LBNL- 49024

A Guide to China's Energy Statistics

Jonathan E. Sinton and David G. Fridley

Energy Analysis Department
MS 90-4000 Lawrence Berkeley National Laboratory
Berkeley, CA 94720 USA
Phone: +1-510-486-7081
Fax: +1-510-486-6996
jesinton@lbl.gov

Accepted for publication in *The Journal of Energy Literature,* June 2002

29 April 2001

Abstract

A tremendous amount of statistical material on China's energy system has become available since the 1980s. In this article, we provide an overview of the published sources on China's energy statistics, mainly concerning energy production and consumption. Aggregate statistics and balances are available through publications of the National Bureau of Statistics, and specialized publications present information on sectors and individual enterprises in greater detail. Some materials are available in English, while most are only in Chinese, and some key information is available on the internet. While shortcomings in coverage and quality affect many energy indicators, China's statistics can be used for meaningful analysis, provided that the factors affecting data quality are given due consideration, and checks using other indicators are performed.

Keywords: China, energy data, energy statistics

Introduction

As the world's second largest consumer of energy, an important actor in regional energy markets, and a major player in regional and global environmental issues, China has drawn increasing attention internationally to its energy system. The country's energy supply is dominated by coal, which currently accounts for about two thirds of primary commercial energy use (**Figure 1**). Unlike most developed countries, where residential, commercial, and transportation uses are the largest consumers, energy use in China is still dominated by industry, which accounts for 70% of final demand (**Figure 2**).

Since the 1980s, a wealth of information has been published in China on energy resources, production, consumption, transportation, prices, and other topics. These have been used by policy makers, businesses, and analysts inside and outside the country. Most statistics are available in aggregated reports only; little primary statistical information, i.e., reports from individual enterprises, is made public. Definitions and coverage of statistical categories are sometimes unclear, and occasionally some indicators are subject to misreporting. Recently, attention has been drawn to problems of misreporting, and the impacts on quality of statistics, particularly concerning economic growth (Rawski 2001). Despite these problems, the publicly available material is vast, of generally good quality, and tremendously useful so long as care is taken to account for potential biases.

For some analytic purposes, the public sources are insufficient, and some commercial information providers exist that can fill in some of the gaps. However, accessibility to primary statistical data is limited not only by usual commercial concerns about proprietary data, but also by the Chinese governments' low threshold for declaring information confidential. Definitions of what constitutes officially secret information are vague, and the punishments for releasing information that is declared secret after it is released can be heavy, so commercial information sources often are unable or unwilling to provide much detail beyond what lies in the public domain, although they may be able to provide information before it is available to the general public.

In this article, we provide an overview of the published sources on China's energy statistics. The most aggregate summary statistics, and some more detailed reports, are easily available, and may be found on the internet and in widely distributed annual publications in both Chinese and English. The majority of the published information, however, is printed and distributed within China and only in Chinese, rendering access difficult for most interested parties in other countries. Because of the great volume of material available, in this article we can provide only a broad view of what is available, and highlight some of the main issues that users of these sources should be aware of.

Primary Data Sources

The primary source for China's energy statistics—and the only authoritative source for complete coverage of all supply and demand statistics—is China's National Bureau of Statistics (NBS; *Guojia Tongjiju*).[1] The balance tables and other series published by NBS are the sources on which most other

[1] Until 2000, NBS was referred to as the State Statistical Bureau (SSB).

published materials are based, e.g., the International Energy Agency's *Energy Statistics of Non-OECD Countries* (IEA 2001), the U.S. Energy Information Agency's *International Energy Annual* (EIA 2001), the *British Petroleum Statistical Review of World Energy*, the World Bank's *World Development Report*, and the *China Energy Databook* (Fridley, *et* al. 2001). NBS's statistical series include primary energy production and consumption, national and provincial balance tables, subsectoral breakouts of industrial energy use, energy intensities of major industrial processes, and other series. These appear primarily in the annual *China Statistical Yearbook* (NBSa various years), which since 1994 has been published as a bilingual Chinese-English edition, the *China Statistical Abstract* (NBSb various years), the occasionally issued *China Energy Statistical Yearbook* (NBSc various years), and the *Statistical Yearbook of China's Industrial Economy* (NBSd various years).

Primary Energy Production and Consumption

China's national total primary energy statistics are released first in the annual *China Statistical Abstract*, usually published in late spring. These contain preliminary statistics that are later revised and released in the *China Statistical Yearbook* in early autumn. In recent years, the magnitude of the revisions to primary energy production figures has increased, while revisions to primary energy consumption have remained small (Sinton 2001).

