

The Chinese Coal Industry: An Economic History

Elsbeth Thomson

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The Chinese Coal Industry: An Economic History

The coal industry has been and continues to be of critical importance to China's economic modernization. With its huge labour force, countrywide infrastructure, and vital strategic importance to the economy, the industry presents special problems for reformers. It also epitomizes the problems of reform in the state industrial sector as a whole.

This book examines the changes in the structure and operation of the Chinese coal industry from the mid-nineteenth century to the present, concentrating on the years of reform. Although the focus is on the economics of the industry, *The Chinese Coal Industry: An Economic History* also provides many insights into China's sociopolitical development.

Elsbeth Thomson received her PhD from the School of Oriental and African Studies, University of London. Her main interests are the energy sector and development of transportation infrastructure in China. She has taught courses on the economies of China, Hong Kong, Taiwan and other Asian countries at Simon Fraser University, Vancouver and Lingnan University, Hong Kong. She is currently a Visiting Fellow at the East Asian Institute, National University of Singapore.

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Contents

<i>List of illustrations</i>	vii
<i>Some explanatory notes</i>	xiii
<i>Acknowledgements</i>	xv
<i>Abbreviations</i>	xvi
Introduction	1
1 The industry before 1949	8
<i>Development by foreign interests</i>	8
<i>Production</i>	9
<i>Financing</i>	18
<i>Transport</i>	20
<i>Consumption</i>	23
<i>The pre-1949 legacy</i>	25
2 Mao's adaptation of Soviet central planning: effects on the industry	27
<i>Soviet central planning applied to the Chinese coal industry</i>	27
<i>Socialism with Chinese characteristics: Mao's frustration with central planning</i>	35
3 Economic assessment of the industry on the eve of the reform and opening up programme	52
<i>Production</i>	52
<i>Financing</i>	76
<i>Transport</i>	87
<i>Consumption</i>	93
<i>Summary</i>	107

4	The industry and Deng's reforms	110
	<i>Introduction</i>	110
	<i>The speeches and writings of Coal Minister Gao Yangwen, 1979–85</i>	111
	<i>Production</i>	112
	<i>Financing</i>	124
	<i>Transport</i>	130
	<i>Consumption</i>	133
5	Central planning in the industry giving way to marketization	136
	<i>Introduction</i>	136
	<i>The Seventh Five Year Plan: 1986–90</i>	141
	<i>The Eighth Five Year Plan: 1991–95</i>	151
	<i>The Ninth Five Year Plan: 1996–2000</i>	161
6	Economic assessment of the industry after twenty years of reforms	176
	<i>Production</i>	176
	<i>Financing</i>	224
	<i>Transport</i>	257
	<i>Consumption</i>	264
7	Retrospect and prospect	297
	<i>Retrospect</i>	297
	<i>Prospect</i>	303
	Epilogue	315
	<i>Notes</i>	320
	<i>Bibliography</i>	373
	<i>Index</i>	403

List of illustrations

Figures

1.1	Provinces and autonomous regions of China	15
2.1	Planning hierarchy of the Chinese coal industry	29
2.2	Planning structure of the CMAs	30
2.3	Planning structure of the LS mines	31
2.4	Monthly production plan matrix	32
3.1	Total coal production, 1949–78	53
6.1	Growth rates of coal production by mine type, 1979–99	185
6.2	Largest coal mining administrations in 1996	205
6.3	Ex-factory price index for coal and other industrial commodities, 1980–99	238
6.4	Structure of the CNCIEC	256

Plates

1	Pile of unprocessed coal from an LNS mine near Shenyang (Liaoning)	285
2	Coal briquettes stacked outside the main entrance of an old building in Shenyang (Liaoning)	285
3	Outdoor cooking using coal briquettes in Shenyang (Liaoning)	286
4	New tunnel construction at Yanzhou CMA (Shandong)	286
5	Coal cutting in Nantun Mine, Yanzhou CMA (Shandong)	287
6	Operation of comprehensive mining equipment at Yongdingzhuang Mine at Datong CMA (Shanxi)	287
7	Coal miners at the end of their shift, Yanzhou CMA (Shandong)	288
8	Coal miners and staff attending university night classes, Yanzhou CMA (Shandong)	288
9	Railway cars loaded mechanically in Zhengzhou (Henan)	289
10	Railway cars loaded with coal traversing Henan Province	289
11	Trucks loaded with clean coal parked outside the Zhengzhou Heat and Power Plant (Henan)	290

viii *Illustrations*

12	Coal waiting to be transferred to ships at Qinhuangdao (Hebei)	290
13	Coal being loaded onto a ship at Qinhuangdao (Hebei)	291
14	Coal ship docked at Qinhuangdao (Hebei)	291
15	Coal barges in Shanghai Harbour	292
16	Camel teams transporting coal from Baidong Mine at Datong CMA (Shanxi) to hillside residents	292
17	Coal pile at the back of a hotel in Hangzhou (Zhejiang)	293
18	Stoking the boiler at a hotel in Hangzhou (Zhejiang)	293
19	Central heating and hot water pipes leading from a boiler to a building (Beijing)	294
20	Coal transport system operations room at the Zhengzhou Heat and Power Plant (Henan)	294
21	Zhengzhou Heat and Power Plant (Henan) cooling tower and chimney; railway cars loaded with coal in the foreground	295
22	Power lines emanating from the Zhengzhou Heat and Power Plant (Henan)	295

Tables

1.1	Output of coal by ownership of enterprise, 1913–42	11
1.2	Production, consumption, imports and exports, 1864–1949	12
1.3	Geographical distribution of large mine output, 1912–36	14
1.4	China's industrial structure 1912–49	19
1.5	Railway trackage, 1876–1949	21
1.6	Estimates of coal consumption breakdown, 1915, 1923, and 1933	24
3.1	Coal production, 1949–78	54
3.2	Coal production by mine type, 1949–78	55
3.3	Proportions of total coal production by mine type, 1949–78	56
3.4	Annual growth rates of coal production by mine type, 1950–78	57
3.5	Annual coal production capacity increases at the CMAs compared with increases in coal washing capacity, 1953–78	58
3.6	Breakdown of coal types, 1952–79	59
3.7	Distribution of coal production, 1952–78	60
3.8	Distribution of coal consumption, 1952–78	62
3.9	Production deficit/surplus for each region, 1952–78	64
3.10	Output–capacity ratios, 1954–78	68
3.11	Investment per ton of new capacity, 1953–80	69
3.12	International comparison of consumption of materials for every 10,000 tons of coal produced, 1952–79	70
3.13	Components of 1978 production costs: national average, Shanxi, Inner Mongolia, and Hunan	71
3.14	Employment at state mines, 1952–78	71
3.15	Average OMS in several coal-producing countries, early 1970s	72

3.16	ICOR and ILOR, 1953–78	74
3.17	Index of overall labour productivity of state owned independent accounting industrial enterprises by branch of industry, 1957–78	75
3.18	Energy investment in developing countries as a percentage of total annual public investment, early 1980s	77
3.19	Capital construction investment, 1953–80	79
3.20	Breakdown of capital construction investment in energy, 1953–80	81
3.21	Breakdown of capital construction investment in industry, 1953–80	82
3.22	Sources of investment for capital construction, 1950–79	83
3.23	Average coal producer prices, production costs, taxes, and profits, 1952–78	84
3.24	Industrial capital profit levels, 1962–78	85
3.25	Railway trackage and freight carried, 1949–78	88
3.26	China's railway network and density compared, late 1970s	90
3.27	Consumption elasticity coefficients, 1954–78	95
3.28	Comprehensive coal consumption ratios, 1953–78	97
3.29	Breakdown of coal consumption, 1953–78	99
3.30	Comparative energy consumption per unit of gross value industrial output, 1980	100
3.31	Comparative energy consumption in the residential/commercial sector per unit of GDP, 1980	100
3.32	Electricity capacity and generation, 1949–78	102
3.33	Electricity capacity and generation growth, 1950–78	103
3.34	Coal consumption in selected countries as a percentage of total energy consumption, 1978	104
6.1	World hard coal production, imports, and exports, 1997	177
6.2	Coal production, 1978–2000	179
6.3	Total coal production by mine type, 1978–99	182
6.4	Proportions of total coal production by mine type, 1978–99	183
6.5	Growth rates of coal production by mine type, 1979–99	184
6.6	Comparative structure of production, 1995	186
6.7	Breakdown of gross value of coal industry output by ownership and enterprise size, 1979–98	187
6.8	Breakdown of national gross value of industrial output by ownership, 1978–99	188
6.9	Breakdown of coal types, 1981–98	190
6.10	Comparison of increases in coal production capacity and in coal washing capacity, 1980–98	191
6.11	Ambient air quality standards	199
6.12	Distribution of coal production, 1981–98	202
6.13	Distribution of coal consumption, 1985–96	203
6.14	Output from the largest CMAs in 1996	204

