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Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

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30. September 2013

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Working Paper

September 2013

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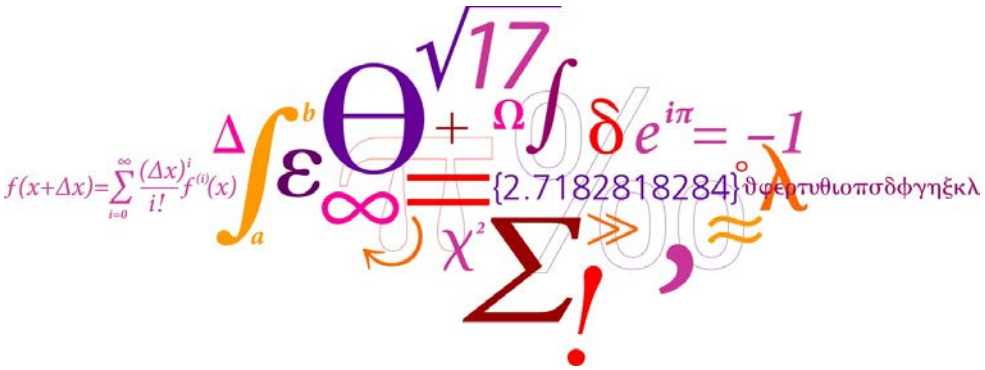

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Summary

Reliable, timely and accurate energy data are critical to carry out analysis of energy system changes. An energy balance, characterizing fuels/commodities in energy supply, transformation and sectoral end uses is an essential tool to calibrate energy system models. China's economy and energy system progressed rapidly over the past decade. Current structural changes include shifts from central planning to markets; from agriculture to services/manufacturing; from rural to urbanized; and from national to globalized. An improved understanding of the quality and reliability of Chinese economic and energy data is becoming more important to to understanding global energy markets and future greenhouse gas emissions. China's national statistical system to track such changes is however still developing and, in some instances, energy data remain unavailable in the public domain.

The 2007 UNFCCC Bali Action Plan[1] highlighted the need to make national emissions trends and reductions for all countries measurable, reportable, and verifiable. Internationally comparable energy indicators and statistics are released from multiple international institutions, including the United Nations, the World Bank and the International Energy Agency (IEA). With a highly-qualified staff of around 220 the IEA is one of the best-equipped public multilateral energy institutions specialised in energy statistics and related policy advice. The IEA's World Energy Outlook (WEO) is widely regarded as one benchmark/reference of global energy data analysis and policy scenarios for the future global energy markets. China is currently not one of the Non OECD IEA member countries and China's national system of statistical classification varies in some degree from international norms.

In order to allow for a comparative analysis and research about the fast pace development of China's energy system in an international context, a simplified methodology to build regional energy balances for China is needed. This working paper reviews China's energy statistics in view of identifying suitable energy system indicators to develop a simplified regional energy balance for China from a variety of publicly available data. As China's national statistical system continuous to be debated and criticised in terms of data quality, comparability and reliability, an overview of the milestones, status and main issues of China's energy statistics is given. In a next step, the energy balance format of IEA is used as an international benchmark to analyze China's national energy statistics in detail and identify indicators to establish regional energy balances inside China. Although this methodology includes a range of data uncertainties, it is intended to stimulate the discussion about current and future regional energy system developments in China in a broader global context. More international comparable and transparent research is needed to better understand and assess China's progress toward meeting energy supply security targets and emission reduction goals, both at a regional, national and global level.

[1] The 2007 Climate Change Conference (the 13th Conference of the UNFCCC Parties) in December 2007 in Bali culminated in the adoption of the Bali Road Map and the Bali Action Plan, including decisions and resolutions for a new negotiating process designed to tackle climate change. See: http://unfccc.int/key_steps/bali_road_map/items/6072.php

China's energy statistics in a global context

Milestones in the development of China's energy statistical system

China's statistical system, as other Chinese administrations, departed from a top-down planned economy with several hierarchical levels for data collection and reporting. Since the elaboration of China's first five year plan in 1953, quantitative indicators were established by the central government to plan and measure economic growth and industrial output, such as coal and steel production. The main focus then was to develop large scale production bases in for instance iron and steel manufacturing, coal mining, cement production, electricity generation, and machine building.

China's energy statistical system started in the 1980s under the 6th five year plan. In the 1980s, the central government created a large set of rules, standards, and methods for formulation physical energy intensity standards, such as the amount of fuel and electricity used per ton of industrial product (Sinton 1988). In 1978 China began implementing a system of energy supply by quota. All enterprises required certification to receive annual allotments of fuels and electricity. 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. The initial regulations on statistical work for trial implementation by the State Council in 1963 were replaced by a statistical law in 1984. Already in 1982 a special energy statistics institution was set up inside China's statistical system. In 1985 the energy statistics started data collection and reporting for energy production and consumption based on all economic units of the planned economy. In 1986 the first specialized energy statistical year book was released.

China's statistical system received less attention as central planning weakened in the 1990s. With the introduction of reforms to open up and introduce market mechanisms in the planned economy under China's 8th five year plan, the central government's control over allocation of many products (including energy) weakened. Energy statistics were affected by understaffing and underfunding in particular at lower administrative levels. Attention to energy issues declined furthermore, as energy availability was no longer considered to be a critical constraint on economic growth in general. Surveys required to complement traditional bottom up reporting were cut back (LBNL 2001, WB 2007). With the allocation of fuels through markets, flows of energy became more difficult to monitor and analyze in China's statistical system. Bilateral statistical corporation started and as a novelty the State Statistical Bureau's general statistical yearbook was published in its first bilingual English-Chinese edition in 1994.

In the 2000s China's statistics received frequent critics relating to data quality and reliability issues. China's entry into the World Trade Organization in 2001 reinforced the shift to market economics and intensified urbanization in the mainly urban centres along the coast. In November 2003, the then Chinese Premier Wen Jiabao called for “urgent improvement of statistical system and methodology in order to increase the accuracy, timeliness and scientific nature of statistical data and to enhance the authority of official statistics” (China Daily 2003). Regular budgetary appropriations to publish energy statistics beyond the few indicators that appear in the China Statistical Yearbook were not available (LBNL 2001). In 2007 only four staff members in NBS worked on China's energy statistics at the country level and only half of China's provinces had one staff member for energy statistics (WB 2007). The 10th five year plan targeted the development of a national statistical information network. A revised statistical law was enacted in 1996, designing the National Bureau of Statistics (NBS), formerly the State Statistical Bureau, as the officially national authority and primary source for China's statistical information in general and energy related statistics in particular (PRC 1996). New census

degrees for industry and agriculture were implemented in 2004 and 2006 to complement traditional bottom up information collection.

China is the largest energy consuming and greenhouse gas emitting country in the world today. Frequent discussion on China's energy statistics are taking place, in the context of the country's accelerated industrialization and urbanization which required more energy-intensive products. In line with international climate change negotiations, targets for emission intensity reduction and energy efficiency were incorporated besides traditional economic growth and production increase targets under the 11th and 12th five year plans. The 11th five year plan furthermore called for expanding international scientific and technology cooperation, including staff exchange programs with international statistical agencies. NBS has implemented a number of international cooperation programs terms of database development, data processing, statistical training and international harmonization. Statistical information released from NBS currently serves as a basis for China's statistical co-operations with IEA, the UN statistical division, the US Department of Energy, British Petroleum Statistical Review of World Energy, the World Bank's World Development Indicators and other international institutions. Several bilateral collaboration projects are ongoing to build consistent international methodologies for various energy statistical issues, e.g. US collaboration with NDRC to establish methods to assess biomass resources in China (ACORE 2012).

Data collection methods

China today has a hybrid statistical system that is in a transition phase as China's economy keeps restructuring. Incomplete energy sector reforms and the persistence of some structural features characteristic of the planning system remain present in statistics. The growth of the economy, the extensions in the statistical coverage of sectors of economic activity previously omitted, and the introduction of new statistical methods have led to a rapid increase in the size of the statistical system. Statistics developed during the planning economy are planned to be cut off by while new and improved statistics on resources, environment, services, etc, will be introduced.

Statistical data published by the National Bureau of Statistics (NBS) are the declared standard data for China. The National Bureau of Statistics (NBS) is responsible for organizing and coordinating official statistics nationwide and to formulate statistical standards, as stipulated in the statistical law. Many international organizations that report national energy figures for China rely on NBS and its sources. NBS is combining various data collection methods, such as traditional bottom up reporting through several administrative levels, infrequent national censuses and some data estimates/adjustments.

Bottom up reporting

China's large national statistical system consists of statistical bureaus under governments at all levels as per the administrative principle of centralized leadership and decentralized responsibility. This network connects NBS under the central government, provincial statistical bureaus under provincial, municipality and autonomous region governments, prefecture statistical bureaus under prefecture governments, and county statistical bureaus under county governments. In 2007 the governmental statistical system included 887 counties and employed an estimated number of 72000 staff. Of these less than 20 percent were employed directly by NBS at the central level and 10 percent were engaged at the provincial level, with the remaining majority of staff distributed between prefectures/cities and counties. In terms of educational qualification, about 30 percent had degree level education (UNSD 2007).

An automated system of statistical information reporting is still under development. The regular published energy statistics by NBS depend on bottom up reporting from provincially controlled statistical offices, which in turn rely on lower-level local branches in creating their energy accounts. At the lowest administrative level, the county and township bureau of statistics are responsible for data collection from all public enterprises and agencies within their geographic administrative boundaries. As stipulated in the statistical law enterprises are responsible to adhere to state or local statistical investigation tasks and establish and improve their information management systems for checking, transferring and filing statistical data. In February 2012 the NBS launched a unified data collection system through which covers 700,000 major companies can send their data directly to the government's statistics centre or authorized provincial branches (Xinhua 2013).

NBS standards for bottom up reporting only cover enterprises above a designated size. NBS collects energy data directly from industrial enterprises. Large energy production enterprises must report their information to the NBS once a month and small energy production enterprises report once a quarter. Measurements of electricity, natural gas, and heat use—which are metered and invoiced by utilities—are not used directly for statistical reporting (Carnegie 2010). Many smaller firms in the industry and service sector with annual revenues below 5 million Chinese RMB (USD $730,000) were excluded from bottom up reporting in 2004. The bottom up reporting in 2008 only covered 10% of China's enterprises (Carnegie 2010). The definition of industrial enterprises above a designated size was revised upwards in 2012, requiring reporting when revenue from principal business exceeds 20 million RMB (NBS 2012).

Besides NBS some ministries and centralized government departments are authorized to provide further data for national accounting. With relevance for energy data, these include the General Administration of Customs (statistics on imports and exports), Ministry of Commerce (statistics on foreign investment), Ministry of Environmental Protection (statistics on environmental protection), Ministry of Agriculture (biomass statistics) and the Ministry of Land and Resources (statistics on geological prospecting and reserves).

National census and surveys

The new economic census was designed to survey the development of the secondary and tertiary industries in China and establish a sound information system of enterprise registers and related data. The 2004 first economic census merged the previously separated census of manufacturing industries, the census of service industries and the census of establishments, and included the construction sector as an additional category. All major energy intensive industries are thus covered by this new economic census including mining, manufacturing, construction, electricity and water supply, and service industries. The statistical method of complete enumeration is the principle of the economic census as stipulated in the economic census degree of 2004. The First National Economic census was conducted during 2004-2006 with a budget of over 3 billion yuan, employing about 10 million enumerators for data collection[2]. Economic census will be conducted once in every five years. A second national economic census followed in 2009.

A new agriculture census was carried out in 2006 as per the agricultural census degree. The scope of the Agricultural Census included farm crops planting, forestry, animal husbandry, fishery and services rendered to these industries. The contents of the agricultural census included many dispersed activities in rural areas of China, including the utilization of agricultural land, rural labour force and employment, rural infrastructural facilities, rural social services, livelihood of farmers, and environment situation. Agricultural census will be conducted once in every ten years.

[2] In comparison the last population census carried out in 2010 employed 6 million enumerators. The budget for this 6th population census was estimated at 700 million yuan. Source: Branigan, Tania (November 1, 2010). "China census could be first to record true population". The Guardian. Accessed on August 20, 2013. http://www.theguardian.com/world/2010/nov/01/china-census-true-population

Estimates and historic data adjustments

China's annual statistics are intended to cover all economic activity, but NBS has better access to information from bottom up reporting in some end use sectors than in others. Since the 1990s the portion of economic activity within the control of government has shrunk, and with it the ability of the NBS to gather data, gradually eroding the completeness and accuracy of bottom up statistics. For end-use sectors dominated by a few, large state-owned entities, like the iron and steel industry, reliable bottom up statistics on consumption are available. In some other sectors, however, there is only a thin statistical basis for gathering energy use statistics without detailed national surveys, especially those in which non-state enterprises are more numerous or changing frequently. Estimates occur for instance for energy consumption of many small locally owned/controlled power plants, refineries, mines and other installations at lowest administrative levels is usually estimated by local officials and renewable rural energy use, where only a few surveys with limited sample sizes are occasionally carried out (LBNL 2001, WB 2007). To a large extend NBS cannot independently verify data accounts from bottom up reporting.