Monthly figures on primary energy production are published throughout the year in *China Monthly Statistics* (CSICSC various years), and are also available after a delay at NBS's website (http://www.stats.gov.cn/). These monthly figures form the basis of the preliminary numbers released in the *China Statistical Abstract*, and are based on complete monthly reporting from larger energy producers and estimates of output from smaller enterprises. The final revised figures in the *China Statistical Yearbook* take into account revisions to the preliminary statistical data. These are also published in the *China Energy Statistical Yearbook*, along with data on energy-industry investment and energy consumption.

Statistical Collection and Reporting System

China's system of statistical collection was developed under a planned economy, and was based on the assumption of complete reporting from all units producing, transforming, delivering, and using commercial energy. There are bureaus of statistics at the national, provincial, city, county, and township levels. The township and county bureaus are responsible for collecting primary statistical reports from enterprises and government agencies within their geographical boundaries. The reports are collected and aggregated at higher levels. Provincial bureaus prepare energy balances, and, based on these and with reference to a variety of other information, NBS prepares national balances.

As China's political economy has shifted towards a market system, the amount of activity occurring outside the units that report regularly to the NBS system has increased. For instance, by the mid-1990s, nearly half of China's coal was produced by small, non-state mines, many of which did not reliably report to statistical collection agencies. NBS consequently supplements information from statistical reports with information gathered by survey teams.

NBS also relies on sectoral government agencies for reporting of many statistical series on production and consumption. Typically, the numbers reported by government agencies cover only state-owned and state-invested enterprises. The statistical summaries published by NBS, therefore, are often slightly larger than those published in sectoral yearbooks, as examples in later sections show.

NBS has agreements on exchanges of energy statistical materials with the International Energy Agency, the US Energy Information Administration, and others. International collaborations have assisted NBS in improving the quality of its energy statistics, and the agency produces material of good quality given the constraints it faces. However, to produce materials that conform to the norms that prevail in most developed countries, China will need to continue restructuring its statistical collection apparatus, further reorganize statistical categories, expand its channels of information gathering (particularly surveys), and devote substantially greater resources to its activities. To drive this, greater attention from higher levels of government will be needed. Unfortunately, attention to energy issues has declined over the past decade, as energy availability is no longer considered to be a critical constraint on economic growth in general, although there is currently great concern about oil supplies.

Coal

China's main fuel is coal, so the accuracy of overall energy output statistics is particularly dependent on the accuracy of coal output figures. Unfortunately, it is in just this area that energy output statistics are weakest. Under the planned economy, when virtually all mines with significant output were state-owned, the statistics were relatively accurate, except when political pressures led to biases in reporting. Under the current system, NBS still obtains monthly and annual reports of coal output from all state-owned mines, and from mines with annual gross output value of 5 million yuan and over (Xu 2002).[2] Output from smaller mines is based on information obtained through quarterly surveys of small enterprises. These surveys are performed in all sectors on a random sample of 5% of all small enterprises. Additional, more-detailed surveys are performed every two to three years to validate the results of the quarterly surveys. In the case of coal output, these validating surveys have found that the quarterly sample surveys tend to underestimate coal production, leading to occasional revisions of previous years' statistics.

False reporting of statistics, particularly inflation of economic output figures, has been widely reported inside and outside China (Rawski 2001). In the coal sector, a campaign to close small mines for safety, economic, and environmental reasons has led to serious underreporting (Horii and Gu 2001). Since the campaign began in 1998, 57,000 mine shafts have reportedly been closed.[3] However, news report and other anecdotal evidence indicate that many closed mines reopened in secret, and miners continued to die in accidents in mines that were ostensibly shut down. As a consequence, the gap between output and consumption figures began to widen, and by 1999 the statistical error in the coal balance table was over 200 million metric tons (Mt), compared to values of several tens of million tons in previous years. Since reported drawdowns of China's substantial stockpiles are already accounted for in the balances, this statistical error is probably almost entirely composed of unreported production.[4]

Coal output statistics from NBS can be considered relatively reliable (i.e., consistent in terms of coverage) from the early 1980s to the mid-1990s, while figures since then should be used carefully. While the reported output figures may be incorrect, there is little doubt that coal output—like consumption—declined significantly in the late 1990s.

