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# Market Research Report of Coal Industry in China

2007

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Beijing HL Consulting Co., Ltd



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## Table of Contents

1 Energy production and consumption in China .....	4
2 China coal resources, quality and distribution .....	9
2.1 China coal resources.....	9
2.1.1 Coal geology .....	9
2.1.2 Coal reserves and distribution .....	13
2.2 China coal quality .....	21
2.2.1 Coal rank classification .....	21
2.2.2 Sulfur content .....	22
2.2.3 Ash content.....	24
2.2.4 Calorific Value .....	24
3 Coal production.....	24
3.1 Raw coal production .....	24
3.1.1 Overview of raw coal output in China in 2005 .....	25
3.1.1.1 Raw coal output in China according to statistics of CHINA NATIONAL COAL ASSOCIATION.....	25
3.1.1.2 Raw coal output in China according to statistics of State Bureau of Statistics P.R.C.....	31
3.1.2 Raw coal output by province in 2005.....	36
3.1.3 Output of raw coal of central government-controlled key coalmines in 2005.....	46
3.1.4 Output of raw coal of local government-owned coalmines in 2005\ .....	51
3.1.5 Output of raw coal of township and private coalmines in 2005.....	52
3.1.6 Output of key state-owned enterprises .....	54
3.2 Washed coal output.....	61
3.2.1 Washed coal output by province in 2005.....	61
3.2.2 Washed coal output by enterprises .....	69
3.3 Coal Output and sales of Shanxi Province in 2005 .....	76
3.3.1 Coal output of Shanxi Province .....	76
3.3.2 Coal output and sales of key mines in Shanxi Province.....	76
3.3.3 Coal output and sales of non-key mines in Shanxi Province .....	77
3.3.4 Sales flows of Jincheng coal by industry in Shanxi .....	79
3.3.5 Sales flows of Jincheng coal by province in Shanxi .....	79
3.4 Production Costs .....	80
3.5 Coal Supply and Demand Balance.....	80
3.6 Future Production Forecast .....	85
3.7 Concentration Degree of China Coal Industry .....	85
3.8 Coal stock .....	86
4 Analysis of the Coke Market in 2006.....	89
4.1 Coke output in 2006 .....	89
4.1.1 Annual coke output by province from 2001 to 2006 in China .....	89
4.1.2 Output of coke by enterprise in 2006 .....	96
4.2 Coke price in 2006.....	98
4.3 Coke consumption from 2005 to 2006.....	101
4.4 Coke import and export in 2006 .....	103
4.5 Forecast of the coke supply and demand .....	105
4.6 Forecast of coke demand .....	107
4.7 Forecast of coke price.....	108
4.8 Forecast of coke export .....	112
4.9 Forecast of international market.....	113
4.10 Measures: Overall control .....	114
5 Coal consumption and coal sales .....	115
5.1 Historical coal consumption analysis.....	115
5.2 Coal consumption by industries in China .....	119

5.2.1	Coal consumption of thermal power industry in China.....	121
5.2.2	Coal consumption of steel industry in China .....	123
5.2.3	Coal consumption of chemical industry in China .....	124
5.3	Coal sales .....	124
5.3.1	Coal sales by province.....	124
5.3.2	Coal sales by enterprises .....	126
6	Coal transportation.....	131
6.1	Coal transportation of 2007 in China .....	131
6.2	Coal transportation of 2006 in China .....	133
6.3	Coal ports.....	144
7	Coal price .....	146
7.1	Average reference prices of raw coal of state-owned mines.....	146
7.2	Average Coal Prices at Qinhuangdao Port,2003-2007 .....	150
7.2	Monthly coal price in Shanxi province .....	163
7.4	Monthly Coal Prices in Tianjin.....	169
7.5	Monthly Coal Prices in Shanghai .....	170
7.6	Monthly Coal Prices in Guangzhou.....	171
8	Coal imports and exports .....	172
8.1	Overview of coal imports and exports in China.....	172
8.2	Statistics of coal imports and exports in China.....	173
8.2.1	Export.....	173
8.2.2	Import.....	181
9	Economic indicators of coal mining and washing in China in 2006.....	184
9.1	Overall indicators of industry ( Total number of enterprises,Total number of loss-making Enterprises,Total Loss of loss-making Enterprises ) .....	184
9.1.1.	Total number of enterprises .....	184
9.1.2.	Total number of loss-making Enterprises.....	186
9.1.3.	Total loss of loss-making Enterprises.....	187
9.1.4.	The total average number of employees.....	190
9.2	Revenue, cost, expenditure and profit indicato .....	193
9.2.1.	Sales revenue of products.....	193
9.2.2.	Sales cost of product .....	200
9.2.3.	Sales expenditure of product .....	203
9.2.4.	Accumulative total product sales taxes and Add-ons .....	206
9.2.5.	Accumulative total profit .....	209
9.2.6.	Accumulative total Finance charge .....	212
9.2.7.	Accumulative total administrative expenses .....	215
9.2.8.	Accumulative Total tax .....	218
9.2.9.	Ratio of Creditors' Equity of Current Year to that of Previous Year.....	221
9.2.10.	Ratio of profit to cost .....	224
9.2.11.	Accumulated net account receivable.....	227
9.2.12.	Accumulated finished products.....	230
9.2.13.	Ratio of Per-tax Profits to Gross Output Value(%) .....	233
9.2.14.	Ratio of Profit to Capital .....	236
9.3	Asset-liability indicators.....	239
9.3.1.	Total assets .....	239
9.3.2.	Total liability .....	242
9.3.3.	The average balance of net fixed assets .....	245
9.3.4.	Accumulated average current assets balance .....	248
9.3.5.	Current assets turnover.....	251
9.3.6.	Ratio of capital use of finished products .....	254
9.3.7.	Debt to assets ratio .....	257
10.	Economic indicators analysis of China's coking industry .....	261
10.1	Basic conditions of China's coking industry.....	261
10.1.1	Number of enterprises .....	261
10.1.2	Number of loss making enterprises.....	263
10.1.3	Loss amount of loss making enterprises.....	265

