Polluting Power:
Ranking China's Power Companies

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Key Findings:

1. The total amount of coal consumed by the top ten Chinese power companies accounted for 20% of China's total coal production in 2008.

2. The environmental loss for the total amount of coal burned by the top ten power companies in 2008 was estimated at RMB 87 billion.

3. In 2008, the top three Chinese power companies together emitted more than the total greenhouse gas emissions of the United Kingdom in the same year.

4. All of the top ten Chinese power companies have met the target in the 11th 5-year-plan to reduce the average coal consumption to 355 grams per kWh of coal power generation.

5. When generating 1 kilowatt hour (kWh) of power, most of China's top ten power companies emit more carbon dioxide than the average in developed countries.

6. In the past three-and-half years, the amount of inefficient coal-fired plants closed down in China reached 54.07 GW, more than the total installed electricity capacity of Australia.

7. To completely phase out the least efficient coal power stations under 100MW, China could reduce coal consumption by 90 million tonnes of coal equivalent per year. As a consequence, 220 million tonnes of carbon dioxide equivalent greenhouse gas emissions would be avoided.

8. By the end of 2008, only three out of the top ten power companies had reached a 10% renewable energy share, while five had less than 7% of their energy coming from renewable energy.

9. By the end of 2008, only one out of the top ten power companies had reached the mandatory renewable (non-hydro) energy obligation of 3%, two years earlier than the Central Government's target date of 2010. At the end of 2008, eight out of the top ten power companies were not yet half way to meeting this target.

10. By the end of 2008, Guodian had installed 2.88 GW of wind power. This accounts for 23.7% of China's total, making it the biggest wind power company in Asia.

PART ONE
Introduction

China is the world's largest producer and consumer of coal. The country's rocketing economic growth is heavily dependent on it, with more than 70 per cent of its energy needs coming from coal. The Chinese electricity sector is China's biggest consumer of the fuel. China is the world's second largest producer and consumer of electricity, with a total generation of 3,433.4TWh in 2008, smaller only than the United States.

By the end of 2008, the installed capacity of electricity generation had reached 792GW. Coal-fired plants account for 75% of this capacity. The massive expansion of coal-fired plants has created enormous economic, social and environmental losses for China. The huge amount of carbon dioxide emitted by these coal-fired plants, the primary greenhouse gas responsible for climate change, has yet to be seriously addressed.

In the last few years, the Chinese Government has made significant progress in improving energy efficiency and reducing major pollutants. However, to ensure the development of a sustainable low-carbon pathway and environmental protection, China has to swiftly transform its energy industry. The electricity sector plays a critical role in deciding China's climate performance.

This briefing also puts into context why the Chinese electricity sector has to grasp this historical opportunity and add to China's efforts to be part of an ambitious climate deal in Copenhagen in December. In an increasingly carbon constrained world, countries that are heavily dependent on coal leave themselves exposed to great risks.

China's electricity sector is dominated by large-scale power companies. The top 10 of these power companies in terms of installed capacity are: China Huaneng Group (Huaneng), China Datang Corporation (Datang), China Guodian Corporation (Guodian), China Huadian Corporation (Huadian), China Power Investment Corporation (CPI), China Three Gorges Project Corporation (Three Gorges), Guangdong Yuedian Group (Yuedian), Zhejiang Provincial Energy Group (Zhejiang Provincial Energy), Shenhua Group Corporation (Shenhua) and China Resources Power Holdings Company (CRP).

In 2008, these 10 biggest companies accounted for 57% of China's total installed electricity capacity and 58% of China's total electricity output. While China is faced with increasing pressure to tackle climate change and energy security concerns, these ten companies must not be exempt from the responsibility of moving China away from coal. This briefing[1] ranks the top 10 power companies using the following criteria:

- Overall coal consumption and carbon dioxide emissions;
- Average coal consumption of coal-fired plants and carbon intensity of power generation;
- Development of renewable energy.

Table 1: Total Installed Capacity and Electricity Generation

Ranking	Power Companies	Total Installed Capacity (GW)	Total Electricity Generation (TWh)
1	China Huaneng Group (Huaneng)	85.86	372.0
2	China Datang Corporation(Datang)	82.42	353.0
3	China Guodian Corporation (Guodian)	70.24	297.8
4	China Huadian Corporation (Huadian)	69.08	287.1
5	China Power Investment Corporation (CPI)	45.71	205.1
6	China Three Gorges Project Corporation (Three Gorges)	21.08	97.9
7	Guangdong Yuedian Group (Yuedian)	21.05	104.7
8	Zhejiang Provincial Energy Group (Zhejiang Provincial Energy)	18.60	86.5
9	Shenhua Group Corporation (Shenhua)	18.50	100.1
10	China Resources Power Holdings Company (CRP)	17.40	104.5
Total		**449.94**	**2008.7**

PART TWO
Ranking

1. Overall coal consumption and carbon dioxide emissions

The Chinese electricity sector has always been overly dependent on coal. Recent years have seen the rapid growth of newly installed capacity that reaches 100GW on a yearly basis. However, the predominant share of coal remains unchanged.