The other major source of coal output statistics is the former Ministry of Coal system, which in 1998 was transformed into an agency under the State Economic and Trade Commission (SETC) (Andrews-Speed 2001). The series reported in the *China Coal Industry Yearbook* (EBCCIY various years) include output by mine ownership type, coal type, and province, as well as indicators for individual state-owned mines, coal quality, coal transportation, employment, and many other categories. While these detailed figures are of great interest to some analysts, their value as a guide to the overall state of coal production in China is limited, since coverage of some series varies from year to year, and coverage of non-state mines is incomplete or absent. The statistics on number of mines, for instance, varies widely between years, and appears to greatly underestimate the number of small mines. Occasionally, results of survey data are published; information from a 1995 survey appears in a 1998 publication from the coal industry's publishing house (Ye and Zhang 1998). Figures concerning the large, state-owned mines, however, appear to be relatively complete and consistent.

Coal output figures are, by some standards, inflated because of the product that is measured. Relatively little of China's coal is cleaned (under 20%), and reported output is run-of-mine coal, containing large amounts of fines and tailings. This problem may have become less severe since the price liberalization in 1993 that led to a buyers' market for coal, in which it became more difficult for mines to sell lower-quality product for a reasonable price.

Since coal is China's major fuel, coal provides the standard by which all other energy forms are measured—although the standard bears little relation to the coal actually used. The usual unit for measuring aggregate energy production and use is the metric ton of standard coal equivalent (tce), equal to 29.31 GJ or 7 million kcal at low heat value. A typical conversion rate for an actual ton of Chinese coal is 20.93 GJ or 5 million kcal per ton. There are signs that the "standard" conversion rate of tons of coal to tce may be changing. A comparison of NBS's aggregate statistics for physical coal output by the coal industry and primary coal output (in tce) in the energy tables shows that the standard rate of 0.7143 tons of coal per tce

[2] This standard is used across sectors for defining which enterprises are required to submit statistical reports. This introduces a problem of variability in coverage, since the number of enterprises fluctuates as the fortunes of individual enterprises rises and falls.
[3] In 1998, the number of operating mines, most of them consisting of a single shaft, was reportedly over 70,000 (Horii and Gu 2001).
[4] Coal consumption is more difficult to underreport, since those statistics are checked for consistency with other indicators, e.g., physical and economic output, freight movements, and population.

was used up until 1995, but thereafter the value has fluctuated slightly. The same holds true for oil and natural gas; until 1995, the same conversion factor was used, but different ones have obtained in each of the following years.

Oil and Natural Gas

The oil and natural gas industries in China are much more highly concentrated than coal. Two companies, PetroChina (the publicly traded company under the China National Petroleum Corporation, or CNPC) and Sinopec, account for the overwhelming majority of oil and natural gas extraction and oil refining, though about 10% of refining capacity is dispersed among small oil processing plants belonging to localities and other industrial sectors. The China National Offshore Oil Company has a monopoly on offshore production of oil and natural gas. International oil trade currently remains primarily the responsibility of Unipec, Sinoil and Sinochem, all state trading companies allied with the national oil majors. Domestic marketing down to the wholesale level is also primarily the authority of the state oil companies, but numerous non-state players participate in the retail market. In recent years, Sinopec and Petrochina have invested heavily to return a larger proportion of retail marketing outlets to their ownership. With closures in recent years of many of the small oil-processing plants, the number of players has become quite small, and those that remain keep close track of production from individual wells and refining runs. In the early 1990s, a nationwide satellite reporting system was established by Sinopec, and now used by both Sinopec and PetroChina, to report daily output figures from each oil and gas well. Consequently, it is possible to produce high-quality statistics in this sector based on full reporting from these few entities. The growing involvement of international oil companies in offshore and onshore activities has tended to increase the amount and accuracy of information, though not necessarily its accessibility.

Sinopec and CNPC both publish yearbooks in which they report their own production and other statistics, as well as figures that purportedly cover the rest of the extraction and refining industry (CNPC various years; Sinopec various years). NBS, of course, also publishes statistics with full sectoral coverage, and these are higher than those released by the oil companies. The source of this discrepancy may be information that NBS gleans from the surveys it conducts of small enterprises, which would gather information on fuel production from oil processing plants in the chemicals and other non-energy sectors.

Import and export statistics are closely watched, and the Sinopec and CNPC yearbook both have such numbers drawn directly from the China Customs Bureau. NBS also publishes international oil and natural gas trade statistics, and these, like the import and export figures for other commodities, are derived from customs statistics (Customs Bureau 2000). The *Customs Statistics Yearbook of the People's Republic of China* provide a very detailed breakdown of trade in oil products and natural gas (exports of which go exclusively to Hong Kong) by country of origin and destination. For a time in the 1990s, large amounts of oil products were smuggled into China, reaching up to 12 Mt of mainly diesel oil in 1998 (Sinton and Fridley 2000). Since then, however, easing of restrictions on oil imports, increases in refinery capacity and utililization, and adjustments of domestic prices to follow international prices have removed many incentives for smuggling, and customs statistics can be considered more accurate. No such problems afflict the statistics regarding trade in coal and electricity.