6.15	Distribution of coal output shipped from Shanxi Province by train, 1980–2000	205
6.16	Destinations of coal shipped from each province and autonomous region, 1996	206
6.17	Production deficit/surplus for each region, 1985–96	209
6.18	Geographical distribution of state and local mines, 1981 and 1995–98	210
6.19	Net coal movement among provinces and regions, 1996	212
6.20	Coal output–capacity ratios, 1979–98	214
6.21	Employment at CMAs, 1979–98	217
6.22	Coal production labourers at CMAs, 1979–98	218
6.23	ILOR 1982–98	219
6.24	International coal mining productivity data, 1997	220
6.25	Breakdown of coal mine fatalities by cause and mine type: average proportions, 1996–98	222
6.26	Output, production costs, and losses/profits at CMA and LS mines in each province/area, 1985	225
6.27	Losses at the CMAs, 1992–99	226
6.28	Capital construction investment, 1976–99	228
6.29	Capital construction investment in energy as a proportion of total investment in industry, 1976–99	230
6.30	Shares of capital construction investment in energy, 1976–99	231
6.31	Investment per ton and ICOR, 1978–99	232
6.32	Sources of capital construction investment funds and procurement of equipment and materials, 1979–98	233
6.33	Capital construction investment spending breakdown, 1979–98	234
6.34	Breakdown of capital construction investment, 1981–98	235
6.35	Average production cost and price of coal, 1978–86	236
6.36	Share of goods sold at state fixed prices, 1978–93	237
6.37	Planned production costs and coal prices in Shanghai, 1978–86	239
6.38	Cost buildup for Datong lump coal shipped to Shanghai and Guangzhou, March 1992	240
6.39	Comparison of planned coal prices with market prices in Shanghai, Nanjing, and Suzhou, 1979–86	241
6.40	Prices charged by Yanzhou Coal Company, 1999 and 2000	241
6.41	Average market prices for the month of June, 1990–2000	242
6.42	Coal exports and imports, 1979–99	254
6.43	Increases and improvements to railway trackage and freight carried, 1979–99	258
6.44	Modal breakdown of coal transport, 1990 and 1995	263
6.45	International comparison of primary energy consumption breakdown, 1997	265
6.46	Consumption elasticity coefficients, 1978–99	267
6.47	Regional energy consumption elasticity coefficients, 1986–90	268
6.48	Coal consumption per 10,000 yuan of GDP by region, 1990	269

6.49	Comprehensive coal consumption and coal intensity ratios, 1978–98	270
6.50	Types of energy used in each economic sector, 1980–90	271
6.51	Breakdown of coal consumption, 1980–98	272
6.52	International comparison of coal consumption, 1996	273
6.53	Electricity capacity and generation, 1978–99	275
6.54	Electricity capacity and generation growth, 1978–99	276
6.55	Capacity and output of main electricity networks, 1995	279
6.56	Coal conservation rates by region, 1992	281
6.57	Breakdown of GDP, 1980–99	282
7.1	Forecasts of future energy consumption structures	313

Some explanatory notes

Statistics

Pitfalls and shortcomings

- figures deliberately inflated or deflated by low level bureaucrats trying to get some message across to superiors. For example, in order to get bonuses they would report that the targets were reached when they weren't, or they would under-report to try to get more funding next year, etc.
- figures for public consumption at home or abroad, deliberately inflated or deflated by authorities, for example, downplaying of accidents.
- discrepancies in figures supplied by Chinese official sources, for example, many typos, and variations found in the statistical yearbooks.
- much fuller information given in Chinese sources, for example, English and Chinese versions of the Coal Industry Yearbook.
- discrepancies in figures from the international organizations, for example, World Bank, International Energy Agency, etc.
- all figures from the non-state mines are estimates, for example, great variation in the approximate number of mines, and their output.
- international comparisons complicated by geopolitical changes, for example, collapse of Soviet Union and creation of CIS.

Gaps

- no central administration of statistics before 1949. All that exists are some regional, local, and individual mine records, some data compiled by the Geological Survey of China, and by individual researchers often hired by commercial enterprises who used the usual quantitative techniques of extrapolation for periods when there was absolutely no data at all.
- governmental statistics collection, analysis, and publication had been carried out in the early years of the PRC, but ended with the GLF and was not resumed by the State Statistical Bureau until 1981.
- only four editions of the *Zhongguo nengyuan tongji nianjian* (China Energy Statistics Yearbook) were published: 1986, 1989, 1991, and 1991–96.
- the hiatus between collection of figures and publishing of them.

Problems in translation

- in material translated in China, precise meanings and/or nuance were often not clear.

Measurements

- ‘tons’ means metric tons.

Romanizations

- the pinyin system of romanization has been used throughout, with the exception of some place and company names in Chapter 1.

Acknowledgements

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Abbreviations

Abbreviations used in the Bibliography, Notes, Tables and Figures

BR	<i>Beijing Review</i> Known as <i>Peking Review</i> until 5 January 1979. Note that page numbering differs between North American and Asian editions. Both editions were used.
CBR	<i>China Business Review</i>
CD	<i>China Daily</i> , Beijing
CDSP	<i>Current Digest of the Soviet Press</i>
CIYB	<i>China Coal Industry Yearbook</i> , Hong Kong: Economic Information and Agency, 1983–2000. See <i>MTGYNJ</i> for Chinese version.
CM	<i>China Market</i>
CMJJ	<i>Cai mao jingji</i> (Finance and Trade Economics)
CMS	<i>China Monthly Statistics</i>
CQ	<i>China Quarterly</i>
CSE	Liu Suinian and Wu Qungan (eds), <i>China's Socialist Economy: An Outline History 1949–1984</i> (Beijing: Beijing Review, 1986)
CWI	<i>Coal Week International</i>
CZ	<i>Caizheng</i> (Finance)
DL	<i>Dili</i> (Geography)
DLKX	<i>Dili kexue</i> (Scientia Geographica Sinica)
DLNJ	Zhongguo dianli nianjian bianji bubian (China Electric Power Yearbook Compiling Dept) <i>Zhongguo dianli nianjian 1996–1997</i> (China Electric Power Yearbook 1996–1997), Beijing: China Electric Power Publishing House, 1997.
DLXB	<i>Dili xuebao</i> (Acta Geographica Sinica)
DLYJ	<i>Dili yanjiu</i> (Geographical Research)
ER	<i>Economic Reporter</i>
FBIS	China Daily Report, <i>Foreign Broadcast Information Service</i> , Washington, DC: US National Technical Information Service, 1981–95.

FT	<i>Financial Times</i> (of London)
GDTZZL	Guojia tongji ju guding zichan touzi tongji ju (State Statistical Bureau, National Fixed Investments Section), <i>Zhongguo guding zichan touzi tongji ziliao 1950–1985</i> (China Fixed Asset Investment Statistical Data 1950–1985), Beijing: Zhongguo tongji chubanshe, 1987.
GRRB	<i>Gongren ribao</i> (Workers' Daily)
GYJJ	<i>Zhongguo gongye jingji</i> (China Industrial Economics)
GYFZBG	<i>Zhongguo gongye fazhan baogao</i> (China Industrial Development Report)
GYJJGLCK	<i>Gongye jingji guanli congkan</i> (Industrial Economics Management Collection)
GYJJTJNJ	Guojia tongji ju, gongye jiaotong tongji si (Industrial Transportation and Communications Statistics Company of the State Statistical Bureau) (ed.), <i>Zhongguo gongye jingji tongji nianjian 1998</i> (China Industrial Economics Statistics 1998), Beijing: Zhongguo tongji chubanshe, 1998.
GYJJTJZL	Guojia tongji ju, gongye jiaotong wuzi tongji sibian, <i>Gongye jingji tongji ziliao 1949–1984</i> (Industrial Economics Statistics 1949–1984), Beijing: Zhongguo tongji chubanshe, 1985.
ICR	<i>International Coal Report</i>
ICW	<i>International Coal Weekly</i>
IEA	International Energy Agency
JDYJ	<i>Jidi yanjiu</i> (Base Research). Refers to Shanxi Energy Base.
JEC	Joint Economic Committee Report, Congress of the United States.
JFRB	<i>Jiefang ribao</i> (Liberation Daily)
JGLLSJ	<i>Jiage lilun yu shijian</i> (Pricing Theory and Practice)
JHJJ	<i>Jihua jingji</i> (Planned Economics)
JJCKB	<i>Jingji cankao bao</i> (Economic Information Daily)
JJDL	<i>Jingji dili</i> (Economic Geography)
JJGL	<i>Jingji guanli</i> (Economic Management)
JJJH	<i>Jingji jihua</i> (Economic Planning)
JJDB	<i>Zhongguo jingji daobao</i> (China Economic Herald)
JJNJ	<i>Zhongguo jingji nianjian</i> (Almanac of China's Economy), Beijing: Jingji guanli chubanshe, 1981–2000.
JJRB	<i>Jingji ribao</i> (Economic Daily)
JJSB	<i>Zhongguo jingji shibao</i> (China Economic Times)
JJWT	<i>Jingji wenti</i> (Economic Problems)
JJYJ	<i>Jingji yanjiu</i> (Economics Research)

- JPRS China Report Joint Publications Research Service, Congress of the United States
- JTNJ *Zhongguo jiaotong nianjian* (China Transportation and Communications Yearbook)
- LDGZZL Guojia tongji ju shehui tongji ju bian (State Statistical Bureau, Social Statistics Department), *Zhongguo laudong gongzi tongji ziliao, 1949–1985* (China Labour and Wages Statistical Data 1949–1985), Beijing: Zhongguo tongji chubanshe, 1987.
- LW *Liaowang* (Outlook)
- MTB *Zhongguo meitan bao* (China Coal News)
- MTGY *Meitan gongye* (Coal Industry)
- MTGYJMSC Fan Weitang et al. (eds), *Zhongguo meitan gongye jianming shouce* (Concise Handbook of China Coal Industry), Beijing: Meitan gongye chubanshe, 1995.
- MTGYNJ *Zhongguo meitan gongye bu bian* (China Coal Industry Ministry), *Zhongguo meitan gongye nianjian* (China Coal Industry Yearbook), Beijing: Meitan gongye chubanshe, 1982–2000. See CIYB for English version.
- MTJJYJ *Meitan jingji yanjiu* (Coal Economics Research)
- MTKXJS *Meitan kexue jishu* (Coal Science and Technology)
- MTQYGL *Meitan qiye guanli* (Coal Enterprise Management)
- NY *Nengyuan* (Energy). *Zhongguo nengyuan* (China Energy) before 1989, abbreviated to *ZGNY*.
- NYFZBG Yan Changyue, *Zhongguo nengyuan fazhan baogao 1997* (China Energy Development Report 1997), Beijing: Jingji guanli chubanshe, 1997.
- NYTJNJ Guojia tongji ju gongye jiaotong tongji sibian (State Statistical Bureau, Industrial Communications Statistics), *Zhongguo nengyuan tongji nianjian* (China Energy Statistics Yearbook), Beijing: Zhongguo tongji chubanshe. (Only four yearbooks published, 1986, 1989, 1991, and 1991–96.)
- PR *Peking Review*
Known as *Beijing Review* as of 5 January 1979.
- RMRB *Renmin ribao* (People's Daily), Beijing
- RMRBHWB *Renmin ribao haiwai ban* (People's Daily, Overseas Edition), Beijing
- SCMP *South China Morning Post*, Hong Kong
- SHKX *Zhongguo shehui kexue* (China Social Sciences)
- SJMYJS *Shijie meitan jishu* (World Coal Technology)
- ST *The Straits Times*, Singapore
- SWB *BBC Summary of World Broadcasts*
- SXJDYJ Shanxi sheng shehui kexue yuan, Taiyuan shi jishu jingji yanjiu zhongxin (Shanxi Academy of Social