National bottom up statistics based on provincial reports need to be adjusted by NBS. This includes methods to account for differences in quality of coal mined and used in different places and to eliminate double counting of industrial activities covering several provinces. Furthermore data from autonomous regions and special administrative regions are not fully integrated with the provincial statistics of mainland China. Statistical data reported from Hong Kong and Macau, which are two special administrative regions of China, is not part of energy statistics. Statistical data from the Tibet Autonomous Region are rarely reported to NBS, these are generally lacking from national statistics when no estimates are carried out.

The results from the two recent economic censuses led to wide ranging historic data adjustments, in particular for coal data. After the first national economic census several historical statistical data from 1993 onwards were revised. Another round of historic data adjustment followed the results of the second national economic census in 2010. In the early 1990s China's unadjusted energy statistic reported a growing gap between coal production and use, indicating missing coal supply in the range of 200 million tons annually (LBNL 2001). Energy production, consumption and energy intensity data for the period of 1998 – 2003 where adjusted upwards due to previous underreporting of coal data following China's reorganization of the coal mining sector under the 10th 5YP. Researchers related this unreported production to small coal mines that were forced to close by a central government decision, but might have re-opened unofficially. The largest historic coal data revision following the second economic census was an addition of 149 million tonnes coal equivalent (Mtce) to the total primary energy consumption in 2007 (LBNL 2007), including an increase of industry final coal use in 2007 by 130 mtce. Furthermore the second census changed once more some of the energy-related data that were already adjusted in the first census, then resulting in a smoother curve for energy consumption after 1996 (Carnegie 2010).

Data availability and data providers

Since the development of China's energy statistical system in the 1980s, the amount and variety of statistical materials about China's energy system continues to increase. Frequently data on China's energy system are published in the format of a statistical yearbook, which in a printed edition contains numerous pages with data tables for different energy indicators at a national and sub-national level. China's statistical material published to date is vast, covering for example more than 50 annual statistical yearbooks for 2012. Each statistical yearbook usually includes at least 400 pages in its printed edition. As most statistics in China are not considered to be public goods, the purchasing prizes per yearbook vary over a wide range from USD 70-1640

for the latest edition. The general national statistical yearbook alone is extensive and consists of more than 4000 data tables on more than 1000 pages to describe the state of the country's overall economy, including basic energy production, residential urban and rural energy statistics and energy imports/exports. The statistical yearbook is released annually in September and contains the whole year statistical data of the previous year. A publicly accessible online NBS Database is at the trial stage since 2007, it mainly contains data from the general statistical yearbook[3].

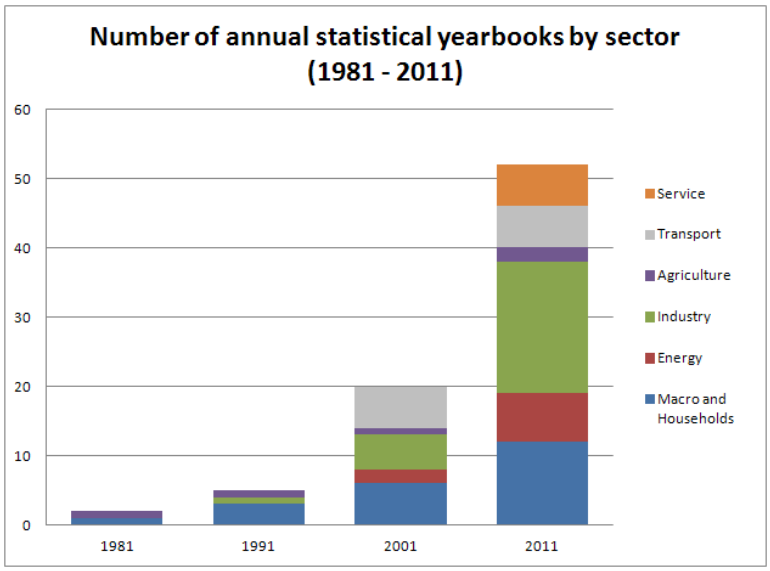


Figure 1: Increase of national statistical yearbooks in China (1981-2011)

The number of data providers besides NBS is increasing. Many industry associations, including the China Building Materials Industrial Association, the China Automotive Industry Association and the China Nonferrous Metals Industry Association, and other high level government institutions, such as NDRC, are publishing energy related statistical yearbooks in parallel to NBS. Increased competition among governmental and private data providers can result in the publication of very similar statistical yearbooks for a sector, such as the Yearbook of the Industrial Economy (published since 1991 by NBS) and the Yearbook of the Industry Economy (published since 2005 by the China Financial and Economic Publishing House affiliated with the People´s Bank of China).

In order to analyse China's energy system data in a comprehensive way, energy indicators scattered in several statistical yearbooks and estimates for data gaps based on expert judgement need to be combined. Energy statistics appear primarily in the following yearbooks published by NBS that have a long tradition and are available in recent bilingual English-Chinese editions: China Statistical Yearbook, China Energy Statistical Yearbook, and the Statistical Yearbook of China's Industrial Economy. However most energy sector specific data remains published in Chinese and needs to be purchased, thus limiting wide scale public access. Provincial energy balances are published in the Energy Statistical Yearbook (and not the Statistical Yearbook), providing an important view of changes in demand and supply in China's widely divergent regions. Sub-sectoral breakouts of industrial energy use are only published at the national level. Coal production and use can be estimated by using several sources of information, such as output by coal type, region, and ownership, however detailed information on the coal quality by coal type is usually not available to the public (Carnegie 2010). Sometimes the format of the published data makes it difficult to analyze them efficiently in databases without additional formatting. Sometimes statistical categories are unclear as these lack detailed explanation and comparison to internationally commonly used definitions.

[3] http://219.235.129.58/welcome.do (accessed September 15, 2013)

The access to and use of company related commercial data and data relating to state secrets remains highly restricted. The 2002 statistical law specifies that "[…] whoever makes use of statistical investigation to steal state secrets or violates the provisions of this [Statistical] Law regarding the maintenance of secrets shall be punished according to provisions of relevant laws […]" (PRC 1996). As no definition of state secrets is included in legal documents, a lot of uncertainty and ambiguity exists with regards to confidential energy statistics. Many information sources often are unable or unwilling to provide much detail beyond what lies in the public domain (LBNL 2001).

Data quality issues

China's statistical capacity and statistical systems is challenged by the size and complexity of the country's energy institutional and administrative framework. NBS data revisions reflect the difficulties of maintaining data accuracy in a rapidly changing, increasingly decentralized economy where information remains highly politicized (WB 2007). The total statistical effort is both too large to manage with the existing technology and skill levels at the sub-national level, and is subject to local pressure (WB expert 2002). NBS cross-checks energy supply data on the basis of enterprise output sales and energy production data once a year (Carnegie 2010).

Concerns about the quality of Chinese energy statistics are longstanding and have received frequent critical international attention over the past years. One example of a prominent dispute about the quality of China's energy data occurred in 2010: China's government disagreed initially with the International Energy Agency's assessment that China already surpassed the U.S. as the world's largest energy consumer in 2009, claiming IEA data are not very reliable. Economic and energy data play a critical role in China's policymaking, because indicators for economic growth and coal energy use will directly affect China's energy and emission intensity in various end use sectors and thus national and international climate change commitments. The effect of the 2010 energy and GDP revisions on energy intensity was judged by some China observers as a move to facilitate China's Eleventh Five Year Plan target of 20% reduction between 2005 and 2010. The Chinese state owned press recently reported about a case of economic data manipulation about by a county government in southwest China's Yunnan Province (Xinhua 2013). Some China observers suggest that provincial data are affected by local authorities' desire to show higher economic growth rates in their region (Carnegie 2010).

Many official energy data are released by Chinese authorities in aggregated format and with considerable delays. Much of NBS's statistical information is only available in aggregated form at the national level, e.g. summary reports for all State Owned Enterprises of a certain company size. NBS issues quarterly data by industrial firm size category for internal government use (Carnegie 2010). China's 2nd official communication to UNFCCC in 2012 used 2005 as a base year for energy and GHG emission related data. A delay until 2010 in publishing Chinese energy data for 2008 raised data quality questions among many China observers (Carnegie 2010). Similarly, the publicly available aggregated energy balance of China for 2011 is released on IEA's public website since September 2013[4].

Differences in statistical definitions and break in series make comparative analysis and independent reviews difficult and time consuming. Assessing energy resources and reserves from Chinese statistics in an international context is challenging, as statistical terms are partly defined broader than according to international norms. In Chinese statistics fossil energy resources include fossil energy deposits under all possible geological conditions, belonging to all geological ages, and proven geological reserves include proven reserves and also reserves that cannot be recovered economically or do not meet operating conditions. Break

[4] http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=CN, accessed August 20, 2013 and September 20, 2013

in series and change in statistical categories for coal production from major coal mining enterprises occurred during 2003-2006, nearly doubling the total coal production from below 600 million tons to above 1000 million tons. Breaks in series for passenger vehicles and trucks occurred in 2002, making comparisons of transport data with previous years more challenging. As of 2002 different coke qualities reported separately are aggregated in a national coke production figure. Disaggregated statistical information relating to single power plants is hardly available, for instance a hydro power plant capacity and power generation by province/location was last published in 1991. As of 2006 disaggregated pipeline data for oil and gas were no longer published in the NBS Statistical Yearbook.

China's energy statistics should be treated as a starting point for policy analysis and uncertainties should be clearly spelled out. As the quality of China's coal statistics is critized, China's electricity production (and consumption) is a widely used unofficial indicator for measuring the state of the country's economy (NYT 2012). Confidence in the quality of data for natural gas, hydropower and nuclear power is higher, as no major revisions occurred during the past two censuses. IEA and US DoE also highlight in several of their recent publications of China's coal data, that China's internal coal statistics are often inconsistent, requiring careful crosschecking and caution for analysis. This unreliability has major implications because coal production and use dominate all important aggregate Chinese energy data, including total energy consumption, energy intensity of the GDP, and carbon dioxide emissions. A prominent issue is that China's national energy balance sheet is not balancing with the sum of the countries provincial balance sheets. Official statistics are not necessarily always accurate, but they are the only comprehensive starting point for analyzing China's national energy system. While energy statistics were probably relatively good in the early 1990s, their quality has declined since the mid-1990s. Recently the quantity of statistical data sources and information providers increased considerably. As NBS data plays a role in Chinese policymaking, analyses and international collaboration based on NBS data are important for improving its accuracy and for providing common ground for policy research.

A triangulation method to develop regional energy balances for East, Central and West China

Based on the current status of China's statistical system and the available public energy data, a new triangulation method of different closely related international and Chinese energy statistics is proposed to build bottom up regional energy balances of China in an international context. While this triangulation approach will include some expert judgement to fill data gaps, it at least offers more insights into regional energy dynamics in China in a transparent way. As discussed before, the preliminary energy data now available in China are insufficient to confidently assign numbers to every energy indicators of interest for energy policy analysis. As China's statistical office currently does not plan to align their national standard for accounting of economic activities to international best practise before 2020, a transparent tool to understand, assess and compare China's national and provincial energy statistics in an international context is required.

Use a national IEA energy balance of China as a starting point. The IEA energy balance will serve as a benchmark and ensure international comparison of statistical categories. IEA's national energy balances for about 100 non-OECD countries, including China, are published annually in September. The unit to compare total energy is ton oil equivalent. IEA's energy balance format distinguishes primary energy supply, energy transformation, energy industry own use and final energy use for up to 60 fuels and energy commodities. The IEA energy balance format will include fuel re-allocations in different sectors based on long term experience from IEA China energy data experts. For example the analysis of China's transportation energy use does require revisions to NBS's statistics, including re-allocations of petroleum products from agriculture, industry and service sector to the transport sector (LBNL 2001).

