# Statistical Information Management Program – SIMP II

## Environment Statistics Project Accounts Component: Technical Report

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# Introduction

The Government of the People's Republic of China is acutely conscious of the need to adopt policies that promote sustainable development and the protection of the environment. It also wishes to closely monitor environmental trends and measure natural capital. To move towards these goals, the Government wishes to develop a 'green national accounts' system based on international recommendations and best practices.

The goals that China has set for itself are consistent with Canadian policy priorities as demonstrated in the Canadian International Development Agency (CIDA) Country Development Programming Framework (CDPF), approved by CIDA and its Chinese counterpart, the Ministry of Commerce (MOFCOM). Taking into account the Chinese government's strong policy commitment and the new CDPF's orientation toward environmental issues, Statistics Canada (StatCan) and the National Bureau of Statistics (NBS) agreed that a project on environment statistics should be incorporated into the Statistical Information Management Program (SIMP) II.

The Environment Statistics Project aims to help the NBS and other relevant Chinese government agencies enhance China's existing environmental statistics programs and establish and develop the NBS's environmental accounting program.

This report is divided in five parts; part one introduces "China's Resources and Environmental Accounting System Framework"; part two presents the evaluation of data and data sources used to compile the pilot accounts; part three describes the compilation methods of the pilot accounts; part four presents the accounts' results and their analysis; finally, part five concludes by presenting the experience gained, and lists future activities.

# 1. China's Resources and Environmental Accounting System Framework

Several countries and international organizations have explored environmental economic accounting since the 1970s. Many countries and regions have done extensive research and measurements in the fields of energy, minerals, forest, land, water resources and other environmental domains. The System of Integrated Environmental and Economic Accounts (SEEA)[1] provides international standards for environmental economic accounting.

The NBS worked with resource and environmental administration authorities and agencies in China and other countries, as well as with international organizations, to jointly conduct a series of methodological studies and empirical practices on resources and environmental accounting. The NBS also participated in corresponding UN programs. China's Resources and Environmental Accounting System Framework, developed through SIMP II, is based on advanced international methodologies and multi-year domestic practice. The framework provides theoretical guidance and standard methodology to implement resources and environmental accounting at the national and regional levels.

The framework covers all relevant aspects of environmental accounting and the standard tables used to present data. Although some accounts are useful to provide comprehensive information for macro policy making, they were difficult to compile with the existing source data. Resources and environmental statistics need to be improved gradually, in accordance with the framework, implementing the standard accounting tables over time.

## 1.1. Objectives and Principles

### 1.1.1. General Objectives

This project's general objective is to establish China's Resources and Environmental Accounting System Framework according to the state of China's resources, the practices of environmental statistics and management, the methodologies of SEEA-2003 and the experiences learned from Canada and other countries. Where conditions permit, China will gradually develop natural resource stock and flow accounts in physical terms (e.g., minerals, land, forest and water accounts) and pollutant flow accounts. Research into natural resources and environmental accounting in monetary terms will be carried out on a trial basis in areas where the data are relatively good.

### 1.1.2. Specific Objectives

The project's specific objectives are to develop several sub-frameworks in accordance with the general objectives of the resources and environmental accounting framework (See Figure 1.1).

#### *1.1.2.1. Natural Capital Stock Accounts*

Natural capital includes natural resources, land and ecosystems. Natural resources include mineral and energy, soil, water and biological resources.

1. United Nations Statistics Division, Handbook of National Accounting: Integrated Environmental and Economic Accounting, 2003, http://unstats.un.org/unsd/envaccounting/seea.asp, accessed October 26, 2009.

The framework suggests various natural capital stock accounts, including their goals, methods and contents. Natural capital stock accounts record the physical and monetary openings and closings of natural resources stock, such as forests, minerals, water and land. Tables can be compiled to show changes between opening and closing stocks in natural capital.

#### *1.1.2.2. Natural Capital Flow Accounts*

The purposes, methods and content of natural capital flow accounts have been determined, the form of accounting tables has been designed and data sources and data requirements have been specified. Natural capital flow accounts record various flows of all natural capital caused by economic activities. Natural capital flow accounts are mainly compiled in physical terms, upon which hybrid accounts are compiled comparable with input–output accounting.

#### *1.1.2.3. Environmental Protection Expenditure Accounts*

The Environment Protection Expenditure (EPE) accounts for government, industrial enterprises and households have been compiled based on surveys of industrial enterprises' environment protection expenditures as well as administrative data and existing statistics, where available. Since compiling EPE accounts would require an integrated survey system and database, this is a long-term objective in China's resource and environmental accounting system framework.

#### *1.1.2.4. Pollutant Flow Accounts*

The purposes, methods and contents of different pollutant flow accounts have been determined, corresponding accounting tables will be defined and data sources and data requirements have been specified. The pollutant flow accounts include pollutant emissions to water and air as well as solid waste discharge.

#### *1.1.2.5. Linking with the National Economic Accounts*

The environmental accounts will supplement national wealth accounting. The natural capital in monetary terms will follow 2008 SNA recommendations and be listed as a supplementary term in the national economic accounts balance sheet.

The environmental accounts will

- be comparable with input–output accounts
- link resources flow accounts with supply
- use a table of input–output accounts to reflect the energy efficiency of different industries.

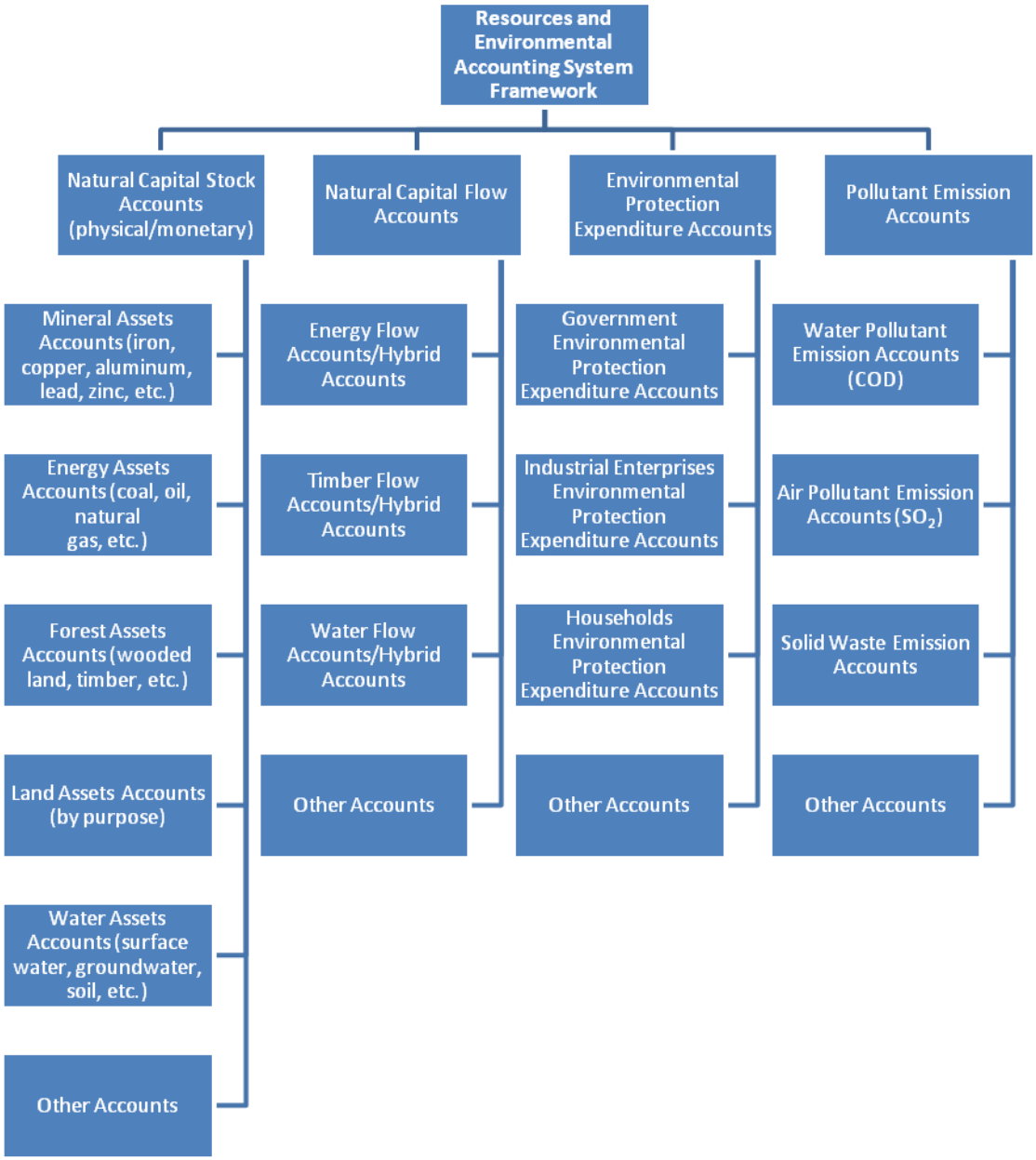
### 1.1.3. Implementation Principles

NBS will implement the following principles:

- draw on the conceptual framework of SEEA and learn from examples set by Canada and other countries.
- improve gradually the required statistical methods, based on available natural resource and environmental statistics, where conditions permit
- compile established physical accounts in monetary terms for selected accounts, when conditions permit, and gradually improve China's resources and environmental accounting system
- extend gradually the adoption of the system, and continuously improve it by conducting national-level research and a regional-level pilot survey.

## 1.2.Specific Accounts

**Figure 1.1 Structure of the Environmental Accounts**



### 1.2.1. Natural Capital Stock Accounts

Natural capital stock accounts record, at the end of the accounting period, the opening and closing stocks as well as the changes during the accounting period for natural capital (e.g., minerals, energy, forest, land or water). The accounts are presented in physical or monetary terms (see Tables 1.1 and 1.2), which share similar formats. The monetary table is compiled by putting monetary values on the physical data using appropriate valuation techniques—the net present value method or appropriation method. The technique used depends on data availability.

The four main reasons for natural capital changes during an accounting period are

1. transactions, which only appear in monetary land asset accounts where changes in land improvement (fixed capital formation in national economic accounts) and declines (fixed capital consumption) in land value are recorded
2. additions to stock levels, which result from discovery, natural growth or reclassification because of quality or function changes
3. deductions from stock levels, which result from extraction or reclassification because of quality or function changes
4. other changes in stock levels, including those resulting from catastrophic losses and uncompensated seizures, valuation changes and changes in classifications and structure.

#### *1.2.1.1. Mineral and Energy Resources Accounts*

Mineral and energy resources accounts comprise physical and monetary mineral and energy resources accounts, which measure the physical and monetary stock of mineral and energy resources at the beginning and end of a given accounting period. Mineral and energy resources accounts consist of three parts: opening stocks, changes during the accounting period and closing stocks. The changes during the accounting period refer to changes because of economic activities, natural occurences or other causes.

Mineral and energy resources accounts have similar account structures to Tables 1.1 and 1.2.

#### *1.2.1.2. Forest Resources Accounts*

Forest resources accounts comprise a table of Forest Resources Stock (see Table 1.3) and a table of Changes of Forest Resources Stock. They will reflect the stock of forest land and timber at the beginning and end of a given accounting period and changes over this period. The changes during the accounting period refer to changes because of economic activities, natural occurences or other causes.

#### *1.2.1.3. Land Resources Accounts*

Land resources accounts comprise physical and monetary land resources tables that measure the stock of land at the beginning and end of an accounting period. Land resources accounting contains three components: opening stock, changes during the accounting period and closing stock. The changes during the accounting period refer to changes because of economic activities, natural occurences or other causes.

#### *1.2.1.4. Water Resources Accounts*

Water resources stock accounts (see Table 1.4) record overall water volume at the beginning and end of an accounting period. Water resources accounts also present volume changes and their related reasons between the beginning and end of an accounting period. These reasons include natural factors such as rainfall, inflow and outflow as well as economic factors such as the extraction

and discharge of water. In the accounting, the coverage of water resources is very broad and basically includes all inland water bodies.

### 1.2.2. Natural Capital Flow Accounts

Natural capital flow accounts show the supply and use of resources products in physical terms between the economy and environment industries. All resources products' flow accounts comprise supply and use tables (Tables 1.5 and 1.6) to show the relationship between the outputs of industries of the economy and their corresponding supply and use of resource products, which enables analysis of resource-utilization efficiency. Physical supply and use tables are usually integrated with monetary supply and use tables in input–output accounting to derive a hybrid account. The classification in the hybrid account follows the homogeneous product and the industry classification in input–output accounting, which can reveal resource allocation for homogeneous economic activities.

#### *1.2.2.1. Energy Flow Accounts*

Energy flow accounts present the production of energy products by different energy industries and the use of energy products by various industrial industries. It consists of a physical supply table and a physical use table.

#### *1.2.2.2. Timber Flow Accounts*

Timber flow accounts present the production and use of different grades of log, firewood and bamboo. It consists of a physical supply table and use table.