	Sciences, Taiyuan City Technological Economics Research Centre), <i>Shanxi nengyuan zhonghua gong jidi zonghe kaifa yanjiu</i> (Research on the Development of the Shanxi Energy and Chemicals Base), Taiyuan: Shanxi renmin chubanshe, 1984.
SXJJNJ	<i>Shanxi jingji nianjian</i> (Shanxi Province Economic Yearbook), Taiyuan: Shanxi renmin chubanshe, 1985–2000.
SXRB	<i>Shanxi ribao</i> (Shanxi Daily)
TDYSJJ	<i>Tiedao yunshu yu jingji</i> (Railway Transport and Economy)
TJNJ	Zhongguo tongji jubian (State Statistical Bureau), <i>Zhongguo tongji nianjian</i> (China Statistical Yearbook), Beijing: Zhongguo tongji chubanshe, 1981–2001. English title varies slightly: sometimes appears on spine and in forepaging as Statistical Yearbook of China.
TJZY	Zhongguo tongji jubian (State Statistical Bureau), <i>Zhongguo tongji zhaiyao 1999</i> (Summary of China Statistics 1999), Beijing: Zhongguo tongji chubanshe, 1999.
UPIA	United Press International Agency
WZB	<i>Zhongguo wuzi bao</i> (China Materials Newspaper)
WZGL	<i>Wuzi guanli</i> (Materials Management)
XNA	<i>Xinhua News Agency</i>
XZQYNJ	<i>Zhongguo xiangzhen qiye nianjian</i> (China Village and Township Enterprise Yearbook)
ZGJJSB	<i>Zhongguo jingji shibao</i> (China Economic Times)
ZGNY	<i>Zhongguo nengyuan</i> (China Energy). <i>Nengyuan</i> (Energy) beginning 1989, abbreviated to <i>NY</i>
ZGWJ	<i>Zhongguo wujia</i> (China Prices)

Abbreviations used in the text

CCT	Clean Coal Technology
CMAs	Central Mining Administrations – large mines under the jurisdiction of the central government
CNCIEC	China National Coal Import and Export Corporation (used to be China National Coal Industry Import and Export Corporation CNCIIEC)
CNCC	China National Coal Corporation
CPC	Communist Party of China
GLF	Great Leap Forward
GVIO	Gross Value of Industrial Output
ICCC	Island Creek Coal Company Ltd.

xx *Abbreviations*

ICOR	Incremental Capital Output Ratio
ILOR	Incremental Labour Output Ratio
kcal	Kilocalorie
kV	Kilovolt
LNS mines	Local non-state mines: under the jurisdiction of townships, villages, collectives, individual households, others
LS mines	Local state mines: under the jurisdiction of provinces, prefectures, counties
MCI	Ministry of Coal Industry
NPC	National People's Congress
NEPA	National Environmental Protection Agency (became SEPA in 1998)
OMS	Output per manshift
PSF	Pingshuo First Coal Company Ltd.
SCE	Standard coal equivalent
SCIB	State Coal Industry Bureau
SEPA	State Environmental Protection Administration (formerly NEPA)
SPC	State Planning Commission
SPMAs	State Priority Mining Administration (formerly CMAs)
WHO	World Health Organization
WTO	World Trade Organization

Introduction

One of the main constraining factors in China's quest to raise living standards, modernize, and become a major world power has been a persistent shortage of energy. More than twenty years after Deng Xiaoping launched the reform and 'opening up' programme in 1978, per capita energy consumption is still less than half of the average for what the World Bank categorizes as 'lower middle-income economies', and about an eighth of what it is for 'high-income economies'. As the main source of energy in China has always been coal, whether for electric power generation, railway transport, an input to a vast array of industries, or as the principal heating fuel in the residential and commercial sectors, the energy shortage problem until the mid-1990s was essentially a coal industry problem, difficulties or bottlenecks having occurred at all stages – production, transportation, or conversion to other energy forms.

Energy shortages have greatly hindered the industrial, agricultural, and social development of China. They have caused tremendous financial losses in foregone potential production and foreign investment. Capital spent on machinery that has been damaged by power failures, or which was forced to operate at only a fraction of its capacity, has been wasted. The lack of an alternative to coal has perpetuated the gathering of burnable vegetation in the rural areas, resulting in the permanent loss of millions of acres of once fertile land through erosion, and thereby greatly contributing to recurring and devastating floods.

Since 1989 China has been by far the world's largest producer and consumer of coal. In approximate terms, China's 1,001.9 billion tons of proven coal reserves represent 50 per cent of the world total. However, only 114.5 billion tons are classified as proven *recoverable* reserves, representing about 11 per cent of the world total, third largest after the Commonwealth of Independent States and the United States, which each have about 23 per cent. About 74 per cent of the reserves are bituminous, 13 per cent anthracite, and 13 per cent lignites. Some 83 per cent of the total can be used as steam coals, the remainder as coking and gas coals.

While coal use in the developed world peaked in the first decades of the 1900s, and after the Second World War was being replaced with higher efficiency energy forms – oil, gas, and later hydro and nuclear electric power – China's use of coal reached its zenith only in the late 1990s. There was no foreign exchange with

2 *Introduction*

which to import oil and gas, and domestic supplies of these were no where near sufficient. In 1949, being a poor, war-exhausted communist country, in fear of foreign domination and exploitation, and under a United Nations embargo, it had no option but to depend on coal as the main source of energy.

The government of the People's Republic did make efforts to replace coal, this relatively low-grade and inconvenient fuel. For a brief period in the 1960s China's oil production ranked among the highest in the world and there was great optimism that new major finds would be discovered. Some consumption equipment was actually converted to the use of oil during those years, but as no new large and easily exploitable fields were found China was forced to revert to coal and to export what oil there was to earn desperately needed foreign exchange. Though there was abundant hydropower potential, materials and technology were sufficient to build only small- and medium-sized plants. Similarly, uranium deposits were adequate, but lack of capital, expertise, and long construction lead-times precluded the nuclear power option.

When the reform and opening up programme began in the late 1970s, the Chinese leadership reviewed its energy options, and concluded a switch to the more modern and efficient fuels would still have to be deferred. While political and security considerations were now less significant factors, costs continued to be a formidable deterrent. Switching from one fuel to one or more other fuels would require huge investments in new equipment and technology. The fear attached to the displacement of a very large work force was probably another factor. It was not until the mid-1990s that there were clear indications that the government was ready to begin a gradual phasing out of the use of coal.

The evolution of the coal industry in China constitutes an important case study because it mirrors the country's economic development as a whole, first with the initial industrialization by foreign capitalists, then a brief period of Soviet-style central planning, followed by several decades of Mao's 'socialism with Chinese characteristics', including two sociopolitical campaigns which led to widespread loss of life and economic breakdown. Then Deng Xiaoping initiated his reform and opening up programme for which there was no blueprint, indeed not even complete agreement among the leadership. Pervasive corruption in government and great disparities in living standards developed very quickly, contributing to mass social unrest and ultimately many deaths near Tiananmen Square in 1989. At the time of writing, the coal industry, indeed the economy as a whole, is in a highly precarious state with overwhelming rates of unemployment combined with ever increasing awareness of Western living standards.

Most analysts would agree that the non-grain agricultural and consumer goods sectors have been virtually fully marketized, and quite successfully so, but that the economic reform of the state industrial sector has lagged far behind. Raising the output, productivity, and profit levels of the state enterprises, where the labour force is very large and many layers of government are involved, is proving extremely difficult. In the cases of sectors it considers strategic, such as energy, transportation, and telecommunications, the government has been particularly cautious about restructuring and opening up to foreign investment.

China's enormous size, population, and diversity make the country's economic problems unique, and the Chinese government had to devise its own plan for development. It could learn from the successes and failures of other countries, particularly from the other formerly centrally planned economies, but could not integrate into its own strategy the entire administrative and regulatory framework of any one country. It was obliged to develop incrementally and suffer some inevitable setbacks resulting from economic experimentation.

China embarked on a radical, though gradual economic transformation with the introduction of the reform programme in late 1978, by which time it had become all too apparent that Mao's adaptation of Soviet central planning and his revolutionary motivational schemes were not working. Deng Xiaoping called for separation of the responsibilities of government and enterprise, incentives for efficiency, and accountability. Opening up of China to the world in order that the Chinese could interact with and learn from other countries and, most importantly, attract foreign investment and technological aid was a top priority. This necessitated developing internationally acceptable standards in the financial and legal sectors, a process which is still far from complete. Of paramount importance, however, was that the reforms in no way lead to an exploitation of the Chinese people and/or their resources by foreign countries, nor to a widening of the difference in income levels between rural and urban areas. This last condition has proved impossible to meet.

After more than twenty years of reforms, the government's principal tenet is still public ownership. One of the main messages of the 15th National Congress, held in September 1997, was that the policy of building socialism with Chinese characteristics must be continued. Socialism was re-confirmed as the primary stage of the ultimate economic goal, communism. However, it was recognized that the concept of public ownership had to be modified somehow in order to accommodate market principles. The dilemma persists.