10.1.4 Number of total employees .....	269
10.2 Assets and liability conditions of China's coking industry in 2006 .....	273
10.2.1 Total asset .....	273
10.2.2 Total liability .....	276
10.2.3 average balance of net fixed assets .....	278
10.2.4 Average balance of floating assets .....	281
10.3 Revenue, cost, expenditure and profit conditions of China's coking industry in 2006 .....	284
10.3.1 Sales revenue .....	284
10.3.2 Sales cost .....	286
10.3.3 Sales expense .....	289
10.3.4 value-added tax and extra charge .....	291
10.3.5 Accumulative Net accounts receivable .....	294
10.3.6 Accumulative finished products .....	297
10.3.7 Accumulative administrative expense .....	299
10.3.8 Accumulative financial expense .....	302
10.3.9 Accumulative profit .....	305
10.3.10 Accumulative tax .....	307
10.4 Economic indicators of China's coking industry .....	310
10.4.1 Capital maintenance and increment ratio .....	310
10.4.2 Debt to assets ratio .....	313
10.4.3 Ratio of output value to profit and tax .....	315
10.4.4 Profitability to capital ratio .....	318
10.4.5 Turnover frequency of floating assets .....	320
10.4.6 Sales rate Per capita .....	323
10.4.7 Funds occupancy rate of finished product .....	325
<b>11 Economic indicators of coal mining and washing owners in China .....</b>	<b>328</b>
11.1 Overall indicators of industry (Total number of enterprises, Total number of loss-making Enterprises, Total Loss of loss-making Enterprises) .....	328
11.1.1 Total number of enterprises .....	328
11.1.2 Total number of loss-making Enterprises .....	329
11.1.3 Total Loss of loss-making Enterprises .....	331
11.1.4 The average total number of employees .....	333
11.2 Revenue, cost, expenditure and profit indicator .....	335
11.2.1 Sales revenue of product .....	335
11.2.2 Sales cost of product .....	338
11.2.3 Sales expenditure of product .....	342
11.2.4 Accumulative total product sales taxes and Add-ons .....	346
11.2.5 Accumulative total profit .....	349
11.2.6 Accumulative total Finance charge .....	351
11.2.7 Accumulative total administrative expenses .....	355
11.2.8 Accumulative Total tax .....	359
11.2.9 Ratio of Profits to Cost .....	363
11.3 Asset-liability indicators .....	365
11.3.1 Total Assets .....	365
11.3.2 Total Liability .....	369
11.3.3 The average balance of net fixed assets .....	373
11.3.4 Debt to assets ratio .....	377
11.4 Economic indicator of ten former enterprise of China's coal mining and washing owners .....	379
Tables .....	390
Figures .....	399
Appendix 1 .....	400
Appendix 2 .....	403

## Tables

Table 1	Composition of energy consumption in China in 2005.....	4
Table 2	Energy consumption in China from 1952 to 2006 .....	5
Table 3	Energy production in China from 1952 to 2004 .....	7
Table 4	Composition of energy production in China, 1952- 2005 .....	7
Table 5	Major Coal-Forming Basins and their Resources.....	12
Table 6	China's Proved-up Coal Reserves & the Distribution up to the End of 1997 13	
Table 7	Coal Resources and Their Distribution in China (Between 0 and 2000 m in depth)	16
Table 8	Distribution of Coal Ranks and Their Predicted Resources in China .....	18
Table 9	Demonstrated and Recoverable Reserves of Different Aged Coal in Different Provinces	20
Table 10	Distribution of Coal Ranks and Their Reserves and Resources by Provinces and Regions	22
Table 11	Distribution of Total Sulfur in China's Coal Resources .....	23
Table 12	Distribution of Total Sulfur in China's Commercial Coal .....	23
Table 13	Accumulation production of coal in China from January to April, 2007 .....	26
Table 14	Main indicators of China's coal production in 2006.....	26
Table 15	China's coal production from January to December, 2006 (by Province , unit 10 thousand tons).....	26
Table 16	Major indicators of Coal production of China in 2005 .....	28
Table 17	Monthly output of raw coal in China in 2005(Source: CHINA NATIONAL COAL ASSOCIATION).....	28
Table 18	Historical Outputs of Raw Coal by Provinces,2000 to 2004 (Mil.tons) .....	29
Table 19	China's Raw Coal Production ,1994 to 2005 (Bt).....	29
Table 20	China's Raw Coal Production and its Growth,1980 to 2005.....	30
Table 21	Statistics of Raw Coal Outputs by Coal Rank,1990 to 2004 .....	30
Table 22	Crude coal production and growth rate in Jan.-Dec., 2006.....	31
Table 23	The gross value of industrial output of coal industry in Jan. - Dec., 2006.....	32
Table 24	Raw Coal Output in China in 2006 .....	33
Table 25	Raw Coal Output in China in 2005 .....	34
Table 26	Monthly output of raw coal in China in 2005(Source: State Bureau of Statistics P.R.C) .....	36
Table 27	Monthly output of raw coal in Hebei Province in 2005.....	36
Table 28	Monthly output of raw coal in Jilin Province in 2005 .....	36
Table 29	Monthly output of raw coal in Jiangsu Province in 2005.....	37
Table 30	Monthly output of raw coal in Fujian Province in 2005 .....	37
Table 31	Monthly output of raw coal in Chongqing City in 2005 .....	38
Table 32	Monthly output of raw coal in Guangdong province in 2005.....	38
Table 33	Monthly output of raw coal in Xinjiang province in 2005 .....	38
Table 34	Monthly output of raw coal in Qinghai province in 2005.....	39
Table 35	Monthly output of raw coal in Henan province in 2005 .....	39
Table 36	Monthly output of raw coal in Jiangxi province in 2005 .....	39
Table 37	Monthly output of raw coal in Heilongjiang province in 2005.....	40
Table 38	Monthly output of raw coal in Zhejiang province in 2005.....	40
Table 39	Monthly output of raw coal in Beijing City in 2005 .....	40
Table 40	Monthly output of raw coal in Shanxi Province in 2005.....	41
Table 41	Monthly output of raw coal in Hubei Province in 2005.....	41
Table 42	Monthly output of raw coal in Guangxi Province in 2005.....	42
Table 43	Monthly output of raw coal in Sichuan Province in 2005.....	42
Table 44	Monthly output of raw coal in Ningxia Province in 2005.....	42