#### *1.2.2.3. Water Flow Accounts*

Water flow accounts (Tables 1.7 and 1.8) provide information on water allocation within the economic sphere and its environmental impact because of extraction and emission.

#### *1.2.2.4. Ecosystem Services Accounts*

Comprehensive accounting of an ecosystem is very challenging because of its complexity and diversity. However, some existing international and domestic practices allow the measurement of forest ecosystem services in both physical and monetary terms.

### 1.2.3. Environmental Protection Expenditure Accounts

Environmental protection expenditure accounts (Table 1.9) record expenditures made to protect the environment, such as expenditures to treat the pollution caused by human economic activities and post-emission treatments, as well as those made to prevent pollution and protect natural areas of the environment. In terms of data availability, the following accounts for environmental protection expenditure could be compiled: national, industrial enterprises, government and households.

### 1.2.4. Pollutant Flow Accounts

Pollutant flow accounts (Table 1.10) show data on the generation, treatment and emission of air pollutants, water pollutants and solid wastes. These accounts comprise a pollutant generation table and a pollutant treatment table that record the pollutant generation and treatment by different sectors.

## 1.3. Policy Implications

The Chinese government is highly concerned about sustainable development and the necessity of having suitable resources and policies related to environmental protection. The purpose of establishing China's resources and environmental accounting system framework is to use the information provided by the statistical accounting system in order to describe the relationship

between the environmental and economic spheres. Specifically, it implies measuring resources and the environmental impact of economic activities in order to provide useful information for making sustainable development strategies and improving governance.

### 1.3.1. Implications of Resources and Environmental Stock Accounting

From the perspective of resources and environmental stocks accounting, the stock data of resources and environmental assets reflect the total volume of resources at a given time and the corresponding changes during the accounting period. The stock represents a country's wealth of natural resources, directly connected to national wealth, which reflects development sustainibility. Therefore, resources stock accounting provides useful information for monitoring sustainable development and for making corresponding policies. For instance, as water is the source of all life, tracking water assets and water use is an integral part of the water resources management. The Water Resources Assets Account measures water resources stock by asset type at the beginning and end of an accounting period. It also measures the corresponding stock changes and their causes, the cycling process of utilization and production process. The Water Resources Assets Account will promote reforming the statistical system and statistical methodology of water resources, which will consequently improve the capacity of water resources statistics. Managing water resources can be done by analyzing water resource stocks, the use of resources and its utilization efficiency, discharged and recycled water, the input–output value of various types of water and the management of various types of water assets.

### 1.3.2. Implications of Resources and Environmental Flow Accounting

From the perspective of resource flows, based on physical accounts, analyzing the degree of links between resource production and consumption (or resource supply and use), the structure of energy consumption industries and the structure of resource industries will help reveal the impact of resources to other economic sectors. This analysis will also aid structural analysis to reflect the relationship between resource consumption and economic growth to facilitate effective policy-making. For example, energy is a strategic resource for a country's economic growth and social development: it is key to guaranteeing a sustainable, rapid and healthy economic development and improving living standards. Energy flow accounts can reveal, with analysis, the relationship between energy industries and energy products, the structure of energy consumption sectors and energy utilization efficiency.

### 1.3.3. Implications of Environmental Protection Expenditure Accounting

Environmental protection expenditure accounts reflect the cost of protecting resources and the environment. The accounts measure environmental protection expenditures which represent people's efforts in protecting the environment in the course of their economic activities.

### 1.3.4. Implications of Pollutant Flow Accounting

Pollutant flow accounting shows the emission, treatment and structural changes of pollutant emissions by different sectors, industries and sources. Pollutant flow accounting links economic activities with environmental changes by describing the emission, treatment, production, origin and destination of different types of pollutants related to various economic activities. For example, the accounting of two main pollutants, sulphur dioxide ($SO_2$) and chemical oxygen demand (COD), will enable comparative analysis by linking related economic indicators to reveal total emission, emission intensity and the shift of different emission sources in various regions by various industries. Such analysis provides scientific arguments for economic structural adjustment, growth model adjustment, emission-reduction policy-making and economic and environmental policy-making.

### 1.3.5. Application Related to Sustainable Development and Green Growth

The framework of the resources and environmental accounting system can provide abundant data for measuring sustainable development and green growth. Most of the sustainable development indicators developed by the UN Sustainable Development Committee and the green growth economic indicators issued by the Organisation for Economic Co-operation and Development can be calculated with data from various resource accounts and the environmental accounting system. The resources and environmental accounting system can also be used to analyze environmental degradation and depletion.

## 1.4.Ecosystem Accounts

The goods and services derived from terrestrial, freshwater, coastal and marine ecosystems are major determinants of economic, social and environmental well-being. However, a consensus is building internationally that ecosystems are deteriorating. This is believed to be largely due to pressures from development and climate change that, in turn, have resulted in part from failure to measure the full value of nature's services.

Improved data on ecosystems, including a coherent body of information on the value of ecosystem goods and services, would facilitate the consideration of long-term ecosystem values in economic decisions and hopefully reduce and reverse their deterioration. These data would also support reporting on sustainability of development and help policy efforts to preserve the natural environment, such as the creation of protected areas and integrated landscape management.

To make efficient use of these data, it is proposed that they be assembled as accounts. By forcing the adoption of an accounting framework upon ecosystems data, the concepts are clarified and harmonised, the relationships between variables are made explicit, and links are established to other data sources and other accounts, such as environment and economic accounts.

The United Nations Statistics Commission that has brought us the statistical standard SEEA Central Framework upon which China's Environmental Accounts are based, is currently producing a document titled "SEEA Experimental Ecosystem Accounts". The document will be released in March 2013. Statistics Canada will be releasing its own publication on experimental ecosystem accounts in the fall of 2013.

Table 1.1 Physical Natural Capital Stock Accounts, by Physical Unit

| | **Mineral** | **Energy** | **Forest** | **Land** | **Water** |
|---|---|---|---|---|---|
| Opening stock | | | | | |
| Increase of stock<br>New discovery and natural growth<br>Reclassification due to quality change<br>Reclassification due to function change | | | | | |
| Decrease of stock<br>Extraction<br>Reclassification due to quality change<br>Reclassification due to function change | | | | | |
| Other changes | | | | | |
| Net changes | | | | | |
| Closing stock | | | | | |

Table 1.2 Monetary Natural Capital Stock Accounts, by Monetary Unit

| | **Mineral** | **Energy** | **Forest** | **Land** | **Water** |
|---|---|---|---|---|---|
| Opening stock | | | | | |
| Changes due to transaction | | | | | |
| Gross capital formation (gross fixed capital formation and changes of inventory)<br>Fixed capital consumption<br>Acquisitions less disposals (non-produced assets) | | | | | |
| Increase of stock<br>New discovery and natural growth<br>Reclassification due to quality change<br>Reclassification due to function change | | | | | |
| Decrease of stock<br>Extraction<br>Reclassification due to quality change<br>Reclassification due to function change | | | | | |
| Other changes | | | | | |
| Net changes | | | | | |
| Closing stock | | | | | |

**Table 1.3 Forest Resources Stock Accounts, by Physical Unit**

| | **Forest land** | **Timber** |
|---|---|---|
| Opening stock | | |
| Increase of stock | | |
| Decrease of stock | | |
| Other changes | | |
| Closing stock | | |

**Table 1.4 Water Resources Stock Accounts, by Physical Unit and Monetary Unit**

| | Total | Surface water | | | | | Ground-water | Soil water |
|---|---|---|---|---|---|---|---|---|
| | | Total | Reservoirs | Lakes | Rivers | Glaciers and snow | | |
| Opening stock | | | | | | | | |
| Increase of stock<br>Emissions from economic activity<br>Rainfall<br>Inflows<br>From upstream<br>From Other water resources within te territory | | | | | | | | |
| Decrease of stock<br>Extraction<br>Evaporation/actual evaporation<br>Outflows<br>To downstream<br>To Ocean<br>To Other water resources within the territory | | | | | | | | |
| Other changes | | | | | | | | |
| Net change | | | | | | | | |
| Closing stock | | | | | | | | |

**Table 1.5 Natural Capital Flow Accounts, Physical Supply**

| Resources | Primary industry | Secondary industry | Tertiary industry | Imports | Total supply |
|---|---|---|---|---|---|
| Mineral | | | | | |
| Energy | | | | | |
| Timber | | | | | |
| Water | | | | | |

**Table 1.6 Natural Capital Flow Accounts, Physical Use**

| Resources | Primary industry | Secondary industry | Tertiary industry | Households | Exports | Changes of inventories | Losses and discrepancy | Total use |
|---|---|---|---|---|---|---|---|---|
| Mineral | | | | | | | | |
| Energy | | | | | | | | |
| Timber | | | | | | | | |
| Water | | | | | | | | |

**Table 1.7 Water Flow Accounts, by Physical Supply and Physical Unit**

| | Agriculture | Forestry, animal husbandry and fishery | Mining | Manufacturing | Construction | Electricity, steam and hot water production and supply[1] | | | | | | Services industry | | Households | | Ecosystem water | | Rest of the world | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Electricity production and supply | Water production and supply | | | | Others | | Water resources management | Urban house-holds | Rural house-holds | Urban environ-ment | Rural environ-ment | | |
| | | | | | | Hydro-electricity | Tap water | Waste water treatment and recycling | Other water treatment, use and allocation | | | | | | | | | | |
| Within the economy | | | | | | | | | | | | | | | | | | | |
| S1. Supply to other economic units | | | | | | | | | | | | | | | | | | | |
| Recycled water | | | | | | | | | | | | | | | | | | | |
| discharge to sewage treatment plant | | | | | | | | | | | | | | | | | | | |
| Desalination | | | | | | | | | | | | | | | | | | | |
| Return to environment | | | | | | | | | | | | | | | | | | | |
| S2. Total emission(=d.1+d.2) | | | | | | | | | | | | | | | | | | | |
| d.1 Emissions to water resources | | | | | | | | | | | | | | | | | | | |
| Surface water | | | | | | | | | | | | | | | | | | | |
| Groundwater | | | | | | | | | | | | | | | | | | | |
| Soil water | | | | | | | | | | | | | | | | | | | |
| d.2 Emissions to other water bodies (such as oceans) | | | | | | | | | | | | | | | | | | | |
| S. Total supply (=S1+S2) | | | | | | | | | | | | | | | | | | | |
| C. Total consumption (=U-S) | | | | | | | | | | | | | | | | | | | |

1. The combination of three industries: electricity, thermal power production and supply; gas production and supply; and water production and supply.

**Table 1.8 Water Flow Accounts Physical Use, by Physical Unit**

| | Agriculture | Forestry, animal husbandry, and fishery | Mining | Manufacturing | Construction | Electricity, steam and hot water production and supply[1] | | | | | | Services industry | | Households | | Ecosystem water | | Rest of the world | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Electricity production and supply | | Water production and supply | | | Others | | Water resources management | Urban house-holds | Rural house-holds | Urban environ-ment | Rural environ-ment | | |
| | | | | | | | Hydro-electricity | Tap water | Waste water treatment and recycling | Other water treatment, use and allocation | | | | | | | | | |
| From the environment | | | | | | | | | | | | | | | | | | | |
| U1. Total Extraction (=a.1+a.2=b.1+b.2) | | | | | | | | | | | | | | | | | | | |
| a.1 Personal use | | | | | | | | | | | | | | | | | | | |
| a.2 Allocation | | | | | | | | | | | | | | | | | | | |
| b.1 Tap water resources | | | | | | | | | | | | | | | | | | | |
| Surface water | | | | | | | | | | | | | | | | | | | |
| Groundwater | | | | | | | | | | | | | | | | | | | |
| Soil water | | | | | | | | | | | | | | | | | | | |
| b.2 Other water sources | | | | | | | | | | | | | | | | | | | |
| Rainfall collection | | | | | | | | | | | | | | | | | | | |
| Seawater utilization | | | | | | | | | | | | | | | | | | | |
| From the economy | | | | | | | | | | | | | | | | | | | |
| U2. Water volume from other economic units | | | | | | | | | | | | | | | | | | | |
| Of which: recycled water | | | | | | | | | | | | | | | | | | | |
| U. Total use (U=U1+U2) | | | | | | | | | | | | | | | | | | | |

1. The combination of three industries: electricity, thermal power production and supply; gas production and supply; and water production and supply.