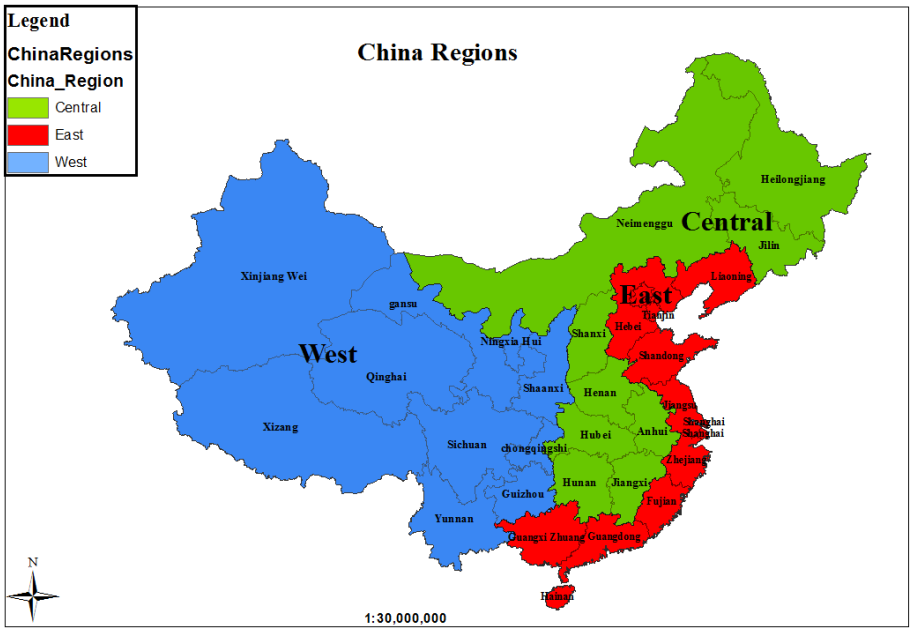
Assign the energy commodities in all categories of China's provincial energy balance to the IEA energy balance. China's national and provincial energy balance tables and detailed national breakouts of sectoral energy end use are published by NBS usually in September one year after the primary energy statistics are released. China’s main fuel is coal and the unit to compare total energy is standard ton coal equivalent. China's national energy balance includes primary energy supply, in- and output of fuels and energy commodities in transformation, losses, and final consumption for 32 fuels and energy commodities. It is commonly understood that China‘s system of statistical classification varies in some degree from international norms. International comparisons and detailed analysis of the data do require making adjustments; many times this is based on expert judgment due to limited statistical reporting categories and energy data confidentiality in China. Energy indicators are analyzed in their physical values to minimize statistical differences due to different conversion factors.

Identify regions in China with different energy system characteristics to build bottom up energy balances for different regions in China from provincial energy data. The suggested regional definition of China is based on the Seventh Five-Year Plan (1986–1990), which grouped all provincial level divisions of China[5] into three economic zones in order to promote medium to long term economic specialization and division of labour (see Figure 2). China researchers refer to similar regional divisions of China by regrouping provincial energy and economic data, when analysing disparities within China (Carnegie 2008). A similar regional classification is currently used in some of the official Chinese economic and energy statistics[6].

[5] The People's Republic of China administers 33 Provincial level divisions, including 22 provinces, five autonomous regions, four municipalities, and two Special administrative regions.

[6] The main difference between the presented regional divisions of China is that a North Region is defined in addition to east, central and west China regions. The north is based on three provinces only (Liaoning, Heilongjiang, Jilin).

Figure 2: A regional division of China's energy system in East, Central and Western Regions



- The **China East Region** consists of Liaoning, Beijing, Tianjing, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, Guangdong, Hainan and Guangxi[7]. This region specialized since the 1980s in export-oriented industries, including steel, chemicals, engineering and textiles. In 2010 about 578 million inhabitants (44% of Chinese population) lived on 13% of China's land area. The China East Region is currently the economic powerhouse of the country, accounting for more than 92% of China's exports and about 97% of China's GDP in 2010 (NBS 2011; Economist 2012). China's fast economic growth resulted in widening disparities in regional developments and incomes, and increase in domestic migration trends towards China's coastal provinces (WB 2006). This regional population density is high with an average 448 persons/km2. The eastern-coastal provinces have higher emissions but lower emissions intensities than the central and western provinces.
- The **China Central Region** consists of Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Anhui, Hubei, Hunan and Jiangxi. This region contains most of China's coal and metallurgical industries, as well as agricultural production. In 2010 about 440 million inhabitants (34% of Chinese population) lived on 29% of China's land area. Although the share of China's GDP was only 2% for these provinces in 2010, this region is crucial for supplying the provinces in China's East Region.
- Finally, the **China Western Region** consists of Shaanxi, Gansu, Ningxia, Xinjiang, Qinghai, Sichuan, Guizhou and Yunnan[8]. In 2010 about 293 million inhabitants (22% of Chinese population) lived on 57% of China's land area, resulting in a low population density of 53 persons/km2. This part of China continues to be the least developed region, with a marginal share of about 1% in China's GDP in 2010. The major hydropower resources are located in the Western Region of China including Tibet. The western provinces have limited emissions but higher emissions intensities than the eastern coastal provinces.

[7] Data on Hong Kong and Macau are excluded, as these follow different statistical systems and are not part of NBS provincial energy balances.
[8] Data on Tibet are excluded due to NBS data gaps.

Calculate regional shares from various provincial energy data to calibrate regional energy balances from a national benchmark. The use of regional shares for East, Central and West China, derived from bottom up provincial energy statistics for the most important energy commodities, has the advantage that those can be applied to a consistent and internationally comparable national energy balance of China (here the IEA China energy balance is used as a national benchmark).

Use closely related statistics and expert assumptions to check consistency and fill data gaps. In addition to NBS's provincial energy balances information from Chinese industry yearbooks, periodicals, and government websites as well as international organisations will be screened to fill data gaps. For consistency check fuel consumption in a given sector could be compared to output and energy intensities that are reported in Chinese statistics. Feedback from Chinese energy researchers will be provided to further minimize uncertainty and improve the regional modelling of China in a global context.

Indicators for modelling regional energy balances of China

Indicators for primary energy supply

The IEA energy balance data for primary energy supply are compared to Chinese provincial data from provincial energy balances and alternative data where required. On this basis it is possible to establish detailed and international comparable indicators for regional primary energy shares for East, Central and West China.

IEA energy balance

The total primary energy supply of a country in the IEA energy balance is calculated from indigenous production, accounting for fuel imports/exports and changes in fuel stocks held on the national territory. In line with international conventions, fuels for ships and aircrafts for international navigation and aviation are excluded from the national energy balance and reflected in the global energy balance. For the 2005 China IEA energy balance data are available for the following primary energy sources: hard coal, oil and petroleum products natural gas, primary solid bio-fuels and biogases, nuclear and hydro electricity. China coal data are aggregated as hard coal and oven coke in IEA statistics - this includes different coal qualities of anthracite, coking coal, other bituminous coal and sub-bituminous coal.

China provincial energy balance

Primary energy production and use are among most frequently reported of China's energy statistics. Typically, aggregate primary energy production and use for a given year are reported the following year in metric tons of standard coal equivalent. The accuracy of overall energy statistics is particularly dependent on the accuracy of coal output figures. Statistics on oil production and use are much better characterized than for coal. On the production side, the three major state owned oil companies produce most of China's crude, and a few dozen refineries produce over 90% of China's oil products (LBNL 2001). The bulk of China's oil imports come from crude oil and fuel oil. Much of this fuel oil is used in power plants along the southern coast, where coal transported from northern China is less competitive. Natural gas information comes from just a few sources, and travels through heavily monitored pipelines and port facilities. Contrary to international statistics the fuels used by Chinese planes and ships in international aviation and navigation is included in imports (NBS 2012).

Alternative provincial energy data

While many official Chinese sources deal with commercial energy sources, there is relatively little information on renewable energy. NBS excludes the production of fuels of low calorific value, bio-energy and solar energy from its energy balances. Measuring renewable energy sources – besides large scale hydropower – is relatively new in China. Data on wind power generation is included since 2010 in the statistical yearbook. Data on biomass energy use by province have been published in some editions of the China Energy Statistical Yearbook, covering wood, crop wastes, and biogas. These are based on estimates provided by the Ministry of Agriculture in the China Rural Energy Yearbook and should only be taken as a rough guide for rural non-commercial energy activities (LBNL 2001).

Conclusions

In general NBS provincial energy data from NBS energy yearbook can be used for a regional energy balance in primary energy supply. If data for several fuels are provided in Chinese statistics, the data of the fuel that dominates primary energy supply is applied, for instance raw coal is the key fuel for hard coal primary energy supply.

The following assumptions based on alternative data sources were made to establish regional energy balances for China (see Table 1 below for further details):

- Crude oil production shares by region were taken from the petroleum industry yearbook (and not the energy yearbook) to account for production from off-shore oilfields in different regions.
- Primary electricity production in China's provincial energy balances was cross-checked with nuclear and hydro-power production to include a more detailed primary electricity supply by energy source.
- The indicator of agricultural grain production is used to assume regional shares for primary biomass energy supply in China.
- Fuels that appear in energy transformation in IEA's energy balance, but are already listed under primary energy in Chinese statistics, are not treated here. This includes coal gases, refined petroleum products and fossil electricity and heat.

Table 1: Regional energy balance of China – primary energy supply

Primary energy supply – IEA energy balance	Primary energy supply – NBS provincial energy balance	Primary energy supply – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal: Indigenous production International import International export	**Raw coal, cleaned coal, other washed coal, briquettes:** Production Imports (international, interprovincial) Exports (international, interprovincial)	Coal throughput of coastal ports, total coal imports; total coal exports (China Customs Bureau)	**Raw coal:** Production: 16% International import: 100% International export: 100%	**Raw coal:** Production: 59%	**Raw coal:** Production: 25%
Coke: International import International export	**Coke, other coking products:** Production Imports (international, interprovincial) Exports (international, interprovincial)		**Coke:** International import: 100% International export: 100%	n.a.	n.a.
n.a.	**Blast furnace gas, coke oven gas, converter gas, other gas:** Recovery of energy Imports (interprovincial) Exports (interprovincial)		n.a.	n.a.	n.a.
Oil and petroleum products					
Crude oil Indigenous production International import International export	**Crude oil:** Production Imports (international, interprovincial) Exports (international, interprovincial)	Crude oil production by oil field from major three SOE (Petroleum industry yearbooks)	**Crude oil:** Production incl. offshore fields: 80% International import: 86% International export: 100%	**Crude oil:** Production by field: 8%; International import: 8%	**Crude oil:** Production by field: 12% International import: 6%
NGL: Indigenous production	n.a.	Crude oil production by oil field from major three SOE (Petroleum industry yearbooks)	**Crude oil:** Production incl. offshore fields: 80%	**Crude oil:** Production by field: 8%;	**Crude oil:** Production by field: 12%
LPG: International imports International exports	**LPG:** Imports (international, interprovincial) Exports (international, interprovincial)		**LPG:** Import: 100% Export: 100%	n.a.	n.a.
Motor gasoline: International exports	**Gasoline:** International exports		**Gasoline:** Export: 100%	n.a.	n.a.
Other kerosene: International imports International exports	**Kerosene:** Imports (international, interprovincial) Exports (international, interprovincial)		**Kerosene**: Import: 100% Export: 100%	n.a.	n.a.
Gas/diesel oil: International imports International exports	**Diesel oil:** Imports (international, interprovincial) Exports (international, interprovincial)		**Diesel oil:** Import: 100% Export: 100%	n.a.	n.a.
Fuel oil: International imports International exports	**Fuel oil:** Imports (international, interprovincial) Exports (international, interprovincial)		**Fuel oil:** Import: 100% Export: 100%	n.a.	n.a.
n.a.	**Naphtha, lubricants, petroleum coke, petroleum waxes:** Imports (international, interprovincial) Exports (international, interprovincial)		n.a.	n.a.	n.a.
Non-specified oil products: International imports International exports	**Other petroleum products:** Imports (international, interprovincial) Exports (international, interprovincial)		**Other petroleum products:** Import: 86% Export: 100%	**Other petroleum products:** Import: 8%	**Other petroleum products:** Import: 6%
Natural gas					
Natural gas: Indigenous production International export	**Natural gas:** Production Imports (international, interprovincial) Exports (international, interprovincial)		**Natural gas:** Production: 13% Exports: 100%	**Natural gas:** Production: 5%	**Natural gas:** Production: 83%
n.a.	**LNG:** Production Imports (international, interprovincial) Exports (international, interprovincial)		n.a.	n.a.	n.a.
Bio-Energy					
Primary solid biomass: Indigenous production	n.a.	Grain production (NBS YB)	**Grain production:** 31%	**Grain production:** 50%	**Grain production:** 19%
Biogas: Indigenous production	n.a.	Grain production (NBS YB)	**Grain production:** 31%	**Grain production:** 50%	**Grain production:** 19%
Electricity and Heat					
Nuclear electricity: Indigenous production	n.a.	National gross nuclear electricity generation (NBS YB) in combination with IEA reports	**Nuclear generation:** 100%	n.a.	n.a.
Hydro electricity: Indigenous production	n.a.	Hydro power generation (NBS YB)	**Hydro generation:** 22%	**Hydro generation:** 30%	**Hydro generation:** 48%
Primary electricity: International imports International export	**Primary electricity:** Production Imports (international, interprovincial) Exports (international, interprovincial)		n.a.	**Electricity generation:** Import: 36%	**Electricity generation:** Import: 64% Export: 100%
n.a.	**Heat:** Recovery of energy		n.a.	n.a.	n.a.

Indicators for energy transformation

The IEA energy balance data for energy transformation are compared to Chinese provincial data from provincial energy balances and alternative data where required. On this basis it is possible to establish detailed and international comparable indicators for regional shares for energy transformation in East, Central and West China.

