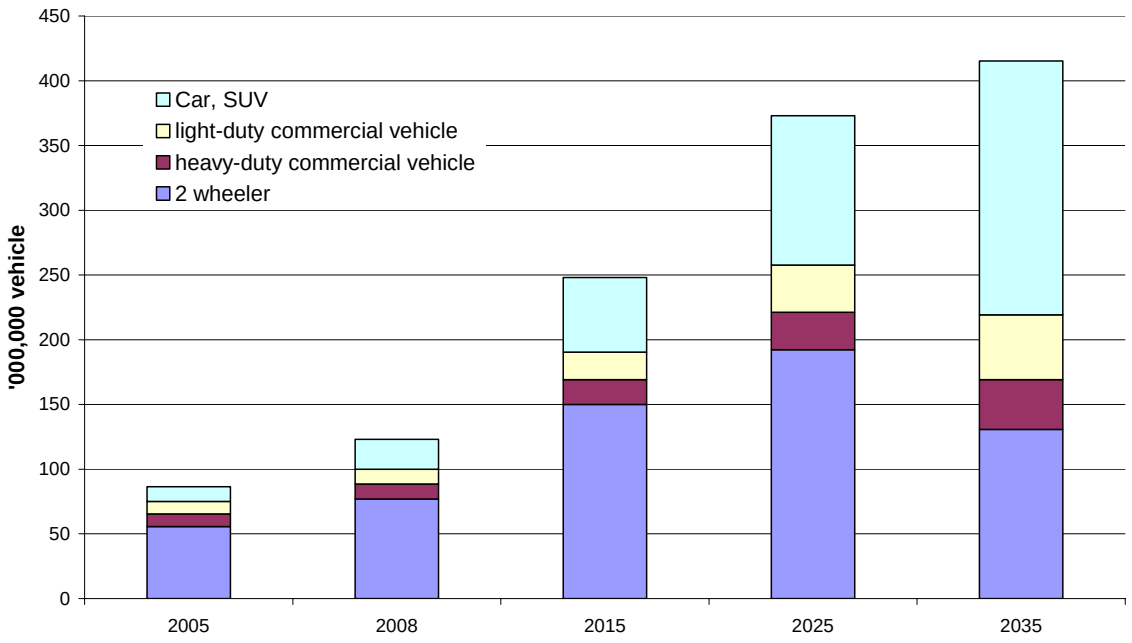
b) Growth in Population and GDP



Source: WDI (2006), APERC (2006)[1].

[1] Future projections

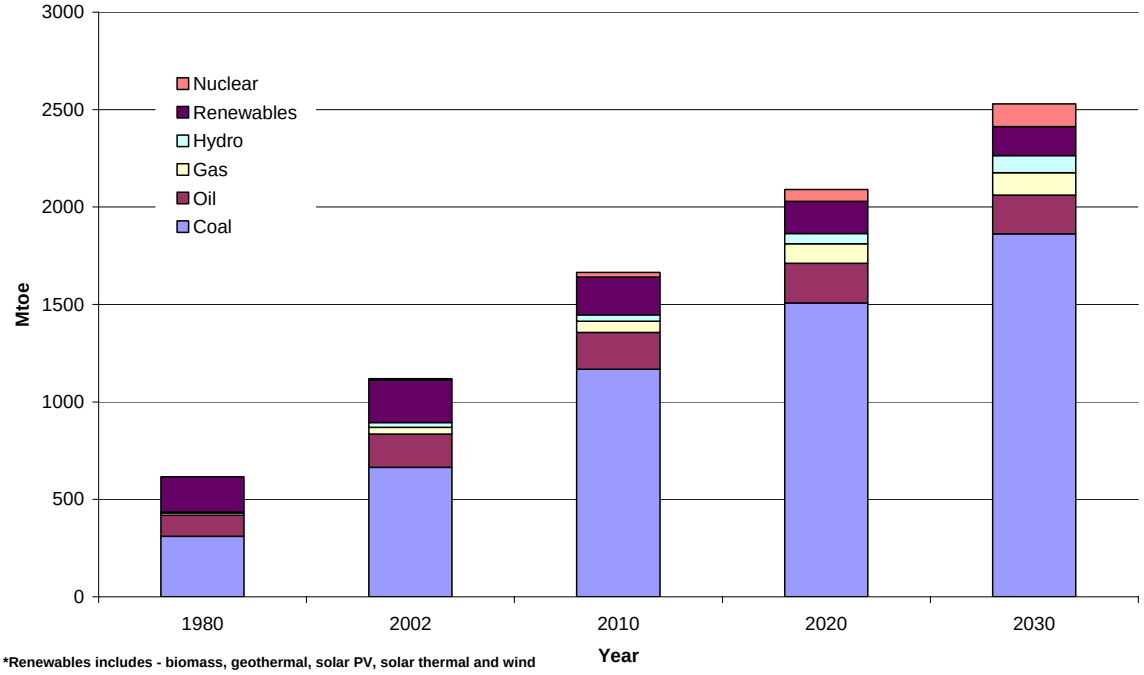
c) c) Number of vehicles in China



Source: ADB (2006).