**Table 1.9 Environmental Protection Expenditure Accounts, Monetary Units**

| | Government | Enterprises | Households | Total |
|---|---|---|---|---|
| Total Environmental Protection Expenditure Accounts | | | | |
| Capital expenditure<br>Waste water treatment<br>Waste gas treatment<br>Solid waste treatment<br>Noise control<br>Others | | | | |
| Current expenditure<br>Waste water treatment<br>Waste gas treatment<br>Solid waste treatment<br>Noise control<br>Others | | | | |

**Table 1.10 Pollutant Flow Accounts, by Physical Unit**

| | Water pollution | | | Air pollution | | | Solid wastes | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Generation | Removal | Emissions | Generation | Treatment | Emissions | Generation | Recycling | Treatment | Storage | Emissions |
| Primary industry | | | | | | | | | | | |
| Secondary industry | | | | | | | | | | | |
| Tertiary industry | | | | | | | | | | | |
| Urban life | | | | | | | | | | | |
| Rural life | | | | | | | | | | | |
| Total | | | | | | | | | | | |

# 2. Data Evaluation (IMDB and data gaps)

Through multiple-rounds of correspondence and discussions between the NBS and StatCan, it was decided that the following four resource accounts would be included in the SIMP II Environment Accounts Project: Physical Mineral and Energy Stock Accounts, Monetary Mineral and Energy Stock Accounts, Hybrid Energy Accounts and Physical Pollutant Flow Accounts.

The National Mineral and Energy Stock Accounts measure six resources: coal, oil, natural gas, iron, copper and aluminum. The Xinjiang Mineral and Energy Stock Accounts have three resources: oil, natural gas and copper; the Chongqing accounts have two resources: coal and manganese. Main Pollutant Flow Accounts comprise sulphur dioxide ($SO_2$) and chemical oxygen demand (COD).

Starting in 2006, the National Bureau of Statistics (NBS) Department of National Accounts collaborated with the NBS Department of Industry Statistics; the NBS Department of Social, Science and Technology Statistics; the Ministry of Land and Resources and the Ministry of Environmental Protection to assess data availability, quality and gaps related to compiling environmental accounts. This process is summarized below.

## 2.1.Evaluation of Existing Environmental Data

### 2.1.1. Methods

A 'Template of Metadatabases for China' was developed based on the StatCan's 'Template for Completing or Updating the Integrated Metadatabase (IMDB)' (see Appendix 1). Using this template, Chinese experts have assessed project-related data such as energy and mineral data[1].

### 2.1.2. Data Sources

#### *2.1.2.1. Data Sources of Mineral and Energy Resources Stock Accounts*

The data for compiling mineral and energy resources stock accounts are mainly from the mineral reserve statistics of the Ministry of Land and Resources.

China's reserve statistics, started in 1955, are based on a basic mineral resources statistical table (questionnaire) and the mineral resources reserve register (administrative records).

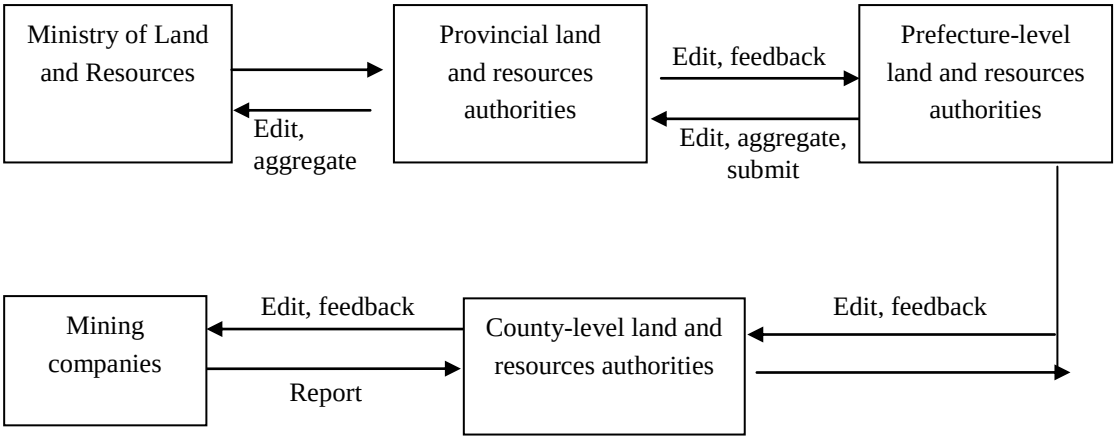
The targeted population for mineral resources statistics are all mining companies holding mining permits and exploration-rights holders, such as geological exploration units, that process identified resource reserves.

The basic mineral resources statistical table is distributed to each mining company. In the fourth quarter of each year, the basic oil and gas resources statistical table is distributed directly to Chinese oil companies by the Ministry of Land and Resources. The oil companies report the required statistical information by basin, district, company and oil field as instructed. In the fourth quarter of each year, county-level land and resources authorities distribute the basic

[1] See **Appendix 2 - Data Evaluation Report** for a detailed description of the data evaluation process

mineral resources statistical table to all mining companies. The mining companies report the required statistical information, such as types of mineral and grade. Figure 1.2 shows the data reporting process.

**Figure 1.2 Statistical Data Reporting Process**




The certificate of the mineral resources reserve register is submitted simultaneously by the company (the respondent) while going through the administrative procedures.

To guarantee the quality of the reporting data, statistical provisions require that the questionnaire must be delivered to each mining company; each mining company must, for its part, report correct data on time. Statistical agencies edit the data by various measures, including spot tests, field visits and comparative analyses to make sure the data are reasonable and reflect reality. After receiving the data, authorities of land and resources at all levels spot test and edit the data reported from their immediate lower-level agencies (or mining companies). The Ministry of Land and Resources organizes an annual data evaluation meeting to assess the reported data by provinces (autonomous regions, municipalities) or oil and gas companies according to the logic relationship, reality consistency and compliance with historical trends.

Mineral resource reserves statistics are published annually in the *China Statistical Yearbook* for all users to see. This year's edition includes last year's mineral resources reserve data—relatively prompt publication.

#### *2.1.2.2. Data Resources of Energy Statistics*

The energy statistical system comprises the Energy Balance Sheet, Statistics on Energy Consumption by Industry; Statistics on Energy Consumption by End Users by Industry; Statistics on Basic Energy Consumption and Storage by Railway, Aviation, and Telecommunications Enterprises; and Statistics on Basic Energy Consumption and Storage by Highway- and Marine-Transportation Enterprises.

### Data collecting and reporting practice

The Energy Balance Sheet (Physical, Standard Equivalent), Statistics on Energy Consumption by Industry (Physical, Standard Equivalent) and Statistics on Energy Consumption by End Users by

Industry (Physical, Standard Equivalent) have been compiled since 1985 by provincial statistical bureaus. These tables are reported to the NBS no later than the end of May of the following year.

The Energies Purchases, Consumption and Inventories by Industrial Enterprises; and Complementary Table of Energies Purchases, Consumption and Inventories by Industrial Enterprises tables were begun in 2003. These tables of key (largest) enterprises are reported within 15 days after the end of the quarter by provincial statistical bureaus.

The Survey on Energy Consumption per unit Product by Major Energy-consuming Industrial Enterprises was started in 2006. This table of key enterprises is reported within 20 days of the end of the quarter by provincial statistical bureaus.

The Ministry of Railways and the Civil Aviation Administration of China are responsible for the survey on Basic Energy Consumption and Storage by Railway and Aviation Enterprises. The Ministry of Transport is responsible for the Survey on Basic Energy Consumption and Storage by Highway- and Marine-Transportation Enterprises, both started in 2006. The data of key enterprises are reported no later than the end of May of the following year.

Energy statistics are quarterly and annual, each with different statistical coverage. Quarterly statistics is comprised of the purchase, consumption, and storage of energy by industrial enterprises; complementary table of energy purchases, consumption and inventories by industrial enterprise; and energy consumption per unit produced by major energy-consuming industrial enterprises. The survey scope is industrial enterprises above the cut-off level (so-called "key interprises").

Annual reports produced are: the Energy Balance Sheet, Statistics on Energy Consumption by Industry, Statistics on Energy Consumption by End Users by Industry, Statistics on Basic Energy Consumption and Storage by Railway and Aviation Enterprises, and Statistics on Basic Energy Consumption and Storage by Highway- and Marine-Transportation Enterprises. The surveys cover all industries.

The energy statistical system is an integrated part of the national statistical system. The statistical scope, estimation method, statistical coverage and catalogue are nation-wide. The data-reporting format and its requirements, as well as the data editing relationship, are identical. The people responsible for a unit and for the statistical section within that unit are responsible for data quality. NBS organizes spot tests to further guarantee the quality of energy data.

Energy statistics are published in the *China Statistical Yearbook* and *China Energy Statistical Yearbook*.

#### *2.1.2.3. Data Sources of Pollutant Flow Accounts*

Data for compiling pollutant flow accounts come mainly from the environmental statistics of the Ministry of Environmental Protection, which was established in 1980. The statistics comprise surveys on industrial source pollutants, household, and other source pollutants.

Statistics on industrial-source pollutants are gathered for both key polluting enterprises and non-key polluting enterprises. For key polluting enterprises, information is collected using questionnaires. For non-key polluting enterprises, information is derived by scientific estimates.

Key polluting enterprises are enterprises whose total emissions accumulatively account for 85% of total industrial emissions, whose waste water emissions have hazardously heavy mental

substances and that produce hazardous residuals. The selection method of key polluting enterprises is as follows:

1. Take all key enterprises in the Key Enterprises Register of environmental statistics as the population.
2. Arrange the enterprises in descending order.
3. Select enterprises one by one until the total emission of these enterprises accumulatively account for 85% of the population's total emissions.

The items used for the selection—waste water, COD, ammonia, $SO_2$, soot, dust and solid wastes—are the critical controlling pollutants in the national catalogue. As long as an enterprise is identified by one item, it is treated as a key polluting enterprise.

For non-key polluting enterprises—those whose emissions accumulatively account for less than 15% of the total regional emission—several estimation methods were applied. The specific methods are as follows:

- Emission coefficient method—the statistical average of the emissions generated per unit produced under normal economic, technological and management conditions. The method is to derive the output of products of non-key enterprises by subtracting the output of key enterprises from the total output of enterprises within the survey scope. Then, the emission of non-key enterprises is derived by applying the emission coefficients to the total non-key enterprises' output.
- Ratio estimation method: When the output of products is not available, an alternative estimation method for non-key enterprises is to apply the trend of the total emissions of key enterprises, sometimes slightly adjusted, to the total non-key enterprises to derive the annual total emissions of non-key enterprises.
- Aggregates estimation method: Total emissions of non-key enterprises are derived for the reference year by considering some aggregates of the area of the reference year such as gross domestic product, industrial value-added, energy consumption and population changes.

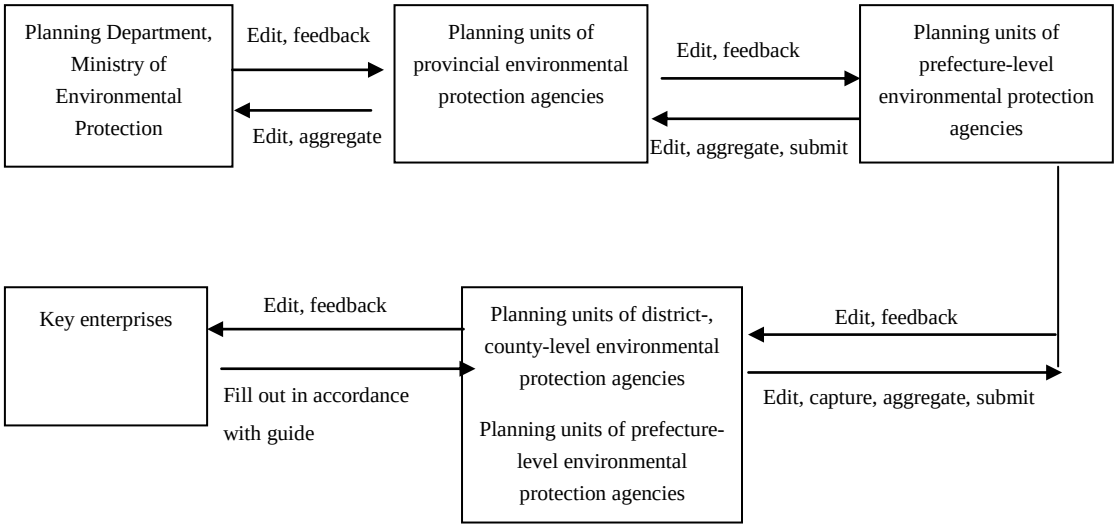
The sum of the total emission of key and non-key enterprises is the total industrial emissions of the area.

The process to collect and report data:

- Printed questionnaires are photocopied and distributed to all survey objects by local-level environmental statistical units and district- and county-level environmental statistical agencies.
- Questionnaires are collected according to a pre-determined schedule.
- Edited data are captured into the environmental statistical information system by staff for district- and county-level environmental statistical agencies.
- Feedback is submitted, edited and given level by level.