IEA energy balance

In the IEA energy balance transformation processes comprise the conversion of primary forms of energy to secondary and further processes (e.g. coking coal to coke, crude oil to oil products, and fuel oil to electricity). The main transformation processes appearing in the IEA China energy balance are electricity and heat plants, blast furnaces, gas works, coke ovens, patent fuel plants and oil refineries.

- So defined **main activity producers for electricity and heat** are included in energy transformation section of the IEA energy balance, as these generate electricity and heat from primary energy for sale to third parties as their main activity. Private or publicly owned entities that generate electricity and heat wholly or partly for their own use to support their primary activity are called **auto-producers** instead. No data on co-generation is given in China's national energy balance.
- **Coke ovens** are included under transformation, as these produce coke and coke oven gas from hard coal (coking coal). Primary energy inputs to large scale industrial **blast furnaces** are included under energy transformation. This includes for example blast furnaces for the Iron and Steel Industry. The production of pig-iron from iron ore in blast furnaces uses fuels for supporting the blast furnace charge and providing heat and carbon for the reduction of the iron ore. The transformation component is shown in the row blast furnaces in the column appropriate for the fuel, and the consumption component is shown in the row iron and steel, in the column appropriate for the fuel. Accounting for the calorific content of the fuels entering the process is a complex matter as transformation (into blast furnace gas) and consumption (heat of combustion) occur simultaneously. Some carbon is also retained in the pig-iron; almost all of this reappears later in the oxygen steel furnace gas (or converter gas) when the pig-iron is converted to steel. The IEA suggests an energy transformation efficiency of 40% for the corresponding fuel for cross checks. Three different process stages for steel manufacturing – from coal to steel – provide three different coal based gas types: coke gas, blast furnace gas and converter gas. Primary energy inputs to manufacture town gas from hard coal in **gas works** is included in transformation. As a by-product of hard coal gas coke is produced here that can be used for heating.
- **Patent fuel plants** are included, as these manufacture the so called patent fuels from hard coal fines with the addition of a binding agent, the output are often called briquettes.
- **Oil refineries** are included under energy transformation as these manufacture a wide range of finished petroleum products from crude oil.

China provincial energy balance

Energy transformation that is reported in China's provincial energy balance relates to processes rather than technologies (see Annex A-2). The sub-categories in energy transformation do not fully match IEA's categories, for example coal transformation processes, such as coal washing and briquette production, are China-specific.

Alternative provincial data

Data from international institutions, such as IEA, were used to cross-check the status of infrastructure for main energy transformation processes. Data suggest that main refining activity takes place in the coastal provinces,

as crude oil input and different refined petroleum products output indicate. There are 21 large scale refineries in three areas in East China (Yangtze River Delta, Pearl River Delta and Bohai Rim) with total refinery capacity of around 270 Mt/year, accounting for 47% of the total refining capacity (IEA 2010). Major coal transformation processes are taken place in the central region, as this also is the area with most abundant coal reserves (IEA 2009). Natural gas is explored in different regions in China, both off-shore and onshore, and a few major national gas pipelines are available to provide gas supply from West to East. China started importing LNG in 2006 only and has now five operational LNG terminals in operation in the eastern coastal provinces (IEA 2010).

Electricity production from fossil fuels and nuclear, both main and auto-producers, is concentrated in the East, as this region hosts the key industrial development zones. Hydro electricity however is dominant in the West, the region of China with the most abundant water resources. There are seven different power grids in China managed by different state owned electricity companies. IEA estimated that 540000 km of transmission lines above 35kV were operational in 1999 (IEA 2009). No fully interconnected national electricity grid exists currently and interconnections between regional grids remain weak. The national electrification rate is 98%. Lack of electricity access is limited to the West Region, where many off grid technologies are traditionally used when no connection to the Southern China Power Grid exists.

Conclusions:

NBS provincial energy data need to be combined with alternative data sources to establish a regional energy balance in energy transformation. If data for several fuels are provided in Chinese statistics, the data of the fuel that dominates primary energy supply is applied, for instance raw coal is the key fuel for hard coal in energy transformation. The regional shares of energy transformation processes were cross checked with Chinese energy sector experts and seem in line with alternative data sources.

The following assumptions based on alternative data sources were made (see Table 2 below for further details):

- Thermal electricity production in China's provincial energy balances was cross-checked with nuclear and hydro-power production to include more detailed electricity and heat indicators.
- The indicator of bio-waste based power production in China's urban areas was used to assume regional shares for biomass related transformation process to produce power and heat.
- Fuels that appear in primary energy in Chinese statistics were allocated here, for example production of coal gases, coke, and refined petroleum products.

Table 2: Regional energy balance of China – energy transformation

Energy transformation - IEA energy balance	Energy transformation – NBS provincial energy balance	Energy transformation – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal: Input for main electricity plants Input for main heat plants Input for coke ovens Input for gas works Input for patent fuel plants	**Raw coal, cleaned coal, other washed coal, briquettes, gangue:** Input for thermal power Input for heating supply Input for coking Input for gas works Input for and output from coal washing Input for and output from briquettes production	Briquette production for patent fuel plants (NBS YB)	**Raw coal:** input power plants:47%; input heat plants:59%; input gas works:21%; **Cleaned coal:** input coking: 39%; **Briquette** output: 58%	**Raw coal:** input power plants: 36%; input heat plants: 31%; input gas works: 68%; **Cleaned coal:** input coking: 47%; **Briquette** output: 27%	**Raw coal:** input power plants: 17%; input heat plants: 10%; input gas works: 11%; **Cleaned coal:** input coking: 13% **Briquette** output: 18%
Oven Coke: Input for gas works Input for coke ovens Output from coke ovens	**Coke, other coking products:** Input for gas works Output from coking Output from gas works	Coke production (NBS YB)	**Coke:** input gas works: 34%; output coking: 35%	**Coke:** input gas works: 65%; output coking: 36%	**Coke:** input gasworks: 1%; output coking: 19%
Gas coke: Output from gas works	**Coke, other coking products:** Output from gas works		**Coke:** output gas works: 5%	**Coke:** output gas works: 18%	**Coke:** output gas works: 77%
Coke oven gas: Input for auto electricity plants Input for auto heat plants Output from coke ovens	**Coke oven gas:** Input for thermal power Input for heating supply Output from coking Output from gas works		**Coke oven gas:** input power plants: 51%; input heat plants: 40%; output coking: 42%	**Coke oven gas:** input power plants: 39%; input heat plants: 53%; output coking: 43%	**Coke oven gas:** input power plants: 10%; input heat plants: output coking: 15%
Blast furnace gas: Input for auto electricity plants Input for auto heat plants Output from blast furnaces	**Blast furnace gas:** Input for thermal power Input for heating supply Input for coking Output from gas works		**Blast furnace gas:** input power plants: 62%; input heat plants: 60%; input coking: 64%;	**Blast furnace gas:** input power plants: 32%; input heat plants: 30%; input coking: 36%; output gas works:100%	**Blast furnace gas:** input power plants: 6%; input heat plants: 10%
Gas works gas: Output from gas works	n.a.	Other gas output from gas works (NBS YB)	**Other coal gas:** output gas works: 35%	**Other coal gas:** output gas works: 62%	**Other coal gas:** output gas works: 3%
n.a.	**Converter gas, other gas:** Input for thermal power Input for heating supply Input for coking Input for and output from gas works		n.a.	n.a.	n.a.
Oil and petroleum products					
Crude oil: Input for auto electricity plants Input for auto heat plants Input for refineries	**Crude oil:** Input for thermal power Input for heating supply Input for refineries		**Crude oil:** Input power: 96%; Input heat: 100%; Input refineries: 71%	**Crude oil:** Input power: 4%; Input refineries: 14%	**Crude oil:** Input refineries: 15%
Refinery gas: Input for auto electricity plants Input for auto heat plants Output from refineries	**Refinery gas:** Input for thermal power Input for heating supply Input for gas works Input for and output from refineries		**Refinery gas:** Input power: 68% Input heat: 38% Output refineries: 71%	**Refinery gas:** Input power: 15% Input heat: 39% Output refineries: 16%	**Refinery gas:** Input power: 17% Input heat: 23% Output refineries: 13%
LPG: Input for auto electricity plants Input for auto heat plants Output from refineries	**LPG:** Input for gas works Input for and output from refineries	LPG consumption in industry (NBS) for power/heat auto-producers	**LPG:** Input power: 74%; Input heat: 74%; Output refineries: 60%	**LPG:** Input power: 18% Input heat: 18% Output refineries: 27%	**LPG:** Input power: 8% Input heat: 8% Output refineries: 13%
Motor gasoline, aviation gasoline: Output from refineries	**Gasoline:** Output from refineries		**Gasoline:** Output refineries: 64%	**Gasoline:** Output refineries: 19%	**Gasoline:** Output refineries: 17%
Jet type fuel kerosene, other kerosene: Output from refineries	**Kerosene:** Output from refineries		**Kerosene:** Output refineries: 85%	**Kerosene:** Output refineries: 9%	**Kerosene:** Output refineries: 6%
Gas/diesel oil: Input for auto electricity plants Output from refineries	**Diesel oil:** Input for thermal power Input for heating supply Output from refineries		**Diesel oil:** Input power: 30%; Output refineries: 68%	**Diesel oil:** Input power: 60%; Output refineries: 15%	**Diesel oil:** Input power: 10%; Output refineries: 17%
Fuel oil: Input for main electricity plants Input for main heat plants Input for gas works Output from refineries	**Fuel oil:** Input for thermal power Input for heating supply Input for and output from refineries	Fuel oil consumption in industry (NBS) for gas works	**Fuel oil:** Input power: 93% Input heat: 81% Input gas works: 76% Output refineries: 82%	**Fuel oil:** Input power: 5% Input heat: 18% Input gas works: 20% Output refineries: 10%	**Fuel oil:** Input power: 2% Input heat: 1% Input gas works: 4% Output refineries: 8%
Naphtha, lubricants, bitumen, paraffin waxes, petroleum coke: Output from refineries	**Naphtha, lubricants, petroleum coke, petroleum waxes, bitumen asphalt, white spirits:** Output from refineries		**Naphtha:** Output refineries: 90%	**Naphtha:** Output refineries: 7%	**Naphtha:** Output refineries: 3%
Non-specified oil products: Output from refineries	**Other petroleum products:** Input for thermal power Input for heating supply Input for and output from refineries		**Other petroleum products:** Output refineries: 75%	**Other petroleum products:** Output refineries: 12%	**Other petroleum products:** Output refineries: 13%
Natural gas					
Natural gas: Input for main electricity plants Input for main heat plants	**Natural gas, LNG:** Input for thermal power Input for heating supply Input for natural gas liquefaction Input for gas works		**Natural gas:** Input power: 71% Input heat: 57%	**Natural gas:** Input power:15% Input heat: 22%	**Natural gas:** Input power:14% Input heat: 21%
Bio-Energy					
Biomass: Input for auto electricity plants Input for auto heat plants	n.a.	Urban power generation from bio-waste (NDRC)	**Urban power generation from bio-waste:** 75%	**Urban power generation from bio-waste:** 20%	**Urban power generation from bio-waste:** 5%
Electricity and Heat					
Nuclear electricity: Input for main electricity plants	n.a.	National gross nuclear electricity generation (NBS YB) and IEA reports;	**Nuclear generation:** 100%	n.a.	n.a.
Hydro electricity: Input for main electricity plants	n.a.	Hydro power generation (NBS YB),	**Hydro generation:** 22%	**Hydro generation:** 30%	**Hydro generation:** 48%
Electricity: Output from main electricity plants Output from auto electricity plants	**Electricity:** Output from thermal power		**Thermal power:** 46%	**Thermal power:** 37%	**Thermal power:** 17%
Heat: Output from main heat plants Output from auto heat plants	**Heat:** Output from heating supply		**Heat supply:** 52%	**Heat supply:** 38%	**Heat supply:** 10%

Indicators for energy industry own use

The IEA energy balance data for energy industry own use are compared to Chinese provincial data from provincial energy balances and alternative data where required. On this basis it is possible to establish detailed and international comparable indicators for regional shares for energy industry own use in East, Central and West China.

IEA energy balance

Energy industry own use in the IEA energy balance covers the amount of fuels used by the energy producing industries (e.g. for heating, lighting and operation of all equipment used in the extraction process, for traction and for distribution). It includes primary and secondary energy consumed by energy industries for heating, pumping, traction and lighting purposes as per UN ISIC categories. Energy which is used directly within c**oal mines, oil and gas extraction, coke ovens, gas works, oil refineries and electricity/heat plants** is listed in sub-categories.

China provincial energy balances

No data are provided, as there is no category for energy industry own use established (see Annex A-2 and A-4). Energy industry own use is reported as part of final energy use. Mining and oil and gas extracting is included in the mining industry in the national energy balance, without specifying the fuel share for energy industry own use. The production and distribution of electricity, heat and gas is also reported in final industry consumption at a national level, without specifying the fuel shares for energy industry own use. Figures for fuel use to operate electricity and heat plants are distributed among end-use sectors by using the gross heat rate of power generation to convert electricity to standard coal (LBNL 2001).