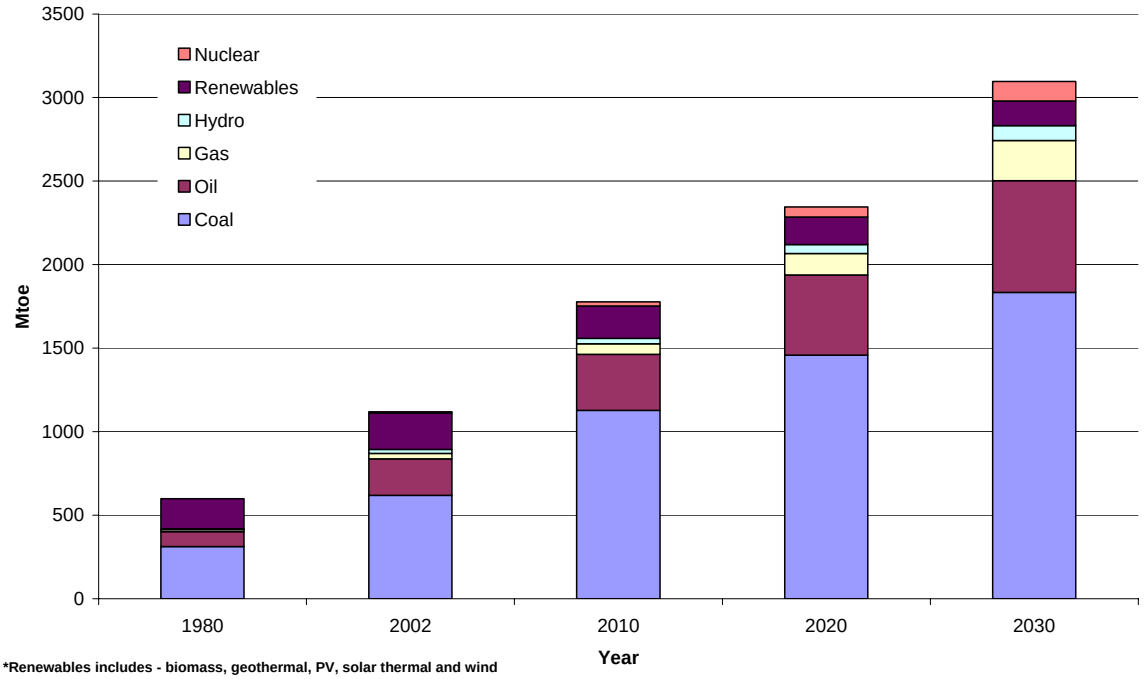
Section 2. Current status of energy supply and demand

d) Primary energy production by source



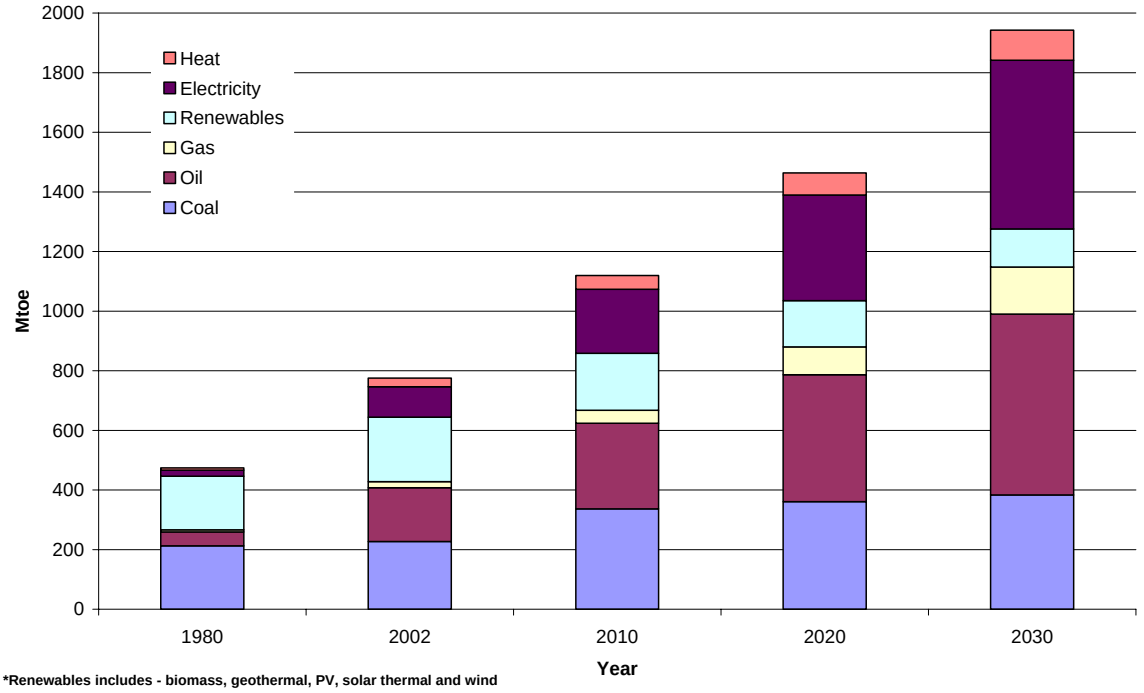
Source: APERC (2006).

e) Primary Energy demand



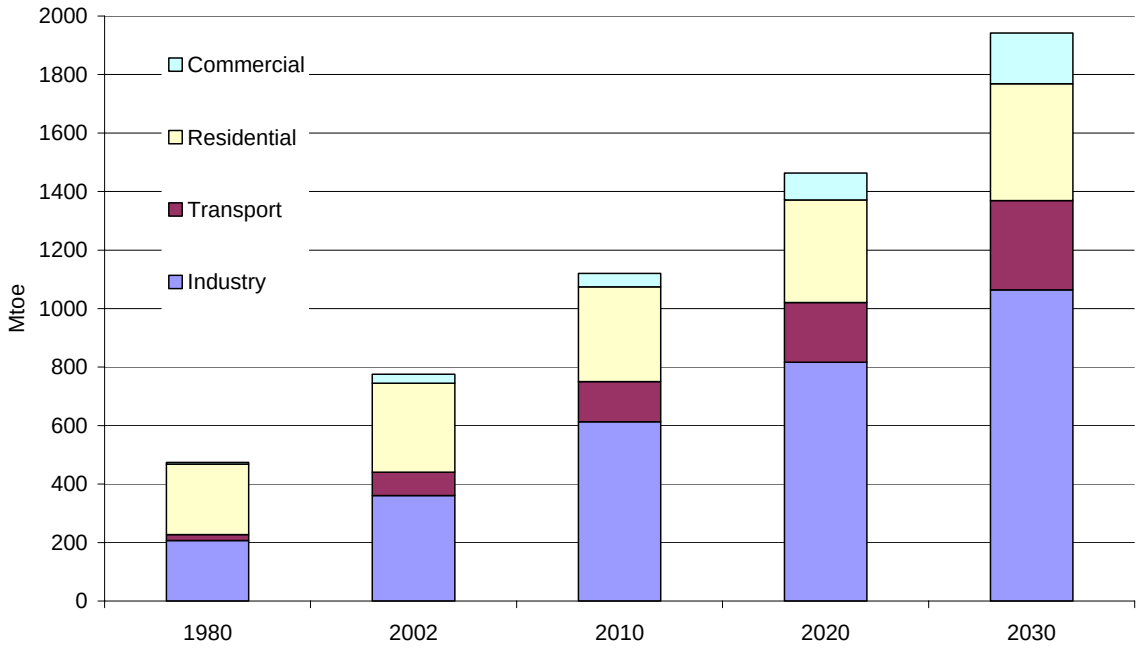
Source: APERC (2006).