Figures on China's oil and natural gas resources are published by Sinopec, CNPC, and CNOOC and annually updated figures are available in the companies' annual reports and in part on their websites. Definitions and classification of resources and reserves in China, however, have tended to differ from those normally used elsewhere. International publications, such as the *British Petroleum Statistical Review of World Energy* (BP various years) and the *Survey of Energy Resources* (World Energy Council 1995) are probably the best sources for figures on energy resources and reserves figures that are comparable to those in other countries. The same applies to statistics on other types of energy as well. Chinese publications that present comprehensive statistics on energy resources are not common, but they do appear occasionally, e.g., the series of energy reviews prepared for the State Development Planning Commission and SETC (e.g., SETC 1997). These also include maps showing the geographic disposition of resources, and renewable and nuclear energy resources.

Electricity

While NBS publishes statistics on total, fossil, and hydro electricity generation, for the nation and by province, as well as heat rates and transmission and distribution losses in the *China Statistical Yearbook* and the *Statistical Yearbook of China's Industrial Economy*, the most extensive resource is the *China Electric Power Industry Yearbook* (EBCEPY various years). This source provides, among other information, statistics on installed capacity by type and size of unit, detailed information by utility region and province, and indicators for the country's largest power plants and networks. This is also the only domestic source that regularly publishes information on output from China's nuclear power plants.

China's overall power generation figures are typically for gross generation, i.e., they include in-plant use, which is significant, and is reflected in the difference between the gross and net heat-rate series. In aggregate energy statistics, electricity is converted at a "standard" value of the amount of primary energy consumed in power plants to produce a kWh of electricity (404 grams of standard coal equivalent [gce]). In the past, some statistical series have occasionally presented alternate sums of total energy with electricity converted at its end use value (123 gce/kWh). The standard conversion is used throughout most statistical series, including balance tables. However, comparison of the primary energy production series with reported power generation figures in the *China Statistical Yearbook* reveals implicit conversion factors that change each year, with a gradually rising trend in efficiency. Such a trend accords with the rapid growth in China's installed capacity by addition of larger, generally more-efficient generating units. Care should be taken in making assumptions about the conversion factors used for electricity in China's statistics.

Renewable Energy

While many sources deal with commercial energy, there are relatively few that present information on renewable energy. This type of energy is particularly important, since much of China's population, still about two thirds agricultural, relies heavily on wood, crop wastes, and other biomass fuels, consumption of which is reportedly equivalent to about one fifth of commercial energy use. Some numbers have been published on biomass fuel resources (e.g., Li *et al*. 1998). Such resource figures are valuable to compare to biomass fuel consumption, but the resource figures suffer from definitional issues, e.g., determining how much of the amount of standing biomass can be "sustainably" harvested. Figures on biomass energy use by province have been published in the two latest editions of the China Energy Statistical Yearbook, covering wood, crop wastes, and biogas. These are based on estimates provided by the Ministry of Agriculture, which itself publishes the China Rural Energy Yearbook (EBCREY 1999). Even more so than other energy consumption statistics (discussed below), these figures rely heavily on estimates, and can only be taken as a rough guide to the magnitudes of the rural noncommercial energy activities they attempt to measure. While exact magnitudes may be in doubt, the stability of these figures suggests that the statistics may be consistent and reflect actual qualitative trends.

Consumption

Statistics on energy consumption are in general more difficult to collect than those on production, since the former attempt to measure the activities of many more actors than the latter. Under the planning system, when most commercial energy and other industrial commodities were allocated and distributed through a limited set of channels, and a small number of mainly industrial users accounted for most consumption, energy use was easier to track. With the advent of allocation through markets, flows of energy have become more difficult to know with as much certainty. NBS's current system is a hybrid, rather like that for tracking coal production, relying in part on full reports from larger energy consumers, and in part on sample survey data, reports from energy marketers and government agencies, and estimates for the balance.

Industry

NBS publishes breakouts of industrial energy use by energy type for over three dozen industrial subsectors (NBSc various years; NBSe 2000). Contrary to international practice, the agency includes statistics from enterprises in energy-producing sectors as well as for energy-consuming sectors in energy consumption tables. In these series, energy use in the energy-producing sectors is defined as in-plant use of

energy only, and excludes energy products being processed. For instance, electric utility sector figures include only energy used for plant operation, not inputs to power and heat generation, which are distributed among end-use sectors by using the gross heat rate of power generation to convert electricity to standard coal.