Alternative provincial data

This section of the IEA energy balance requires alternative data for all fuels. As explained in Table 3 below, energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS). For example regional shares in raw coal production are assumed to specify regional shares of hard coal use in the coal mining industry.

Conclusions:

This section of the energy balance contains many assumptions due to lack of data. The suggested shares in Table 3 were cross-checked with Chinese energy sector experts.

Table 3: Regional energy balance of China – energy industry own use

Energy industry own use – IEA energy balance	Energy industry own use – NBS provincial energy balance	Energy industry own use – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal: Own use in coal mines Own use in coke ovens Own use in electricity and heat plants Own use in gas works	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Raw coal:** Production: 16% Transformation loss: 17% Power plants: 47% Gas works: 21% **Cleaned coal:** Coking: 39%	**Raw coal:** Production: 59% Transformation loss: 2% Power plants: 36% Gas works: 68% **Cleaned coal:** Coking: 47%	**Raw coal:** Production: 25% Transformation loss: 82% Power plants: 17% Gas works: 11% **Cleaned coal:** Coking: 13%
Oven Coke: Own use in coal mines Own use in coke ovens Own use in electricity and heat plants Own use in gas works	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Coke:** Coking: 35% Heat plants: 0% Gas works: 34%	**Coke:** Coking: 36% Heat plants: 100% Gas works: 65%	**Coke:** Transformation loss: 100% Coking: 19% Heat plants: 0% Gas works: 1%
Gas coke: Own use in gas works	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Coke:** Gas works: 34%	**Coke:** Gas works: 65%	**Coke:** Gas works: 1%
Coke oven gas: Own use in coal mines Own use in coke ovens Own use in electricity and heat plants Own use in gas works	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Coke oven gas:** Transformation loss: 50% Coking: 42% Power plants: 51%	**Coke oven gas:** Coking: 43% Power plants: 39% **Blast furnace gas:** Gas works: 100%	**Coke oven gas:** Transformation loss: 50% Coking: 15% Power plants: 10%
Gas works gas: Own use in gas works	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Other coal gas** Gas works: 35%	**Other coal gas** Gas works: 62%	**Other coal gas** Gas works: 3%
Oil and petroleum products					
Crude oil Own use in oil and gas extraction	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Crude oil:** Production: 44%	**Crude oil:** Production: 46%	**Crude oil:** Production: 30%
Refinery gas: Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Refinery gas:** Refineries: 71%	**Refinery gas:** Refineries: 16%	**Refinery gas:** Refineries:13%
LPG: Own use in oil and gas extraction Own use in gas works Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**LPG:** Transformation loss: 99% Gas works: 99% Refineries: 60%	**LPG:** Refineries: 27%	**LPG:** Gas works: 1% Refineries: 13%
Motor gasoline: Own use in electricity and heat plants	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	n.a.	n.a.	**Gasoline:** Power plants: 100%
Other kerosene: Own use in coal mines Own use in oil and gas extraction Own use in refineries non specified	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Kerosene:** Transformation loss: 92% Refineries: 85%	**Kerosene:** Refineries: 9%	**Kerosene:** Transformation loss: 8% Refineries: 6%
Gas/diesel oil: Own use in coal mines Own use in oil and gas extraction Own use in electricity and heat plants Own use in gas works Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Diesel oil:** Transformation loss: 85% Power plants: 30% Refineries: 68%	**Diesel oil:** Transformation loss: 6% Power plants: 60% Refineries: 15%	**Diesel oil:** Transformation loss: 9% Power plants: 10% Refineries: 17%
Fuel oil: Own use in coal mines Own use in oil and gas extraction Own use in electricity and heat plants Own use in gas works Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Fuel oil:** Transformation loss: 100% Power plants: 93% Gas works:76% Refineries: 82%	**Fuel oil:** Power plants: 5% Gas works:20% Refineries: 10%	**Fuel oil:** Power plants: 2% Gas works:4% Refineries: 8%
Natural gas					
Natural gas: Own use in oil and gas extraction Own use in electricity and heat plants Own use in gas works Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Natural gas:** Transformation loss: 48% Power plants: 71% Gas works:100%	**Natural gas:** Transformation loss: 14% Power plants: 15%	**Natural gas:** Transformation loss: 36% Power plants: 14%
Electricity and Heat					
Electricity: Own use in coal mines Own use in oil and gas extraction Own use in electricity and heat plants Own use in coke ovens Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Electricity:** Transformation loss: 54%	**Electricity:** Transformation loss: 23%	**Electricity:** Transformation loss: 23%
Heat: Own use in coal mines Own use in oil and gas extraction Own use in electricity and heat plants Own use in coke ovens Own use in refineries	n.a.	Energy industry own use of the main fuel is related to other corresponding economic activities in the provincial energy balance (NBS)	**Heat:** Transformation loss: 64%	**Heat:** Transformation loss: 36%	n.a.

Indicators for final energy consumption

The IEA energy balance data for final energy consumption are compared to Chinese provincial data from provincial energy balances and alternative data if required. On this basis it is possible to establish detailed and international comparable indicators for regional shares for energy consumption in East, Central and West China. Appendices A-2 to A-5 provide additional information on the structure of IEA and Chinese provincial energy balances.

Final consumption in IEA's energy balance is all fuel and energy that is delivered to the consumption sectors, both for use as for energy needs and non–energy needs. Consumption sectors comprise industry (excluding the energy industry), commerce and public administration, agriculture, forestry and fishing, residential and other non-specified fuel consumption by other consumers (including military). As discussed before, any fuel consumption by consumers which is used for electricity and heat generation for sale is reported as part of the transformation sector in the IEA energy balance format.

China's provincial energy balances have limited detail on final energy consumption and the reported aggregated fuel mix might be misleading in comparison with international statistical energy end use categories. Final end use subsectors that report aggregated final energy use in the provincial energy balances of China are industry; construction; farming, forestry, animal husbandry, fishery conservancy; transport, storage, post; wholesale, retail trade, hotel, restaurants; residential consumption and other (referring to public institutions such as schools, hospitals, and the military). Fuels in total energy consumption include coal, crude oil and petroleum products, natural gas and electricity. As in primary energy supply, the consumption of fuel of low calorific value, bio-energy and solar energy is excluded from energy statistics.

As a main difference to international energy statistics, many energy end use categories in China's statistical system are sorted by their institutional arrangement (e.g. ownership of goods and companies) and not by economic activity and purpose. In the 2012 NBS statistical yearbook more than 10 different reporting categories for enterprise ownership were established[9]. Large state-owned enterprises in rural areas are often major providers of social services. Some large, integrated steel plants 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 (LBNL 2001). Energy consumption statistics from enterprises in industrial (and other) sectors includes therefore a certain amount of activity that belongs in other sectors as per international statistical standards.

Industry

IEA energy balance

The industry classification in the IEA energy balance follows the UN International Standard Industrial Classification of All Economic Activities (ISIC). ISIC is one international reference classification of productive activities. Its main purpose is to provide a set of activity categories that can be utilized for the collection and reporting of statistics according to such activities. Since the adoption of the original version of ISIC in 1948, the majority of countries have used ISIC as their national activity classification or have developed national classifications derived from ISIC.

[9] Enterprise ownership categories include amongst others state-owned enterprises; collective owned enterprises; cooperative entities; joint ownership entities; limited liability corporations; shareholding corporations; private enterprises; other domestic funded entities; enterprises with sole foreign investment; other enterprises with foreign funds

The industry sector in IEA's energy balance specifies the use of fuels within the **manufacturing and construction industries**, excluding fuels used in energy industries (under energy industry own use), solid fuels use for coke manufacture and in blast furnaces within the iron and steel sector (under transformation) and fuels consumed for the transport of goods (under transport sector). Major energy consuming industries in China are iron and steel industry; chemical and petrochemical industry; non-ferrous metals industry, non-metallic minerals industry and paper, pulp and print industry. Less energy intensive industry sub-sectors include for instance food and tobacco, wood and wood products, textile and leather, machinery, transport equipment.

China provincial energy balance

China's Industrial Classification for National Economic Activities (ICNEA) is used to specify industry end uses in China's national and provincial energy balances. While the ICNEA is derived from ISIC many aggregations and breakdowns are defined according to China specific national conditions. The latest ICNEA revision was carried out in 2011, it is planned to revise the current version within 8 – 10 years.

Industrial energy use by energy type for over thirty industrial subsectors is available for China. This series exists only on a national (and not at the provincial) level, and begins in 1980. Industry refers to the material production sector in the extraction of natural resources and processing and reprocessing of minerals and agricultural products. The three main sub-categories in China's industry classification are (i) mining, (ii) manufacturing and (iii) electric power, gas, water production and supply. Mining includes the mining and transformation of coal and the extraction of petroleum and natural gas. Under manufacturing more than 30 sub-divisions exist. Major energy consuming categories under manufacturing include the smelting and pressing of ferrous and non-ferrous metals; the manufacturing of raw chemical materials and chemical products; the manufacturing of non-metallic mineral products; the manufacturing of metal products; and the processing of petroleum, nuclear fuel and coking. In addition the construction sector is separated from the industry sector, while it is included in industry in the IEA energy balance. Contrary to international best practice NBS includes statistics from enterprises in energy-producing sectors as well as for energy-consuming sectors under energy consumption (and not under energy transformation).

Alternative provincial energy indicators

For China the accuracy of overall energy statistics is particularly dependent on the accuracy of industry end use figures in heavy, energy intensive industries. Coal is the main fuel for industry consumption in China and the majority (87% in 2010) is untreated raw coal.

China's major economic zones are located in the eastern coastal provinces around Beijing, in the Pearl river delta around Hong Kong, in the Yangtze river delta around Shanghai and in the area west of Taiwan street. General industrial activity in different regions of China can be cross-checked with alternative provincial energy indicators that deal with statistics about economic development zones, employment or enterprise ownership by industry. Some statistical indicators for general industry activity from various data sources are:

- Provincial distribution of large SOEs (NBS YB);
- Provincial distribution of private enterprises (NBS YB);
- Provincial distribution of free trade zones, high tech industrial development zones and economic and development zones (World Bank and Asian Development Bank research reports);
- Employment in construction and manufacturing by SOEs and private enterprises by province (NBS YB);
- Provincial distribution of top 1000 energy consuming enterprises under 11th 5YP (US LBNL research reports).

The outputs of key industrial, energy intensive products can also be used to assume China's industrial energy end use. A few energy-intensive industrial products determine a very large share of the country's coal demand, and thus total energy demand. One ton of coal equivalent is needed to manufacture for example 0,6 tons of synthetic ammonia; 1,5 tons of steel; or 6,6 tons of cement (NBS 2012).

Conclusions:

NBS provincial energy data need to be combined with alternative data sources to establish a regional energy balance in final energy consumption in industry. The following assumptions based on alternative data sources were discussed with Chinese energy sector exports (see Table 4 below for further details):

- China accounted for nearly 40% in world steel production in 2010 (World Steel Association 2011). Crude steel output is chosen as it's the key output from iron and steel industry. It is matched with all main fuels, as no fuel specific data are provided in NBS statistics.
- China's cement industry accounts for about 10% of industrial final energy consumption (LBNL 2011). Cement is thus chosen as the key energy indicator to assume regional shares in the non-ferrous metal industry.
- Fertilizers are the main output of the chemical and petrochemical industry. Share of fertilizer outputs are used to derive regional fuel shares in chemical and petrochemical industry.
- Regional shares of Paper and paperboard output outputs are used to derive regional fuel shares in the pulp, paper and printing industry.
- Aluminium production and output are not reported in NBS statistics. Therefore the fuel consumption in the industry sector in general is chosen as main indicator for the non-metallic mineral industry.