f) Total final energy demand by Source



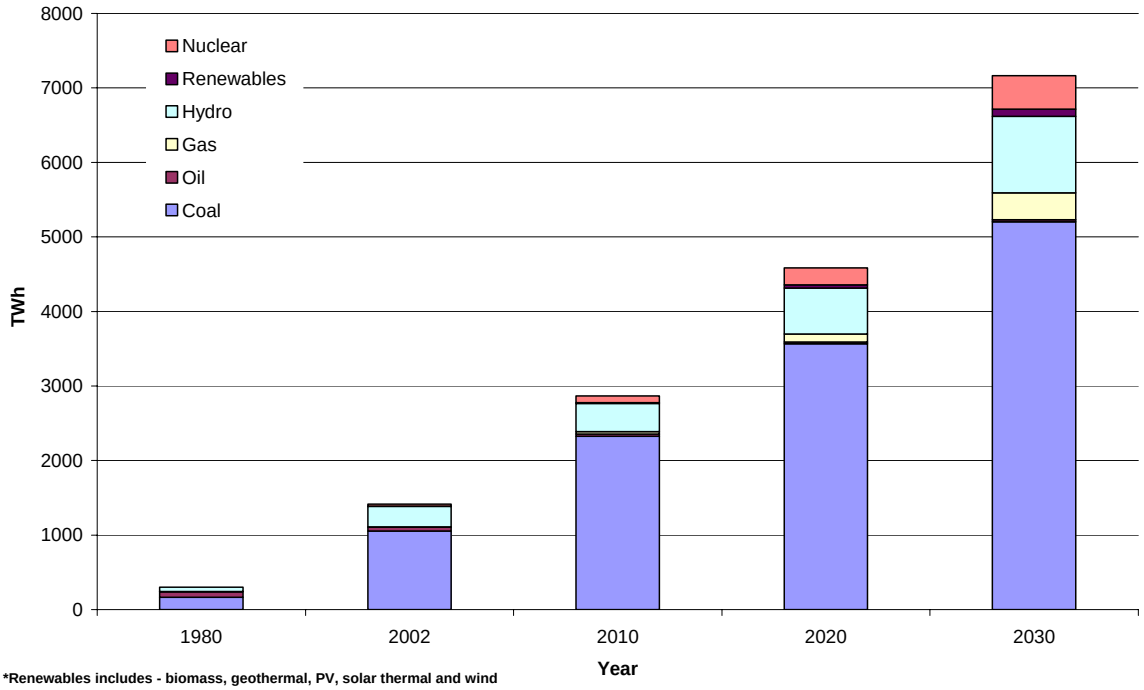
Source: APERC (2006).

g) Total final energy demand by sector



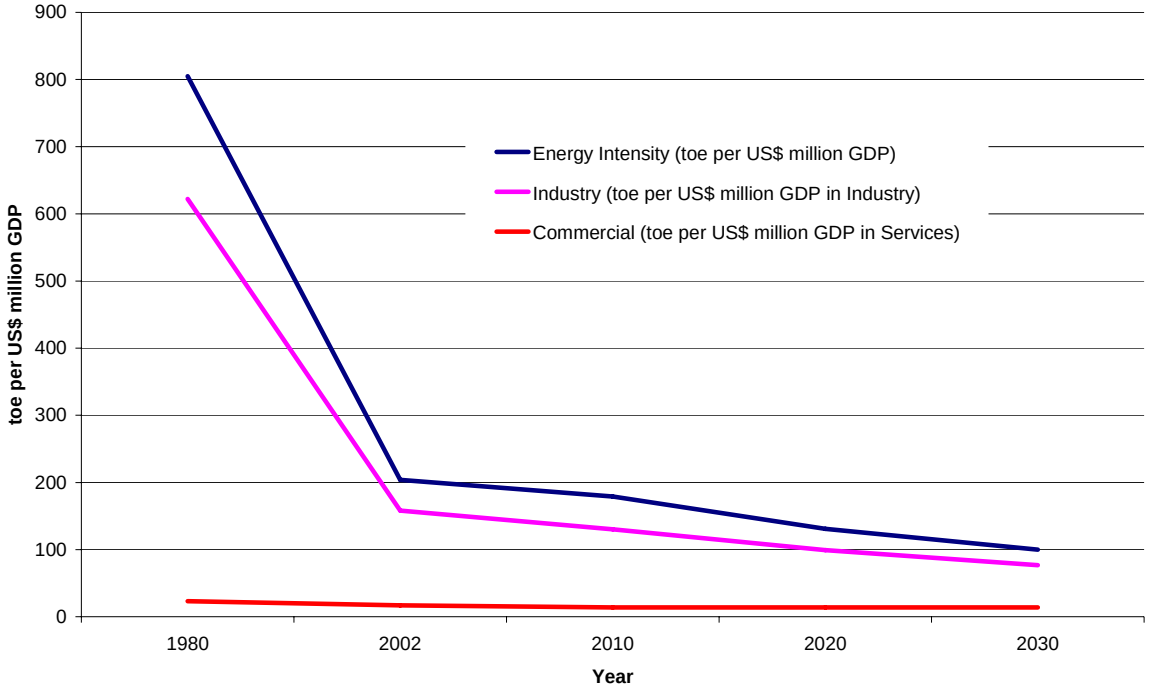
Source: APERC (2006).