The energy consumption statistics suffer from other idiosyncrasies that originate in China's former planning system. Reports from enterprises include all energy consumed by the reporting unit, regardless of the purpose. This results in conflation of end-use sectors, and is particularly serious in the case of older, large state-owned enterprises that function as "small societies". Many large, integrated steel plants, for instance, continue to provide housing, education, and social services, and run a variety of ancillary activities from trucking to publishing to restaurants and hotels, in addition to the core business of manufacturing iron and steel products. Some of these enterprises are, in effect, complete cities. A recent study estimated that, when consumption for non-steel-making activities was excluded from 1996 statistics on steel sector energy use and other adjustments made (i.e., removal double-counting of some fuel use, and inclusion of some small plants excluded from statistics), the total dropped from 4,018 PJ to 3,067 PJ, and adjustment of nearly 24% (Price *et al*. 2002).[5] For a short while (1992-1994), statistical reporting forms required enterprises to break out energy consumption by purpose, e.g., production, offices, transportation, and residences. This experiment was quickly abolished in a wave of reforms aimed at reducing the reporting burdens on enterprises. Thus, current energy consumption statistics from enterprises in industrial (and other sectors) include a certain amount of activity that belongs in other sectors.

In most cases, the impact is minimal. One effect of enterprise system reforms in the 1990s was to disaggregate many formerly integrated enterprises into units that now make separate reports to statistical collection agencies. Moreover, "non-production" energy uses at industrial enterprises are usually dwarfed by the amount of energy used for core manufacturing activities. The conflation of sectoral activities within reporting units remains an issue mainly for large state-owned enterprises in rural areas, where they are major providers of social services. In some cases, there may be a problem for smaller companies as well, e.g., water-bottling companies whose main use of energy is for fleets of delivery trucks (Xu 2002).

In addition to energy consumption statistics, NBS publishes figures on energy intensity of industrial products, i.e., energy use per unit of physical output. Enterprises report these intensities directly, and non-production energy use is not included. The reported statistics are simple averages of figures submitted only by state-owned, and usually large enterprises, and are sometimes broken out by scale of enterprise. For sectors like metals smelting, these statistics cover most of the production activity, but for others, like building materials, where much or most output comes from small and non-state enterprises that do not report energy intensities, these figures must be used with caution, as they may not be representative of the whole sector.

Greater detail on state-owned enterprises is available in yearbook and supplemental volumes published for the various sectors, for instance, the *China Steel Yearbook*, the *China Nonferrous Metals Industry Yearbook*, and the *China Chemical Industry Yearbook* (EBCISIY various years; EBCNMIY various years; CPCIA2001). In addition to energy use, these typically present average energy intensities for the industry, and a variety of indicators for individual enterprises. Some of these sources also present figures for non-state enterprises, but such figures should be considered estimates.

Transportation

The most prominent deficiency in China's Energy consumption figures is the burial of up to half of transportation energy use in other sectors' statistics. For example, 8 PJ of off-site transportation fuel was included in the 1996 steel statistics (Price *et al*. 2002). China's largest refiner, Sinopec, unofficially estimates that about 45% percent of diesel is consumed for transport, while NBS's most recent published balance table (1999) puts the fraction at 37%. According to the same balance table, the exact same fraction of gasoline use is attributable to the transportation sector. This results from including only energy use from enterprises whose main business is transport in this category. NBS recognizes the problem presented by this definition of the transport and other sectors, and it is currently revising sectoral definitions and reporting methods. This is part of a comprehensive and gradual change, however, and could take some time to implement.

[5] This is in final energy terms. In primary energy terms, i.e., counting electricity at its fuel replacement value in an average power plant, the corresponding figures would be 4,555 PJ and 3,582 PJ. The steel industry, which accounts for over 20% of industrial energy use, is probably the most extreme example of industrial sectors that overcount energy use.

In the meantime, realistic appraisal of China's transportation energy use requires estimating revisions to NBS's figures. We presented one possible method in the 1996 edition of the *China Energy Databook* (Sinton *et al*. 1996), in which gasoline use and portions of diesel use in other sectors were reassigned to the transport sector. Based on examination of vehicle and equipment statistics and discussions with transport experts in China, we recategorized 20% of agricultural diesel use, 10% of industrial diesel use, and 12% of service sector diesel use. As a result, we calculated the transport sector share of final commercial energy use to be over 7% in 1994, whereas the official statistics reported that it accounted for 4.5%.

As with industrial sectors, the sectoral yearbooks (e.g., CCTA 2000) provide greater detail on energy use and energy intensities, containing sections on highway, rail, water, pipeline, and air transport covering state-owned units.