Table 4: Regional energy balance of China – final consumption in Industry

Industry final consumption – IEA energy balance	Industry final consumption – NBS provincial energy balance	Industry final consumption – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Raw coal, washed coal, other cleaned coal, briquettes, gangue:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Raw coal:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 43% Paper & –board output: 70% Industry: 43%	**Raw coal:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 37% Paper & –board output: 23% Industry: 43%	**Raw coal:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 20% Paper & –board output: 7% Industry: 43%
Oven Coke: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Coke and other coking products:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Coke:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 56% Paper & –board output: 70% Industry: 56%	**Coke:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 29% Paper & –board output: 23% Industry: 29%	**Coke:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 15% Paper & –board output: 7% Industry: 15%
Coke oven gas: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Coke oven gas:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Coke oven gas:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 39% Paper & –board output: 70% Industry: 39%	**Coke oven gas:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 45% Paper & –board output: 23% Industry: 45%	**Coke oven gas:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 16% Paper & –board output: 7% Industry: 16%
Blast furnace gas: Iron and Steel Industry	**Blast furnace gas, converter gas, other gas:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB);	**Blast furnace gas:** Crude steel output: 64%	**Blast furnace gas:** Crude steel output: 26%	**Blast furnace gas:** Crude steel output: 10%
Oil and petroleum products					
LPG: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**LPG:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB); LPG network length (NBS YB)	**LPG:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 74% Paper & –board output: 70% Industry: 74%	**LPG:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 18% Paper & –board output: 23% Industry: 18%	**LPG:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 8% Paper & –board output: 7% Industry: 8%
Gas/diesel oil: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Diesel oil:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Diesel oil:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 65% Paper & –board output: 70% Industry: 65%	**Diesel oil:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 21% Paper & –board output: 23% Industry: 21%	**Diesel oil:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 14% Paper & –board output: 7% Industry: 14%
Fuel oil: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Fuel oil:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Fuel oil:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 76% Paper & –board output: 70% Industry: 76%	**Fuel oil:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 20% Paper & –board output: 23% Industry: 20%	**Fuel oil:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 4% Paper & –board output: 7% Industry: 4%
Ethane: Chemical and petrochemical Industry Non-specified Industry	n.a.	Fertilizer output (NBS YB);	**Ethane:** Fertilizer output: 25%	**Ethane:** Fertilizer output: 41%	**Ethane:** Fertilizer output: 34%
n.a.	**Naphtha, Lubricants, Petroleum waxes, white spirits, bitumen asphalt, other petroleum products:** Industry Construction		n.a.	n.a.	n.a.
Natural gas					
Natural gas: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Natural gas, LNG:** Industry Construction	Production of crude steel (NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Natural gas:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 30% Paper & –board output: 70% Industry: 30%	**Natural gas:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 21% Paper & –board output: 23% Industry: 21%	**Natural gas:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 49% Paper & –board output: 7% Industry: 49%
Electricity and Heat					
Electricity: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Electricity:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Electricity:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 55% Paper & –board output: 70% Industry: 55%	**Electricity:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 28% Paper & –board output: 23% Industry: 28%	**Electricity:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 17% Paper & –board output: 7% Industry: 17%
Heat: Iron and Steel Industry Chemical and petrochemical Industry Non-ferrous Metal Industry Non-metallic Mineral Industry Pulp, paper and printing Industry Non-specified Industry	**Heat:** Industry Construction	Production of crude steel (Steel Industry YB, NBS YB); Fertilizer output (NBS YB); Cement output (NBS YB); Output of paper and paperboard (NBS YB);	**Heat:** Crude steel output: 64% Fertilizer output: 25% Cement output: 45% Industry: 69% Paper & –board output: 70% Industry: 69%	**Heat:** Crude steel output: 26% Fertilizer output: 41% Cement output: 33% Industry: 22% Paper & –board output: 23% Industry: 22%	**Heat:** Crude steel output: 10% Fertilizer output: 34% Cement output: 22% Industry: 9% Paper & –board output: 7% Industry: 9%

Transport

IEA energy balance

IEA's transportation sector represents the fuels and energy used in the transport of goods and persons regardless of the economic sector to which it is contributing in line with ISIC specifications. Sub-categories in the transport sector according to transport modes are road, rail, domestic navigation, domestic aviation and pipeline transport. Pipeline transport includes fuel and energy used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities. It comprises the consumption at pumping stations and for maintenance of the pipeline. Losses occurring during the transport between distributor and final are reported as distribution losses. Appraisal of China's transportation energy use in an international context requires estimating revisions to NBS's figures. One commonly used method for re-allocating gasoline use and portions of diesel use from other sectors to transport is as follows: 20% of agricultural diesel use, 10% of industrial diesel use, and 12% of service sector diesel use (LBNL 2011).

China provincial energy balance

The transport final consumption category in China's provincial energy balance is merged with storage and post/telecommunication. Transport sector data in NBS energy balances are collected from a wide range of sources, including the Ministry of Railways, Ministry of Transport, Civil Aviation Administration of China, the divisions of vehicle management under the provincial departments of public security of the Ministry of Public Security. Pipeline network statistics are mainly supplied by the respective state owned enterprises, such as the China National Petroleum and Natural Gas Corporation Group and the China Petrochemical Corporation Group.

Many Chinese specific definitions appear in the transport sector energy use, when comparing them with international statistics. A China specific characteristic of transport sector statistics is that vehicles are classified primarily by their function into civil or special vehicles. Civil vehicles include passenger vehicles and trucks for commercial transportation, vehicles owned by private enterprises and government institutions, and private vehicles. Vehicles for special purpose include fire trucks, municipal sanitation service vehicles, and military vehicles. Since 2002, the statistical standard of detail item of passenger vehicles and trucks, other vehicles have been revised, the data are not comparable with previous years. A major deficiency is the reporting of up to 50% of transportation energy use in other final end use sectors' statistics due to NBS's reporting methods and sectoral definitions (LBNL 2001). Only energy use from enterprises whose main business activity is classified as transport is reported. Industrial and agricultural enterprises, as well as individuals operate a large fraction of China's motor vehicles, and their consumption of motor fuels is reported as industrial, agricultural, or household consumption.

Alternative provincial energy indicators

A general indication of the regional development of transport infrastructure is given in national and provincial statistics about the length of rail, road and pipeline networks. Historically the country's rail network was vital to transport coal from major coal mining bases to the load centres in the eastern coastal provinces. Many coal power bases have rail access in near distance. The average coal and coke by rail transport distance in China was 642 km and 990 km in 2010 (NBS 2012). A Stanford study estimated the economic threshold for transporting coal by rail in China at 1200 km (Stanford 2010). Most of the rail locomotives continue to be coal-fired while the length of electrified railway tracks is increasing steadily. Currently about 10% of the railway lines are electrified.

Taking the indicator rail network length a homogenous rail network coverage of China is visible – of more than 93000 km of rail lines 31% are operational in East; 43% in Central and 26% in West China. A similar pattern is shown when the indicator road network length is taken – of more than 4 million km of roads 30% are operational in East; 37% in Central and 33% in West China (aggregating all road categories from dirt roads to highways). About 85000 km of express highways are included, but these are limited mainly to East and Central China (40% and 37% of express highway road km respectively). With regards to shipping by inland waterways, this transport mode is mainly feasible in East and Central China, where 47% and 33% of the 125000 km of inland waterways are operational.

The oil and natural gas pipeline network expansion shows the efforts to connect distant, resource rich provinces in China with the coastal provinces. About 40000 km of natural gas pipelines; 20000 km of crude oil pipelines and 18000 km of refined petroleum product pipelines are operational in China (IEA 2009). China's first national East West gas pipeline was completed in 2004; it required 890 km to connect the Ordos Basin in Inner Mongolia province with Beijing. A second national East West gas pipeline of 3900 km was built in 2009; this connects the Tarim Basin in Xingjian with Shanghai (IEA 2009). More than 50% of the natural gas network is operational in the East coastal provinces (NBS 2012).

Conclusions:

NBS provincial energy data need to be combined with alternative data sources to establish a regional energy balance in final energy consumption in the transport sector. As aggregated transport data from Chinese statistics might be misleading, the following assumptions were discussed and agreed on with Chinese energy sector exports (see Table 5 below for further details):

- Freight weight distance for different transport modes are used as an alternative indicator to assume final fuel consumption in different regions of China
- Passenger weight distance shares for different transport modes were calculated in addition to freight weight distance shares in order to give additional insights for more detailed transport sector modelling.
- Comparing freight weight distance, passenger weight distance and fuel use in transport, post and storage category, major differences appear for coal, LPG, fuel oil, natural gas and electricity.

Table 5: Regional energy balance of China – final consumption in Transport

Transport sector final consumption – IEA energy balance	Transport sector final consumption – NBS provincial energy balance	Transport sector final consumption – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal: Rail	**Raw coal, washed coal, other cleaned coal, briquettes, gangue:** Transport, storage and post	Freight weight distance –rail (NBS YB); Passenger weight distance rail (NBS YB); Length of rail network (NBS YB)	**Raw coal:** Freight weight distance rail: 36% Passenger weight distance rail:40% Transport: 17%	**Raw coal:** Freight weight distance rail: 43% Passenger weight distance rail: 42% Transport: 64%	**Raw coal:** Freight weight distance rail: 21% Passenger weight distance rail: 18% Transport: 19%
n.a.	**Coke and other coking products:** Transport, storage and post		n.a.	n.a.	n.a.
n.a.	**Coke oven gas:** Transport, storage and post		n.a.	n.a.	n.a.
Oil and petroleum products					
LPG: Road	**LPG:** Transport, storage and post	Passenger weight distance road (NBS YB); Freight weight distance road (NBS YB); Length of highway network (NBS YB)	**LPG:** Freight weight distance road: 43% Passenger weight distance road: 50% Transport: 82%	**LPG:** Freight weight distance road: 44% Passenger weight distance road: 31% Transport: 15%	**LPG:** Freight weight distance road: 13% **Passenger weight distance road: 19%** Transport: 3%
Motor gasoline: Road	**Gasoline:** Transport, storage and post	Passenger weight distance road (NBS YB); Freight weight distance road (NBS YB); Ownership of private vehicles (NBS YB)	**Gasoline:** Freight weight distance road: 43% Passenger weight distance road: 50% Private vehicles: 59% Transport: 56%	**Gasoline:** Freight weight distance road: 44% Passenger weight distance road: 31% Private vehicles: 25% Transport: 27%	**Gasoline:** Freight weight distance road: 13% Passenger weight distance road: 19% Private vehicles: 16% Transport: 17%
Gas/diesel oil: Road Rail Domestic navigation Pipeline transport	**Diesel oil:** Transport, storage and post	Passenger – weight distance – road, rail, inland waterways (NBS YB); Freight – weight distance – road, rail, inland waterways (NBS YB)	**Diesel oil:** Freight weight distance road: 43% Freight weight distance rail: 36% Freight weight distance water: 92% Passenger weight distance road: 50% Passenger weight distance rail: 40% Passenger weight distance water: 61% Transport: 49%	**Diesel oil:** Freight weight distance road: 44% Freight weight distance rail: 43% Freight weight distance water: 6% Passenger weight distance road: 31% Passenger weight distance rail: 42% Passenger weight distance water: 10% Transport: 29%	**Diesel oil:** Freight weight distance road: 13% Freight weight distance rail: 21% Freight weight distance water: 2% Passenger weight distance road: 19% Passenger weight distance rail: 18% Passenger weight distance water: 29% Transport: 22%
Fuel oil: Road Rail Domestic navigation	**Fuel oil:** Transport, storage and post	Passenger – weight distance – road, rail, inland waterways (NBS YB);Freight – weight distance – road, rail, inland waterways (NBS YB)	**Fuel oil:** Freight weight distance road: 43% Freight weight distance rail: 36% Freight weight distance water: 92% Passenger weight distance road: 50% Passenger weight distance rail: 40% Passenger weight distance water: 61% Transport: 94%	**Fuel oil:** Freight weight distance road: 44% Freight weight distance rail: 43% Freight weight distance water: 6% Passenger weight distance road: 31% Passenger weight distance rail: 42% Passenger weight distance water: 10% Transport: 6%	**Fuel oil:** Freight weight distance road: 13% Freight weight distance rail: 21% Freight weight distance water: 2% Passenger weight distance road: 19% Passenger weight distance rail: 18% Passenger weight distance water: 29%
Jet fuel type kerosene: Domestic aviation	**Kerosene:** Transport, storage and post		**Kerosene:** Transport: 74%	**Kerosene:** Transport: 18%	**Kerosene:** Transport: 8%
n.a.	**Naphtha, Lubricants, Petroleum waxes, white spirits, bitumen asphalt, other petroleum products:** Transport, storage and post		n.a.	n.a.	n.a.
Natural gas					
Natural gas: Road Pipeline transport	**Natural gas, LNG:** Transport, storage and post	Freight weight distance road (NBS YB); Passenger weight distance road (NBS YB);	**Natural gas:** Freight weight distance road: 43% Passenger weight distance road: 50% Transport: 26%	**Natural gas:** Freight weight distance road: 44% Passenger weight distance road: 31% Transport:35%	**Natural gas:** Freight weight distance road: 13% Passenger weight distance road: 19% Transport: 39%
Electricity and Heat					
Electricity: Rail	**Electricity:** Transport, storage and post	Freight weight distance –rail (NBS YB); Passenger weight distance rail (NBS YB);	**Electricity:** Freight weight distance rail: 36% Passenger weight distance rail:40% Transport: 50%	**Electricity:** Freight weight distance rail: 43% Passenger weight distance rail: 42% Transport: 28%	**Electricity:** Freight weight distance rail: 21% Passenger weight distance rail: 18% Transport: 22%
n.a.	**Heat:** Transport, storage and post		n.a.	n.a.	n.a.