h) Total electricity generation



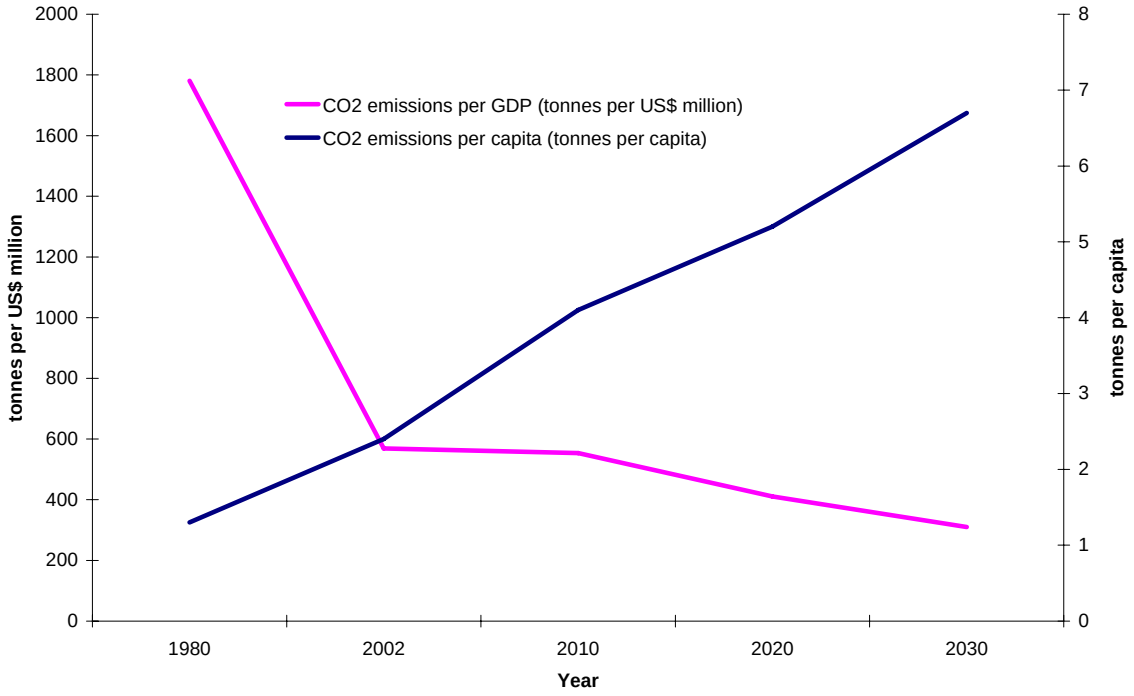
Source: APERC (2006).

i) Energy intensity



Source: APERC (2006).

j) CO_2 emissions intensity



Source: APERC (2006).

k) Retail price of various energy sources

Fuel type	*Most recent year available data*
Gasoline (Cent US$/liter)	70
Coal (Cent US$/kg)	0.6
Electricity (Household) (Cent US$/KWh)	7
Electricity (Industry) (Cent US$/KWh)	4-8

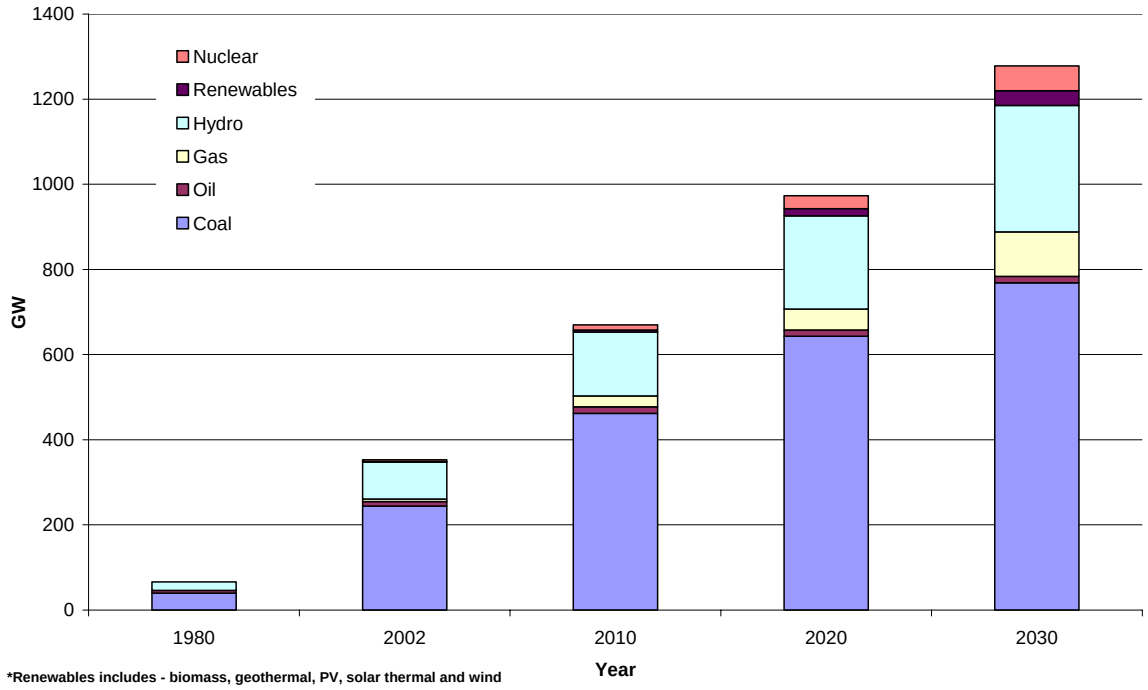
Source: Compiled by ECO-Asia from various sources.

l) Energy reserves status

Energy Reserves (2005)	Total	Proven	Production	R/P ratio
Coal (million ton) #	189270	189270	2190	86
Oil (million barrel) ##	16038	16038	1323	12
NG (billion cubic meter) ##	2350	2350	50	47