The most urgent task of the mid-1990s was restructuring the industrial state enterprise sector, especially the textiles, paper products, armaments, machinery, gas, and coal industries, and the process is still ongoing. These dinosaurs of central planning were losing billions of yuan each year. For decades their inputs, outputs, distribution, and product pricing had been determined not by dynamic market forces but by government decree. Local managers and workers had no input into decisions, there were few incentives and little accountability at any level, and the government routinely extended loans to keep them going. After not being able to pay workers' wages and pensions for months, many declared bankruptcy, resulting in, by 1997, a frighteningly high level of unemployment – 14 million in the cities and 130 million in the rural areas – creating not only an economic problem, but nationwide social instability and unrest. Indeed, after the announcement of the massive sale of state owned enterprises (SOEs), labour staged many demonstrations, and these have been accelerating.

Considerable research has been done in the 1980s and 1990s on the economic reforms as a whole, or those pertaining to a given sector, but there have been few case studies of individual industries.¹ A case study of the coal industry is of

4 Introduction

enormous importance to a better understanding not only of China's modernization and economic growth, but of its political economy. The industry has deep historical roots, is widely dispersed over the country, involves a multiplicity of levels of government, interfaces with many other industries, is classified as 'strategic', and has one of the largest labour forces. Not least of all, China has been cast in the international spotlight as a result of the link between its incomparable consumption of coal and the potentially devastating effects of global warming on the planet as a whole.

This book is an economic and sociopolitical history of China's coal industry, tracing its development since the mid-nineteenth century to the present, with greatest emphasis on the reform era. The concurrent though far from synchronous development of the railways and thermal electric plants is also considered in some detail because they provide the critical links between coal producers and energy consumers. The study will be of interest not only to China specialists, but to students of comparative and development economics, energy economics, energy geography, reformation of centrally planned economies, the locational dynamics of industry, and the history of the coal industry generally. Production, financing, transportation, and consumption – the four components of coal industry economics – provide the framework for discussion. International comparisons have been given wherever pertinent and possible. Based in large part on state publications, the Chinese press, reports, and studies by Chinese scholars, and the author's own field work, the presentation is longitudinal with topical subdivision.

Chapter 1 is a summary, based almost entirely on the very thorough research of Wright and Ikonnikov, of the first century of development of the modern coal industry in China, beginning around 1840, and highlights the major involvement of foreign governments and commercial ventures in mine and railway development.² It establishes the level of progress at the time of the proclamation of the People's Republic of China (PRC) on 1 October 1949.

The first part of Chapter 2 explains why Soviet central planning was chosen, how the material balances system worked, and the specifics of the plans, formulated with Soviet assistance, for China's coal industry. The material for this part came mainly from a wide variety of Chinese language journals and collection of articles. The second part gives the reasons why Mao Zedong believed it was necessary to modify Soviet central planning, and describes how the coal industry was transformed completely and disastrously by his Great Leap Forward campaign in the late 1950s and his second and equally damaging sociopolitical experiment, the Cultural Revolution, beginning in 1966 and lasting for ten years. Throughout his active tenure a debate raged between him and his supporters on the one hand, who favoured decentralized, small-scale industrial development, and the 'pragmatists', including Liu Shaoqi, Zhou Enlai, and Deng Xiaoping on the other, who argued at this time for centralized, large-scale industrial development. This debate, and others stemming from the radical differences in approaches to economic and social reform, were clearly played out in the government's policies for the coal industry. The main sources of information here were the *Zhongguo meitan gongye nianjian* (China Coal Industry Yearbook),³ *Zhonghua renmin gongheguo*

jingji da shiji 1949–1980 (Major Economic Events in Communist China 1949–1980),⁴ and *China's Socialist Economy – An Outline History (1949–1984)*.⁵

Chapter 3 is an assessment of production, financing, transportation, and consumption in 1978, after Mao's death two years earlier, and on the eve of Deng Xiaoping's launching of the programme for reform and opening up. A variety of standard performance indicators is employed, and the weaknesses of central planning – both inherent but especially as applied to the Chinese coal industry – are discussed, as are the pivotal problems of inter-industry linkages.

The total growth in production that was achieved between 1949 and 1978 despite the collapse of the industry after the Great Leap Forward and major disruptions during the Cultural Revolution is astounding, especially considering the out-of-date, ill-adapted, and worn machinery used at the large state mines and the very little, if any, machinery available at the local mines. The cost to the country was astronomical in terms of the thousands of lives lost and the pollution caused by the burning of unparalleled amounts of mostly untreated coal.

In the early 1980s an avalanche of new newspapers, journals, and yearbooks began publication in China, or resumed after a hiatus of some fifteen to twenty years.⁶ The government wanted the outside world to know as much as possible about China's economy in order to promote and facilitate foreign trade and investment. Chinese academics were encouraged to write and publish their ideas about how the reforms should be carried out. The volume and detail of the information, some of which is available in English, but mostly only in Chinese, and the exposure of the hitherto hidden sharp dissent and debate over government policy presented foreign China scholars the unprecedented problem of vast amounts of information to digest and assess. Compared to the pre-reform years, the amount of material becoming available in the 1980s and 1990s was not only ever-increasing, but came from a wide variety of often disagreeing sources, making the writing of Chapters 4 to 7 more challenging.

The energy industry was a core component of the Sixth Five Year Plan (1981–85), the first under the leadership of Deng Xiaoping. Chapter 4 recounts how the coal industry was affected by Deng's attacking the problems of too much centralized control and the pervasive lack of motivation and responsibility by separating government from enterprise management, and introducing financial incentives and market forces. His determination to open up China was characterized by persistent pursuit of foreign capital and technology through such instruments as the China National Coal Import and Export Corporation created in 1982, to be responsible for trade, importing foreign technology, and the establishment of joint ventures.

Chapter 5 relates how the widening and deepening of the reforms over the next fifteen years – the Seventh, Eighth and Ninth Five Year Plans – combined to transform the coal industry. The 1989 Tiananmen Incident caused a relatively brief period of retrenchment and consolidation, which was followed in 1992 by Deng's trip to South China where he was so impressed with the rapid modernization that he called upon the whole country to pursue reform and opening up more vigorously, and had the phrase 'socialist market economy' entrenched in the constitution to

6 Introduction

replace 'central planning'. The coal industry would undergo major organizational changes, with individual administrations and enterprises having greater decision-making authority and responsibility for profit and loss. Coal enterprises would participate in labour contracts, profit retention schemes, price reforms, revenue-sharing systems, new measures to attract investment, the sale of shares, and listing on stock exchanges.

However, at the very time many of these reforms were being introduced the demand for coal began to decline, and in the late 1990s the government, for the first time ever, actually sought to curtail production, and to do so sharply. They also forced many enterprises, including coal, to declare bankruptcy, an unheard of measure hitherto.

The reduction in coal consumption was the result of a combination of a number of more or less equally important factors: the bankruptcy of thousands of state owned industrial enterprises meant far less coal was required; urban residents were switching to gas for cooking and heating as soon as it became available; the demand for light industry products was surpassing that for heavy; many industries by this time, in the interests of efficiency, had installed modern coal-burning equipment or replaced coal entirely with oil or electricity in order to compete internationally; the alarm being expressed worldwide about the local and global effects of pollution caused by the burning of so much untreated coal could no longer be ignored; and two decades of buoyant trade and the securing of global export market niches, particularly in electric equipment and accessories and textile materials and products, assured continuing sizable reserves of foreign exchange with which to import large quantities of oil products.

In the late 1990s, economists were no longer surmising 'if', but 'when' coal consumption in China would fall from accounting for over 70 per cent of total energy consumption to the 20–30 per cent average in the rest of the world. At the time of writing they expected that coal would still be required for at least 50 per cent of national energy requirements until 2020.

Chapter 6 is an assessment of the coal industry after twenty years of reform, using the same performance indicators employed in Chapter 3, and some additional ones. Over the 1980s and 1990s the structure of production changed dramatically, with the proportion of total production coming from the state mines decreasing from nearly 85 per cent in 1978 to a low of about 54 in 1995, while that from the small, local non-state mines increased from about 15 per cent to 46. Great strides had been made at the former in raising average technical standards including safety levels, as well as the quality of output. However, the high ratio of coal from the local non-state mines kept the average safety and quality statistics for the country as a whole still alarmingly low, internationally speaking. From approximately 1996 the demand for coal began to fall quickly and the government's two-pronged strategy since then has been to close thousands of the small mines that had been opened in the 1980s and to begin to consolidate total production at a greatly reduced number of large, modern operations. In 2000, the state: non-state ratio of production stood at about 70:30 per cent. Attainment country-wide of international standards for production methods, quality and safety would finally be a possibility.

The first section of Chapter 7 summarizes the development of China's coal industry over some 150 years, while the second is a conjectural look towards the early decades of the new millennium. The issues to be resolved in the industry at the turn of the century, the expected development of other forms of energy, and some energy consumption structure scenarios up to 2050 put forward by several Chinese energy analysts are discussed.

This much is certain: China has abandoned its policy of energy self-sufficiency. At the beginning of the reform period, the leadership reassessed the role of coal in the hopes of decreasing, if not replacing, its use, and concluded it was not feasible at that time. About sixteen years later, they began to compete eagerly for a share of international liquid fossil fuel supplies and to build the necessary infrastructure for importing these. This testifies in some measure to both the success of the reform programme and the depth of integration into the global economy.

1 The industry before 1949

Development by foreign interests

Historical sources are more or less in agreement that coal was first used in various parts of the world during the Bronze Age, 3,000–4,000 years ago, that the Chinese began to use coal for heating and smelting in the Warring States Period (475–221 BCE), and that they are credited with organizing production and consumption to the extent that by the year 1,000 this activity could be called an industry. China remained the world's largest producer and consumer of coal until the perfecting and patenting of the steam engine by James Watt in 1769.

Europe's coal industry began in England and Belgium in the 1200s. Initially, coal was used almost exclusively for smelting and forging of metals. Wood and charcoal made from wood remained the main forms of fuel for residential heating as late as the 1600s when a switch to coal for most energy needs was necessitated by the exhaustion of accessible forests.