Table 2 shows the overall coal consumption and the carbon emissions of the top 10 Chinese power companies in 2008. Due to the absence of a monitoring and accounting system of carbon dioxide emissions from coal-fired plants, all the carbon dioxide emissions data is extrapolated from the amount of coal burned[2].

The total amount of coal consumed by the top 10 Chinese power companies is more than 590 million tonnes, consuming 20% of China's total coal production[3] in 2008.

The True Cost of Coal in China Report in 2008 quantified, for the first time, the environmental loss for every tonne of coal burned in China at RMB 150[4]. It concentrated on air and water pollution, other environmental degradation and health impacts[5]. Based on this estimation, the use of coal by these companies cost Chinese society RMB 87 billion in 2008 alone (about USD 12.7 billion[7]).

The more coal a company burns, the more carbon dioxide it emits, and the greater their contribution to worsening climate change and climate disasters. The carbon dioxide emissions of China's top three power companies in 2008 were already bigger than the total emissions of the United Kingdom[8] in the same year.

China's reliance on coal comes with heavy economic, environmental and social costs. For China to achieve a low-carbon sustainable development pathway, the biggest power companies, as the major emitters in China, have to take a lead in combating climate change.

2. Average coal consumption of coal-fired plants and carbon intensity of power generation

Average coal consumption for each kWh of power generated by coal-fired plants is an important indicator in determining the efficiency of the coal power generation. According to the Government's 11th 5-year-plan for the Electricity Sector, power companies are required to "reduce the average coal consumption to 355 gram per kWh of coal power generation", which could avoid burning 45.42 million tonnes of coal every year[9]. Table 3 highlights the average coal consumption per

Table 2: Total Coal Consumption and Carbon Dioxide Emissions in 2008

Ranking	Power Companies	Total coal consumption (1,000 tonnes of coal equivalent)	Total carbon dioxide emissions (1,000 tonnes of CO2 equivalent)
1	Huaneng	117969	287844
2	Datang	102577	250288
3	Guodian	94798	231307
4	Huadian	88400	215696
5	CPI	59640	145522
6	CRP	34969	85324
7	Yuedian	31872	77768
8	Shenhua	31650	77226
9	Zhejiang Provincial Energy	28359	69196
10	Three Gorges[6]	0	0
Total		**590234**	**1440171**

Table 3: Average Coal Consumption of Coal-fired Plants in 2008

Ranking	Power Companies	Average Coal Consumption (gram/kWh)
1	CPI	350.0
2	Guodian	341.0
3	CRP	340.5
4	Huadian	338.0
5	Datang	335.0
6	Huaneng	333.9
7	Yuedian	332.3
8	Zhejiang Provincial Energy	329.4
9	Shenhua	316.5
10	Three Gorges	0.0

kWh of the coal installed capacities for each of the top 10 power companies. As indicated, all of the 10 companies have reached the target specified in the 11th 5-year-plan earlier than required.

Although China has built a number of coal plants using the most efficient coal technology available, many of China's power stations are still burning coal with inefficient, outdated technologies. According to the National Development and Reform Commission, by the end of 2005, coal-fired plants smaller than 100MW accounted for 115 GW, which was 29.4% of the total coal installed capacity. One important measure to achieve the 5-year-plan target and improve the energy efficiency within the electricity sector includes aggressively phasing out the least efficient coal-fired plants.

From 2006 to the first half of 2009, 54.07 GW[10] worth of the least efficient coal-fired plants were closed down, that is more than the total installed electricity capacity of Australia[11] . This sector reached the phase-out target in the 11th 5-year-plan one and a half years earlier than specified. In the next three years, the Chinese Government plans to close down another 31 GW (13 GW in 2010, 10 GW in 2011 and 8 GW in 2012) of small coal-fired plants[12].To completely phase out the least efficient coal power stations under 100MW, China could reduce coal consumption by 90 million tonnes of coal equivalent per year. As a consequence, 220 million tonnes of carbon dioxide equivalent greenhouse gas emissions would be avoided[13].

Besides comparing the power generation efficiency of the coal-fired plants of each power company, this briefing also looks into the carbon dioxide intensity (the amount of CO_2 emitted for generating each kWh) of power generation[14]. Carbon dioxide intensity evaluates the climate impacts of generating 1 kWh of power by each company.