Table 45	Monthly output of raw coal in Shaanxi Province in 2005.....	43
Table 46	Monthly output of raw coal in Shandong Province in 2005.....	43
Table 47	Monthly output of raw coal in Hunan Province in 2005.....	43
Table 48	Monthly output of raw coal in Gansu Province in 2005.....	44
Table 49	Monthly output of raw coal in Inner Mongolia Province in 2005.....	44
Table 50	Monthly output of raw coal in Guizhou Province in 2005.....	44
Table 51	Monthly output of raw coal in Anhui Province in 2005.....	45
Table 52	Raw coal output by province in 2005 by province(Soruce:CHINA NATIONAL COAL ASSOCIATION).....	45
Table 53	Output of raw coal of central government-controlled key coalmines in 2006	46
Table 54	Output of raw coal of central government-controlled key coalmines in 2005	47
Table 55	Raw Coal Production of Key government coalmines (1996-2005).....	47
Table 56	Output growth by type of coalmines in China, 1981 to 2005.....	49
Table 57	Monthly output of raw coal of government-controlled key coal mines in China in 2004	49
Table 58	Monthly output of raw coal of government-controlled key coal mines in China in 2004(continued).....	50
Table 59	Raw coal output of key state mines in China in 2004.....	50
Table 60	Raw coal output of local government-owned coalmines in 2006.....	51
Table 61	Raw coal output of local government-owned coal mines ,1996-2005.....	51
Table 62	Raw coal output of local government-owned coalmines in 2005.....	52
Table 63	Accumulative output of raw coal of township and private coalmines in 2006.....	52
Table 64	Output of raw coal of township and private coalmines in 2005.....	53
Table 65	Historical output of raw coal of township and private coalmines (1996-2005)	53
Table 66	Monthly output of raw coal of township and private coalmines in China in 2004	53
Table 67	Monthly output of raw coal of village or private owned mines in China in 2004(continued).....	54
Table 68	Output of raw coal, commercial coal, inventory of state-owned enterprises in 2005	54
Table 69	Output of key state-owned enterprises in 2004 (10kt).....	56
Table 70	Output of top 8 coal enterprises in 2005 in China.....	59
Table 71	Rank of Output of key state-owned enterprises in 2004 (10kt).....	59
Table 72	Monthly output of washed coal in China in 2005.....	61
Table 73	Monthly output of washed coal in Jilin province in 2005.....	61
Table 74	Monthly output of washed coal in Jiangsu province in 2005.....	61
Table 75	Monthly output of washed coal in Hebei province in 2005.....	62
Table 76	Monthly output of washed coal in Yunnan province in 2005.....	62
Table 77	Monthly output of washed coal in Xinjiang province in 2005.....	62
Table 78	Monthly output of washed coal in Chongqing City in 2005.....	63
Table 79	Monthly output of washed coal in Henan province in 2005.....	63
Table 80	Monthly output of washed coal in Shaanxi province in 2005.....	64
Table 81	Monthly output of washed coal in Ningxia province in 2005.....	64
Table 82	Monthly output of washed coal in Sichuan province in 2005.....	64
Table 83	Monthly output of washed coal in Jiangxi province in 2005.....	65
Table 84	Monthly output of washed coal in Heilongjiang province in 2005.....	65
Table 85	Monthly output of washed coal in Shanxi province in 2005.....	65
Table 86	Monthly output of washed coal in Inner Mongolia province in 2005.....	66
Table 87	Monthly output of washed coal in Liaoning province in 2005.....	66
Table 88	Monthly output of washed coal in Anhui province in 2005.....	67
Table 89	Monthly output of washed coal in Shandong province in 2005.....	67
Table 90	Monthly output of washed coal in Hunan province in 2005.....	67
Table 91	Monthly output of washed coal in Gansu province in 2005.....	68
Table 92	Monthly output of washed coal in Guizhou province in 2005.....	68

Table 93	Washed coal output by province in 2004(tons).....	69
Table 94	Washed Coal Production by enterprises of China in 2004.....	69
Table 95	Monthly Washed Coal Production of central government-controlled key coal mines of China in 2004.....	72
Table 96	Monthly Washed Coal Production of central government-controlled key coal mines of China in 2004.....	73
Table 97	Raw and Washed Coal Production by enterprises of China in 2003.....	73
Table 98	Coal output and Sales of Shanxi Province from Jan to Dec in 2005 (Unit: Ten thousand Ton) .....	76
Table 99	Coal output and Sales of key mines in Shanxi Province from Jan to Dec in 2005 (Unit: Ten thousand Ton) .....	76
Table 100	Coal output and Sales of non-key mines in Shanxi Province from Jan to Dec in 2005 (Unit: Ten thousand Ton) .....	77
Table 101	Sales flows of Jincheng coal by industry in Shanxi, 2005.....	79
Table 102	Sales flows of Jincheng coal By province in Shanxi, 2005.....	79
Table 103	Coal economy operation indicators in 2006.....	81
Table 104	Coal stock of all mines, central government-controlled key coalmine, central government-controlled local coalmines.....	86
Table 105	Coal stock of township and private coalmines, local government-owned coalmines, Jan 2003-Apr,2007 .....	88
Table 106	Output of coke of scale above enterprises by province in December 2006 in China Unit: 10, 000tons .....	90
Table 107	Output of coke of scale above enterprises by province in December 2005 in China Unit: 10, 000tons .....	91
Table 108	Output of coke by province in December 2004 in China (ton) .....	92
Table 109	Output of Coke produced by Mechanized Coke Oven by province in China in 2004 (ton) 92	
Table 110	Output of Coke produced by Mechanized Coke Oven by province in December 2003.....	93
Table 111	Output of Coke produced by Mechanized Coke Oven by province in December 2002.....	94
Table 112	Output of coke by month in 2001 .....	95
Table 113	Output of coke by province in 2001 .....	95
	(Unit: ton) .....	95
Table 114	Output of Coke produced by Mechanized Coke Oven of main enterprises in 2006 96	
Table 115	Changes in the Coke Price Index .....	100
Table 116	Coke Consumption in Major Sectors 2001-2006.....	101
Table 117	Comparison between the total coke export volume in tons and in US dollars 104	
Table 118	Statistics on China's Coke Export in Each Custom.....	104
Table 119	Forecast the consumption of coke of major industries in 2007-2011 .....	107
Table 120	Coal Consumption from 1995 to 2004 .....	115
Table 121	Statistics of Coal Consumption in China by Provinces from 1992 to 1995 117	
Table 122	Statistics of Coal Consumption of China by Provinces from 1996 to 1997 118	
Table 123	Coal Consumption by Industrial Sectors of Coal from key State Coal Mines from 1995 to 2000 .....	120
Table 124	Output of major coal-consuming industries In 2004(Unit: Mt) .....	121
Table 125	Total Installed capacity, fossil,hydro generating capacity in China ,1998-2005(Unit: 10 <sup>8</sup> Kwh) .....	121
Table 126	Annual Electricity Generation in China,1990-2005(Unit: 10 <sup>8</sup> Kwh).....	121
Table 127	Fossil Electricity Generation in 2004 by province.....	122
Table 128	Sales Revenue and total profits of Coal Industry by province in 2004(Unit: RMB1000 yuan ).....	124
Table 129	Coal sales of state-owned key mines in 2004.....	125
Table 130	Output of raw coal, commercial coal, inventory of state-owned enterprises in 2006	