The Industrial Revolution, which began in Britain in the 1700s and later spread to Europe, North America, and Japan, was based on the availability of coal, and human and animal powered industries were transformed in scale and scope with the invention of the steam engine. International trade expanded exponentially when these coal-fed engines were built for the railways and ships, but this technology did not reach China until the mid- to late-1800s.

The demand for Chinese coal greatly increased when foreign steamships began to arrive following the opening of several treaty ports in the 1840s. Initially, coal for the return voyage was brought from the US or Britain, or wherever the home or last refuelling port happened to be, but this was, of course, impractical. At that time, China's coal was very expensive due to the high transportation costs in combination with heavy government taxation – the mineral production tax, mining area tax, land tax, provincial transit dues, coast trade and maritime customs duties, and others. The poor quality of the coal from the native pits was also a drawback. Coal bought from Japan was a cheaper alternative, but by the mid-1800s the demand for coal by the Chinese navy, international shipping companies, and economic growth generally, was such that both Chinese and foreigners sought larger-scale development of China's coal industry.¹

The first foreign proposal for development was made by a Briton, John William Howell, in 1864, and construction was started on a mine at Jilong

(Taiwan) in 1874 which was to supply the Fuzhou shipyard and the Chinese navy.² In the late 1800s British, German, Belgian, and Russian interests built, invested capital and/or operated mines in Hebei, Shanxi, Shandong, Liaoning, and Inner Mongolia.³

The Treaty of Shimonoseki in 1895, the Sino-British Treaty of 1902, and the Sino-American Treaty of 1903, *inter alia*, clarified the regulations regarding foreign involvement in the mining sector and investors were quick to respond. Between 1895 and 1912 thirty-three coal mining agreements were signed with foreigners and many Chinese mines were taken over by foreign interests.⁴ In 1898 mining rights ten miles on either side of the Jiaozhou-Jinan Railway in Shandong were given to the Germans, and similar rights were awarded to the Russians along the Chinese Eastern Railway in Jilin and Heilongjiang. In the same year, the Peking Syndicate, an Anglo-Italian Corporation, was granted mining rights in Shanxi and Henan. Concessions were also given to Great Britain at Tungkuanshan (Anhui), and to the Japanese at Fushun, Yantai, and Benxi (all in Liaoning).

However, the Chinese soon began to understand fully both the economic and strategic value of their coal industry and in 1906 the government sought to redeem some of these concessions. The regulations that were officially promulgated in 1908 stipulated that foreign capital in any enterprise was limited to 50 per cent of the total. The same policy was perpetuated in the mining regulations of 1914, and it was further specified that the general manager of any Sino-foreign company had to be Chinese. It was later ruled that foreigners could not invest in small mines unless they introduced machinery.⁵ Generally, the fifty:fifty arrangement functioned well enough. However, many foreigners believed that enterprises could never be profitable if managed predominantly by Chinese and found ways to disregard the regulation.

When the Qing Dynasty collapsed in 1911, the development and modernization of the coal industry were disrupted. However, the effects of the civil wars that took place in the 1920s were far worse. Only a few railway lines outside of Manchuria continued to operate at full capacity, if at all. During this period no new agreements with foreigners were signed, and most of those who had already been operating mines, apart from the Japanese who by now had established ascendancy, lost their rights.

Production

Quantity, geographical distribution, and quality

The Japanese involvement in the industry gained momentum after their defeat of the Russians in the Russo-Japanese War of 1904–05 and soon thereafter they were the most active foreign participants in China's coal industry. The Fushun mine (Liaoning), which had been developed by the Russians before the turn of the century, was now taken over completely by the Japanese South Manchurian Railway Company. It had some of the world's thickest seams, and of all the mines involving foreign interests was by far the largest. In fact it was one of only two

entirely foreign-controlled coal enterprises, the other being Yantai (Sino-Russian from 1899–1905, Japanese after the War), south of Mukden City (now Shenyang). The Fushun mine exported to southern China, Formosa (now Taiwan), Japan, and to the East Indies.⁶

The mines operated by the Japanese, by 1926, accounted for almost all of the output from the foreign-connected mines, and of the output from the Japanese mines alone, never less than 65 per cent came from Fushun. Production was evidently highly concentrated. Indeed, the Kailuan Mining Administration accounted for never less than 70 per cent of production from the British-connected mines.⁷ Many of the foreign companies enjoyed several advantages, for not only did they control some of the best coal seams and had the most advantageous locations in China in terms of transportation and markets, they had diplomatic protection against extra taxes and imposts levied by zealous local authorities and warlords demanding lump sums for military funds.⁸

The Japanese occupied Manchuria in 1931 and set up a puppet state called Manchoukuo. The second Sino-Japanese War began in 1937. By 1942 the Japanese controlled all the major coal centres in the country, not only in Manchuria, but in the north, northeast, as well as the east, and central south, all together accounting for 90 per cent of all the coal produced. The British enterprises accounted for 7–9 per cent, the German 0.8–1.6 per cent, and the Russian 0.2–0.3 per cent.⁹

Table 1.1 gives the percentages of total output from Chinese enterprises, joint Chinese-foreign enterprises, and foreign enterprises from 1913 to 1942.¹⁰ Chinese enterprises accounted for over 50 per cent of the total output in 1919, while joint Chinese-foreign and foreign together made up the remainder. Of the joint Chinese-foreign enterprises, those with English interests had the largest outputs. The ‘other’ category included Russian, German, French, and Belgium interests. By 1936 the Chinese share had fallen to 43 per cent and in 1942, almost 90 per cent of the production was in the hands of the Japanese.

The mines owned and operated solely by the Chinese were generally small pits. Most were worked only during the winter as harvesting diverted the labour force over the summer months, and because there was less flooding and better ventilation in the colder season. They lacked mechanized equipment and productivity was very low and accidents frequent. In all they contributed about one-sixth to one-quarter of the total output.¹¹ In some cases, small and large mines worked together in harmony, the large mines buying coal from the small and organizing its sale. Often up to 10 per cent of the output sold by the large mines actually came from the surrounding pits.¹² In other situations, small mines competed with the larger ones, putting coal on the local market at comparable or lower prices, and although all mines were supposed to have a licence from the government, many of the smaller operations were mining illegally on territory granted to large companies.¹³

Table 1.2 gives the annual coal production in China between 1896 and 1949. In 1936 it accounted for 2.7 per cent of the world’s bituminous output, 5.6 per cent of its anthracite, and less than one-fifth of one per cent of its lignite.¹⁴ The pre-1949 coal production peak was 65.7 million tons in 1942, over one-third of this having been produced in areas occupied by the Japanese.¹⁵ For perspective, the

Table 1.1 Output of coal by ownership of enterprise, 1913–42 (%)

	1913	1919	1926	1936	1942
National total	100.00	100.00	100.00	100.00	100.00
Chinese enterprises	44.00	50.26	44.92	42.52	10.06
Private	43.29	42.83	42.25	35.11	8.12
Joint government–private	0.17	4.21	2.02	4.83	0.67
Government	0.54	3.22	0.65	2.58	1.27
Joint Chinese-foreign enterprises	32.37	26.54	23.50	19.80	0.60
Chinese–Japanese	11.76	6.84	7.05	1.71	0.0
Chinese–English	15.66	17.96	15.08	15.95	0.60
Chinese–Other	4.95	1.74	1.37	2.14	0.0
Foreign enterprises	23.64	23.20	31.58	37.68	89.34
Japanese	14.35	20.87	31.11	37.68	89.34
English	3.20	2.33	0.47	0.00	0.00
Other	6.09	0.00	0.00	0.00	0.00

Sources: Alexander B. Ikonnikov, *The Coal Industry of China*, Canberra: Research School of Pacific Studies, Australian National University, 1977, p. 23. Adaptation of Table 1. Ikonnikov used data from The Geological Survey of China, *Chungkuo k'uangyeh chiyao no. 7* (7th General Statement on the Mining Industry of China), Chungking: 1945, pp. 53–72; Taiwan yinhang, chingchi yenchiushih (The Bank of Taiwan, Economic Research Unit), *Jichushihtai Taiwan chingchishih* (The Economic History of Taiwan Under the Japanese Occupation), Taipei: 1958, vol. II, pp. 182–3; and Yen Chung-ping and others, *Chungkuo chintai chingchishih t'ungchi tzuliao hsuanchi* (Modern Economic History of China, Selected Statistical Data), Peking: 1955, pp. 102–3, 126, and 154. Reproduced with permission from the Department of Economics, Australian National University.

Ikonnikov's explanatory notes:

- a. The entire pit output of the mainland part of China has been included in the item 'private' of 'Chinese enterprises', with the exception of 1936 and 1942; for these two years, the total output (mines and pits) in the areas under Japanese occupation, has been included in the item 'Japanese' of 'Foreign enterprises'.
- b. No statistics of output of Taiwan with a break-down by ownership have been found. In 1929 Japanese capital represented 76.45 per cent of the total capital invested in all industries, while Chinese capital represented 21.89 per cent. [Taiwan yinhang, chingchi yenchiushih (The Bank of Taiwan, Economic Research Unit), *Jichushihtai Taiwan chingchishih* (The Economic History of Taiwan Under the Japanese Occupation), Taipei: 1958, vol. I, p. 76.] In this table, 80 per cent of the total output of coal of Taiwan (100 per cent in 1942), has been included in the item 'Japanese' of 'Foreign enterprises', and 20 per cent (none in 1942), in the 'private' of 'Chinese enterprises'.

largest quantity the coal industry in the UK ever produced in one year was 287.4 million tons in 1913.¹⁶

The production peak in Manchuria alone was in 1944, at 25.6 million tons.¹⁷ During the war with the Japanese, between 1937 and 1945, despite shortages in the south, which was forced to import, northern coal was shipped to Japan for their war effort. Output in 1946 fell dramatically, but recovered in 1949. Nationalization of the industry began immediately after evacuation of the Japanese forces in 1945. Between 1945 and 1947, government capital in the industry rose from 12 to 29 per cent.¹⁸

Between August 1945 and May 1946, the Soviets removed whatever industrial equipment they could find in Manchuria. What they could not take back to the