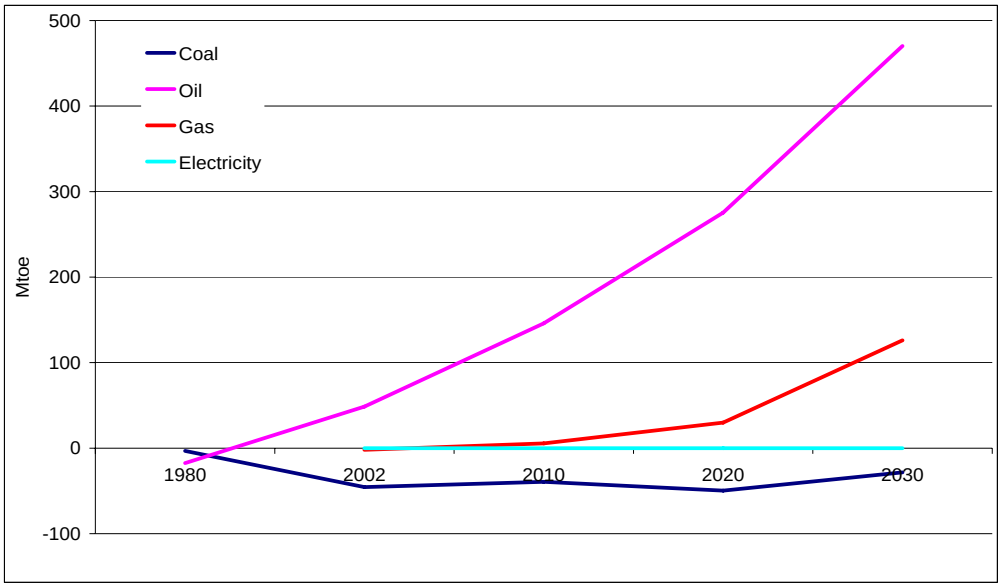
Source: ## BP Statistics (2006), # CSY (2005).

m) Electricity installed generation capacity



Source: APERC (2006).

n) Demand supply gap analysis



Source: APERC (2006).

Section 3. Environmental impacts related to energy use

o) Ambient levels

PRC Standards vs. WHO Guideline Values (mg/m^3)

Pollutant	Averaging Time	Grade 1	Grade 2	Grade 3	WHO
SO_2	1 year	0.02	0.06	0.1	
	24 hours	0.05	0.15	0.25	0.20
	1 hour	0.15	0.5	0.7	
	10 min	-			0.5
TSP	1 year	0.08	0.2	0.3	
	24 hours	0.12	0.3	0.5	-
PM_{10}	1 year	0.04	0.1	0.15	0.02
	24 hours	0.05	0.15	0.25	0.05
NO_2	1 year	0.04	0.08	0.08	0.04
	24 hours	0.08	0.12	0.12	-
	1 hour	0.12	0.24	0.24	0.20
CO	24 hours	4	4	6	
	1 hr	10	10	20	
O_3	8 hours				0.10
	1 hr	0.16	0.20	0.20	-

Notes:

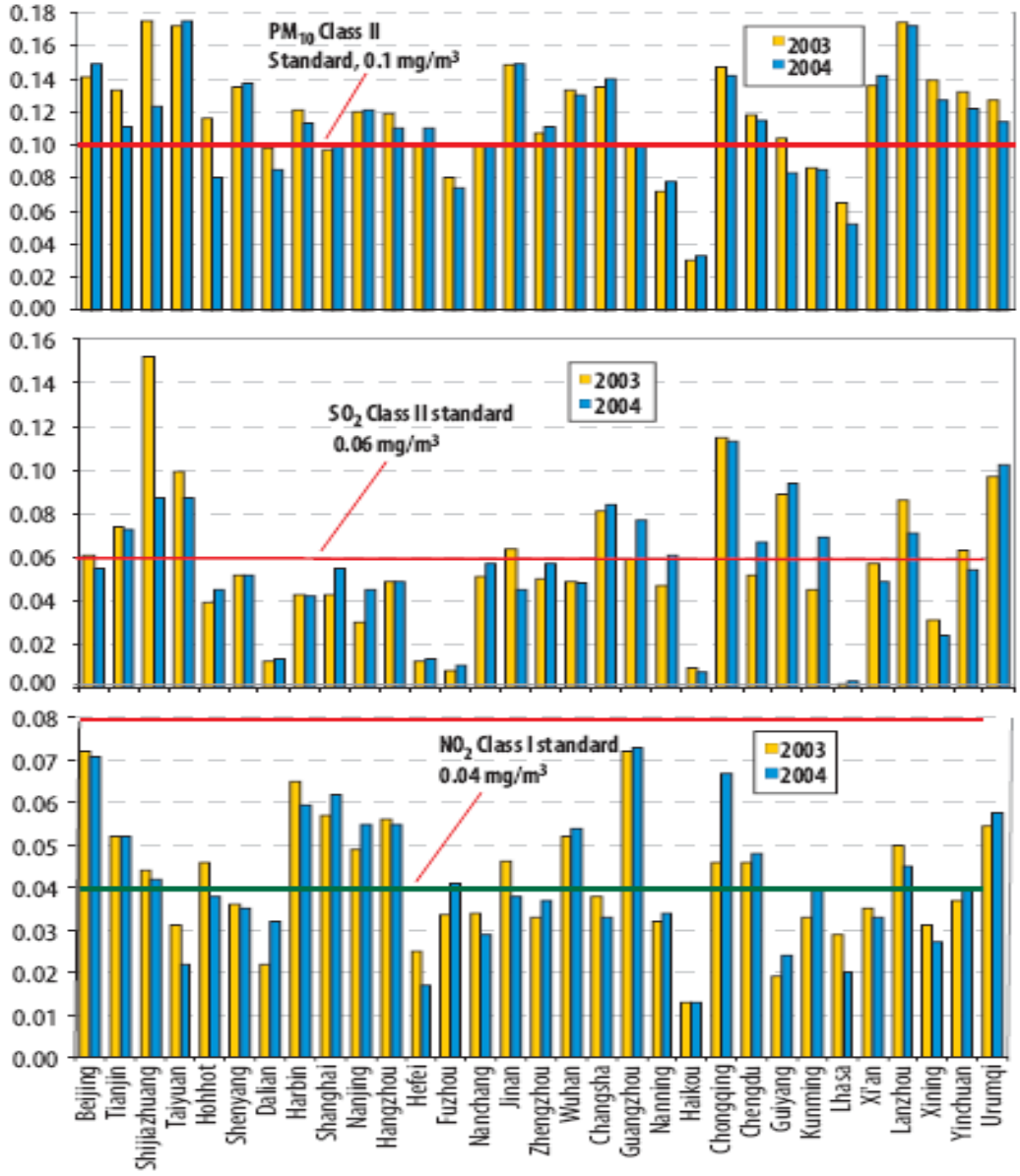
Grade 1 standards apply to specially protected areas, such as natural conservation areas, scenic spots, and historical sites.