	126	
Table 131	Coal sales of key stated-owned enterprises in 2004 .....	128
Table 132	Railway Coal Transportation of Jan.-Apr. in China (10,000 tons, %)	132
Table 133	Coal transportation by railway, Jan,2004-Apr,2007 .....	137
Table 134	Coal Transportation by Railways in China, 1981-2004(10000 tons) .....	139
Table 135	Coal Transportation by Railways in 2002 & 2003.....	139
Table 136	Coal Transportation by Railways in 2001 & 2002.....	140
Table 137	Coal Transportation by Railways in 2000 & 2001.....	140
Table 138	China's Coal Transportation Statistics from 1990 to 1999 .....	140
Table 139	Monthly coal transportation by railway in China in 2005 (Unit:10 <sup>4</sup> tons).....	141
Table 140	Coal transportation and trade of state-owned key mines in 2004 .....	143
Table 141	Coal stockpiles of different producers in December, 2004.....	144
Table 142	Mean Prices of Raw Coal of China from 1990 to 2006 .....	148
Table 143	Monthly coal price of state-owned key coal mines, 2003-2005.....	149
Table 144	Average Coal Prices at Qinhuangdao Port,2003-2007 .....	150
Table 145	Monthly coal price in Shanxi province by region, Jan., 2005- Dec., 2005.	164
Table 146	Monthly coal price in Shanxi province by region, Jan., 2004- Dec., 2004.	167
Table 147	Monthly export of coal in China,Jan. to Dec. in 2005 .....	173
Table 148	Import and export of coal in China by coal type in 2005 .....	174
Table 149	Comparison of volume and value of coal between 2005 and 2004.....	174
Table 150	Coal exports by country/district in December, 2005.....	175
Table 151	Details of coal exports by country in 2004 .....	177
Table 152	Coke exports of China in December, 2005.....	179
Table 153	coal imports of China in 2005 .....	181
Table 154	Origin and price of import of coal in 2005 by coal type.....	182
Table 155	Total number of enterprises of China's coal mining and washing owners from Jan to Dec in2006 (Data of each month by province) .....	184
Table 156	Total number of loss-making Enterprises of China's coal mining and washing owners from Jan to Dec in2006 (Data of each month by province) .....	186
Table 157	Total loss of loss-making Enterprises of China's coal mining and washing owners from Jan to Dec in2006 (Data of each month by province Unit:1000Yuan) .....	187
Table 158	Growth of total loss of loss-making Enterprises of China's coal mining and washing owners from Jan to Dec in2006 (Data of each month by province Unit:%) .....	189
Table 159	The total average number of employees of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province) .....	190
Table 160	Growth of total average number of employees of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province) % .....	192
Table 161	Sales revenue of China's mining and washing owners from Jan to Dec in2006(Data of each month by province,Unit:1000Yuan) .....	193
Table 162	Growth of sales revenue of China's mining and washing owners from Jan to Dec in2006 (Data of each month by province,Unit:%) .....	195
Table 163	Average sales ratio of China's coal mining and washing in 2006(unit Yuan) .....	196
Table 164	Best average sales ratio of China's coal mining and washing in 2006(unit Yuan)	198
Table 165	Sales cost of product of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan) .....	200
Table 166	.....	201
Table 167	Growth of sales cost of product of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%) .....	202
Table 168	Sales expenditure of product of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan) .....	203
Table 169	Growth of Sales expenditure of product of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%) .....	205
Table 170	Accumulative total product sales taxes and Add-ons of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan) .	206
Table 171	Growth of Accumulative total product sales taxes and Add-ons of China's coal	

mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	208
Table 172 Accumulative total profit of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	209
Table 173 Accumulative total profit of China's coal mining and washing owners from Jan to Dec in 2005 (Data of each month by province,Unit:1000 Yuan)	211
Table 174 Accumulative total Finance charge of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	212
Table 175 Growth of Accumulative total Finance charge of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	214
Table 176 Accumulative total administrative expenses of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000yuan)	215
Table 177 Growth of Accumulative total administrative expenses of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	217
Table 178 Accumulative total tax of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	218
Table 179.....	220
Table 180 Growth of Accumulative total tax of China's coal mining and washing owners from Jan to Dec in 2006 Compared with the same period last year (Data of each month by province,Unit:%)	220
Table 181 Ratio of creditors equity of current year to that of previous year of China's coal mining and washing in 2006	221
Table 182 Best ratio of creditors equity of current year to that of previous year of China's coal mining and washing in 2006 (%)	223
Table 183 Ratio of profit to cost of China's coal mining and washing in 2006 (by province, unit %)	224
Table 184 Best ratio of profit to cost of China's coal mining and washing in 2006	226
Table 185 Accumulated net account receivable of China's coal mining and washing in 2006 (unit 1000Yuan)	227
Table 186 Growth of Accumulated net account receivable of China's coal mining and washing in 2006 (unit:%)	229
Table 187 Accumulated finished products of China's coal mining and washing industry in 2006 (unit 1000 Yuan)	230
Table 188 Growth of Accumulated finished products of China's coal mining and washing industry in 2006 (unit 1000 Yuan%)	231
Table 189 Ratio of Per-tax Profits to Gross Output Value(%)of China's coal mining and washing industry in 2006	233
Table 190 Best Ratio of Per-tax Profits to Gross Output Value(%)of China's coal mining and washing industry in 2006	234
Table 191 Ratio of Profit to Capital(%) of China's coal mining and washing industry in 2006	236
Table 192 Best Ratio of Profit to Capital(%) of China's coal mining and washing industry in 2006 (%)	237
Table 193 Total Assets of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	239
Table 194 Growth of Total Assets of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	241
Table 195 Total Liability of net fixed assets of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	242
Table 196 Growth of Total Liability of net fixed assets of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	244
Table 197 The average balance of net fixed assets of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:1000Yuan)	245
Table 198.....	247
Table 199 Growth of The average balance of net fixed assets of China's coal mining and	

washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	247
Table 200 Accumulated average current assets balance of China's coal mining and washing owners from Jan to Dec in 2006(unit 1000 Yuan)	248
Table 201 Growth of Accumulated average current assets balance of China's coal mining and washing owners from Jan to Dec in 2006(unit%)	250
Table 202 Current assets turn over of China's coal mining and washing owners from Jan to Dec in 2006	251
Table 203 Best current assets turn over of China's coal mining and washing owners from Jan to Dec in 2006	253
Table 204 Ratio of capital use of finished products of China's coal mining and washing owners from Jan to Dec in 2006	254
Table 205 Best Ratio of capital use of finished products of China's coal mining and washing owners from Jan to Dec in 2006 %	256
Table 206 Debt to assets ratio of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	257
Table 207 Best debt to assets ratio of China's coal mining and washing owners from Jan to Dec in 2006 (Data of each month by province,Unit:%)	259
Table 208 Number of enterprises of China's coking industry in 2006	261
Table 209 Number of loss making enterprises of China's coking industry in 2006	263
Table 210 loss amount of loss making enterprises of China's coking industry in 2006	265
Table 211 Growth of loss amount of loss making enterprises of China's coking industry in 2006 compared with the same period of last year	267
Table 212 Number of employees of China's coking industry in 2006	269
Table 213 Growth of Number of employees of China's coking industry in 2006 compared with the same period of last year	271
Table 214 Total assets of China's coking industry in 2006	273
Table 215 Growth of Total assets of China's coking industry in 2006 compared with the same period of last year	275
Table 216 Total liability of China's coking industry in 2006	276
Table 217 Growth of Total liability of China's coking industry in 2006 compared with the same period of last year	277
Table 218 average balance of net fixed assets of China's coking industry in 2006	278
Table 219 Growth of average balance of net fixed assets of China's coking industry in 2006 compared with the same period of last year	280
Table 220 average balance of floating assets of China's coking industry in 2006	281
Table 221 Growth of average balance of floating assets of China's coking industry in 2006 compared with the same period of last year	282
Table 222 Sales revenue of China's coking industry in 2006	284
Table 223 Growth of Sales revenue of China's coking industry in 2006 compared with the same period of last year	285
Table 224 Sales cost of China's coking industry in 2006	286
Table 225 Growth of Sales cost of China's coking industry in 2006 compared with the same period of last year	288
Table 226 Sales expenditure of China's coking industry in 2006	289
Table 227 Growth of Sales expenditure of China's coking industry in 2006 compared with the same period of last year	290
Table 228 value-added tax and extra charge of China's coking industry in 2006	291
Table 229 Growth of value-added tax and extra charge of China's coking industry in 2006 compared with the same period of last year	293
Table 230 Accumulative Net accounts receivable of China's coking industry in 2006	294
Table 231 Growth of Accumulative Net accounts receivable of China's coking industry in 2006 compared with the same period of last year	295
Table 232 Accumulative finished products of China's coking industry in 2006	297
Table 233 Accumulative administrative expense of China's coking industry in 2006	298
Table 234 Accumulative administrative expense of China's coking industry in 2006	299

Table 235	Growth of Accumulative administrative expense of China's coking industry in 2006 compared with the same period of last year .....	301
Table 236	Accumulative financial expense of China's coking industry in 2006.....	302
Table 237	Growth of Accumulative financial expense of China's coking industry in 2006 compared with the same period of last year .....	303
Table 238	Accumulative profit of China's coking industry in 2006.....	305
Table 239	Accumulative profit of China's coking industry in 2006 by this month since last year	306
Table 240	Accumulative tax of China's coking industry in 2006 .....	307
Table 241	Growth of Accumulative tax of China's coking industry in 2006 compared with the same period of last year .....	309
Table 242	Capital maintenance and increment ratio of China's coking industry in 2006	310
Table 243	The best level of Capital maintenance and increment ratio of China's coking industry in 2006 .....	311
Table 244	Debt to assets ratio of China's coking industry in 2006.....	313
Table 245	The best level of Debt to assets ratio of China's coking industry in 2006..	314
Table 246	Ratio of output value to profit and tax of China's coking industry in 2006 .	315
Table 247	The best level of Ratio of output value to profit and tax of China's coking industry in 2006 .....	316
Table 248	Profitability to capital ratio of China's coking industry in 2006.....	318
Table 249	The best level of Profitability to capital ratio of China's coking industry in 2006	319
Table 250	Turnover frequency of floating assets of China's coking industry in 2006.	320
Table 251	The best level of Turnover frequency of floating assets of China's coking industry in 2006 .....	321
Table 252	Sales rate Per capita of China's coking industry in 2006 .....	323
Table 253	The best level of Sales rate Per capita of China's coking industry in 2006	324
Table 254	Funds occupancy rate of finished product of China's coking industry in 2006	325
Table 255	The best level of Funds occupancy rate of finished product of China's coking industry in 2006 .....	326
Table 256	Total number of enterprises of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province) .....	328
Table 257	Total number of loss-making Enterprises of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province) .....	329
Table 258	Total Loss of loss-making Enterprises of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province Unit:1000Yuan) ....	331
Table 259	The average total number of employees of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province) .....	333
Table 260	Sales revenue of product of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	335
Table 261	Growth of Sales revenue of product of China's coal mining and washing owners from Jan to Dec in 2005 Compared with the same period last year (Data of each month by province,Unit:%) .....	336
Table 262	Sales cost of product of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	338
Table 263	Growth of Sales cost of product of China's coal mining and washing owners from Jan to Dec in 2005 Compared with the same period last year (Data of each month by province,Unit:%) .....	340
Table 264	Sales expenditure of product of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	342
Table 265	Growth of Sales expenditure of product of China's coal mining and washing owners from Jan to Dec in 2005 Compared with the same period last year (Data of each month by province,Unit:%) .....	344

Table 266	Accumulative total product sales taxes and Add-ons of China's coal mining and washing owners from Jan to Dec in2005 ( Data of each month by province,Unit:1000Yuan) .....	346
Table 267	Growth of Accumulative total product sales taxes and Add-ons of China's coal mining and washing owners from Jan to Dec in 2005 Compared with the same period last year (Data of each month by province,Unit:%) .....	347
Table 268	Accumulative total profit of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	349
Table 269	Accumulative total Finance charge of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) ....	351
Table 270	Growth of Accumulative total finace charge of China's coal mining and washing owners from Jan to Dec in 2005 Compared with the same period last year (Data of each month by province,Unit:%) .....	353
Table 271	Accumulative total administrative expenses of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000yuan)	355
Table 272	Growth of Accumulative total administrative expenses of China's coal mining and washing owners from Jan to Dec in2005Compared with the same period last year (Data of each month by province,Unit:%) .....	357
Table 273	Accumulative total tax of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	359
Table 274	Growth of Accumulative total tax of China's coal mining and washing owners from Jan to Dec in2005Compared with the same period last year (Data of each month by province,Unit:%) .....	361
Table 275	Ratio of Profits to Cost of net fixed assets of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:%) ...	363
Table 276	Total Assets of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	365
Table 277	Growth of Total assets of China's coal mining and washing owners from Jan to Dec in2005Compared with the same period last year (Data of each month by province,Unit:%) .....	367
Table 278	Total Liability of net fixed assets of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) .....	369
Table 279	Growth of Total Liability of China's coal mining and washing owners from Jan to Dec in2005Compared with the same period last year (Data of each month by province,Unit:%) .....	371
Table 280	The average balance of net fixed assets of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:1000Yuan) ....	373
Table 281	Growth of The average balance of net fixed assets of China's coal mining and washing owners from Jan to Dec in2005Compared with the same period last year (Data of each month by province,Unit:%) .....	375
Table 282	Debt to assets ratio of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province,Unit:%) .....	377
Table 283	Sales revenue,profit,total acess,total numer of employees of China's coal mining and washing owners from Jan to Dec in2005 (Data of each month by province)	379
Table 284	Monthly Statistics of Volume of Coke Export of China in 2005(Kg).....	380
Table 285	Monthly Statistics of Value of Coke Export of China in 2005(USD).....	380
Table 286	Monthly Statistics of Volume of Anthracite import of China in 2005(Kg)....	380
Table 287	Monthly Statistics of Value of Anthracite import of China in 2005(USD)....	381
Table 288	Monthly Statistics of Volume of Anthracite export of China in 2005(Kg)....	381
Table 289	Monthly Statistics of Value of Anthracite export of China in 2005(USD)....	382
Table 290	Monthly Statistics of Volume of coking coal import of China in 2005(Kg)...	382
Table 291	Monthly Statistics of Value of coking coal import of China in 2005(USD)...	383