Table 1.2 Production, consumption, imports and exports, 1864–1949
(mt)

<i>Year</i>	<i>Production</i>	<i>Consumption</i>	<i>Imports</i>	<i>Exports</i>
1864			0.1175	
1865			0.1005	0.0001
1866			0.1217	0.0512
1867			0.1152	0.0007
1868			0.1603	0.0034
1869			0.1288	0.0001
1870			0.0797	0.0002
1871			0.0869	0.0000
1872			0.1365	0.0010
1873			0.1170	0.0022
1874			0.1182	0.0005
1875			0.1456	0.0000
1876			0.1296	0.0007
1877			0.1709	0.0001
1878			0.2070	
1879			0.1786	0.0003
1880			0.2179	0.0000
1881			0.2568	0.0001
1882			0.2572	0.0006
1883			0.2457	0.0000
1884			0.2676	0.0004
1885			0.3068	0.0005
1886			0.3160	0.0003
1887			0.3098	0.0018
1888			0.2726	0.0054
1889			0.3765	0.0156
1890			0.3109	0.0129
1891			0.3759	0.0020
1892			0.4046	0.0045
1893			0.4358	0.0027
1894			0.1941	0.0057
1895			0.5816	0.0046
1896	0.489		0.6349	0.0088
1897	0.539		0.5581	0.0272
1898	0.783		0.7423	0.0160
1899	0.842		0.8731	0.0070
1900			0.8780	0.0031
1901	0.521		1.1714	0.0030
1902	0.954		1.1924	0.0268
1903	1.026		1.4301	0.0770
1904	1.274		1.2706	0.0105
1905	1.345		1.2292	0.0117
1906	1.696		1.5831	0.0023
1907	2.189		1.4259	0.0065
1908	2.788		1.5286	0.0283
1909	3.868		1.5409	0.1991
1910	4.237		1.4670	0.3232
1911	5.266		1.5656	0.3318

Table 1.2 (Continued)

<i>Year</i>	<i>Production</i>	<i>Consumption</i>	<i>Imports</i>	<i>Exports</i>
1912	8.988	9.8377	1.5411	0.6914
1913	12.800	12.8261	1.7179	1.6918
1914	14.102	13.6909	1.6266	2.0377
1915	13.417	13.5042	1.4238	1.3366
1916	15.903	16.0118	1.4447	1.3359
1917	16.902	16.7683	1.4672	1.6009
1918	18.340	17.6966	1.0923	1.7355
1919	20.055	19.7455	1.1916	1.5011
1920	21.260	20.5329	1.2746	2.0017
1921	20.459	19.9260	1.3836	1.9166
1922	21.097	19.8513	1.1698	2.4155
1923	24.552	22.7816	1.3880	3.1584
1924	25.781	24.1632	1.6358	3.2536
1925	24.255	24.0062	2.8021	3.0509
1926	23.040	22.8498	2.9439	3.1341
1927	24.172	12.4496	2.3559	4.0783
1928	25.092	23.6101	2.4655	3.9474
1929	25.437	23.5654	2.3177	4.1893
1930	26.037	24.9822	2.5065	3.5613
1931	27.245	25.5379	1.9333	3.6404
1932	26.376	24.2292	1.4544	3.6913
1933	28.359	28.8978	1.9854	4.4656
1934	32.725	29.0258	1.0619	4.7611
1935	38.032	34.0247	0.8292	4.8365
1936	39.342	35.0417	0.6152	4.9155
1937	36.913	31.8812	0.4911	5.5229
1938	31.943	30.9574	1.0918	2.0774
1939	38.542	36.9911	1.4137	2.9646
1940	46.828	43.9984	2.0084	4.8380
1941	58.823	54.0947	1.1318	5.8601
1942	65.686	59.2589	0.2694	6.6965
1943	56.687		0.0819	5.1140
1944	53.782		0.0160	
1945	29.206		0.0003	
1946	18.898		0.0731	0.0560
1947	21.904		0.2154	0.0162
1948	20.106		0.1382	0.0173
1949	32.430			

Sources: All figures from are *Zhongguo jindai meikuang shi bianxue zu* (The History of Coal Mining in Contemporary China Compiling and Study Group), *Zhongguo jindai meikuang shi* (The History of Coal Mining in Contemporary China), Beijing: Meitan gongye chubanshe, 1990, pp. 268, 269, 271, and 538 except the production figures for 1896 to 1911, which are for large mines only, and are from Tim Wright, *Coal Mining in China's Economy and Society, 1895-1937*, Cambridge Studies in Chinese History, Literature and Institutions, Cambridge: Cambridge University Press, 1984, p. 10. Ikonnikov, and Wu and Ling gave incomplete and different sets of figures. The 1949 production figure is from *CIYB 1982*, p. 24.

Soviet Union they destroyed. It has been estimated that Soviet looting and destruction reduced the plant and equipment capacity of the coal industry by some 80–90 per cent and further losses throughout the rest of the country occurred as a result of the civil war in 1947–48.¹⁹ By 1949 there was little operable machinery in any industry. Yet the mine development that took place before 1949 had lasting significance. Six of the country's largest mines in the 1990s, Fushun and Fuxin (Liaoning), Hegang and Jixi (Heilongjiang), Huainan (Anhui), and Kailuan (Hebei), were built in the early 1900s, largely with foreign capital. Other large mines constructed around that time were Benxi (Liaoning), Jingxing (Hebei), Zhongxing and Luta (both in Shandong), Chiaotso (Henan), and Pingxiang (Jiangxi). For the sake of comparison, while China's total output in 1949 was 32.4 million tons, and ranked ninth in the world, it was 435.9 million tons in the US, 218.6 million tons in the UK, 176.1 in Germany, 74.1 in Poland, 52.9 in France, 37.9 in Japan, 32.0 in India, 27.9 in Belgium, 25.0 in South Africa, and 14.3 in Australia.²⁰

Table 1.3 shows the geographical distribution of large mine production between 1912 and 1936. Production was concentrated in the north and northeast regions which together accounted for over 90 per cent of the country's large mine output, and of this, two provinces, Liaoning and Hebei, alone accounted for a minimum of 66 per cent (see Figure 1.1). Kailuan and Fushun mines almost consistently accounted for over half of the total large mine output and actually accounted for 71 per cent in 1927.²¹ According to the management, Kailuan's

Table 1.3 Geographical distribution of large mine output, 1912–36 (% of total output)

	1912–16	1917–21	1922–26	1927–31	1932–36
Northeast	33.2	29.5	39.1	50.2	42.1
of which:					
Liaoning	30.8	27.5	37.3	37.3	38.2
North	57.7	61.9	55.4	46.5	50.8
of which:					
Hebei	39.3	39.6	34.4	34.0	27.9
Northwest	—	—	—	—	—
Centraleast	9.1	8.5	5.5	2.9	5.7
West and Southwest	—	—	—	—	0.4
Southeast	—	—	—	0.3	1.0

Source: Tim Wright, *Coal Mining in China's Economy and Society 1895–1937*, Cambridge Studies in Chinese History, Literature and Institutions, Cambridge: Cambridge University Press, 1984, Table 24, p. 78. Copyright © 1984 Cambridge University Press. Reprinted by permission of Cambridge University Press.

Wright's notes:

Northeast: Liaoning, Heilongjiang, Jilin, Rehe.

North: Hebei, Shanxi, Shandong, Henan, Chahar, Suiyuan.

Northwest: Shaanxi, Gansu, Ningxia.

Centraleast: Hunan, Hubei, Anhui, Jiangxi, Jiangsu.

West and Southwest: Sichuan, Yunnan, Guizhou, Guangxi.

Southeast: Zhejiang, Fujian, Guangdong.

The percentages may not all add up to 100 because of rounding errors.

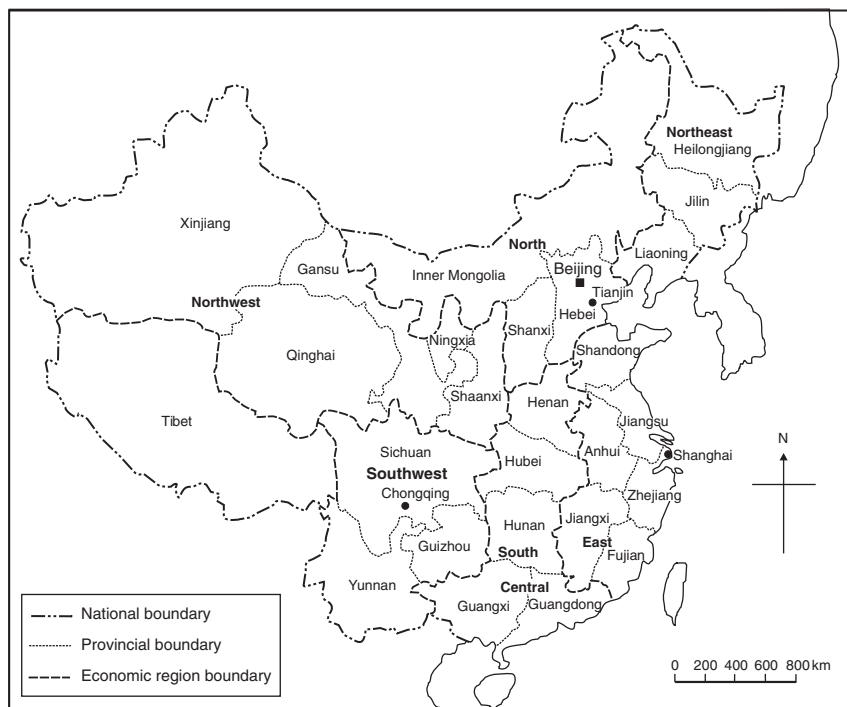


Figure 1.1 Provinces and autonomous regions of China

Zhaogezhuang, with a capacity of some two million tons, was the largest underground colliery outside the US in the early 1920s.²² The result of this concentration in the north and northeast was that the country's overall industrial development became increasingly imbalanced. Not surprisingly, most of the coal was consumed where the industrial development was greatest, namely, Manchuria, Shanghai, and the Treaty Ports. In 1936, 36.0 per cent was consumed in the north, 26.4 per cent in the northeast, 22.9 per cent in the centre and east, 7.9 in the southeast, 5.6 in the northwest, and 4.2 in the west and southwest.²³

In the early 1910s and early 1920s Manchuria produced over 30 per cent of China's coal even though it had under 2 per cent of China's coal reserves and only about 7 per cent of its population. In 1925–26, when the civil wars disrupted production in the north, it accounted for over 50 per cent of the total coal production. Output from large mines in Liaoning, Jilin, Heilongjiang, and Rehe (a province in the pre-1949 period) grew at 10.9 per cent per year between 1907 and 1936, while in the rest of China the rate was 5.8 per cent.²⁴ Compared to growth in China proper, the coal industry's expansion in Manchuria was rapid. The area enjoyed relative political stability, GNP was higher, and per capita consumption of coal was twice as high. Japan's intention was that Manchuria serve not just as a raw materials hinterland, but also as a new industrial and population base.