The data reporting flow chart is as follows:

**Figure 1.3 Data Reporting of Industrial Sources Emissions**

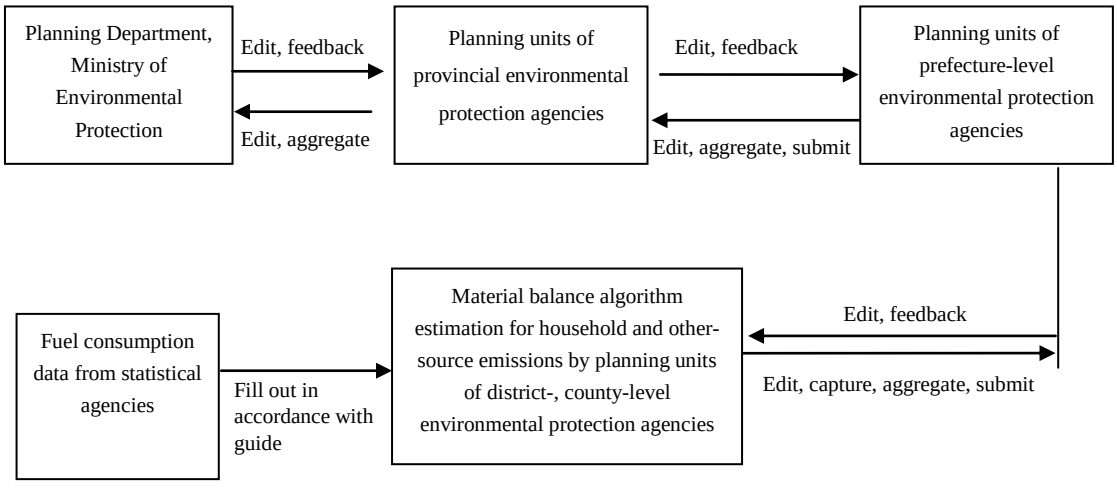



Household emissions and other sources' emissions statistics and reporting procedure: For most household air pollutants statistics, the Material Balance Method was adopted to estimate the emissions by district and county. This method applies corresponding coefficients to non-industrial fuel consumption such as coal and oil.

To measure urban household sewage pollutants emissions statistics, multiply urban population by sewage pollutant emissions coefficient.

Figure 1.4 illustrates the specific data reporting process.

**Figure 1.4 Data Reporting of Household-source Emissions**




To guarantee data quality, an inter-departmental reviewing group was jointly established by the supervision, pollutant control, environmental assessment, planning and monitoring departments to verify and double-check the reported data. The head of the bureau is the chairman of the

group. Each level's environmental protection agency is responsible for checking the reported statistics against its subordinate agencies.

Environmental statistics are reported quarterly and annually. Quarterly reports should be submitted within 15 days after the end of the quarter: annual reports should be submitted from January 1 to March 20 of the following year. Annual data are published promptly in the *China Statistical Yearbook* and *China Environmental Statistical Yearbook*.

#### *2.1.2.4. Data Sources for the Input–output Tables*

NBS have conducted national input–output surveys and compiled input–output tables every five years since 1987 in years ending in 2 or 7. In addition, updated tables are compiled in years ending in 0 or 5.

For input–output surveys, a questionnaire survey is used. The survey takers (statistical offices of different levels) distribute the questionnaires to survey respondents, survey respondents fill out the questionnaires according to their original financial statements or statistics and the completed questionnaires are submitted back to and edited by the survey takers.

To guarantee data quality, all survey field staff edited data in accordance with a set of equilibrium functions or logic relationships. After all questionnaires were collected, a spot test was conducted to cross-check whether the reported data were consistent with the original records.

The intermediate consumption data of input–output table comes from the survey; the aggregates of total output, value-added and final consumption are consistent with those in the production-based and expenditure-based GDP accounting; the imports and exports data are consistent with customs import–export statistics and the balance of payments.

In addition to the four main data sources above, other data sources for compiling the SIMP II environmental accounts include financial statements of industrial enterprises from the NBS Department of Industry Statistics and investment statistics from the NBS Department of Investment and Construction Statistics. All these data sources were assessed. Since only one or a few indicators from these additional data sources were used for the project, no details of the assessment are presented here.

### 2.1.3. Data Gaps

#### *2.1.3.1. Data Gaps in Resource Stock Accounts*

There are two methods for evaluating resources stocks in the SIMP II project: appropriation and net present value (NPV). Different data sources are used for each method.

To evaluate resource stocks by the appropriation method mainly requires statistics on fees, taxes and royalties by type of mineral; the NPV method requires information on mining enterprises' fixed capital stocks, revenues and expenditures.

The fees, taxes and royalties required by the appropriation method include resource taxes, fees for exploration rights and mining rights, mineral resources compensation fees, mining site royalties, as well as enterprises' income taxes and production taxes.

In China, not all fees, taxes and royalties required required to compile appropriation method-based estimates are collected by individual mineral type. Specifically, resource taxes data are only available for non-ferrous metals; no break-down is available for copper and aluminum. There are

only *totals* for exploration royalties and extraction royalties. As well, with respect to enterprises' income taxes, only an income tax *total* for mining enterprises is available; no information by material type is available. All of these totals must be broken out for the purposes of this project.

Putting values on resource stocks using the NPV method requires data on the value of the stock of produced capital. The internationally accepted method for estimating capital stock is the perpetual inventory method (PIM), which requires

- time series for fixed capital investment (fixed capital formation) at historic cost
- stock value of fixed capital of the base year at historic cost
- service lives for different types of fixed assets by industry and by types of fixed assets
- depreciation rates of different types of fixed assets.

In the existing data, only statistics for state-owned enterprises are available. There are no full coverage statistics for all enterprises, which need to be derived using the investment of state-owned enterprises as a percentage of that of all enterprises.

#### *2.1.3.2. Hybrid Energy Accounts Data Gaps*

Hybrid energy accounts mainly need two types of data: energy consumption and an input–output table. The energy consumption data are mainly from the Energy Balance Sheet and the Statistics on Energy Consumption by End Users by Industry tables that are compiled by the Department of Energy Statistics of the NBS. The input–output table is compiled by the input–output Division, Department of National Accounts of NBS. Both types of data are relatively comprehensive, and can meet the requirements of the hybrid energy accounts compilation. However, the classification for these two types of data is inconsistent. Adjustments must be applied to the energy consumption data to link them to the input–output table.

#### *2.1.3.3. Data Gaps in the Pollutant Flow Accounts*

Pollutant flow accounts were compiled according to the input–output classification. The data gaps of the main pollutants ($SO_2$, COD) of various industries are as follows:

1. For the agriculture industry, there are no data on the generation and emissions of $SO_2$ and COD. For $SO_2$ emissions, it may be possibile to estimate the production and emissions by applying the corresponding coefficients to the energy consumption in the agriculture industry, that is, the material balance method. For COD, the existing statistics in China are very weak, especially in the crop and livestock-breeding industries. The corresponding coefficients need to be obtained by referring to the results from China's First National Census on Pollution Sources for estimating the generation and emissions of COD in the agriculture industry.
2. For manufacturing industries, environmental statistics in China are relatively good. The generation and emissions of both $SO_2$ and COD are available in the *China Statistical Yearbook on the Environment*. The data source is very reliable. The only difficult industry is waste processing, an emerging industry that started producing statistics only in recent years. Therefore, in the original environmental statistics, no information is available for this industry. Thus, estimating the generation and emissions of $SO_2$ and COD for waste processing is almost impossible for the moment.
3. For some service industries, data on generation and emissions of $SO_2$ and COD are not available for the moment because some service industries statistics are combined with urban household statistics. Data are available, however, for service industries such as

transport, retail sales, finance and insurance: generation and emissions of $SO_2$ can be derived using the material balance method while applying corresponding coefficients verified by China's First National Census on Pollution Sources to the historical energy consumption series.

## 2.2. Data Used for Accounts Compilation

### 2.2.1. Data in Resources Stock Accounts: NPV and Appropriation Method-based estimates

Data such as resource taxes and income taxes are required to derive the monetary value of stocks using the appropriation method. Specific information on data and their sources is presented in Table 2.1.

**Table 2.1 Mineral and Energy Resources Stock Accounts Data**

| Data sources | Main indicators |
|---|---|
| *China Taxes Yearbook* | Resource taxes, income taxes |
| *China Mining Industry Yearbook* | Fees for exploration rights and mining rights, purchase price of exploration rights, number of exploration permits with register approval, number of extraction permits with register approval |
| *China Urban Construction Statistical Yearbook* | Investment in municipal public infrastructure |
| *China Statistical Yearbook* | Investment Price Index of Construction and Installation, Investment Price Index of Equipment Purchasing, Investment Price Index of Fixed Assets |
| Ministry of Land and Resources | Physical stocks of mineral resources, annual extraction volumes |
| Internal Materials of NBS | Departments of Industry Statistics: revenue from main activities, intermediate industrial input, direct material input, management overheads, various types of insurance, subsidises, salaries and benefits, etc.<br>For industries at four-digit level of industrial classification under the mining industry classification<br>Departments of Investment and Construction statistics: total investment in fixed assets |
| Research Results | Service life of fixed assets, rate of capital return, discount rate |
| | |

### 2.2.2. Data in Hybrid Energy Accounts

Compiling hybrid energy accounts mainly depends on energy consumption data and the input–output table. Energy consumption data is comprised of industrial terminal energy consumption, energy consumption by industries, and energy consumption of urban and rural households, all of which are from the China Energy Statistical Yearbook and compiled by the Department of Energy Statistics of the NBS. The input–output data are from the input–output table compiled by the Department of National Accounts of NBS.

Price indexes and the GDP deflators prepared by the Department of National Accounts of NBS will be used for time series analysis based on hybrid energy accounts.

### 2.2.3. Data in Pollutant Flow Accounts

The pollutant flow accounts present generating, discharging and treating volumes for main pollutants by various industries and households through the production process and households activities. The required source data are mainly from the environmental statistics prepared by the Ministry of Environmental Protection. Some other data sources are available from other agencies. Specific data sources are presented in Table 2.2.

**Table 2.2 Pollutant Flow Accounts Data Sources**

| Data sources | Main indicators |
|---|---|
| *China Environmental Statistics Annual Report* | The volume of pollutant emissions and removal in waste water from industries and households in different regions, the volume of pollutant emissions and removal in air ($SO_2$, soot, dust) of various industries in different regions, the households' $SO_2$ emission volume. |
| *China Energy Statistical Yearbook*<br><br>Hybrid Energy Accounts | Energy consumption by industry |
| *China Husbandry Statistical Yearbook* | Livestock and poultry breeding stock in different regions |
| *China Statistical Yearbook* | Planted acreages of different types of farmland and the rural population in different regions |
| *China Urban Construction Statistical Yearbook* | The proportion of water consumption from public facilities to households |
| Existing research results, empirical data | Wastewater loss coefficients for different types of farmland, farmland COD intensity coefficients, unit discharge coefficients of different types of livestock, removal ratio of pollutants generated by different types of livestock, waste water treatment ratio of different types of livestock, rural resident domestic COD generation coefficient, $SO_2$ emission factors |

# 3. Estimation Methods

## 3.1. Mineral and Energy Resources Stock Accounts

### 3.1.1. Net Present Value Method

The net present value method (NPV) approach to valuing resources is similar to that used to value annuities—a resource's value is equated to the stream of income that can be generated from extracting the entire reserve.

#### *3.1.1.1. Data Sources*

The main data sources for the NPV-based accounts include data from the NBS Department of Industry, the NBS Department of National Accounts and the Ministry of Land and Resources. Further details on the data sources are in Section 2.1.2.

#### *3.1.1.2. Estimation Method*

The first step to estimating the stream of income from a resource involves calculating the current year's income from extraction. Income, also known as resource rent, is equal to total revenue received from sales of the resource throughout the year minus all costs incurred during extraction. Costs include operating costs, such as fuel and labour, as well as costs associated with the capital used for extraction of the resources. These capital costs include depreciation and return to capital.[1] Income taxes, royalties[2] and other costs that are directly due to the extraction process are not subtracted.

Next, it is assumed that the quantity extracted and the rent generated from extracting the resource will remain constant in each successive year until reserves are exhausted. With this assumption in mind, the present value of this stream of income can be expressed as follows:

1. Depreciation and net capital stock data used to calculate the return to capital are modeled according to the approach outlined in the NBS document "NPV Valuation Approach for Mineral Resource Stocks," presented by the NBS during the November 2008 mission to Canada.
2. Because part of the income from extracting a resource goes to governments (e.g., taxes and royalties), taxes and fees paid by extractors are not subtracted as costs: this makes them implicitly part of the rent.

$$NPV = \sum_{t=1}^{T}\left[\frac{R_t (= R)}{(1+r_d)^t}\right] = \frac{R}{(1+r_d)} + \frac{R}{(1+r_d)^2} \cdots\cdots + \frac{R}{(1+r_d)^T}$$

*where* R = Resource rent = TR - C - ($r_i$K + $\delta$K)

TR is total revenue from the extraction,

C is non - capital expense (including compensation of employees, cost of fuel and raw materials),

$\delta$ is the depreciation rate of produced assests,

K is the stock of produced assets,

$r_i$ is rate of return to capital.