Table 292	Monthly Statistics of Volume of coking coal export of China in 2005(Kg)..	383
Table 293	Monthly Statistics of Value of coking coal export of China in 2005(USD)..	384
Table 294	Statistics of Coal Export of China from 1995 to 2004 .....	385
Table 295	China's Coal importation and exportation in 2004 and 2003 (MMt).....	386
Table 296	Coal export by enterprises in 2003 and 2004 .....	387
Table 297	Coal export by enterprises from 2001 to 2002.....	388
Table 298	Coal Export by Enterprises in December and Whole Year 2001 .....	388
Table 299	Coal export by by destination in 2003 and 2004 .....	389

## Figures

Figure 1	Energy consumption in China, 2001-2006.....	4
Figure 2	Composition of energy production in China in 2004 .....	6
Figure 3	Energy production in China from 1952 to 2005 .....	6
Figure 4	Distribution of China's Demonstrated Reserves by Regions .....	10
Figure 5	Coal resources in China .....	17
Figure 6	Coal Rank Mix of China.....	21
Figure 7	China's Raw Coal Production ,1994 to 2005 .....	30
Figure 8	Monthly production and growth trends of crude coal, 2004-2006.....	32
Figure 9	Monthly accumulative production and growth trends of crude coal, 2004-2006....	32
Figure 10	Monthly accumulative gross value of industrial output and growth trends of coal industry, 2004-2006 .....	33
Figure 11	Raw coal production in China by type of enterprises.....	48
Figure 12	Trend of China's Coke Output 2001-2006 (10, 000 tons .....	89
Figure 13	Trend of China's Coke Monthly Output in 2006 (10, 000 tons) .....	90
Figure 14	Price Trend of Grade II Metallurgical Coke in China (Yuan/ton) .....	101
Figure 15	China's Coke Consumption in Major Sectors 2005-2006 .....	102
Figure 16	Coke Rate (kg/t) of Steel Enterprises 1993-2006.....	103
Figure 17	Forecast on the Coke Output in China (10,000 tons) .....	107
Figure 18	Coal Consumption from 1995 to 2004 .....	115
Figure 19	Coal consumption, by province, 1999 .....	119
Figure 20	Coal consumption of thermal power industry in China(Unit:10 <sup>8</sup> tons).....	123
Figure 21	Coal consumption of steel industry in China(Unit:10 <sup>8</sup> tons).....	123
Figure 22	Coal consumption of chemical industry in China (Unit:10 <sup>8</sup> tons) .....	124
Figure 23	Location of China's Major Ports .....	146
Figure 24	Monthly average price of commercial coal of State-run Mines in 2006 .....	147
Figure 25	Monthly average price of thermal coal of State-run Mines in 2006.....	148
Figure 26	Datong therma coal price(6000, tax not included ),Jan 06-Apr,04(Yuan/t) 163	
Figure 27	Minehead pric of Tianyuan thermal coal (6300, tax not included ),Dec 04-Apr,04 (Yuan/t).....	163
Figure 28	Minehead pric of Shanxi coking coal,Jan 05-Apr,04 (Yuan/t) .....	164
Figure 29	Minehead pric of anthracite coal,Jan 05-Apr,04 (Yuan/t).....	164
Figure 30	Coal Export of China,1995 to 2005.....	385
Figure 31	International coal trade of China in 2004 .....	386

## Appendix 1

According to *the Regulation of Coal Exploration* issued by the Committee of China Mineral Resources in 1986, coal resources are categorized into usable reserves and useless reserves.

**Coal resources:** The estimates cover all coal existing on the earth, which can be economically exploited and which may not be reasonable prospects for economic extraction at this stage, but probably in the future.

**Useable reserves:** The coal resources that can be used under the present-day mining technological and economic conditions.

**Useless reserves:** The coal resources which can not be economically utilized under the current mining technology without causing problems of legislation and environments, because they are of too small thickness, or too high ash content, or too difficult to be mined as results of the complication of the geological and hydrogeological conditions.

In turn, the *Useable reserves* can also be divided into demonstrated reserves and recoverable or available reserves:

**Demonstrated (or proven) reserves:** The part of useable reserves which was measured and estimated by means of geological mapping, drilling, sampling and other geophysical investigation etc., and then was re-examined and approved by the authority of mineral resources of China (i.e., State Ore Reserve Committee). This category can be divided into A, B, C and D grade, based on degree of exploration.

**Recoverable reserves** The currently remained demonstrated reserves of a given coalfield or a given mining area that is calculated from:

Recoverable reserves = Total demonstrated reserves –/+ Adjustment - Mined amount – Loss during the mining – Other reductions

Where the total demonstrated reserves is the reserves reported in the final exploration documents; the adjustment signifies the reserve change resulted during the re-examination of SORC, the mined amount is the updated outputs from this area/mine, and the coal loss during the mine includes all coal which are left underground and will never be mined as natural and technological reasons, which depends on mining methods. Other reduction may include all allowances for loss and dilution occurring during the coal exploitation. This category can be divided into A, B, C and D grades, based on the density of controlling points.

Recoverable reserves are changeable in the mining districts.

Based on degree of geological exploration and research (Level A through C), referring to the current condition of technology and economics as well as demand of coal mining planning and design, the **demonstrated reserves** can be classified into A, B, C, and D, among of which A and B are the advanced reserves.

**Grade A reserves (GA)** the reserves based on data obtained at the precise exploration stage (Level A) from strictly controlling and detailed geological research. They provide a highest level of confidence in the deposit sufficient for detailed mine plan and provide specifications for a marketable production (likely correcting to measured reserve in Australia).

**Grade B reserves (GB)** the reserves based on data obtained at the stages of the detailed exploration (Level B) and the precise exploration (Level A) from the systematic explorative controlling and precise geological research. They provides a higher level of confidence in the deposit sufficient to generate mine plans and determine the likely quality of product coal (likely correcting to the indicated reserves in Australia).