In the 1930s Shanxi, China's most coal-rich province and one of the largest deposits in the world, was producing less than 4 per cent of total output. Reasons that have been given for this include: shortage of water for steam engines and timber for pit props; shortage of capital, which not only limited growth potential but resulted in horrific working conditions; and the high cost of transportation to coastal markets.²⁵ Moreover, before 1937 the area was continually plagued with political and military upheavals which disrupted railway traffic. The Peking Syndicate did plan to develop the resources, but was unsuccessful in gaining permission to build a railway to Pukou (Jiangsu), where the coal would have been unloaded onto ships and transported on the Changjiang.²⁶

The ratio between production in Manchuria and China proper in 1942 was 63 : 37. In 1947 it was 75 : 25, but by the time of the Communist takeover in 1949 it was down to 60 : 40.²⁷ In order to reduce the demand on northern coal, the Nationalist government had opened the Huainan mine (Anhui) in 1929 and by 1936 it was supplying much of Shanghai's needs. The southwest region, held by the Nationalists and sometimes referred to as 'Free China', was developed after 1937, when the wars disrupted the supplies in the north.

Washing coal removes various impurities such as shale, clay, pyrites, etc., and may involve either physical separation, which mechanically distinguishes the relative gravities and/or surface properties of the coal, or magnetic or chemical separation. Often after the coal is washed, it is processed, which entails the crushing of the large lumps, and screening them into various standard sizes. Up to two-thirds more raw than clean coal is required to achieve the necessary heat levels, and up to one-third more space is occupied in transit and storage.

A good quality washed coal has about 7,000 kcal per kg. The average caloric value before washing at the best mines was about 6,600 kcal, but from the least good may have been as low as 3,500.²⁸ Before 1949 little attention was given to improving the quality of the coal. Generally, it was simply used in its raw form without being washed, though some was sized.

Mechanization and use of labour

Apart from opencast mines at the Guchengzi site at Fushun (Liaoning) and at Zhalainuoer and Hegang (Heilongjiang), almost all the mines before the Sino-Japanese War (1937–45) were underground and used the room and pillar system.²⁹ The longwall system was not implemented until the 1950s.³⁰ Compared to European mines, which had been built much earlier, the mines in China were relatively shallow. The average depth in the deepest shafts at China's largest mines was 163 m, comparable to that in the US.³¹

The level of technology used for cutting the coal was rudimentary. While the proportion of coal cut by mechanized means was less than 1 per cent at the time the PRC was established, 55 per cent of the coal was cut by mechanized means in the UK in 1936, 97 per cent in Germany's Ruhr Valley, 99 per cent in Belgium, and 88 per cent in France's Pas-de-Calais mines in 1935.³² The main reason for the lack of mechanized operations in China was the abundant and cheap labour

available to the contractors. Other factors were the shallowness of the mines, and the fear on the part of foreign developers that the prevalent political turmoil could at any time disrupt mining or coal transport. It was simply not in the interests of the foreigners to bring the best and most expensive equipment available. As the mines became deeper, however, not only was extraction more dangerous, but the miners needed training. This was not easy to provide to the illiterate gangs of men from the farms who worked only for a few years at the mines, and for only part of the year at that.

The hauling of the coal to the surface was generally the first mining process to be mechanized, and at the Japanese-operated mines in particular, it was relatively sophisticated. While over 50,000 pit ponies were in use in British mines in the late 1930s, the Japanese-operated mines had switched to electrically powered ropes or locomotives.³³

Most mines had contractors to oversee the coal cutting and hauling. They were charged with supervising crews of men to bring to the surface, by a certain target date, an agreed amount of coal. Often bonuses were given if the amount was exceeded. Under this contract system, the contractor hired the men, mainly peasants from rural areas, and provided them lodging, meals, and pay. For the mine owners, this system was very convenient, but for the gangs of men it was abusive. The living and working conditions were primitive and the pay paltry. The contractors tended to cut corners wherever possible and to request extra fees for the smallest of services to both the workers and the mine owners. Initially, the workers had no rights (apart from a free coffin!) or recourse whatsoever, though as time went on it was necessary to improve the conditions and terms in order to reduce the high turnover of men.³⁴ A minimum wage was eventually instituted and the responsibility of paying the workers was taken out of the hands of the contractors and assumed by the mine owners.

Most of the labourers were male rural peasants who returned to their fields during the planting and harvest seasons. Though often ignored, there was a law prohibiting the hiring of workers under the age of sixteen. A few women hauled coal to the surface, while many worked at the surface level. Unlike the mines in Japan, where convicts made up a large proportion of the miners, it seems in China convict labour was used only in Sichuan Province.³⁵ There was some use of slaves and instances of kidnapped workers. Others were tricked into amassing gambling or drinking debts and then forced to sell their labour. Some signed up on the basis of feigned promises.

While unskilled labour was rarely in short supply, an insufficiency of skilled labour characterized the industry until the 1920s. Mining companies were forced to seek out foreign engineers and technical staff. This raised production costs considerably. When the Japanese took over all the Chinese-owned mines in the northeast, they brought their own engineers.

The average output per manshift at the largest mines in the 1930s and 1940s was 0.592 tons.³⁶ By contrast, in 1937 it was 1.534 tons in the UK, 2.002 in West Germany, 1.435 in the Saar, 1.236 in France, 2.413 in Poland, 1.139 in Belgium, 2.550 in the Netherlands, and 1.837 in Czechoslovakia.³⁷

The accident rate was very high. While there were between 5 and 21 fatalities per million tons of output at the American, Indian, and Japanese mines in the late 1800s and early 1900s, there were between 25 and 212 at the main mines in China between 1907 and 1934.³⁸ The difference would be very much greater if the small Chinese-run mines were included. A gas explosion at Benxi (Liaoning) in 1942 killed 1,662. This was the biggest ever coal mine accident in world history to date. The rate of lung and skin disease was also very high, and the average working life of the miners was but a decade.

Wages, though barely enough to survive on, were not the lowest in the industrial category. The mainly women workers in the cotton spinning, silk reeling, and match industries were paid less. Relatively speaking, though, working conditions in these industries were somewhat better. Unlike in other countries, the Chinese mine workers were not highly organized. There were several altercations – mainly protests against the barbaric treatment accorded them by the contractors – but until the 1920s the workers were insufficiently integrated to form unions. There were a number of reasons for this. The mines were spread over a large geographical area, the men were not at the mines all year round, and due to the wretched working conditions and exploitative contract system the worker turnover rate was high. They were illiterate and completely uninformed about alternative industrial management structures, far less the militancy in other countries' coal mining industries.

Mention must be made, however, of an escalation in organized labour protests in the 1920s, especially among miners at the larger operations. Marxist Study Groups, the Chinese Labour Organization Secretariat, and after its formation in 1921, the Chinese Communist Party had been organizing labour in those areas where it was concentrated. Miners staged strikes at Pingxiang (Jiangxi), Kailuan (Hebei), Tangshan (Hebei), Zhaogezhuang (Hebei), Linxi (Hebei), Majiagou (Shanxi), and several other sites. The issue was usually low or non-payment of wages, maltreatment of workers, or some aspect of working conditions or terms. This heightened agitation of the miners lasted throughout the decade.

This localized and short-lived intensification of labour unrest apart, the figures for mine worker unionization were never large when considered over the whole pre-1949 period. In China proper never more than 40 per cent of the workers were unionized. This was half the rate of unionization at the American mines in the same period. If the work force in the large mines in Manchuria were factored in, the percentage would be reduced to 20 per cent, while inclusion of the workers at the native pits would further reduce it to less than 10.³⁹ In the 1940s the key strategic industries such as the railroads and communications were nationalized for defence reasons and in 1942 a draft labour policy forbade 'workers in military industries' (all heavy industries including coal) to strike or participate in collective bargaining.⁴⁰

Financing

The big mines either made direct sales to retailers or consumers at the ports or at stops along railway lines, or sold it through distributing companies or agents who

earned commissions. It was the responsibility of the mines to organize the transport and handling of the coal, while the agent managed storage and sales. The coal that was not sold directly to consumers often went through several middlemen, who in turn raised the price higher and higher.

Managers of all urban coal distribution centres with capital amounting to over a certain level belonged to 'coal guilds'. The Peiping Coal Guild was registered with the Peiping Chamber of Commerce and its members met monthly.⁴¹ In Manchuria, distribution was managed by the Japan–Manchukuo Trading Corporation, while marketing came under the jurisdiction of the main railway, metallurgical, and other heavy industry companies.

The blockage of railway traffic during the civil wars in the late 1920s nearly forced the closure of some mines in the interior, but mines with foreign connections such as Kailuan and Fushun were spared and continued to make high profits. In the 1930s, the depression affected Manchuria first, and China proper later.

Coal occupied a very important role in the economy. Compared to consumer goods or other mining products its percentage contribution to total industrial net value-added was fairly consistent (see Table 1.4). It accounted for about one-quarter to one-third of the total between 1912 and 1945, dropped sharply to about one-sixth in 1946, but came back up to about one-quarter in 1949.