Services

Services-sector statistics cover a variety of disparate activities, including commercial and public services, and government, including military, energy use. As noted above, a portion of energy use that in other countries would be reported as service sector use is included in industrial (and other) sectoral use, but it is though that the great majority of service-sector energy use is captured in these statistics. Yearbooks on the service sector do not contain energy statistics.

Households

Energy statistics on this rapidly growing and changing sector are limited in their accuracy by the lack of a regular national survey of household energy use. Figures for residential energy consumption are essentially estimates informed by urban and rural surveys, sales reports from utilities and energy marketers, and other materials. Since there are no records for a large portion of coal sales to rural households, for instance, estimates of rural residential coal use must be developed by combining information on output from small rural mines and survey data on coal purchases by households. Urban residential coal use is somewhat easier to track, since a far higher proportion is sold, often in briquette form, through enterprises that report sales. Urban utilities that deliver gas and electricity have monopolies, allowing greater accuracy in tracking consumption.

Prices

Figures on energy prices are not as easily available as on production and consumption, and they are not featured in the *China Energy Statistical Yearbook*. The *China Statistical Yearbook* includes among its producer price indexes those for energy products, but this does not give actual prices (NBSa various years). Price information is scattered throughout periodicals and yearbooks. Some is available online (e.g., BECon 2002), and the *China Energy Databook* contains some mainly older price information that is otherwise unavailable outside China. Electricity rate schedules for China's provincial grids have been published in the *China Price Yearbook* (EBCPY 1998). The lack of coverage of prices is one of the most serious gaps in coverage in China's energy statistics.

Conclusion

While large amounts of data on China's energy system are available, recent media reports of inaccuracies in China's statistics may tempt some observers to dismiss all of the country's statistical materials as fabrications. The issues discussed in this paper show that it would be unwise to accept all statistics at face value, but also that outright rejection is also unwarranted. China's energy statistics can be used for meaningful analysis, provided that careful consideration of the factors that influence coverage and quality of specific indicators is combined with a realistic assessment of the degree of accuracy needed for the analytic task. It is often worthwhile to perform simple checks using other statistics. For instance, energy consumption in a given sector could be compared to output and energy intensities, with parallel trends increasing confidence in the direction and magnitude of observed changes. A healthy skepticism, rather than prejudice, and informed cross-checks are called for in drawing conclusions from these materials.

References

Andrews-Speed, Philip. 2001. China's energy policy in transition: Pressures and constraints. *Journal of Energy Literature* VII(2): 3-34.

Beijing Energy Efficiency Center (BECon). 2002. Energy price statistics, posted online at http://www.beconchina.org/price.asp and http://www.gcinfo.com/becon/price.html. Beijing: Beijing Energy efficiency Center.

British Petroleum Company. 2001. *British Petroleum Statistical Review of World Energy 2001*. London: Economics Unit, British Petroleum Company. http://www.bp.com/centres/energy/world_stat_rev/.

Customs Bureau of the People's Republic of China. 2000. *Zhonghua Renmin Gongheguo Haiguan Tongji Nianjian (Customs Statistics Yearbook of the People's Republic of China)*, 1999 editions. Beijing: China Customs Bureau.

China Communications and Transport Association (CCTA). 2000. *Zhongguo Jiaotong Nianjian (Jinghuaben) 1986-2000 (Yearbook of China Transportation and Communications (Prime Edition))*. Beijing: Zhongguo Jiaotong Nianjian She.

China National Petroleum Corporation (CNPC). 1988-1999. *China Petroleum Industry Yearbook*. Beijing: Petroleum Industry Press.

China Petroleum and Chemical Industry Administration (CPCIA). 2001. *Zhongguo Huaxue Gongye Nianjian (China Chemical Industry Yearbook) 2000-2001*. 17th edition. Beijing: Zhongguo Huagong Xinxi Zhongxin.

China Statistical Information and Consultancy Service Centre (CSICSC). 1992-2002. *China Monthly Statistics*. Beijing: China Statistical Information and Consultancy Service Centre.

Editorial Board of the China Coal Industry Yearbook (EBCCIY). 1982-2000. *Zhongguo Meitan Gongye Nianjian (China Coal Industry Yearbook)*, 1982-2000 editions. Beijing: Meitan Gongye Chubanshe.

Editorial Board of the China Electric Power Yearbook (EBCEPY). 1995-2001. *Zhongguo Dianli Nianjian (China Electric Power Yearbook)*, 1993-2001 editions. Beijing: Zhongguo Dianli Chubanshe.