Grade 2 standards apply to residential areas, mixed commercial/residential areas, cultural, industrial,

and rural areas.
Grade 3 standards apply to special industrial areas.

Source: ADB (2006).

Ambient PM_{10} (top), SO_2 (center), and NO_2 (bottom) in Selected Cities in the PRC



Source: PRC Statistical Yearbook (2004, 2005).

Source: ADB (2006).

p) Ambient Air Concentrations of Selected Cities in the PRC (in μg/m^3)

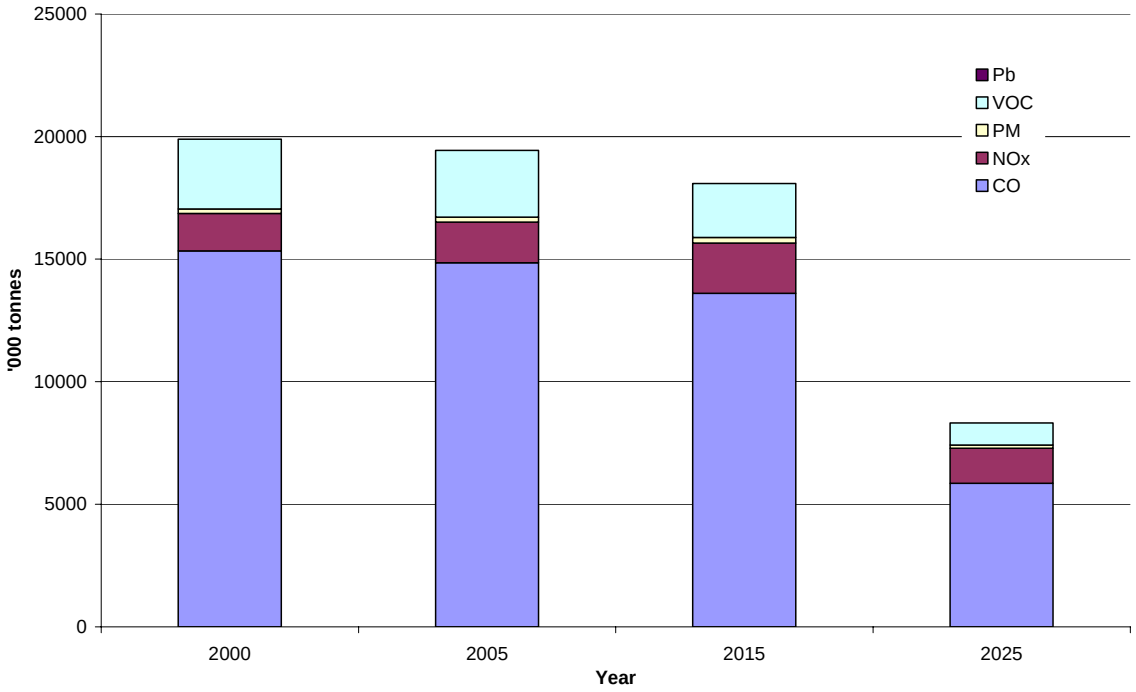
TSP	1997	1998	1999	2000	2001	2002	2003	2004	2005	Trend
Shanghai	233	215	168	156	162	167	140			decreasing
Chongqing	199	234	204	248						inconclusive
Guangzhou		204	182	158	150	161	178			inconclusive
Tianjin	339	340	348	340	283	278				inconclusive
PM_{10}	1997	1998	1999	2000	2001	2002	2003	2004	2005	Trend
Beijing			180	162	165	166	141	149		decreasing
Guangzhou					73	82	98	96		increasing
Guiyang				180			103	80		decreasing
Jinan							149	150	127	decreasing
Luoyang							209	175	127	decreasing
Shanghai				102	100	108	97	99		unchanged
Shijazhuang							171	123	132	increasing
Tianjin					167	138	133	111		decreasing
Urumqi							129	117	114	decreasing
Wuhan							120	130	116	inconclusive
Xi'an							135	142	129	inconclusive
SO_2	1997	1998	1999	2000	2001	2002	2003	2004	2005	Trend
Beijing	125	120	80	71	64	67	61	55		decreasing
Chongqing	207	183	171	156			115	113		decreasing
Guangzhou		61	54	45	51	58	60	78		inconclusive
Guiyang				132			89	80		decreasing
Jinan							65	45	60	inconclusive
Luoyang							105	99	62	decreasing
Shanghai	68	53	44	45	43	35	43	55		inconclusive
Shijazhuang							89	89	55	inconclusive
Tianjin	80	82	68	56	76	69	73	73		decreasing
Urumqi							101	106	117	inconclusive
Wuhan							43	45	48	inconclusive
Xi'an							57	45	45	inconclusive
NO_2	1997	1998	1999	2000	2001	2002	2003	2004	2005	Trend
Beijing (NOx)	133	152	140	126	127	136	132	119		decreasing
Chongqing	66	56	62	68			46	67		unchanged
Guangzhou					71	68	74	75		Increasing
Guiyang				27			19	24		inconclusive
Jinan							46	39	25	Decreasing
Luoyang							60	37	40	Inconclusive
Shanghai	69	67	63	61	63	58	57	62		unchanged
Shijazhuang							46	32	41	Inconclusive
Tianjin	42	43	45	43	53	46	52	52		unchanged
Urumqi							57	58	56	Inconclusive
Wuhan							49	52	52	Inconclusive
Xi'an							35	33	32	inconclusive

Source: ADB (2006).