Commercial and public services

IEA energy balance

The commercial and public service category in IEA's energy balance specifies fuels consumed by business and offices in the public and private sectors. This category is based on UN ISIC and includes a variety of disparate activities, amongst others water supply, sewage, waste management and remediation activities; real estate activities; accommodation and food services; repair and installation of machinery and equipment; wholesale and retail trade; professional, scientific and technical activities; public administration and defence; education; healthcare; arts, entertainment and recreation; financial services.

China provincial energy balance

The main category in China's provincial energy balance that can be attributed to ISIC definition of commercial and public services is final energy consumption in "wholesale, retail trade and hotel, restaurants". A share of energy use that in IEA's energy balance format is reported under commercial and public service sector use is included in industrial consumption in China's energy balance, such as water supply, sewage, waste management; repair and installation of machinery and equipment; arts, entertainment and recreation. Furthermore some commercial and public services, such as defence, are merged in "other" end use. Research suggests that up to 44% of commercial energy consumption in China is allocated in other end use sectors when comparing Chinese and international statistics (MGI 2007).

Conclusions:

Final consumption data for the service sector should be carefully analyzed, as few Chinese and alternative statistics currently focus on this segment. The NBS data for the service sector and other sector are used to derive regional shares of household fuel consumption in Table 6 below. The sector with the largest fuel consumption is chosen to calculate regional shares.

Table 6: Regional energy balance of China – final consumption in the Service Sector

Commercial and public services consumption – IEA energy balance	Commercial and public services consumption – NBS provincial energy balance	Commercial and public services consumption – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal	**Raw coal, briquettes:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Raw coal:** Service: 35% Other sectors: 40%	**Raw coal:** Service: 42% Other sectors: 29%	**Raw coal:** Service: 23% Other sectors: 31%
Coke	**Coke:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Coke:** Service: 5% Other sectors: 100%	**Coke:** Service: 23%	**Coke:** Service: 72%
Coke oven gas	**Coke oven gas** Wholesale, Retail Trade and Hotels, Restaurants Others		**Coke oven gas:** Service: 20% Other sectors: 57%	**Coke oven gas:** Service: 52% Other sectors: 28%	**Coke oven gas:** Service: 28% Other sectors: 15%
Gas works gas	n.a.	Blast Furnace gas, Other gas	**Other coal gas:** Service: 79% Other sectors: 100%	**Other coal gas:** Service: 21%	
Oil and petroleum products					
Gas/diesel oil	**Diesel oil:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Diesel oil:** Service: 45% Other sectors: 70%	**Diesel oil:** Service: 37% Other sectors: 10%	**Diesel oil:** Service: 18% Other sectors: 20%
Other kerosene	**Kerosene:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Kerosene:** Service: 20% Other sectors: 13%	**Kerosene:** Service: 13% Other sectors: 64%	**Kerosene:** Service: 67% Other sectors: 23%
Fuel oil	**Fuel oil:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Fuel oil:** Service: 95% Other sectors: 90%	**Fuel oil:** Service: 5% Other sectors: 10%	
n.a.	**Gasoline, white spirits, LPG, other petroleum products:** Wholesale, Retail Trade and Hotels, Restaurants Others		n.a.	n.a.	n.a.
Natural gas					
Natural gas	**Natural gas:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Natural gas:** Service: 44% Other sectors: 73%	**Natural gas:** Service: 20% Other sectors: 11%	**Natural gas:** Service: 36% Other sectors: 17%
Electricity and Heat					
Electricity	**Electricity:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Electricity:** Other sectors: 69% Service: 65%	**Electricity:** Other sectors: 19% Service: 22%	**Electricity:** Other sectors: 12% Service: 13%
Heat	**Heat:** Wholesale, Retail Trade and Hotels, Restaurants Others		**Heat:** Service: 67% Other sectors: 66%	**Heat:** Service: 31% Other sectors: 29%	**Heat:** Service: 2% Other sectors: 5%

Residential Sector

IEA energy balance

IEA's energy balance includes consumption by households in the residential end use sector, excluding fuels used by households for transport. Biomass end use in China is mainly reported in the residential sector, as many rural household depend on biomass for final energy consumption needs.

China provincial energy balance

Data for household consumption by fuel, disaggregated for urban and rural residents, are given in Chinese energy statistics by NBS. Raw coal dominates the hard coal products used in China. Briquettes and washed coal still play a minor role as Chinese statistics suggest. Contrary to international best practice, statistics on household energy use might include fuels and electricity used in housing that is operated by enterprises in industry and other sectors. Bio-energy use is furthermore excluded from NBS energy balances. Many figures for residential energy consumption are estimates informed by urban and rural surveys of limited sample size, sales reports from utilities and energy marketers, and specific reports on for instance rural energy access.

Alternative provincial data

Urban residential coal use can be cross-checked through enterprises that report sales of coal briquettes. Urban residential gas and electricity use can be tracked through utilities that report gas and electricity sales. Since there are no records for a large portion of coal sales to rural households, estimates of rural residential coal use could be developed by combining information on output from small rural coal mines and survey data on coal purchases by rural households (LBNL 2001).

A few studies on population without electricity access in China's rural areas exist, which provide additional data on the use of biomass and kerosene (WB 2007). A recent ADB study summarized the status of China's central heating network and the population requiring space heating (ADB 2010).

With regards to biomass end use, the biomass projects registered in the CDM pipeline were analysed. About 10% of China's nearly 4000 CDM projects relate to biomass (UNEP 2013). The capacity and emission reduction potential from biomass use of the projects could be used as a bottom up indicator for regional biomass use in China.

Conclusions:

Final consumption data for rural households should be carefully analyzed, as only irregular surveys and national census data provide detailed energy statistics on this rapidly growing and changing sector. As few alternative residential energy statistics on China's provinces exist, the set of household data published in the NBS yearbook is used to derive regional shares of household fuel consumption in Table 7 below.

Table 7: Regional energy balance of China – final consumption in Households

Residential consumption – IEA energy balance	Residential consumption – NBS provincial energy balance	Residential consumption – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal	**Raw coal, other washed coal and briquettes:** Urban Households Rural Households		**Raw coal:** Households: 23% Urban:27% Rural: 20%	**Raw coal:** Households: 41% Urban: 54% Rural: 34%	**Raw coal:** Households: 36% Urban: 19% Rural: 46%
Coke	**Coke:** Urban Households Rural Households		**Coke:** Households: 0% Urban: 0% Rural: 0%	**Coke:** Households: 92% Urban:95% Rural: 40%	**Coke:** Households: 8% Urban:5% Rural: 60%
Coke oven gas	**Coke oven gas:** Urban Households Rural Households		**Coke oven gas:** Households: 30% Urban: 31%	**Coke oven gas:** Households: 60% Urban:59% Rural: 100%	**Coke oven gas:** Households: 10% Urban:10%
Gas works gas	n.a.	Other gas	**Other coal gas:** Households: 97% Urban: 97%	**Other coal gas:** Households: 2% Urban:2%	**Other coal gas:** Households: 1% Urban:1%
n.a.	**Blast furnace gas, converter gas and other gas:** Urban Households		n.a.	n.a.	n.a.
Oil and petroleum products					
Gas/diesel oil	**Diesel oil:** Urban Households Rural Households		**Diesel oil:** Households: 47% Urban: 36% Rural: 61%	**Diesel oil:** Households: 48% Urban: 61% Rural: 21%	**Diesel oil:** Households: 5% Urban: 3% Rural: 18%
Other kerosene	**Kerosene:** Urban Households Rural Households	Spatial distribution of population requiring kerosene for lighting (ADB)	**Kerosene:** Households: 23% Urban: 15% Rural: 24%	**Kerosene:** Households: 61% Urban: 1% Rural: 71%	**Kerosene:** Households: 16% Urban: 84% Rural: 5% Kerosene lighting: 100%
LPG	**LPG:** Urban Households Rural Households		**LPG:** Households: 73% Urban: 70% Rural: 82%	**LPG:** Households: 22% Urban: 25% Rural: 14%	**LPG:** Households: 5% Urban: 5% Rural: 4%
n.a.	**Gasoline, fuel oil, lubricants, bitumen asphalt, other petroleum products:** Urban Households Rural Households		n.a.	n.a.	n.a.
Natural gas					
Natural gas	**Natural gas:** Urban Households Rural Households		**Natural gas:** Households: 35% Urban: 34% Rural: 70%	**Natural gas:** Households: 21% Urban: 21% Rural: 6%	**Natural gas:** Households: 44% Urban: 45% Rural: 26%
n.a.	**LNG:** Urban Households		n.a.	n.a.	n.a.
Bio-Energy					
Bio-fuels	n.a.	Emission reduction of registered biomass CDM projects (UNEP)	**Biomass CDM:** 54%	**Biomass CDM:** 37%	**Biomass CDM:** 9%
Biogas	n.a.	Biogas production for power generation (NDRC)	**Biogas:** 24%	**Biogas:** 48%	**Biogas:** 28%
Electricity and Heat					
Electricity	**Electricity:** Urban Households Rural Households	Population without electricity (WB study); Rural hydropower production small scale (NBS YB)	**Electricity:** Households: 56% Urban: 55% Rural: 58% Rural hydro: 79%	**Electricity:** Households: 27% Urban: 27% Rural: 27% Rural hydro: 13%	**Electricity:** Households: 17% Urban: 18% Rural: 15% Rural hydro: 8% No electricity: 100%
Heat	**Heat:** Urban Households Rural Households	Population requiring space heating (ADB); Central heating network length (NBS YB)	**Heat:** Households: 40% Urban: 39% Rural: 100% Space heating: 45% Heat network: 68%	**Heat:** Households: 44% Urban: 44% Space heating: 33% Heat network: 25%	**Heat:** Households: 16% Urban: 17% Space heating: 22% Heat network: 7%

Agriculture

IEA energy balance

Agriculture and forestry is specified as a final consumption category, apart from fishing, in the IEA energy balance.

China provincial energy balance

"Farming, Forestry, Animal Husbandry, Fishery Conservancy" is defined as a final energy consumption category. In Chinese statistics more fuel categories than in the IEA energy balance are used for agricultural end use, for instance natural gas and coke oven gas use is reported.

Alternative provincial data

Few alternative provincial statistics exists besides NBS provincial energy balances. Some NBS indicators report the distribution and use of agricultural machinery in China, including the regional distribution of diesel engines for agricultural activities, which provides an alternative estimate for diesel specific consumption in agriculture.

Conclusions:

The fuel shares of the "Farming, Forestry, Animal Husbandry, Fishery Conservancy" are used to calculate regional shares for East, Central and West China (see Table 8 below). Fuels in Chinese statistics that are not represented for agricultural activities in the IEA energy balance are left out.

Table 8: Regional energy balance of China – final consumption in Agriculture

Agriculture and forestry consumption – IEA energy balance	Agriculture consumption – NBS provincial energy balance	Agriculture consumption – alternative provincial data	Key Indicator – EAST CHINA	Key Indicator – CENTRAL CHINA	Key Indicator – WEST CHINA
Coal and coal products					
Hard coal	**Raw coal, other washed coal and briquettes**		**Raw coal:** Farming: 18%	**Raw coal:** Farming: 46%	**Raw coal:** Farming: 36%
Coke	**Coke**		n.a.	**Coke:** Farming: 49%	**Coke:** Farming: 51%
n.a.	**Coke oven gas**		n.a.	n.a.	n.a.
Oil and petroleum products					
Gas/diesel oil	**Diesel oil**	Agricultural machines with diesel engines (NBS YB)	**Diesel oil:** Farming: 48% Diesel engines: 48%	**Diesel oil:** Farming: 36% Diesel engines: 41%	**Diesel oil:** Farming: 16% Diesel engines: 11%
Motor gasoline	**Gasoline**	Agricultural machines by capacity (NBS YB)	**Gasoline:** Farming:48% Machines: 40%	**Gasoline:** Farming:41% Machines:42%	**Gasoline:** Farming:11% Machines:18%
Other kerosene	**Kerosene**		**Kerosene:** Farming: 22%	**Kerosene:** Farming: 0%	**Kerosene:** Farming: 78%
Fuel oil	**Fuel oil**		**Fuel oil:** Farming: 100%		
n.a.	**LPG, lubricants, other petroleum products**		n.a.	n.a.	n.a.
Natural gas					
n.a.	**Natural gas**		n.a.	n.a.	n.a.
Electricity and Heat					
Electricity	**Electricity**		**Electricity:** Farming: 35%	**Electricity:** Farming: 45%	**Electricity:** Farming: 20%
Heat	**Heat**		**Heat:** Farming: 0%	**Heat:** Farming: 97%	**Heat:** Farming: 3%

Acknowledgement

A part of financial support for this research is from the Sino-Danish Centre for Education and Research (SDC) (www.sinodanishcenter.dk) and the support is gratefully acknowledged. I am furthermore grateful to my colleagues at Denmark Technical University, Energy Systems Analysis Group, the members of the IEA ETSAP group, and various Chinese partners from the Chinese Acedemy of Sciences, the China National Renewable Energy Center and Tsinghua University for their remarks and their constructive suggestions in various meetings and seminars.