Editorial Board of the China Iron and Steel Industry Yearbook (EBCISIY). 1994-2000. *Zhongguo Gangtie Gongye Nianjian (China Steel Yearbook)*, 1994-2000 editions. Beijing: Editorial Board of the China Iron and Steel Industry Yearbook .

Editorial Board of the China Nonferrous Metals Industry Yearbook (EBCNMIY). 1994-2000. *Zhongguo Youse Jinshu Gongye Nianjian (China Nonferrous Metals Industry Yearbook)*, 1994-2000 editions. Beijing: Editorial Board of the China Nonferrous Metals Industry Yearbook.

Editorial Board of The China Price Yearbook (EBCPY). 1998. *Zhongguo Wujia Nianjian (China Price Yearbook),* 1998. Beijing: China Price Press.

Editorial Board of the China Rural Energy Yearbook (EBCREY). 1999. *Zhongguo Nongcun Nengyuan Nianjian (China Rural Energy Yearbook) 1998-1999*. Beijing: Zhongguo Nongye Chubanshe.

Editorial Board of the Sinopec Yearbook. 1991. *Zhongguo Shiyou Huagong Zonggongsi Nianjian (Sinopec Yearbook)*, 1991. Beijing: Zhongguo Shihua Chubanshe.

Energy Information Administration (EIA). 2001. *International Energy Annual 1999*. Washington, D.C.: U.S. Department of Energy. http://tonto.eia.doe.gov/FTPROOT/international/021999.pdf.

Fridley, David G., Jonathan E. Sinton, Joanna I. Lewis, Zhou Fengqi, and Li Ji. 2001. *China Energy Databook*, fifth revised edition (CD-ROM). Report no. LBL-47832. Berkeley: Lawrence Berkeley National Laboratory, and Beijing: Energy Research Institute..

Horii, Nobuhiro, and Gu Shuhua, eds. 2001. *Transformation of China's Energy Industries in Market Transition and Its Prospects*. Chiba, Japan: Institute of Developing Economies, Japan External Trade Organization.

International Energy Agency (IEA). 2001. Energy Statistics of Non-OECD Countries 1998-1999 (2001 Edition). Paris: International Energy Agency.

Li Jingjing, Bai Jinming, and Ralph Overend, eds. 1998. *Assessment of Biomass Resource Availability in China*. Beijing: China Environmental Science Press.

National Bureau of Statistics (NBS, formerly State Statistical Bureau) a. 1982-2001. *Zhongguo Tongji Nianjian (China Statistical Yearbook), 2001*. Beijing: Zhongguo Tongji Chubanshe.

NBSb. 1990-2001. *Zhongguo Tongji Zhaiyao (China Statistical Abstract)* , 1990-2000 editions. Beijing: Zhongguo Tongji Chubanshe.

NBSc. 1986, 1989, 1991, 1998 and 2001. *Zhongguo Nengyuan Tongji Nianjian (China Energy Statistical Yearbook)*, 1986, 1989, 1991, 1991-1996, and 1997-1999 editions. Beijing: Zhongguo Tongji Chubanshe.

NBSd. 1988-2000. *Zhongguo Gongye Jingji Tongji Nianjian (Statistical Yearbook of China's Industrial Economy),* 1988-2000 editions. Beijing: Zhongguo Tongji Chubanshe.

NBSe. 2000. *Zhongguo Gongye Jiaotong Nengyuan 50 Nian Tongji Ziliao Huibian (Compendium of 50 Years of China's Industry, Transport, and Energy Statistical Materials)*. Beijing: Zhongguo Tongji Chubanshe.

Price, Lynn, Jonathan Sinton, Ernst Worrell, Dian Phylipsen, Hu Xiulian, and Li Ji. 2002. Energy use and carbon dioxide emissions from steel production in China. *Energy* 27(2002): 429-446.

Rawski, Thomas G. What is happening to China's GDP statistics? *China Economic Review* (12)4 (2001) pp. 347-354.

Sinton, Jonathan E. 2001. Accuracy and reliability of China's energy statistics. *China Economic Review* 12(2001): 373-383.

Sinton, Jonathan E. and David G. Fridley. 2000. "What Goes Up: Recent Trends in China's Energy Consumption". *Energy Policy*, 28(10):671-687.

Sinton, Jonathan E., David G. Fridley, Mark D. Levine, Yang Fuqiang, Jiang Zhenping, Zhuang Xing, Jiang Kejun, and Liu Xiaofeng. 1996. *China Energy Databook*, fourth revised edition. Report no. LBL-32822 Rev.4. Berkeley: Lawrence Berkeley National Laboratory, and Beijing: Energy Research Institute..