Table 1.4 China's industrial structure 1912–49 (% of total net value-added in 1933)

	<i>Consumer goods</i>	<i>Coal</i>	<i>Ferrous metals</i>	<i>Other mining products</i>	<i>Electric power</i>
1912	21.9	31.2	1.5	40.0	3.3
1917	29.2	31.0	7.2	25.6	3.7
1921	44.1	29.8	7.7	11.7	5.4
1922	32.7	34.1	6.8	16.3	7.3
1926	40.6	24.2	4.5	15.6	12.0
1930	44.3	23.5	5.3	8.9	13.5
1933	41.6	20.9	5.2	7.4	20.2
1936	30.7	23.7	8.5	8.6	22.1
1937	25.4	26.4	13.0	11.4	16.1
1940	8.7	30.5	13.8	9.5	23.6
1943	5.7	30.4	19.5	3.1	32.3
1945	5.3	26.4	5.0	3.9	50.4
1946	37.5	16.5	0.7	4.7	37.7
1949	29.3	24.6	3.3	3.3	35.2

Source: John K. Chang, *Industrial Development in Pre-Communist China: A Quantitative Analysis*, Edinburgh: University of Edinburgh Press, 1969, p. 76. Adaptation of Table 20.

Chang's note:

Consumer goods: cotton yarn and cotton cloth; ferrous metals: iron ore, pig iron, and steel; other mining products: antimony, copper, gold, mercury, tin, and tungsten. Cement and crude oil, accounting for only negligible fractions of the total, have been omitted; the percentages, therefore, do not add up to 100.

Coal exports and imports between 1864 and 1948 are given in Table 1.2. Before 1915, imports were greater than exports. During the early 1800s coal had been brought from Japan, India, America, Britain, and Australia. Between 1917 and 1943 the situation was reversed. The volume of exports depended largely on the supply situation in Japan, and concomitantly, the relative prices of Chinese and Japanese coal. Exports as a proportion of total national coal output were as high as 14–16 per cent in some years, though as southern China imported some coal from Vietnam (mainly anthracite), India, the Netherlands, East Indies, and Japan, the adjusted net export figures were somewhat less.⁴²

Most but not all of the export shipments came from Japanese-operated mines and most – up to one-third of their production – were destined for Japan. Some shipments were also sent to Hong Kong and Korea. In 1936 exports from China proper amounted to 7 per cent of total production and 1.5 per cent of total export trade. Imports amounted to 3 per cent of domestic consumption and 0.7 per cent of total import trade.⁴³ For perspective, 4.92 million tons were exported from China in 1936, compared to 51.2 million tons from the UK in 1935.⁴⁴

The demand for extra coal supplies from China rose sharply in the years leading up to the Second World War. Ironically, it was Chinese coal which fuelled the Japanese war in Southeast Asia, including China. One of the first acts of the invading Japanese soldiers was to commandeer all the largest mines.⁴⁵ Of particular interest was the coking coal, used in the manufacture of steel, at Kailuan. Its output was shipped north to Manchuria and to Japan. In 1944 the Kailuan mines were incapacitated by bombs, forcing China proper to import coal from Indo-China.

Transport

As in the majority of other countries, the most efficient way to move coal from the mines to points of consumption in China was the railways. There was a symbiotic relationship between the coal industry and the railways – neither could survive without the other. The cost of railway transport was as low as less than a fifth of that for the other forms of land transport, and, in any case, humans or pack animals were capable of pulling or carrying this heavy bulky commodity only limited distances.⁴⁶ Wright calculates that for cart transport of coal, the approximate economic radius in 1913 was 75 km, and for railways well over 500 km.⁴⁷ The development and modernization of railway transport made it feasible for foreign mining companies to operate profitably, and immediately created in the cities an insatiable demand for coal from manufacturing and commercial enterprises. Factories grew in such number and scope that imports of manufactured items dropped sharply. The development of railways also made domestic coal competitive with coal imports, which came to be used only in emergencies.

A proposal for a railway line from Shanghai to Suzhou had been made in 1863 by a group of British businessmen. The Chinese government, however, fearful that this technology would make the Chinese vulnerable to foreign economic and political dominance, refused permission. It was not until 1876 that a ten-mile line

Table 1.5 Railway trackage, 1876–1949 (km)

<i>Year</i>	<i>Annual increment</i>	<i>Total to date</i>
1876	16	16
1877	–16	0
1878	0	0
1879	0	0
1880	0	0
1881	10	10
1882	0	10
1883	0	10
1884	0	10
1885	0	10
1886	32	42
1887	0	42
1888	103	145
1889	0	145
1890	0	145
1891	0	145
1892	45	190
1893	98	288
1894	122	410
1895	0	410
1896	0	410
1897	134	544
1898	30	574
1899	287	861
1900	209	1,070
1901	243	1,313
1902	2,645	3,958
1903	645	4,603
1904	948	5,551
1905	494	6,045
1906	201	6,246
1907	246	6,492
1908	256	6,748
1909	800	7,548
1910	769	8,317
1911	983	9,300
1912	322	9,622
1913	75	9,697
1914	39	9,736
1915	768	10,504
1916	145	10,649
1917	0	10,649
1918	534	11,183
1919	14	11,197
1920	84	11,281
1921	461	11,742
1922	305	12,047
1923	244	12,291
1924	398	12,689
1925	278	12,967

Table 1.5 (Continued)

<i>Year</i>	<i>Annual increment</i>	<i>Total to date</i>
1926	417	13,384
1927	698	14,082
1928	455	14,537
1929	201	14,738
1930	226	14,964
1931	120	15,084
1932	424	15,508
1933	296	15,804
1934	1,255	17,059
1935	1,834	18,893
1936	1,849	20,742
1937	973	21,715
1938		
1939		
1940		
1941		
1942		
1943		
1944		
1945		
1946		
1947		
1948		
1949		21,800

Sources: Figures for 1876–1937 are calculated from Ralph W. Huenemann, *The Dragon and the Iron Horse: The Economics of Railroads in China 1876–1937*, Cambridge, MA: Council on East Asian Studies, Harvard University, 1984, pp. 76–7, Table 3. The 1949 figure is from *TJNJ 1985*, p. 385.

was actually built – by a Briton, Gabriel James Morrison – connecting Shanghai with Wusung.⁴⁸ However, the authorities tore it up the following year and shipped it to Taiwan, never to be reassembled. The second line was begun in 1878 by an English engineer, Claude Kinder, from the Kaiping mines to Xugezhuang (Hebei), which is situated on a canal. It was later extended to Tianjin and then Peking, Mukden, now called Shenyang (Liaoning), and Hankou, now part of Wuhan (Hubei) becoming a major trunk line.⁴⁹

France, in 1885, was the first to obtain a railway concession which bordered Indo-China. Russia was given rights the following year in Manchuria, which permitted the construction of the Chinese Eastern Railway and the South Manchurian Railway. The Germans, British, and Japanese were also granted railway concessions for both trunk and feeder lines and 9,300 km had been built by the end of the Qing Dynasty in 1911 (see Table 1.5). Though the differences in gauge were problematic, taken together these lines became a vital network and coal was a main cargo.

Only another 11,442 km were laid before the end of the Republican period, 40 per cent of which were in Manchuria. The First World War, the civil wars, and the Japanese invasion of Manchuria, and the Second World War all severely affected railway construction, the military and/or warlords expropriating all the rolling stock. Whereas India in 1936 had about 72,000 km of railway trackage and 33.5 billion ton-km of freight, China had only 20,742 and 14.6 billion, respectively.⁵⁰ The Nationalists constructed several railways in the southwest during the 1940s. By 1949 the per capita national trackage was still very low compared to that in other countries.

In the 1930s coal shipments occupied about half of the country's railway capacity and on average accounted for 17 per cent of the railway revenues. On some lines they accounted for much more of the revenues, for example, about 31 per cent on the Kiaochow-Jinan (Shandong) line, 33 per cent on the Peking-Mukden line, 41 per cent on the Chengting-Taiyuan (Shanxi) line, and 68 per cent on the Taokow-Chinghua line.⁵¹ The trackage and rolling stock were not only inadequate relative to production rates, but there was a lack of coordination between the mining and railway sectors. Railway capacity often determined coal production.⁵² Coal was also shipped by water, southwards along the coast, and on the lower Changjiang and Wei River, and on various small rivers throughout the southwest. There were some 40,000 miles of canals at that time including the Grand Canal.⁵³ Total shipments on the Changjiang and along the coast were about one-quarter those on the railways and were for the most part overseen by the foreign-controlled mines.⁵⁴

Consumption

Total coal consumption figures for 1912 to 1942 are given in Table 1.2. The highest figure here is 59.3 million tons in 1942. For perspective, total coal consumption in the UK in 1925 was 176.0 million tons.⁵⁵ Before the introduction of railways in China, coal use was necessarily restricted to a small radius around the mines. The demand for coal to fuel ships rose sharply with the opening of the Treaty Ports, beginning in 1840, which hastened both mining and railway development. Total potential demand was about 300,000 tons per annum in the early 1870s and rose to some 2 million tons in the early 1900s.⁵⁶ The demand for bunker coal slowed later due to a downturn in world trade, more efficient use of coal by the steamships, and the beginning of their conversion to the use of fuel oil. About 7 per cent of the coal from the large mines was sold to shipping companies in the mid-1930s.⁵⁷

When fuel oil was replacing bunker coal, the new railways became a major consumer of coal and some railway owners invested directly in mines to guarantee their supplies. Among these were the South Manchurian Railway, Chinese Eastern Railway, and the Jing-Han line, connecting Peking and Hankou (Hubei). Several railway companies actually built their own mines.

Table 1.6 gives a breakdown of coal consumption in China from 1915 to 1933. For contrast, the corresponding breakdown in 1929 in the UK was: gas works 10 per cent, electricity generation 6 per cent, railways 7 per cent, coastal shipping