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Appendix A-1: China statistical yearbooks[10]

Table A-1.1: Macro-economic statistical yearbooks including residential sector

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
National Statistical Yearbook	China Statistics Press	Chinese, English	annually since 1981, English language edition annually since 1994	1096	USD 170
Statistical Yearbook for Regional Economy	China Statistics Press	Chinese, English	annually since 2000, since 2004 in a bilingual edition	567	USD 123
Customs Statistical Yearbook	China Customs Press	Chinese, English	annually since 1990, first English version in 2001	n.a.	USD 440
City Statistical Yearbook	China Statistics Press	Chinese, English	annually since 2001, first edition in 1985	401	USD 100
Input-Output Tables	China Statistics Press	Chinese	occasionally, recent editions in 2002, 2007 and 2012	493	USD 73
Rural Statistical Yearbook	China Statistics Press	Chinese	annually since 2004, first edition in 1987	n.a.	USD 82
Urban Economy Yearbook	China City Press	Chinese	occasionally, recent editions in 2010 and 2012	n.a.	USD 143
Household Survey Yearbook	China Statistics Press	Chinese	annually since 2011, combining rural and urban household data	394	USD 73
County Economic Statistical Yearbook	China Statistics Press	Chinese	annually since 2005	n.a.	USD 90

Table A-1.2: Energy specific statistical yearbooks

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
Energy Statistical Yearbook	China Statistics Press	Chinese, English	annually since 2004, first English edition in 2000, first edition in 1986	286	USD 98
Energy Data Book	NDRC	Chinese	annually since 2010	87	USD 90
New energy and renewable energy Yearbook	China Renewable Energy Society	Chinese	annually since 2009	n.a.	USD 104
Electric Power Yearbook	China Electric Power Press	Chinese	annually since 2001, first edition in 1993	607	USD 89
Power Industry Yearbook	China Machinery Industry Press	Chinese	annually since 2012	663	USD 90
China Low Carbon Yearbook	China Financial and Economic Publishing House	Chinese	annually since 2010	n.a.	USD 137
Electric Power Industry Statistics	China Electricity Council	Chinese	annually since 2000, first edition in 1988	n.a.	USD 1640
Energy Conservation and Emission reduction Development Report	China Economic Publishing House	Chinese	annually since 2011	564	USD 69

Table A-1.3: Industry specific statistical yearbooks

[10] research via http://www.chinabookshop.net – prices for most recent edition, if bilingual then price for English edition, n.a. = not available (assessed on August 16, 2013)

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
Chemical Industry Yearbook	China National Chemical Information Centre	Chinese, English	annually since 1984, occasional English editions since 1999	n.a.	
Steel Yearbook	China Steel Yearbook Editorial Book	Chinese, English	annually since 1992, occasional English editions since 2007, first edition in 1985	370	USD 590
Statistical Yearbook of High Technology Industry	China Statistics Press	Chinese, English	annually since 2005, bilingual editions since 2009, first edition in 2002	114	USD 87
Statistical Yearbook of the Tertiary Industry	China Statistics Press	Chinese	annually since 2006	n.a.	USD 94
Statistical Yearbook on Construction	China Statistics Press	Chinese	annually since 2000	n.a.	USD 68
Coal Industry Yearbook	Coal Information Research Centre	Chinese	annually since 2004	n.a.	USD 110
Coal Construction Yearbook	China Coal Industry Press	Chinese	occasionally, most recent edition 2006-2010	n.a.	USD 77
Coal Industry Statistics Compendium	China Coal Industry Press	Chinese	one edition for 1949-2004	n.a.	USD 90
SME Yearbook	The vast land of China Publishing House	Chinese	annually since 2006	n.a.	USD 117
Industry Economy Yearbook	China Statistics Press	Chinese	annually since 2006, first edition in 1991	455	USD 73
Industrial Economy Yearbook	China Financial and Economic Publishing House	Chinese	annually since 2005	n.a.	USD 120
Petroleum and Petrochemical Equipment Industry Yearbook	China Machinery Industry Press	Chinese	annually since 2007	n.a.	USD 90
Petrochemical Corporation Yearbook	China Petrochemical Consulting Company	Chinese	annually since 2004, first edition in 1997	n.a.	USD 87
Petroleum and Chemical Industry Statistical Yearbook	China Petroleum Group Consulting Center	Chinese	discontinued – annual editions 2001-2006	n.a.	USD 77
Machinery Industry Yearbook	China Machinery Industry Press	Chinese	annually since 2001, 1st edition in 1984	n.a.	USD 120
Nonferrous Metals Industry Yearbook	China Nonferrous Metals Industry Yearbook Editorial Board	Chinese	annually since 1998	n.a.	USD 107
China Gas Industry Yearbook	China Light Industry Press	Chinese	one edition in 2012, to be published annually	n.a.	USD 115
National Petroleum Corporation Yearbook	Petroleum Industry Press	Chinese	annually since 2004, 1st edition in 2001	n.a.	USD 89
China Iron and Steel Statistics	China Steel Industry Association	Chinese	annually since 2004, first edition in 1993	n.a.	USD 74
China Mining Yearbook	Earthquake Press	Chinese	annually since 2003, first edition in 2003	n.a.	USD 95
Steel Annual Development Report	China Steel Industry Association	Chinese	annually since 2005	n.a.	USD 90
Development Zones Yearbook	China Financial and Economic Publishing House	Chinese	annually since 2005	484	USD 107
High-tech Industrial Development Zone Yearbook	China Financial and Economic Publishing House	Chinese	annually since 2010	389	USD 76

Table A-1.4: Agriculture specific statistical yearbooks

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
Agriculture Yearbook	China Agriculture Press	Chinese, English	annually since 1981, English language edition annually since 1995	227	USD 180
Township Enterprises and Agricultural Product Processing Yearbook	China Agriculture Press	Chinese	annually since 2004, first edition in 1997 (as township enterprises yearbook)	505	USD 80

Table A-1.5: Transport specific statistical yearbooks

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
Energy-saving and new energy vehicle Yearbook	China Economic Publishing House	Chinese, English	annually since 2010, English editon in 2012	303	USD 688
Automotive Industry Yearbook	China Automotive Research Centre	Chinese	annually since 1993, first edition in 1991	745	USD 260
Automotive Trade Yearbook (Auto Market Almanac)	China Commercial Press (China Association of Automobile Circulation)	Chinese	annually since 1999, first edition in 1995	n.a.	USD 246
Yearbook of Transportation and Communication	Yearbook House of China Transportation and Communication	Chinese	annually since 1990, first edition in 1986	n.a.	USD 167
Statistical Yearbook of National Railway	China Railway Press	Chinese	discontinued, 2 editions for 2006 and 2007	n.a.	USD 50
Motorcycle Industry Yearbook	Motorcycle Technology Magazine	Chinese	annually since 2006	n.a.	USD 66
Civil Aviation Industry Yearbook	China Statistics Press	Chinese	annually since 2008	n.a.	USD 60

Table A-1.6: Commercial and public service specific statistical yearbooks

Yearbook	Publisher	Language	Frequency	Pages in recent edition	Online Bookshop Price
Urban Construction Statistical Yearbook	China Building Industry Press	Chinese, English	annually since 2003, first English edition in 2003, first edition in 2000	656	USD 98
Urban and Rural Construction Yearbook	China Building Industry Press	Chinese, English	annually since 2006 in a bilingual version	656	USD 98
Commerce Yearbook	China Business Press (Ministry of Commerce)	Chinese, English	annually since 2004 in a bilingual edition	801	USD 197
Real Estate Statistics Yearbook	China Statistics Press	Chinese	annually since 2006, first edition in 1999	n.a.	USD 123
Building Industry Yearbook	China Construction Association	Chinese	annually since 2002	n.a.	USD 104
Building Materials Industry Yearbook (Almanac)	Almanac of China Buildings Materials Industry Press	Chinese	annually since 2005, first edition in 1981	n.a.	USD 148
Chain Stores of Retail Trade and Catering Services Yearbook	China Statistics Press	Chinese	annually since 2007	n.a.	USD 103
Large-Middle Size Retail and Accomodation Enterprises Yearbook	China Statistics Press	Chinese	annually since 2007	n.a.	USD 106

Appendix A-2: Categories of a provincial energy balance of China

Total Primary Energy Supply
Indigenous Production
Recovery of Energy
Moving In from Other Provinces (interprovincial import)
Import
Domestic Airplanes & Ships Refueling Abroad
Sending Out to Other Provinces (interprovincial export)
Export
Oversea Airplanes & Ships Refueling in China
Stock Change
Input & Output of Transformation
Thermal Power
Heating Supply
Coal Washing
Coking
Petroleum Refineries; including Petroleum Products input
Gas Works; including Coke input
Natural Gas Liquefaction
Briquettes
Loss
Total Final Consumption
Farming, Forestry, Animal Husbandry, Fishery Conservancy
Industry; including Non-Energy Use in Industry
Construction
Transport, Storage and Post
Wholesale, Retail Trade and Hotel, Restaurants
Others
Residential Consumption; including urban and rural consumption
Statistical Difference

Appendix A-3: Categories of a final industry consumption in national energy balance of China

Total Final Industry Consumption
Mining
Mining and Washing of Coal; Extraction of Petroleum and Natural Gas; Mining and Processing of Ferrous Metal Ores; Mining and Processing of Non-Ferrous Metal Ores; Mining and Processing of Non-metal Ores; Mining of Other Ores
Manufacturing
Smelting and Pressing of Ferrous Metals; Manufacture of Metal Products
Smelting and Pressing of Non-ferrous Metals
Manufacture of Non-metallic Mineral Products
Manufacture of Raw Chemical Materials and Chemical Products; Manufacture of Medicines; Manufacture of Chemical Fiber; Manufacture of Rubber; Manufacture of Plastics
Manufacture of Paper and Paper Products; Printing, Reproduction of Recording Media
Processing of Food from Agricultural Products; Manufacture of Foods; Manufacture of Beverages; Manufacture of Tobacco;
Manufacture of Textile; Manufacture of Textile Wearing Apparel, Footwear, and Caps; Manufacture of Leather, Fur, Feather and Related Products; Manufacture of Articles For Culture, Education and Sport Activity; Manufacture of Artwork and Other Manufacturing
Processing of Timber, Manufacture of Wood, Bamboo, Rattan, Palm, and Straw Products; Manufacture of Furniture
Processing of Petroleum, Coking, Processing of Nuclear Fuel
Manufacture of General Purpose Machinery; Manufacture of Special Purpose Machinery; Manufacture of Transport Equipment; Manufacture of Electrical Machinery and Equipment; Manufacture of Communication Equipment, Computers and Other Electronic Equipment; Manufacture of Measuring Instruments and Machinery for Cultural Activity and Office Work
Recycling and Disposal of Waste
Electric Power, Gas and Water Production and Supply
Production and Distribution of Electric Power and Heat Power
Production and Distribution of Gas
Production and Distribution of Water

Appendix A-4: Categories of the IEA energy balance

Production
Imports
Exports
International Marine Bunkers (included in World Total)
International Aviation Bunkers (included in World Total)
Stock Changes
TPES – Total Primary Energy Supply
Transformation and Energy Industry Own Use
Transfers
Statistical Differences
Transformation Electricity Plants; CHP Plants; Heat Plants; Gas Works; Oil Refineries; Coal Transformation; Liquefaction Plants; Other Transformation
Energy Industry Own Use
Losses
TFC – Total Final Consumption
Industry Iron and Steel Industry; Chemical and petrochemical Industry; Non-ferrous metal Industry; Non-metallic mineral Industry; Transport equipment; Machinery; Mining and quarrying; Food and Tobacco; Paper, pulp and print; Wood and Wood Products; Construction; Textile and leather; Non-Specified
Transport Road; Rail; Domestic navigation; Domestic aviation; Pipeline transport; Non-specified
Residential
Commercial and Public Services
Agriculture / Forestry
Fishing
Non-Specified
Non-Energy Use; including petrochemical Feedstock

Appendix A-5: UN ISIC categories for economic activities in selected energy intensive industry sectors

Industry sub-sector	Economic activities based on UN ISIC
Iron and steel	Manufacture of basic iron and steel, Casting of iron and steel in foundries
chemical and petrochemical	Manufacture of basic chemicals, fertilizers, nitrogen compounds, plastics and synthetic rubber in primary forms; manufacture of other chemicals incl. pesticides and agrochemicals, paints, soap and detergents; manufacture of man-made fibres; Manufacture of pharmaceuticals and medicinal chemical and botanical production
non-ferrous metals industry	Manufacture of basic precious (such as gold, silver, platinum) and other non-ferrous metals (such as aluminium, zinc, lead, tin, magnesium); Casting of non-ferrous metals
non-metallic minerals industry	Manufacture of non-metallic mineral products including glass, cement, ceramics, concrete
paper, pulp and print industry	Manufacture of pulp, paper and paperboard; Printing and reproduction of recorded media