**Grade C reserves (GC)** the reserves based on data obtained from less controlled areas during the different stages from the reconnaissance (Level C) to precise exploration (Level A). from the explorative controlling and geological research. Addition to GA and GB, They provide the basis to confirm potential for coal mine plan and further exploration.

**Grade D reserves** the reserves indicated by regional geological mapping and investigation (Level D) with some point controls and well as the all stage of exploration (Level D to A). They provide a relative lower confidence in deposit and basis for the further coal exploration or small scale coal mining plan.

Generally, **GA, GB, and GC** can be regarded as **industrial reserves**, whereas GD can be regarded as **prospective reserves**.

The reserve code for geological reporting in different exploration stages has been regulated as:

**Prospecting reserves** Coal estimates reported to the State Ore Reserve Committee (SORC) as result of regionally geological survey and mapping (Level D). After the approval of SORC, it becomes into Grade D reserves, which is regarded as the basis for further prospecting planning.

**Reconnaissance reserves** Results from the exploration Level C. After the approve of SORC, it becomes Grade C+D reserves, in which GC should not be less 20% to 30% of the all reserves.

**Detailed-explored reserves** Results from the exploration Level C and including Grade B+C+D reserves. Of the total reserves, Grade B+C are not less than 70%, and Grade B is not less than 20%-30%.

**Precisely-explored reserves** Reported reserves in the final documents of the exploration Level A. They turn into Grade A+B+C reserves after re-examination and approval of SORC, of these reserves, Grade A +B is mainly distributed in the shallow areas where coal mines will be set up at first.

The following table shows the correlation of Chinese reserve Categories with western countries.

China (1986)	<b>Demonstrated Reserves</b>				<b>Predicted Reserves (or resources)</b>		
	<b>Industrial Reserves</b>			<b>Prospective Reserves</b>			
	<b>Grade A</b>	<b>Grade B</b>	<b>Grade C</b>	<b>Grade D</b>			
Soviet (1982)	<b>Reserves</b>				<b>Predicted Reserves</b>		
	<b>Demonstrated Reserves</b>			<b>Prospective reserves</b>			
	Grade A	<b>Grade B</b>	<b>Grade C1</b>	<b>Grade C2</b>	<b>Grade P1</b>	<b>Grade P2</b>	Grade P3
U.S.A	<b>Reserves</b>				<b>Resources</b>		
	<b>Demonstrated</b>		<b>Inferred</b>		<b>Hypothetical</b>		<b>Speculative</b>
	<b>Measured</b>	<b>Indicated</b>					
Australia	<b>Coal Resources</b>				<b>Coal In Situ</b>		
	<b>Measured</b>	<b>Indicated</b>	<b>Inferred</b>				
U. N.	<b>Grade R-1</b>		<b>Grade R-2</b>		<b>Grade R-3</b>		

The categories and terminology of coal resources and reserves here may be different from the earlier documents, because the regulation and definition of them have been modified in several times.

## Appendix 2

### Classifications of coal ranks of China (1986 standard)

In China, the classification of coal ranks is mainly based on following indexes:

$V_{daf}(\%)$ : Volatile matter on dry ash-free basis;

$G_{R-I}$ : G index, caking index

$Y(\text{mm})$ : Maximum thickness of plastic layer or plasteometer index

$b(\%)$ : Dilatation;

$H_{daf}(\%)$ : Hydrogen content on dry ash-free basis;

$P_M(\%)$ : Transmittance;

$Q_{gr,maf}$  (MJ/kg): Gross calorific value on moist ash-free basis.

Type	Code	No	Classification Index						
			$V_{daf}(\%)$	$G_{R-I}^{\text{①}}$	$Y(\text{mm})$	$b(\%)$	$H_{daf}^{\text{②}}(\%)$	$P_M^{\text{③}}(\%)$	$Q_{gr,maf}$ (MJ/kg)
Anthracite	WY	01	$\leq 3.5$					$\leq 2.0$	
		02	$> 3.5-6.5$					$> 2.0-3.0$	
		03	$> 6.5-10.0$					$> 3.0$	
Meager coal	PM	11	$> 10.0-20.0$	$\leq 5$					
Meager-lean coal	PS	12	$> 10.0-20.0$	$> 5-20$					
Lean coal	SM	13	$> 10.0-20.0$	$> 20-30$					
		14	$> 10.0-28.0$	$> 50-65$					
Coking coal	JM	15	$> 10.0-28.0$	$> 65$	$\leq 25.0$	$(\leq 150)$			
		24	$> 20.0-28.0$	$> 50-65$					
		25	$> 20.0-28.0$	$> 65$	$\leq 25.0$	$(\leq 150)$			
1/3 coking coal	1/3JM	35	$> 28.0-37.0$	$> 65$	$\leq 25.0$	$(\leq 220)$			
Fat coal	FM	16	$> 10.0-20.0$	$> 85$	$> 25.0$	$(> 150)$			
		26	$> 20.0-28.0$	$> 85$	$> 25.0$	$(> 150)$			
		36	$> 28.0-37.0$	$> 85$	$> 25.0$	$(> 220)$			
Gas-fat coal	QF	46	$> 37.0$	$> 85$	$> 25.0$	$(> 220)$			
Gas coal	QM	34	$> 28.0-37.0$	$> 50-65$					
		43	$> 37.0$	$> 35-50$					
Gas coal	QM	44	$> 37.0$	$> 50-65$	$\leq 25.6$				
		45	$> 37.0$	$> 65$					
1/2 medium caking coal	1/2ZM	23	$> 20.0-28.0$	$> 30-50$		$(\leq 220)$			
		33	$> 28.0-37.0$	$> 30-50$					
Weakly caking coal	RN	22	$> 20.0-23.0$	$> 5-30$					
		32	$> 28.0-37.0$	$> 5-30$					
Non-caking coal	BN	21	$> 20.0-28.0$	$\leq 5$					
		31	$> 28.0-37.0$	$\leq 5$					
Flame (or Long flame) coal	CY	41	$> 37.0$	$\leq 5$				$> 50$	
		42	$> 37.0$	$> 5-35$					
Brown Coal	HM	51	$> 37.0$					$\leq 30$	$\leq 24$
		52	$> 37.0$					$> 30-50$	