State Economic and Tract Commission. 1997. *China Energy Annual Review 1997*. Beijing: Department of Resources Conservation and Comprehensive Utilization, State Economic and Tract Commission.

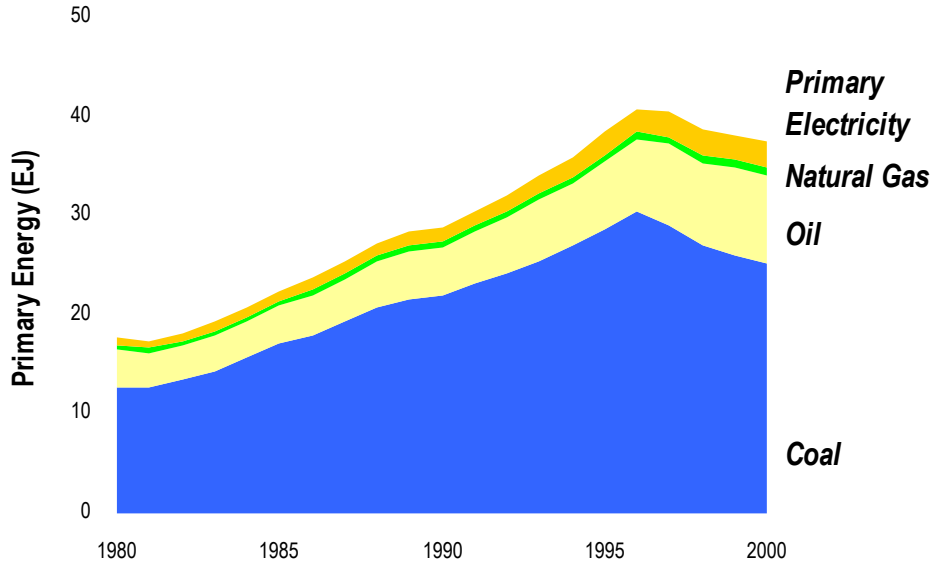
Ye, Qing and Zhang Baoming. 1998. *Zhongguo Xiangzhen Meikuang (China's Township and Village Mines)*. Beijing: Meitan Gongye Chubanshe.

World Bank. 2000. *World Development Report*, 2000 editions.. New York: Oxford University Press.

World Energy Council. 1995. *Survey of Energy Resources*. United Nations National Committee.

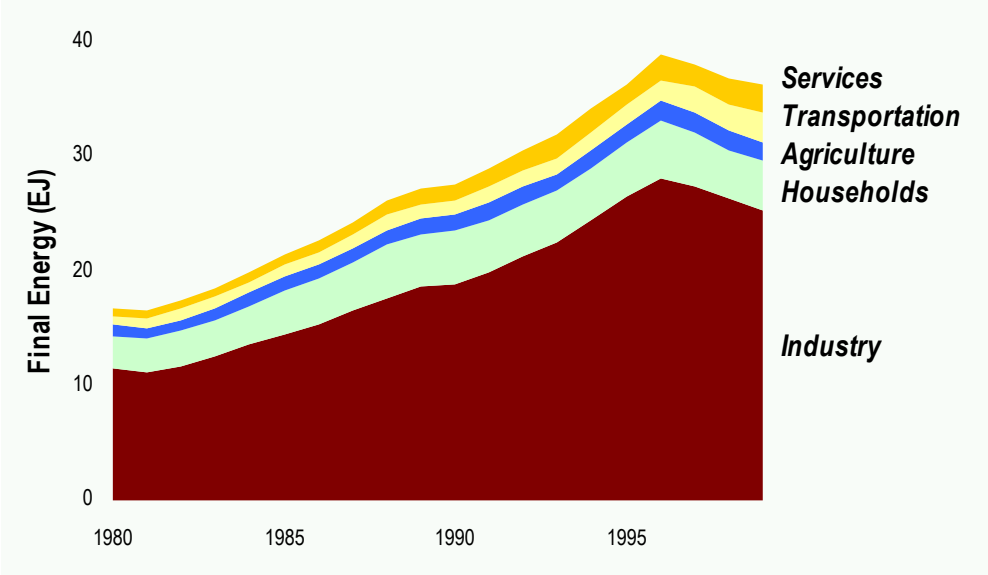
Xu Jianyi, Industry and Transportation Department, National Bureau of Statistics. 2002. Personal communication. Beijing: Meitan Gongye Chubanshe.

Figure 1. Primary Energy Consumption in China by Energy Type, 1980-2000



Source: NBSa various years.

Figure 2. Energy Consumption in China by Sector, 1980-1999



Source: NBSc various years.