$r_d = discount \quad rate$

$$T = reserve\,life = \left(\frac{Period\ end\ reserve}{\text{Pr}oduction\ during\ the\ period}\right)$$

Two limitations to this approach are the assumptions that the quantity of extraction will remain constant over the life of a resource and that the difference between sales revenue and extraction costs will remain the same through time. Often, the price of a natural resource is more volatile than labour and capital costs. These limitations tend to be magnified during periods of extreme volatility in resource prices. Despite these limitations, this method has been widely used by many countries given the difficulty in accurately forecasting commodity prices.

### 3.1.2. Appropriation Method

In many countries, including China, the government is the legal owner of most natural resource assets. As such, the government has the right to collect all rent derived from the extraction of these resources. Governments collect these rents through imposing various fees, taxes and royalties on entities engaged in resource extraction. The appropriation method (AM) involves summing the value (equivalent to rent) of fees, taxes and royalties collected from businesses involved in extracting the resource. The next step is to apply the NPV formula to the appropriated value.

#### *3.1.2.1. Data Sources*

The main data sources for the AM-based accounts are the *China Taxes Yearbook of State Administration of Taxation,* the *China Mining Industry Yearbook* of the Ministry of Land and Resources, Industrial Statistics' *Annual Report of the Department of Industry Statistics* of the NBS and national accounts data from the Department of National Accounts of NBS. Further details on the data sources are outlined in Section 2.1.2.

#### *3.1.2.2. Estimation Method*

In theory, the total value of fees, taxes and royalties collected by the government for a particular resource should be equal to the total rent associated with that resource in a given year. As with the NPV approach noted above, it is assumed that the quantity extracted in that year, as well as the AM-based rent, will remain constant in each successive year until reserves of the resource are exhausted. To arrive at the resource's value of reserves, like the NPV of rents, the present value of this stream of royalties can be calculated.

In China, resources' rent-related fees include resource taxes, as well as fees for exploration rights and mining rights. The estimation methods are as follows.

### (1) Resource taxes

Taxes on coal, petroleum, natural gas and iron can be found in the *China Taxes Yearbook.* Taxes on copper and aluminum are included in a broad category of "resource taxes of non-ferrous metals" rather than listed explicitly. Therefore, the taxes need to be derived by splitting the non-ferrous metals tax total by referring to the gross output, total sales and total revenue from the main economic activities of copper, aluminum and non-ferrous metals.

### (2) Fees for Exploration Rights and Mining Rights

Fees for exploration and mining rights are composed of fees for exploration rights and fees for mining rights. Fees for exploration rights are fees that the authority charged from an exploring (legal) person when the exploration rights were transferred from the authority to the (legal) person. Fees for mining rights are fees that the authority charged an exploring (legal) person when the mining rights were transferred from the authority to the (legal) person.

There are only two totals of "fees for exploration rights" and "fees for mining rights" in the *China Mining Industry Yearboo:* fees by type of minerals are not available. The yearbook also provides the "number of exploration permits with register approval" and the "number of extraction permits with register approval," which further break down into permits for coal, iron, petroleum and natural gas, and non-ferrous metals.

Fees for exploration and mining rights are levied according to area. However, area data are not available in existing records. Therefore, numbers of permits are used to split the totals of fees for exploration and mining rights into four parts corresponding to four categories of minerals, coal, iron, petroleum and natural gas, and non-ferrous metals.

A further breakdown of petroleum and natural gas is according to sales revenue data, while a further breakdown of copper and aluminum is according to revenue from main economic activities.

### (3) Purchase Price of Exploration Rights and Mining Rights

The purchase price of exploration rights is the money that the authority charged an exploring (legal) person when the exploration rights formed out of the state money were transferred from the state to the exploring (legal) person.

In the *China Mining Industry Yearbook,* there is another related term, 'transfer fees of exploration rights', which refers to transactions between enterprises. These transactions are not involved in the AM.

### (4) Mineral Resources Compensation

Mineral resources compensation data for coal, iron, copper and aluminum can be derived directly from data from the Ministry of Land and Resources, while resources for petroleum and natural gas are combined in one category and will be split according to the sales revenue of petroleum and natural gas.

#### (5) Mining Site Usage Fees

Mining site usage fees are the fees contributed by joint-venture, offshore oil companies that go to central budget accounts. Corporations that pay mining site usage fees no longer pay mineral resources compensation.

Mining site usage fees from onshore oil corporations go to local budget accounts.

#### (6) Income Taxes

For 2005 data, only one total of income taxes can be found in the *2006 China Taxes Yearbook*. For 2007 data, income taxes for the coal mining and washing, extraction of crude petroleum and natural gas, ferrous metals mining and washing, non-ferrous metals mining and washing, and non-metallic minerals mining and washing industries can be found in the table, "National Income Taxes by Type of Mineral and by Industry" in the *2008 China Taxes Yearbook*. The total income taxes of 2005 can be broken down based on the 2007 composition.

Income taxes for petroleum and natural gas can be broken down according to their sales revenue.

#### (7) Value-added Taxes

Value-added taxes for the coal mining and washing industry, crude petroleum and natural gas extraction, ferrous metals mining and washing, non-ferrous metals mining and washing, and non-metallic minerals mining and washing can be found in the *2006 China Taxes Yearbook*.

Value-added taxes for petroleum and natural gas can be broken down according to their sales revenue.

There are some limitations to the approach. As noted in SEEA 2003, for most countries the AM approach tends to understate the value of resources, as fees, taxes and royalties may be set with other priorities in mind, such as providing implicit price subsidies to extractors and encouraging employment and innovation in the extraction sectors. As well, the rate of payments to government (fees, taxes and royalties) may not move in line with market prices for the extracted product, even though the true economic rent may be expected to do so.

Despite these caveats, AM-based estimates of resource values are useful for two important reasons:

1. When the data required for estimating NPV-based estimates are unavailable, as is the case in the SIMP II pilot regions, the AM approach provides analysts with a sense of the value of resources in situ.
2. When NPV-based estimates can be calculated, as is the case for the NBS national estimates, AM-based estimates provide a useful point of comparison for policy analysis.

## 3.2. Hybrid Energy Accounts

### 3.2.1. Introduction

The hybrid energy account records in quantitative units (joules) the annual consumption of energy commodities by industries, households and governments. The current coverage period is 2002, 2005 and 2007.

The commodities covered are: coal (raw, cleaned, other washed, briquettes), coke, waste, bioenergy (crop residues, wood, biogas), gas (natural gas, coke oven gas, refinery gas, other gas), crude oil, refined petroleum products (liquid petroleum gases, gasoline, fuel oil, diesel oil, kerosene, other petroleum products, coking products), electricity, heat and other energy.

The energy commodities represented in the hybrid energy account match exactly those represented in the *China Energy Statistical Yearbook.* To create a hybrid account, the industry classifications in the *China Energy Statistical Yearbook* were mapped to the industry classification in the Chinese input–output accounts. This enabled combining the energy data with the economic data to analyze hybrid accounts.

### 3.2.2. Data sources

The main data sources for the hybrid energy account are the NBS's *China Energy Statistical Yearbook* and the input–output tables from the NBS Department of National Accounts. Further details on the data sources are outlined in Section 2.1.2.

### 3.2.3. Method

The energy statistics are compiled according to the industry classification of the input–output accounts. The input–output classification consists of 42 industries in 2002 and 2007 and 34 industries in 2005—these industries map fairly well to the industrial classification in the *China Energy Statistical Yearbook* (See Appendix 3 – Concordance between ISIC and IO Classification). Rural and urban households are also included as energy users.

For the energy transformation industries (e.g., electricity and hot water production), the data can be prepared in gross or net terms depending on the application. Gross accounts record total energy use by the industry. Net accounts record total energy use less the amount of energy in the outputs (e.g., the energy content of coal used to produce electricity less the amount of energy in the electricity produced from coal).

To use the input-output tables for analyzing energy account data, some adjustments were required for the input-output data. These adjustments are in the form of ratios and are needed to control the use of imported goods (μ), use of goods withdrawn from inventories (β) and statistical discrepancy (γ). The adjustments ensure that energy use data are associated with only domestic production in the current accounting period. Their calculations are outlined below.

1) Imports were removed from the input-output table with the vector μ. It is a column vector describing the import share of industrial output. Its expression takes the form

$\mu = mD/(Bg+e)$

where mD = domestically used imports (i.e., imports less imports for re-export)

Bg = total intermediate use

e = domestic final demand, including additions to inventory

2) Withdrawals from inventory were removed from the input-output table with the factor β. It is a column vector describing the inventory share of industrial output. Its expression takes the form

$\beta = v/(Bg+e+XD^{*}-mD)$

where v = inventory withdrawals (i.e., negative additions to inventory)

Bg = total intermediate use

e = domestic final demand, including additions to inventory

XD* = domestic exports (i.e., exports less imports for re-export)

mD = domestically used imports (i.e., imports less imports for re-export)

3) The statistical discrepancy was removed from the input-output table with the factor γ. It is a column vector describing the share of overestimated consumption in industrial output. Its expression takes the form

$\gamma = s/(Bg+e+XD^*-mD)$

where s = overestimates of consumption (i.e., negative components of statistical discrepancy)

Bg = total intermediate use

e = domestic final demand, including additions to inventory

XD* = domestic exports (i.e., exports less imports for re-export)

mD = domestically used imports (i.e., imports less imports for re-export)

Two further factors were calculated to adjust for the import component of withdrawals from inventory and the statistical discrepancy. These take the form

$\beta_i = \beta(1- \mu)$

and

$\gamma_i = \gamma(1- \mu)$

The factors above were applied to the input-output table components in the following way:

Columns of the intermediate-use matrix and positive elements of the final-demand matrix were multiplied by $(1- \mu- \beta_i - \gamma_i)$. Negative elements of the inventories and statistical difference columns were replaced with zero).

The column of exports was multiplied by $(1 - \beta - \gamma)$.

Imports were not adjusted.

Once these adjustments were made to the table, it was then used in conjunction with the energy use account to conduct hybrid analysis using the input-output model.

### 3.2.4. The Input–Output Model

The input–output model is the economic tool used for the hybrid energy account. Gross output is the common denominator used to link the physical and economic data. Combining the economic and physical energy data requires the following calculations: [1]

**(1)** Direct consumption intensity

Consumption intensity is the use of a given resource *x* (in this case energy) per unit of gross

$$\alpha_x = \frac{U_{ru_x}}{g'}$$

output.

For analytical purposes, current-price gross output was used to compare across industries in a given year; constant-price gross output was used to analyze trends of a given industry over time.

$$\alpha_x (I - \mathrm{A})^{-1}$$

**(2)** Direct plus indirect consumption intensity

The consumption intensity vector ($\alpha_x$) was multiplied by the Leontief inverse matrix to derive direct plus indirect intensity per unit of output.[2] Note that in this case, the adjusted input–output table described above was used to generate the A matrix used in the inverse calculation.

These intensity measures are useful for analyzing the total resource use required to generate a unit of output. In this case, they take account not only of direct energy use but also of energy use embodied in the inputs required by each industry. Current-price intensity was used for analyzing a given year, while constant-price intensity was used for analyzing time series.

**(3)** Intensity of household consumption

Households use resources directly and require resource use by industry to furnish the goods and services that they consume. The total resource use required by household consumption was calculated as follows:

$$\frac{\sum_h H_{ru_x} + \alpha_x (I - A)^{-1} H}{\sum_c \sum_h H}$$

where

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1. For further information on these methods, see Statistics Canada, *Concepts, sources and methods of the Canadian system of environmental and resource accounts*, 16-505-GIE. http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=16-505-GIE&lang=eng

2. For further detail, see Miller, R.E. and Blair, P. D. (1985), *Input–output analysis: Foundations and extensions*, Prentice-Hall, New Jersey.

$\sum_h H_{ru_x}$

is physical household direct consumption of resource *x* (in this case energy), *H* is monetary household consumption goods vector and

$\sum_c \sum_h H$

is the gross value of household consumption summed over all commodities (c) and all categories of household demand (h). These intensity indicators can be used to further analyze the link between final demand and energy use. Current price measures of industrial intensity and household demand were used to derive the physical quantity of energy use in the numerator; the denominator was expressed in constant prices for comparison over time.

**(4)** Disaggregation by final demand component

Resource use can be partitioned across the various components of final demand using the following equation:

$\alpha_x (I-A)^{-1} y_f$

where $y_f$ represents the value final demand for destination of demand *f*. In this way, estimates were derived for the energy required to furnish final demand generated by households, government, capital formation and exports.

## 3.3. Pollutant Flow Accounts[1]

### 3.3.1. Introduction

The main pollutant accounts record—in quantitative units—the annual generation, removals, and discharge of sulphur dioxide ($SO_2$) and chemical oxygen demand (COD) by industries, households and governments. The current coverage period is 2005.