q) Vehicular related emissions

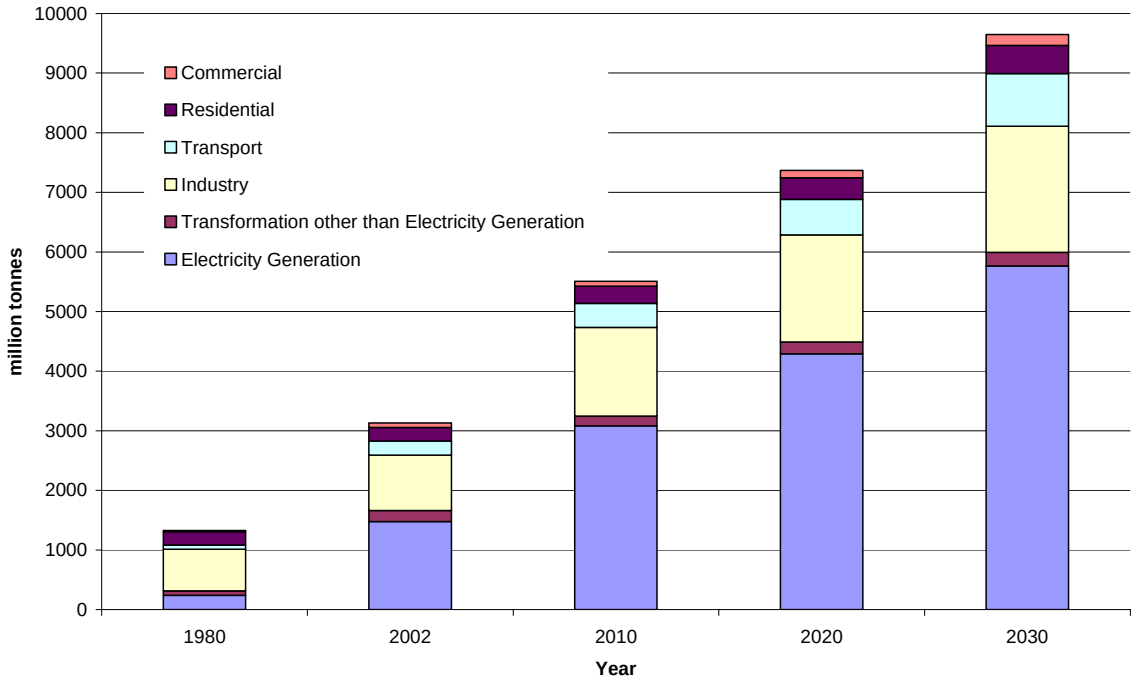
Indicator	Unit	2000	2005	2015	2025
CO	1000 tons	15334	14856	13608	5858
NOx	1000 tons	1529	1657	2050	1425
PM	1000 tons	183	203	219	135
VOC	1000 tons	2841	2717	2206	902
Pb	1000 tons	1.17	0.25	0	0

Source: ADB (2006).



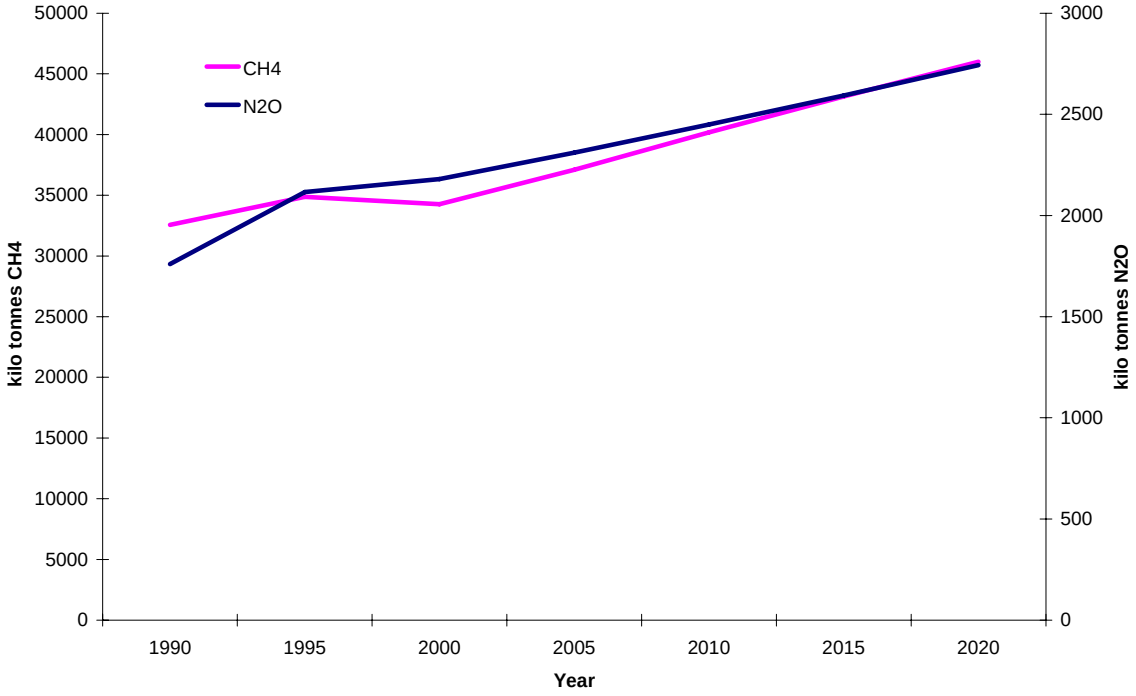
Source: ADB (2006).

r) CO_2 emissions sector wise



Source: APERC (2006).

s) Emission of other GHGs



Source: EPA (2006).

t) National aggregate emission of other gases

Type emission	Amount
NOx (kilo tonnes - 2003)	11300
SO_2 (kilo tonnes - 2004)	22500
Mercury (tonnes - 1999)	536
Black carbon (kilo tonnes - 1995)	9.05
Smoke dust (kilo tonnes - 2005)	10950
Industrial dust (kilo tonnes -2005)	9050

Source: ADB (2006).

Section 4. Health and economic impacts

u) Health impacts in PRC[2]

Burden of Disease from Urban Outdoor Air Pollution in Western; PRC, 2000

Health end-point	Age group	Deaths (000s)	Years of Life Loss (000s)
Cardiopulmonary disease	≥ 30 years	263	1,653
Lung cancer	≥30 years	27	256
Acute respiratory infections	0-4 years	5	169
Total		295	2078

Source: ADB (2006).