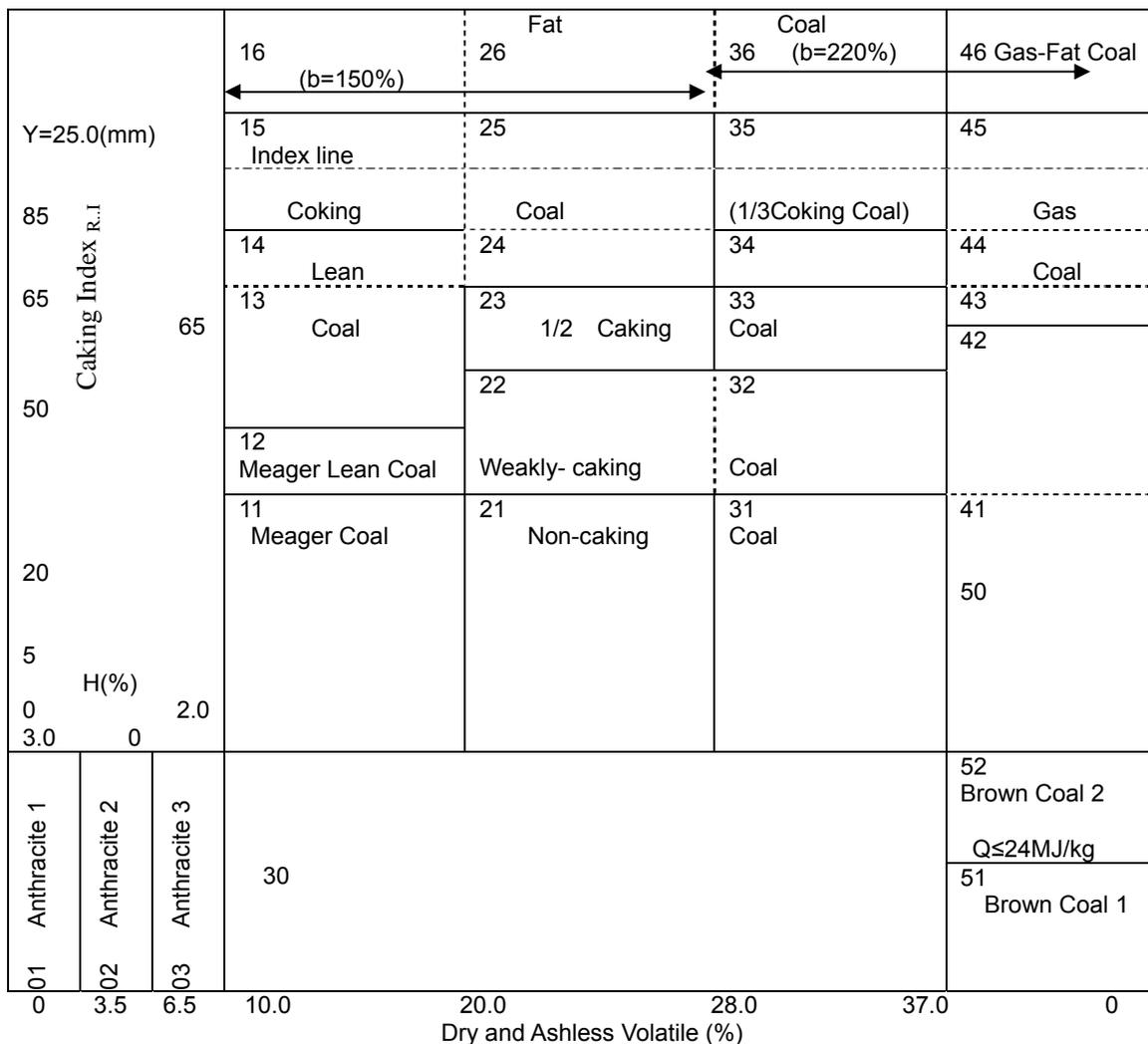
Notes: ① When  $G > 85$ , we can use the value of  $Y$  (or  $b$ ) to classify fat coal; Gas-fat coal and other types. When  $Y > 25.0\text{mm}$ , if  $V_{daf} \leq 37.0\%$ , it should be classified into fat coal; If  $Y \leq 25.0$ ,

then it should be classified into other corresponding types of coals, according to the value of  $V_{daf}$ . When using the value of  $b$  to classify fat coal, gas-fat coal and other types, if  $V_{daf} \leq 28.0\%$ , we temporarily classify that, whose value of  $b > 150\%$ , into fat coal. If  $V_{daf} > 28.0\%$  and  $b > 220\%$ , we regard it as fat coal or gas-fat coal ( $V_{daf} > 37\%$ ). When there're some conflicts between the classifications (by value of  $b$  and  $Y$ ), we'll choose the latter one.

② When there are some conflicts in the classifications of sub-divisions by  $V_{daf}$  and  $H_{daf}$ , we should choose the latter. During the daily inspection of producing plants and mines, which have been classified into the sub-type of Anthracite, we may make classifications only by  $V_{daf}$ . During the geological exploration, we should determine both value of  $V_{daf}$  and  $H_{daf}$ , when classifying the sub-divisions of the new fields, or re-classifying the sub-divisions of the producing mines and plants. We should determine the sub-divisions, according to the rules.

③ When  $V_{daf} > 37.0\%$ , and  $G_{R-1} \leq 5$ , We can judge whether it's long flame coal or lignite by the value of  $P_M$ . If  $P_M > 30\% - 50\%$ , then re-testing  $Q_{gr,mar}$ , if it's value is over 24MJ/kg, then it should be classified into long flame coal. Then we can distinguish bituminous and lignite by  $P_M$ .

The following diagram illustrates the relationship between different ranks and their definitions:



Sampling and preparation for classification must be based on GB474-83 of the National Standard of China.

The line of  $G=85$  represents the special limit. Over this line ( $G>85$ ), both  $Y$  and  $b$  can be used as classification index to distinguish fat coal or gas-fat coal from other types. If  $Y$  of coal  $>25.0$  mm, it should be classified into fat coal or gas-fat coal; When  $V_{daf}\leq 28.0\%$ , the value of  $b$  can temporarily be settled by 150%; When  $V_{daf}>28.0\%$ , the value of  $b$  is 220%. When there're some conflicts between value of  $b$  and  $y$  in classifying the coal types,  $Y$  should be taken as key index.

When there're some conflicts in making sub-divisions of anthracite by using  $H_{daf}$  and  $V_{daf}$ , we'll choose the former ( $H_{daf}$ ).

If  $V_{daf}>37.0\%$ ,  $P_M>50\%$ , it is bituminous coal; when  $P_M$  between 30% and 50%, and  $Q_{gr,maf}$  is  $>24$ MJ/kg, it is long flame coal.

Sampling and preparation for classification must be based on GB474-83 of the National Standard of China.

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When there're some conflicts in making sub-divisions of anthracite by using  $H_{daf}$  and  $V_{daf}$ , we'll choose the former ( $H_{daf}$ ).

If  $V_{daf}>37.0\%$ ,  $PM>50\%$ , it is bituminous coal; when  $PM$  between 30% and 50%, and  $Q_{gr,maf}$  is  $>24$ MJ/kg, it is long flame coal.