To facilitate linking with the economic data produced by the NBS, the industry classifications in the *China Statistical Yearbook on the Environment* were mapped to the industry classification in the Chinese input–output accounts. This enables combining of emissions data with economic data for analyzing hybrid accounts, as described in the section on hybrid energy accounts.

### 3.3.2. Sulphur Dioxide

#### *3.3.2.1. Data sources*

The main data sources for the $SO_2$ flow accounts are the *China Statistical Yearbook on the Environment*, *China Urban Construction Statistical Yearbook, China Energy Statistical Yearbook, China Statistical Yearbook* and the input–output tables from the Department of National Accounts of the NBS. Further details on the data sources are in Section 2.1.2.

1. More information on these methods is available in the SIMP II working document, "Accounting Method of Main Pollutant Emission (Revised)."

#### *3.3.2.2. Method*

Data on $SO_2$ emissions for manufacturing are available in the *China Statistical Yearbook on the Environment*. For agriculture, tertiary industries and households, emissions are calculated by multiplying energy consumption form the energy accounts with appropriate emissions factors by fuel type.

Enterprises covered in existing Chinese environmental statistics are divided into 'key polluting enterprises' and 'non-key polluting enterprises'. Total physical data for key polluting enterprises were summed up from the survey enterprises; data for non-key polluting enterprises were estimated according to regional emissions statistics, which include both key and non-key enterprises. Total industrial emissions estimates are the sum of the key and non-key enterprises.

$$Q_{\mathrm{AI,\,i}} = Q_R \times \frac{Q_{T,i}}{Q_{ST,\,i}}$$

In the formula above, $Q_{T,.i}$ represents the pollutant of industry *i* in the environmental statistics, $Q_{ST.i}$ represents the pollutant sum of all industrial sectors in the environmental statistics, $Q_R$ represents the industrial pollutant emissions by region and $Q_{AT,.i}$ represents the adjusted data of industry *i*.

The environmental statistics have no emissions estimates for agriculture, construction, services or households. For these sectors, the volume of discharged $SO_2$ is calculated based on energy consumption in the energy accounts. No information is available on the volume of removed emissions, so the volume generated is assumed to be equal to the discharge volume.

Volume of $SO_2$ discharged = consumption of coal × sulphur content × conversion coefficient of $SO_2$ + consumption of fuel oil × sulphur content × conversion coefficient of $SO_2$

The sulphur content of coal and fuel oil is 0.9%, the conversion coefficient of $SO_2$ from bunker coal is 1.6%, and the conversion coefficient of $SO_2$ from fuel oil is 1.8%. Conversion coefficients are based on the fact that one mass unit of sulphur yields two mass units of $SO_2$ and are reduced to reflect, for each fuel type, the amount of sulphur that is retained in ash after combustion.

**Note:** Sulphur content is low in liquified petroleum gas (LPG), gasoline and kerosene, so the volume of $SO_2$ discharged is also low. Thus, LPG, gasoline and kerosene are excluded from the $SO_2$ estimates.

### 3.3.3. Chemical Oxygen Demand

#### *3.3.3.1. Data sources*

The main data sources for the chemical oxygen demand (COD) pollution flow accounts are the *China Statistical Yearbook on the Environment, China Urban Development Statistics Yearbook, China Statistical Yearbook, China Animal Husbandry Yearbook* and the input–output tables from the NBS Department of National Accounts. Further details on the data sources are in Section 2.1.2.

#### *3.3.3.2. Method*

As with sulphur dioxide ($SO_2$) estimates, COD estimates are derived using coefficients.

## Agriculture

Agricultural COD emissions are mainly related to the crop and livestock industries.

For crop production, the quantity of COD production and discharge mainly depend on the farmland pollutants' source strength and the crop area. The accounting model for crops classifies those areas into paddy and dry farmland. The former only refers to land for rice; the latter refers to all other cropland.

The following equation is applied: Pollutant discharge quantity = pollutants' source strength coefficient ×

(waste water loss coefficient of various types of farmlands × crop area of various types of farmlands).

At present, the farmland pollutant' source strength coefficient is not supported with systematic research. However, factors such as farmland gradient, crop category, soil type, amount and method of chemical fertilizer applied and rainfall all have an impact on COD. It is recommended that the standard farmland pollutants' source strength coefficient proposed by the National Technical Guidance (150 kg/hectare) be modified according to these factors and local conditions. For the livestock and poultry industry, the equation is

Generation quantity =breeding quantity of livestock and poultry × proportion of scale breeding × discharge coefficient

In this case, the accounting uses the livestock and poultry pollutant discharge coefficient recommended by the Ministry of Environmental Protection.

The quantity of COD removal of livestock and poultry is related to factors such as the desludging process, waste water treatment rate and pollutant removal ratio. The formula for the quantity of pollutant removal is as follows:

COD removal – dry method COD removal + wet method COD removal

Dry method COD removal = COD generation x dry method proportion x dry method COD removal ratio

Wet method COD removal = COD generation x wet method proportion x waste water treatment proportion x wet method COD removal ratio

The quantity of COD discharge of livestock and poultry:

Quantity of COD discharge = (quantity of COD generation – quantity of COD removal) x loss coefficient

## Industry

In existing environmental statistics, industrial pollutant data are collected for key polluting enterprises and non-key pollutiing enterprises. For key polluting enterprises, physical measurements are derived by aggregating data of local-level enterprises; measurements for non-key polluting enterprises are estimated. The measurements for key and non-key polluting enterprises are added together to derive total industrial pollution. The current *China Statistical*

*Yearbook on the Environment* presents environmental statistics by industry, which comprises data from the key polluting enterprises. It also presents environmental statistics by region, which comprise data from both key and non-key polluting enterprises. Therefore, only the statistics by region reflect the total generation, treatment and discharge of industrial pollutants for all industries.

Thus, the quantity of COD removal and discharge by industry has to be adjusted by the total quantity of COD removal and discharge by region to derive the total quantity of COD generation by industry. The adjustment formula is as follows:

Adjusted quantity of COD removal = pre-adjusted quantity of COD removal / total quantity of COD removal of industries x total quantity of COD removal of regions

Adjusted quantity of COD discharge = pre-adjusted quantity of COD discharge / total quantity of COD discharge of industries x total quantity of COD discharge of regions

Then adjusted quantity of COD generation can be derived as follows:

Adjusted quantity of COD generation = adjusted quantity of COD discharge + adjusted quantity of COD removal

Finally, regroup the industrial classification in the *China Statistical Yearbook on the Environment* according to the classifications of input–output table.

### Services Industry and Urban Households

In urban waste water discharge statistics, data on sewage from households and sewage from the services industry are collected in one category. Therefore, the urban COD discharge has to be estimated first for this broader category, then broken down into two sub-categories: COD Discharge of Services Industry and COD Discharge of Urban Households, according to the water usage proportion of public facility and of households. The physical measurement can be derived as follows:

Quantity of COD discharge of services industry = public facility water usage proportion x urban services' and households' COD discharge

Quantity of COD discharge of urban households = households water usage proportion x urban services' and households' COD discharge

### Rural Households

The quantity of COD generated by the rural population is estimated based on COD generation coefficient per capita and the population in rural areas. The quantity of COD discharges equals the loss coefficient of COD emissions into water bodies multiplied by the quantity of COD generation. The quantity of COD generation and the quantity of COD discharge by rural households are calculated as follows:

Quantity of COD generation of rural households = 365 x households' COD generation coefficient x rural population

Quantity of COD discharge of rural households = COD loss coefficient x COD generation

# 4. Estimation Results and Accounts Analysis

In the SIMP II Environment Accounts Project, the Mineral and Energy Resources Stock Accounts, Hybrid Energy Accounts and Pollutant Flow Accounts were compiled by the NBS using a method agreed to by Chinese and Canadian partners in discussions based on data availability in China. The estimates for each account are presented in the following sections, accompanied by corresponding analysis.

## 4.1. Mineral and Energy Stock Accounts

### 4.1.1. Mineral and Energy Stock Accounts 2005

In the SIMPI II Environment Statistics Project, the appropriation method (AM) and net present value (NPV) method were nationally applied to the mineral resources valuation. The estimation results are shown in Table 4.1.

**Table 4.1 Mineral and Energy Resources Stock Accounts, 2005**

| Mineral | Unit of Measure | Reserves | Appropriation method | Capital returns: 0% | | | Capital returns: 8% | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | (Discount rate: 3-year average) | (Discount rate: 5-year average) | (Discount rate: 10-year average) | (Discount rate: 3-year average) | (Discount rate: 5-year average) | (Di ra av |
| | | | (100 million Yuan) | | | | | | |
| Coal | 1,000 tonnes | 33,263,500 | 16,001 | 61,691 | 48,752 | 50,394 | 13,169 | 8,351 | |
| Petroleum | 1,000 $m^3$ | 243,909 | 9,169 | 37,957 | 35,745 | 36,074 | 10,200 | 8,976 | |
| Natural gas | 100 million $m^3$ | 26,629 | 1,126 | 5,041 | 4,259 | 4,367 | 1,355 | 960 | |
| Iron | 1,000 tonnes | 2,160,400 | 3,475 | 9,190 | 7,711 | 7,913 | 829 | 580 | |
| Copper | 1,000 tonnes | 439,424 | 231 | 711 | 588 | 605 | 0[1] | 0 | |
| Aluminum | 1,000 tonnes | 73,100 | 37 | 34 | 29 | 30 | 0 | 0 | |

The estimates generated by these two methods are quite different. Usually, the government chooses to reduce or waive taxes to encourage enterprises to explore and extract resources. Therefore, resource values calculated with AM are generally lower than values calculated by NPV.

The discount rate is calculated as a moving average of the deflated returns of 10-year government bonds. A 3-, 5- and 10-year moving average were used to reflect different impacts on evaluating resources from different discount rates. There are also different ways to calculate the rate of capital returns, such as the ratio of net operating surplus over capital stock, enterprise stock earning rate and long-term government bound earning. In SIMP II, two rates of capital returns—0% and 8%—were adopted. The 8% rate was determined by referring to the rates of each country with statistics provided by Statistics Canada. In both cases, the three-year moving average led to the lowest discount rate and corresponded to the highest resources value. The rate of capital returns has significant impact on resource values. The resource values

[1] If the calculation result is negative, zero is used as a substitute. The following 5 zeros are derived in the same way.

estimated with the 8% rate of capital returns are far lower than those estimated with no capital returns, which is a much closer estimation to that from AM.

Among the selected energy resources, coal has the highest value, followed by petroleum. Coal and petroleum are the main types of energy in China, and are vital to economic development. Although natural gas reserves and their value are lower than that of coal and petroleum, natural gas is gaining importance because it is high in energy content, convenient to transport and less polluting. Among the selected mineral resources, iron has the highest value; that of copper and aluminum are relatively low. Since each resource has its own role, its importance cannot be only measured by its value.

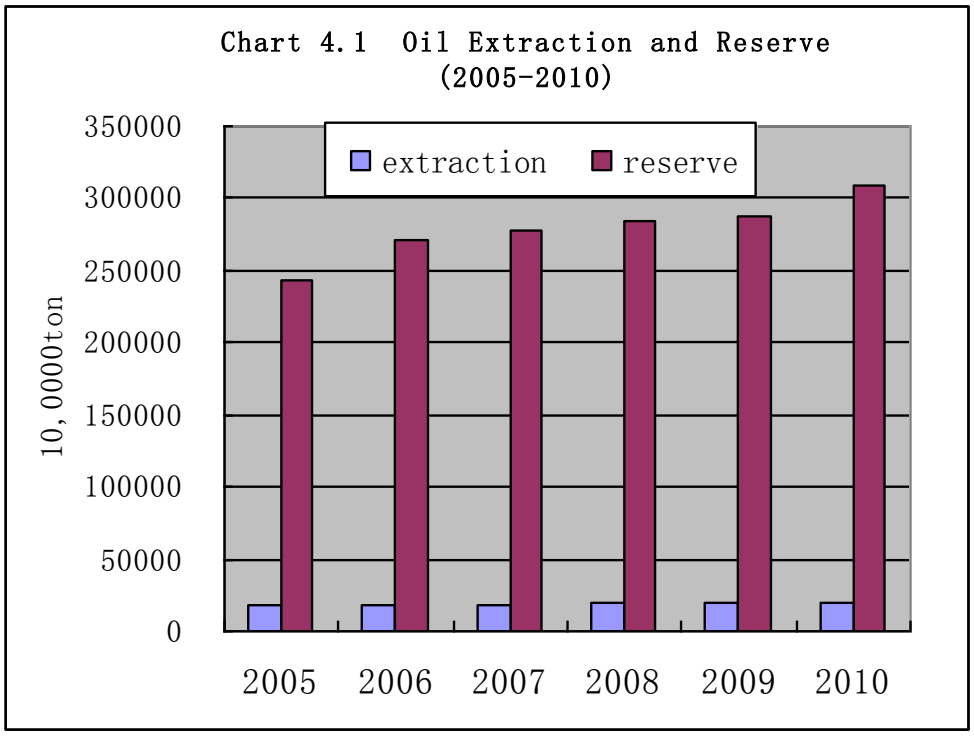
### 4.1.2. Mineral and Energy Resources Time Series

To reflect the reserve changes of these mineral and energy resources and analyze their supporting roles in economic development, NBS compiled a time series of reserves and reserve lives (Figures 4.1 and 4.2).