In Japan, 418 grams of carbon dioxide are emitted for each kWh of power generation; in Germany, 497 grams of carbon dioxide are emitted and, in the US, 625 grams of carbon dioxide are emitted[15]. Most of China's top 10 power companies emit 1.8 times more carbon dioxide than the Japanese average in producing 1 kWh of power. As a result, every kWh of electricity generated by the China electricity sector is causing more damage to the climate when compared with most developed countries.

The main reasons leading to the high carbon dioxide intensity of the Chinese electricity sector include the following: firstly, inefficient coal-fired plants still make up a large share of the coal installed capacity; secondly, the share of renewable energy in the mix is too low. In order to improve the electricity sector's carbon footprint, China has to continue to increase efficiency through upgrading technologies and developing renewable energy.

Table 4: Carbon Dioxide Intensity of Power Generation in 2008

Ranking	Power Companies	Carbon Dioxide Intensity (gram/kWh)
1	CRP	816.5
2	Zhejiang Provincial Energy	800.0
3	Guodian	776.7
4	Huaneng	773.8
5	Shenhua	771.5
6	Huadian	751.3
7	Yuedian	742.8
8	CPI	709.5
9	Datang	709.0
10	Three Gorges	0.0

Table 5: Share of Renewable Energy in Total Power Generation

Ranking	Power Companies	Share of Renewable Energy in Total Power Generation (100%)
1	Three Gorges	100.00
2	CPI	16.92
3	Datang	13.26
4	Huadian	8.92
5	Yuedian	8.40
6	Guodian	6.65
7	Huaneng	5.03
8	CRP	0.96
9	Shenhua	0.03
10	Zhejiang Provincial Energy	0.00

3. Development of Renewable Energy

Although renewable energy in China is expanding very quickly, the share of renewable energy in the total electricity output is still very low. Table 5 lists the percentage of renewable energy (including hydro) power generation over total power generation.

According to *China's Renewable Energy Long and Mid Term Development Plan*[16], renewable energy should make up 10% of the total energy consumption by 2010 and 15% by 2020[17]. The biggest potential for renewable energy development lies within the electricity sector. Therefore the electricity sector has the biggest responsibility for meeting this target. By the end of 2008, only three out of the ten power companies had reached a 10% renewable energy share, while half of the ten companies had less than 7% of their energy coming from renewable energy.

The *Renewable Energy Long and Mid Term Development Plan* also requires that electricity utilities with more than 5 GW of installed capacity are obliged to meet a 3% renewable energy portfolio standard. That is, by 2010, the targeted utilities or power companies must have at least 3% of their installed capacity from non-hydro renewable sources, including wind, solar, biomass, geothermal, tidal and wave. The Development Plan also states that the obligation will increase to 8% by 2020.

The 10 power companies ranked are all obligated to meet the 3% target by 2010. Table 6 shows the share of non-hydro renewable energy capacity in the total installed capacity for each company. Guodian was the only company that had met the renewable energy obligation two years in advance. The No.2 ranked Datang had 2.65% of its capacity as renewable energy. The other eight power companies had not yet even met half of the 2010 government target. Based on the number of renewable energy projects in the pipeline for these eight companies, it is unlikely that these companies will meet their 3% obligation.

China is now the fourth largest wind market in the world. In 2008, China also doubled its installed capacity of wind power for the fourth year running. By the end of 2008, China's total installed wind capacity was 12.15 GW.

Table 7 shows the wind power installed capacity of the top 10 power companies and their share with regard to the total installed wind capacity of China by 2008. Guodian is the undisputed leader. By the end of 2008, Guodian had installed 2.88 GW of wind power. This accounts for 23.7% of China's total, making it the biggest wind power company in Asia.

Table 6: Share of Non-hydro Renewable Energy in the Total Installed Capacity by 2008

Ranking	Power Companies	Share of Non-hydro Renewable Energy In Total Installed Capacity
1	Guodian	4.16
2	Datang	2.65
3	Huaneng	1.30
4	CPI	0.72
5	Huadian	0.59
6	Yuedian	0.48
7	CRP	0.29
8	Three Gorges	0.24
9	Shenhua	0.11
10	Zhejiang Provincial Energy	0.00

Table 7: Installed Wind Capacity and the Share in the Total National Installed Wind Capacity

Ranking	Power Companies	Installed Capacity (MW)	Share in the Total National Installed Wind Capacity (100%)
1	Guodian	2880	23.70
2	Datang	2150	17.69
3	Huaneng	1120	9.22
4	Huadian	380	3.13
5	CPI	330	2.72
6	Yuedian	100	0.82
7	Three Gorges	50	0.41
8	CRP	50	0.41
9	Shenhua	20	0.16
10	Zhejiang Provincial Energy	0	0.00
Total		**7080**	**58.26**