[2] In Shanghai, the health benefits to be derived from implementing various policies in controlling air pollution are estimated to range from $113 million to $950 million in 2010 and from $327 million to $2 billion in 2020. Similarly, the estimates derived for Beijing from air quality management measures will range from $270 million to $760 million for 2010 and from $380 million to $1 billion for 2020.

v) Economic Losses Caused by Air Pollution[3]

Studies	Base Year	Economy Losses (billion CNY)	Research Categories	GNP (%)
Guo & Zhang	1983	12.4		2.2
Xia	1992	57.9	Health, crops, animals, and materials	2.4
Sun	1992	60.5		2.5
Zheng et al.	1995	30	Health damage due to TSP pollution, crop, forest, and materials damage due to acid rain	0.5
Xu	1993	39.1	Health agriculture, acid rain, household upkeep (cleaning)	1.1
Smil	1999	15.1±4.1		0.86 ± 0.16
World Bank	1995	44.88	Health effects from urban air pollution, damage from indoor rural air pollution; crop, forest, materials, and ecosystem damage from acid rain; lead exposure for children	7.1

Source: ADB (2006).

[3] A number of studies conducted in the 1990s have documented the economic costs of air pollution. Depending on the methodology used and assumptions applied, the studies projected an annual cost ranging from 0.5% to 7.1% of GNP. But few studies so far have investigated the monetary costs of air pollution impacts on agriculture in the PRC. Shah et al. 2000 reports that economic losses due to damage caused by acid rain to forests and farmlands was estimated by SEPA at $13.25 billion in 2000, equivalent to five times its 1996 value. O3 concentrations are responsible for 1%–9% yield loss in wheat, rice, and corn and for 23%–27% yield loss in soybeans. The PRC projections of O3 concentrations for 2020 will cause an expected 2%–16% yield loss in wheat, rice, and corn and 28%–35% yield loss in soybeans. Compliance with O3 air quality standards in East Asia would increase yield by a value of $2.6 billion–$2.7 billion in grain revenues, a large part of which is in the PRC (Wang and Mauzerall 2004).

Section 5. Clean energy outlook

w) Renewable energy outlook table

	Potential	Installed (MW)		Generation Cost (Yuan/KWh)	Target (MW)							
		2004	2005		2010	Potential	Price (Yuan/KWh)	2020	Potential	Price (Yuan/KWh)	2030 Price (Yuan/KWh)	2050
Wind	1000 GW	560	970	0.79	2032		0.32	20000			0.22	
Biomass	700 Mtce (estimated in 1998)	2000				3 GW		20000	10-15 GW			
Solar Thermal		60 (million m2 collector area)						270 (million m2 collector area)				500 (million m2 collector area)
Solar PV			60		450		1.1-1.4	1000		0.5-1		
Geothermal	6744 (estimated in 1998)	27.78 (Estimated in 1998)		0.64	100							500-1000
Small Hydro	125 GW (estimated in 2004)	30000			41400			50000-55000				
ethanol		500000 ton/annum										
Biodiesel												
Tidal	21.8 GW (estimated in 1998)	6										
Ocean	14 (estimated in 1998)											
Wave energy	12.9 (estimated in 1998)											
Ocean thermal energy	1320-1480 (estimated in 1998)											
Biogas	80 billion m3 (estimated in 2004)	5 billion m3 per annum										

Source: Compiled by ECO-Asia from various sources.

x) Energy Efficiency outlook table

Unit Energy Consumption Reduction Target Between 2006-2010

	Base year 2005	2006	Reduction rate 2010 to 2005
Coal consumption for electricity (kgce/kWh)	377	360	4.5%
Overall energy consumption of cement (kgce/t)	181	157	13.3%
Overall energy consumption of steel (kgce/t)	760	730	3.9%
Overall energy consumption of ammonia synthesis (kgce/t)	1,210	1,140	5.8%

Source: HE, Jiankun (2006).

Additional notes on energy efficiency outlook:

- Energy consumption per RMB 10,000 GDP (constant price in 1990) is expected to drop from 2.68 tons of coal equivalent (tce) in 2002 to 2.25 tce by 2010, with an annual average energy conservation rate of 2.2%. The energy conservation capacity is expected to reach 400 million tce.
- Energy consumption per RMB 10,000 GDP is expected to drop to 1.54 tce in 2020, with an annual average energy conservation rate of 3%. The energy conservation capacity is expected to reach 1.4 billion tce, 111% of the total planned increased energy production of 1.26 billion tce during the same period, with a corresponding reduction of 21 million tons of sulfur dioxide.
- By 2020, China's products are expected to reach or approach advanced international levels. For example, coal consumption of power supply is expected to decrease from 377 gram coal equivalent/kilowatt hours (gce/kWh) in 2005 to 320 gce/kWh in 2020
- Energy savings can be achieved by changing the industrial structure through adjusting the secondary and tertiary industries as well as heavy and light industries. The energy savings potential from adjusting the industrial structure will be 0.0313 kWh/RMB in the next 5 to 10 years. The GDP will be at least 19,217.2 billion RMB in 2010. If 20% of the potential is considered, about 0.00626 kWh/ RMB can be saved. Hence, electricity savings could be 60 TWh in 2010. The cumulative savings is estimated to be 265 TWh in the next five years.
- Adopting technical improvements of equipment and processes in the PRC would result in a significant energy savings potential of 30% to 40% of the total electricity consumption. In 2004, total electricity consumption was 2,176 TWh with 74% consumed in industry, 12% in residential, 11% in commercial and 3% in agriculture. The majority of industrial equipment, such as motors, pumps, fans, etc., have low efficiency. Hence, there is a significant gap of specific electricity consumption as compared with international advanced electricity used in the products. The potential energy savings from industry alone is between 483 and 644 TWh per year. An economic potential of less than 15% can be assumed, which makes the potential energy savings from industry approximately 70 TWh. It is estimated that cumulative energy savings as a result of technical improvements will be approximately 360 TWh in 2010.
- Energy savings potential and energy efficiency improvements in the commercial sector are at 50 million tce and about 29 TWh of electricity. Implementation of possible projects include Building Energy Conservation, Green Lighting, and Government Agency Energy Conservation.

Source: ADB (2006b).

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