Coal is the most important energy type in China, accounting for 70% of total energy consumption. However, coal reserves are decreasing—reserve lives declined from 154 years in 2005 to 87 in 2010—while extraction is increasing year over year. Furthermore, coal is a major source of greenhouse gases. Coal combustion has brought heavy pollution to China. To reduce this pollution, China needs to reduce coal consumption and raise the share of energy that is derived from non-fossil sources.

Petroleum and natural gas play a crucial role in satisfying China's energy demands. However, China's petroleum and natural gas reserves are relatively small, and production is far lower than consumption. More than half of crude petroleum demand is filled by imports. The encouraging news is that the technically extractable volume of petroleum is steadily growing, although the

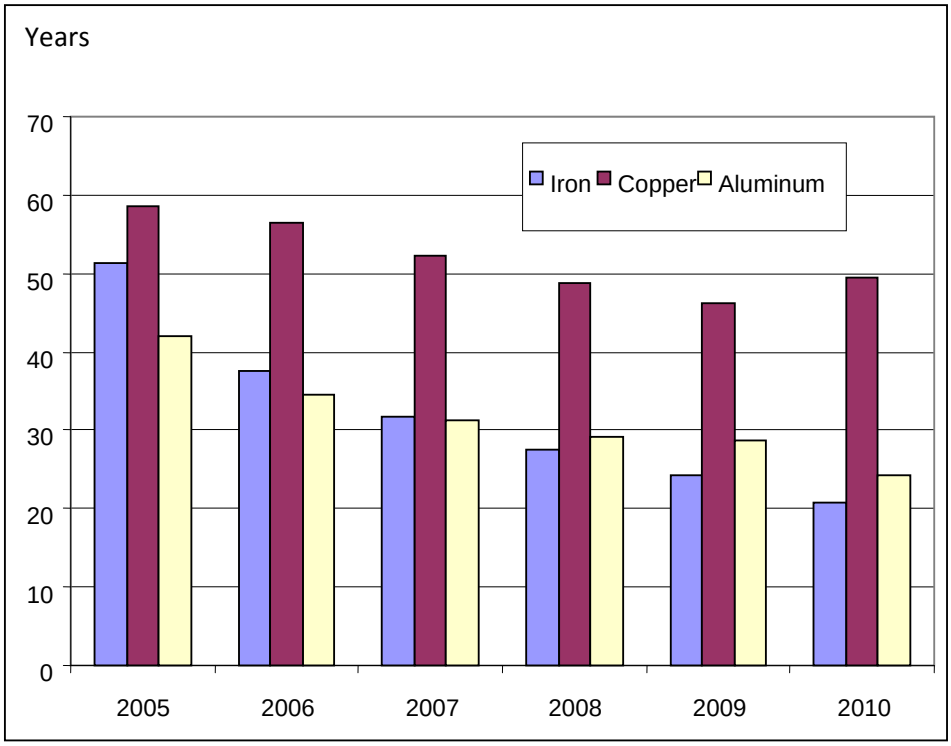
**Figure 4.1 Oil Extraction and Reserves, 2005-2010**



annual extraction volume is increasing as well, which keeps the reserve life of extraction basically constant. Along with economic development and a deteriorating environment, China is increasingly realizing the importance of exploring and extracting natural gas. China treats the reserve as an effective way to solve energy shortage and to reduce environmental pollution by raising the percentage of natural gas consumption in total primary energy consumption. In 2010, China's natural gas resources reached 3.7 trillion cubic metres, suggesting an abundant reserve. However, because of the rapid increase of extraction volumes, natural gas's reserve life dropped from 52 years in 2005 to 38 years in 2010. China must enhance infrastructure and improve techniques for exploring and extracting natural gas to meet economic development needs.

Iron, copper and aluminum are three important minerals in China. As the volume of extraction increases, their extraction reserve lives are trending downward. Table 4.2 shows that the reserves of these three minerals have changed little. Exploring and prospecting techniques need to be enhanced to fulfill economic development needs.

**Figure 4.2 Reserve Life for Iron, Copper and Aluminum, 2005-2010**




## 4.2. Hybrid Energy Accounts

### 4.2.1. Total Energy Consumption

The flow accounts in the SIMP II Environment Accounts Project comprise hybrid energy accounts and pollutant flow accounts.

The hybrid energy accounts present total energy consumption and net energy consumption tables. Physical energy tables are also used in conjunction with an input–output table to analyze energy consumption intensity.

Complete data for total energy consumption in 2002, 2005 and 2007 are presented in Appendix 4, Tables 4.3, 4.4 and 4.5.

The total energy consumption of the five energy-transformable industries in 2002 are

- coal mining and washing, 5,192 PJ
- extraction of crude petroleum and natural gas, 857 PJ
- petroleum processing, coking and nuclear fuel, 15,635 PJ
- electricity, thermal power production and supply, 18,353 PJ
- gas production and supply, 370 PJ.

Some of the major non-energy-transformable industries that have relatively large total energy consumption are

- metal smelting and rolling, 5,649 PJ
- chemicals, 4,438 PJ
- transport and storage, 3,185 PJ
- non-metallic mineral products, 2,937 PJ.

The total energy consumption of the five energy-transformable industries in 2005 are

- coal mining and washing, 10,547 PJ; up 103.1% from 2002; average annual growth of 26.6%
- extraction of crude petroleum and natural gas, 756 PJ; down 11.8% from 2002; average annual decrease, 4.1%
- petroleum processing, coking and nuclear fuel, 23,445 PJ; up 50.0% from 2002; average annual growth, 14.5%
- electricity, thermal power production and supply, 27,145 PJ; up 47.9% from 2002; average annual growth, 13.9%
- gas production and supply, 478 PJ; up 29.3% from 2002; average annual growth, 9.0%.

The four major non-energy-transformable industries with relatively large total energy consumption are

- metal smelting and tolling, 10,883 PJ; up 92.7% from 2002; average annual growth of 24.4%
- chemicals, 5,930 PJ; up 33.6% from 2002; average annual growth, 10.1%
- transport and storage, 4,955 PJ; up 55.6% from 2002; average annual growth, 15.9%
- non-metallic mineral products, 4,741 PJ; up 61.4% from 2002; average annual growth, 17.3%.

The total energy consumption of the five energy-transformable industries in 2007 was

- coal mining and washing, 12,705 PJ; up 20.5% from 2005; average annual growth, 9.8%
- extraction of crude petroleum and natural gas, 799 PJ; up 5.8% from 2005; average annual growth, 2.9%
- petroleum processing, coking and nuclear fuel, 26,965 PJ; up 15.0% from 2005; average annual growth, 7.2%

- electricity, thermal power production and supply, 33,192 PJ; up 22.3% from 2005; average annual growth, 10.6%
- gas production and supply, 550 PJ; up 15.1% from 2005; average annual growth, 7.3%.

The four major non-energy-transformable industries with relatively large total energy consumption are

- metal smelting and tolling, 13,653 PJ; up 25.5% from 2005; average annual growth, 12.0%
- chemicals, 7,182 PJ; up 21.1% from 2005; average annual growth, 10.1%
- transport and storage, 5,836 PJ; up 17.8% from 2005; average annual growth, 8.5%
- non-metallic mineral products, 5,176 PJ; up 9.2% from 2005;, average annual growth, 4.5%.

### 4.2.2. Net Energy Consumption

In energy industries, primary energy is used as input to produce secondary energy as output. The output of transformed energy is not used by the energy industry and should be deducted from its total energy consumption to reflect the industry's actual energy consumption. Net energy consumption, measured in calorific units, is derived by subtracting the transformed energy output from the total energy consumption. Net energy consumption data in 2002, 2005 and 2007 are presented in Table 4.6.

Total net energy consumption in 2002 was 51,536 PJ. Of those petajoules, the net energy consumption totals for the five energy-transformable industries were coal mining and washing, 1,152 PJ; extraction of crude petroleum and natural gas, 857 PJ; petroleum processing, coking and nuclear fuel, 2,235 PJ; electricity, thermal power production and supply, 11,899 PJ; gas production and supply, 101 PJ.

Total net energy consumption in 2005 was 71,570 PJ, up 42.1% from 2002, for an average annual growth of 12.4%. Net energy consumption for the five energy-transformable industries are

- coal mining and washing, 1,960 PJ, up 70.2% from 2002, with an average annual growth of 19.4%
- extraction of crude petroleum and natural gas, 756 PJ, down 11.8% from 2002, average annual decrease, 4.1%
- petroleum processing, coking and nuclear fuel, 2,996 PJ, up 34.1% from 2002, average annual growth, 10.3%
- electricity, thermal power production and supply, 17,493 PJ, up 47.0% from 2002, average annual growth, 13.7%
- gas production and supply, 94 PJ, down 7.0% from 2002, average annual decrease, 2.4%.

Total net energy consumption in 2007 was 83,105 PJ, a 16.1% increase from 2005 and an average annual growth rate of 7.8%. The net energy consumption for the five energy-transformable industries are

- coal mining and washing, 2,268 PJ, up 15.7% increase from 2005, average annual growth, 7.6%.
- extraction of crude petroleum and natural gas, 799 PJ, down 5.8% from 2005, average annual decrease, 2.9%

- petroleum processing, coking and nuclear fuel, 3,443 PJ, up 14.9% from 2005, average annual growth, 7.2%
- electricity, thermal power production and supply, 20,815 PJ, up 19.0% from 2005, average annual growth, 9.1%
- gas production and supply, 68 PJ, down 28.1% from 2002, average annual decrease, 15.2%.

**Table 4.6 Net Energy Consumption, Petajoules, 2002-2007**

| Industry | 2002 | 2005 | 2007 |
|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 826.9 | 1,231.2 | 1,246.5 |
| Coal mining and washing | 1,151.5 | 1,959.8 | 2,268.0 |
| Extraction of crude petroleum and natural gas | 857.2 | 755.8 | 799.5 |
| Metals mining and dressing | 143.9 | 237.1 | 302.2 |
| Non-metallic minerals and other mining | 186.8 | 193.8 | 221.7 |
| Food manufacturing and tobacco processing | 869.9 | 946.2 | 1,070.6 |
| Textiles | 649.9 | 906.8 | 1,112.2 |
| Clothing, leather and feather products | 115.9 | 160.1 | 188.9 |
| Wood processing and furniture manufacturing | 107.4 | 163.3 | 186.5 |
| Papermaking, printing and educational and sports goods | 598.3 | 769.9 | 814.4 |
| Petroleum processing, coking and nuclear fuel | 2,234.5 | 2,996.2 | 3,442.9 |
| Chemicals | 4,438.4 | 5,929.5 | 7,182.0 |
| Non-metallic mineral products | 2,936.9 | 4,741.4 | 5,175.7 |
| Metal smelting and rolling | 5,648.8 | 10,883.2 | 13,652.7 |
| Fabricated metal products | 257.7 | 319.8 | 394.6 |
| General, special equipment manufacturing | 448.3 | 641.0 | 784.2 |
| Transport equipment manufacturing | 325.2 | 376.5 | 440.8 |
| Electrical machinery and equipment manufacturing | 136.0 | 185.1 | 231.0 |
| Communications equipment, computers and other electronic equipment manufacturing | 135.1 | 209.5 | 270.9 |
| Measuring instruments and office machinery manufacturing | 29.7 | 28.5 | 36.3 |
| Artwork and other manufacturing | 346.8 | 376.8 | 365.8 |
| Wastes | 0.0 | 5.6 | 7.5 |
| Electricity, thermal power production and supply | 11,898.8 | 17,493.7 | 20,814.8 |
| Gas production and supply | 162.9 | 208.3 | 232.1 |
| Water production and supply | 61.8 | 78.3 | 90.5 |
| Construction | 614.9 | 859.5 | 1,026.9 |
| Transport and storage | 3,184.7 | 4,954.6 | 5,836.3 |
| Post | 19.1 | 20.6 | 28.4 |
| Wholesale and retail trade | 365.5 | 548.4 | 508.3 |
| Accommodation and catering | 255.0 | 331.9 | 538.4 |

| | | | |
|---|---|---|---|
| Financial intermediations | 90.4 | 101.2 | 160.1 |
| Real estate | 101.4 | 75.5 | 117.2 |
| Other services | 1171.9 | 1587.1 | 1938.8 |
| Urban households | 2,160.8 | 3,092.9 | 3,844.6 |
| Rural households | 9,065.9 | 9,903.1 | 9,876.5 |
| Total | 51598.3 | 73272.3 | 85208.0 |

### 4.2.3. Energy Consumption Intensity

Energy consumption intensity is comprised of energy consumption and direct and indirect energy consumption intensity. Energy consumption output efficiency is the ratio of net energy consumption over the total output of the industry. Direct and indirect energy consumption intensity was derived by an input–output method described in Section 3.