PART THREE
Policy Recommendations

China's biggest power companies have a broader responsibility to society than just power generation. They must also play an industry leadership role by helping China combat climate change. In order to achieve a low-carbon sustainable development in China's electricity sector, Greenpeace calls on:

1.the Government of China to introduce a price signal through an energy tax and environmental tax for coal that not only drives power companies to rapidly move to renewable energy, but also ensures that, during the transition, coal is used as efficiently as possible;

2.the Government of China to increase the national renewable energy target to 30% by 2020 and to introduce favourable policies to facilitate its rapid development;

3.the Government of China to adopt stricter energy efficiency standards for coal installed capacity in the 12th 5-year-plan, which requires average coal consumption to be below 335 gram per kWh of coal power generation[18];

4.the power companies to ensure that the obligation of 3% of electricity coming from renewable energy sources by 2010 will be met;

5.the power companies to accelerate the shut-down of the least efficient coal power stations so that, by 2012, all of the inefficient power plants under 100 MW and, by 2015, all of the inefficient power plants under 200MW are either shut-down or converted to more efficient technologies;

6.the power companies to release a detailed strategy paper on combating climate change and reducing carbon dioxide emissions, under the framework of the government's national policies.

Greenpeace recognises that China is still a developing country with pressing responsibilities for dealing with poverty alleviation and other development issues. To ensure energy security, environmental protection and healthy economic and societal development, the electricity sector in China must play a strong role in tackling climate change and reducing China's reliance on coal. What is needed is an Energy [R]evolution[19] , a revolution in how energy is generated and used. And, fortunately, China is ideally placed to do this becoming the world's superpower in terms of smart energy and renewable energy.

Endnotes:

1.Data used in the briefing comes from the State Electricity Regulatory Commission, the China Electricity Council, and the websites of the power companies. Greenpeace processed this data to arrive at the stated conclusions.

2.The conversion formula is: for each gram of coal burned, 2.44 gram of carbon dioxide is emitted. Refer to the calculation used by the National Development and Reform Commission: http://www.ndrc.gov.cn/mtbd/t20070226_118219.htm

3.According to the National Statistics Bureau, China's total coal production in 2008 is 2.87 billion tonnes in 2008.

4.*The True Cost of Coal Report* was jointly released by Greenpeace, the Energy Foundation and WWF. The main authors of this report include Mao Yushi, Shen Hong and Yang Fuqiang. To download the report, please visit: http://www.greenpeace.org/china/en/news/coal-crisis

5.This figure however did not take into account the costs of climate change due to insufficient data being available.

6.This analysis is only looking at CO_2 emissions from power generation, not full-life cycle emissions.

7.1 USD=6.83 RMB

8.The United Kingdom's total emissions in 2008 were 623.8 million tonnes of CO_2 equivalent. For more details, please see the Department of Energy and Climate Change, UK Climate Change Sustainable Development Indicator: 2008 Greenhouse Gas Emissions, Provisional Figures. March 2009. http://www.defra.gov.uk/ENVIRONMENT/statistics/globatmos/download/ghg_ns_20090326.pdf

9.The Government of China's 11th 5-year-plan runs from 2006 to 2010.

10.Data from the Minister of Environmental Protection. For more details, please refer to http://www.mep.gov.cn/zlkz/zxfb/200907/t20090709_154946.htm

11.Data from the Department of Resources, Energy and Tourism, Government of Australia. For more details, please refer to http://www.ret.gov.au/energy/facts/Pages/EnergyFacts.aspx

12.For more details, please refer to http://www.ccchina.gov.cn/cn/NewsInfo.asp?NewsId=16822

13.Data from the National Development and Reform Commission. For more details, please refer to http://www.ndrc.gov.cn/mtbd/t20070226_118219.htm

14.Besides coal, a few of the top 10 power companies have also installed some oil or natural gas power generation. However, because the shares are very small and do not affect the results of the ranking, this report does not include decided to neglect the carbon dioxide emissions from these two types of installed capacities.

15.For more details, please refer to http://knowledge.allianz.com/en/globalissues/climate_change/top_climate_stories/g8_climatescorecards_2009.pdf

16.For the whole document, please refer to http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/2007/20079583745145.pdf

17.Greenpeace's position on renewable energy development is that, before development approval, every power project must undergo a strict environmental impacts assessment to ensure that the project does not cause social or environmental impacts such as ecosystem destruction, displacement of communities or water shortages.

18.335 gram/kWh is the average level of coal consumption by coal-fired plants in developed countries. Please refer to http://www.ndrc.gov.cn/mtbd/t20070226_118219.htm

19.European Renewable Energy Council, Greenpeace, *Energy Revolution: A Sustainable Global Energy Outlook*, 2008

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