**Table 4.7 Energy Consumption Intensity, 2002**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption/ output (megajoules/yuan) | Direct and indirect energy consumption intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 285,787,423.0 | 826.9 | 0.3 | 1.5 |
| Coal mining and washing | 40,109,089.4 | 1,151.5 | 2.9 | 5.3 |
| Extraction of crude petroleum and natural gas | 32,633,054.0 | 857.2 | 2.6 | 4.2 |
| Metals mining and dressing | 14,524,833.3 | 143.9 | 1.0 | 4.6 |
| Non-metallic minerals and other mining | 15,904,914.4 | 186.8 | 1.2 | 3.7 |
| Food manufacturing and tobacco processing | 144,807,827.9 | 869.9 | 0.6 | 2.2 |
| Textiles | 90,055,513.8 | 649.9 | 0.7 | 3.0 |
| Clothing, leather and feather products | 66,298,844.5 | 115.9 | 0.2 | 2.1 |
| Wood processing and furniture manufacturing | 39,489,397.6 | 107.4 | 0.3 | 2.7 |
| Papermaking, printing and educational and sports goods | 70,501,801.7 | 598.3 | 0.8 | 3.1 |
| Petroleum processing, coking and nuclear fuel | 60,846,185.6 | 2,234.5 | 3.7 | 6.8 |
| Chemicals | 215,726,168.2 | 4,438.4 | 2.1 | 5.6 |
| Non-metallic mineral products | 58,045,337.2 | 2,936.9 | 5.1 | 8.6 |
| Metal smelting and rolling | 153,676,938.9 | 5,648.8 | 3.7 | 8.1 |
| Fabricated metal products | 59,976,479.1 | 257.7 | 0.4 | 4.9 |

| | | | | |
|---|---|---|---|---|
| General, special equipment manufacturing | 129,973,097.2 | 448.3 | 0.3 | 3.5 |
| Transport equipment manufacturing | 96,466,982.9 | 325.2 | 0.3 | 3.2 |
| Electrical machinery and equipment manufacturing | 71,216,365.0 | 136.0 | 0.2 | 3.6 |
| Communications equipment, computers and other electronic equipment manufacturing | 129,773,660.0 | 135.1 | 0.1 | 1.9 |
| Measuring instruments and office machinery manufacturing | 16,892,786.3 | 29.7 | 0.2 | 2.5 |
| Artwork and other manufacturing | 20,507,401.1 | 346.8 | 1.7 | 4.4 |
| Wastes | 8,417,752.3 | 0.0 | 0.0 | 0.0 |
| Electricity, thermal power production and supply | 79,116,902.6 | 11,898.8 | 15.0 | 17.4 |
| Gas production and supply | 3,637,766.6 | 162.9 | 4.5 | 8.6 |
| Water production and supply | 5,664,668.5 | 61.8 | 1.1 | 5.2 |
| Construction | 281,326,817.3 | 614.9 | 0.2 | 3.6 |
| Transport and storage | 140,959,758.1 | 3,184.7 | 2.3 | 4.4 |
| Post | 5,104,534.0 | 19.1 | 0.4 | 2.4 |
| Wholesale and retail trade | 171,449,131.3 | 365.5 | 0.2 | 1.5 |
| Accommodation and catering | 71,460,886.8 | 255.0 | 0.4 | 1.9 |
| Financial intermediations | 73,139,315.5 | 90.4 | 0.1 | 0.9 |
| Real estate | 73,536,925.1 | 101.4 | 0.1 | 0.9 |

The industries with the highest direct energy consumption intensity in 2002 were electricity, thermal power production and supply, 15.0 MJ/yuan; non-metallic mineral products, 5.1 MJ/yuan; petroleum processing, coking and nuclear fuel, 3.7 MJ/yuan; metal smelting and rolling, 3.7 MJ/yuan; and coal mining and washing, 2.9 MJ/yuan.

The industries with the highest complete energy consumption intensity in 2002 were electricity, thermal power production and supply, 17.4 MJ/yuan; non-metallic mineral products, 8.6Mj/yuan; metal smelting and rolling, 8.1 MJ/yuan; petroleum processing, coking and nuclear fuel, 6.8 MJ/yuan; and gas production and supply, 6.8 MJ/yuan.

**Table 4.8 Energy Consumption Intensity, 2005**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption/ output (megajoules/ yuan) | Direct and indirect energy consumption intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 393,566,962.5 | 1,231.2 | 0.3 | 1.3 |
| Coal mining and washing | 79,239,752.6 | 1,959.8 | 2.5 | 5.4 |
| Extraction of crude petroleum and natural gas | 60,374,479.4 | 755.8 | 1.3 | 3.0 |
| Metals mining and dressing | 31,822,327.0 | 237.1 | 0.7 | 3.9 |
| Non-metallic minerals and other mining | 23,266,775.6 | 193.8 | 0.8 | 3.5 |
| Food manufacturing and tobacco processing | 258,777,955.2 | 946.2 | 0.4 | 1.7 |
| Textiles | 158,599,567.2 | 906.8 | 0.6 | 2.6 |
| Clothing, leather and feather products | 122,220,532.7 | 160.1 | 0.1 | 1.8 |
| Wood processing and furniture manufacturing | 60,236,289.9 | 163.3 | 0.3 | 2.4 |
| Papermaking, printing and educational and sports goods | 108,523,051.4 | 769.9 | 0.7 | 2.9 |
| Petroleum processing, coking and nuclear fuel | 126,202,872.5 | 2,996.2 | 2.4 | 4.4 |
| Chemicals | 400,316,693.7 | 5,929.5 | 1.5 | 4.4 |
| Non-metallic mineral products | 153,602,496.5 | 4,741.4 | 3.1 | 6.3 |
| Metal smelting and rolling | 314,341,377.6 | 10,883.2 | 3.5 | 7.3 |
| Fabricated metal products | 106,323,436.3 | 319.8 | 0.3 | 4.3 |
| General, special equipment manufacturing | 250,957,755.1 | 641.0 | 0.3 | 3.3 |
| Transport equipment manufacturing | 175,742,883.8 | 376.5 | 0.2 | 2.8 |
| Electrical machinery and equipment manufacturing | 165,712,512.7 | 185.1 | 0.1 | 3.3 |
| Communications equipment, computers and other electronic equipment manufacturing | 280,490,576.6 | 209.5 | 0.1 | 1.8 |
| Measuring instruments and office machinery manufacturing | 35,960,454.0 | 28.5 | 0.1 | 2.2 |
| Artwork and other manufacturing | 37,374,411.5 | 376.8 | 1.0 | 3.3 |
| Wastes | 12,275,983.8 | 5.6 | 0.0 | 0.0 |
| Electricity, thermal power production and supply | 184,531,570.6 | 17,493.7 | 9.5 | 12.3 |
| Gas production and supply | 7,442,114.0 | 208.3 | 2.8 | 5.8 |
| Water production and supply | 9,650,293.9 | 78.3 | 0.8 | 4.3 |
| Construction | 425,643,566.4 | 859.5 | 0.2 | 3.3 |

| | | | | |
|---|---|---|---|---|
| Transport and storage | 244,582,228.5 | 4,954.6 | 2.0 | 3.8 |
| Post | 6,546,772.5 | 20.6 | 0.3 | 1.9 |
| Wholesale and retail trade | 238,072,985.2 | 548.4 | 0.2 | 1.5 |
| Accommodation and catering | 102,825,964.5 | 331.9 | 0.3 | 1.6 |
| Financial intermediations | 102,616,150.8 | 101.2 | 0.1 | 0.9 |
| Real estate | 102,501,573.7 | 75.5 | 0.1 | 0.6 |

The top five industries with the highest direct energy consumption intensity in 2005 were electricity, thermal power production and supply, 9.5 MJ/yuan; metal smelting and rolling, 3.5 MJ/yuan; non-metallic mineral products, 3.1 MJ/yuan; coal mining and washing, 2.5 MJ/yuan and petroleum processing, coking and nuclear fuel, 2.4 MJ/yuan.

The top five industries with the highest complete energy consumption intensity in 2005 were electricity, thermal power production and supply, 12.3 MJ/yuan; metal smelting and rolling, 7.3 MJ/yuan; non-metallic mineral products, 6.3 MJ/yuan; coal mining and washing, 5.4 MJ/yuan; and chemicals, 4.4 MJ/yuan.

**Table 4.9 Energy Consumption Intensity, 2007**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption/ output (megajoules/ yuan) | Direct and Indirect Energy Consumption Intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 488,929,999.9 | 1,246.5 | 0.3 | 1.0 |
| Coal mining and washing | 96,450,529.9 | 2,268.0 | 2.4 | 4.4 |
| Extraction of crude petroleum and natural gas | 95,348,873.8 | 799.5 | 0.8 | 2.5 |
| Metals mining and dressing | 61,493,459.5 | 302.2 | 0.5 | 3.2 |
| Non-metallic minerals and other mining | 38,516,131.3 | 221.7 | 0.6 | 2.7 |
| Food manufacturing and tobacco processing | 417,903,946.7 | 1,070.6 | 0.3 | 1.4 |
| Textiles | 251,973,509.1 | 1,112.2 | 0.4 | 2.3 |
| Clothing, leather and feather products | 180,725,774.1 | 188.9 | 0.1 | 1.7 |
| Wood processing and furniture manufacturing | 109,939,305.8 | 186.5 | 0.2 | 1.9 |
| Papermaking, printing and educational and sports goods | 149,330,074.9 | 814.4 | 0.5 | 2.4 |
| Petroleum processing, coking and nuclear fuel | 210,745,642.4 | 3,442.9 | 1.6 | 3.4 |
| Chemicals | 619,980,925.8 | 7,182.0 | 1.2 | 3.7 |
| Non-metallic mineral products | 228,043,740.3 | 5,175.7 | 2.3 | 5.1 |
| Metal smelting and rolling | 610,959,761.7 | 13,652.7 | 2.2 | 5.2 |

| | | | | |
|---|---|---|---|---|
| Fabricated metal products | 177,054,747.6 | 394.6 | 0.2 | 3.4 |
| General, special equipment manufacturing | 394,865,917.2 | 784.2 | 0.2 | 2.6 |
| Transport equipment manufacturing | 329,784,416.0 | 440.8 | 0.1 | 2.2 |
| Electrical machinery and equipment manufacturing | 271,550,145.8 | 231.0 | 0.1 | 2.7 |
| Communications equipment, computers and other electronic equipment manufacturing | 411,902,530.0 | 270.9 | 0.1 | 1.3 |
| Measuring instruments and office machinery manufacturing | 48,796,643.9 | 36.3 | 0.1 | 1.6 |
| Artwork and other manufacturing | 61,834,239.0 | 365.8 | 0.6 | 2.7 |
| Wastes | 43,659,772.3 | 7.5 | 0.0 | 0.3 |
| Electricity, thermal power production and supply | 314,859,883.7 | 20,814.8 | 6.6 | 11.5 |
| Gas production and supply | 11,082,895.2 | 208.3 | 2.8 | 5.8 |
| Water production and supply | 11,788,262.4 | 90.5 | 0.8 | 3.7 |
| Construction | 627,217,352.1 | 1,026.9 | 0.2 | 3.0 |
| Transport and storage | 317,001,112.9 | 5,836.3 | 1.8 | 3.2 |
| Post | 7,307,574.0 | 28.4 | 0.4 | 1.6 |
| Wholesale and retail trade | 288,325,410.5 | 508.3 | 0.2 | 1.0 |
| Accommodation and catering | 148,154,357.3 | 538.4 | 0.4 | 1.5 |
| Financial intermediations | 194,810,240.1 | 160.1 | 0.1 | 0.6 |
| Real estate | 147,746,231.8 | 117.2 | 0.1 | 0.4 |

The top five industries with the highest direct energy consumption intensity in 2007 were electricity, thermal power production and supply, 6.6 MJ/yuan; coal mining and washing, 2.4 MJ/yuan; non-metallic mineral products, 2.3 MJ/yuan; metal smelting and rolling, 2.2 MJ/yuan and transport and storage, 1.8 MJ/yuan.

The top five industries with the highest complete energy consumption intensity in 2007 were electricity, thermal power production and supply, 11.5 MJ/yuan; metal smelting and rolling, 5.2 MJ/yuan; non-metallic mineral products, 5.1 MJ/yuan; coal mining and washing, 4.4 MJ/yuan and chemicals, 3.7 MJ/yuan.

### 4.2.4. Time Series of Energy Consumption Intensity

**Table 4.10 Time Series of Energy Consumption Intensity, 2002-2007**

**(index, 2002 = 1)**

| Industry | Direct | | | Direct+ Indirect | | |
|---|---|---|---|---|---|---|
| | 2002 | 2005 | 2007 | 2002 | 2005 | 2007 |
| Agriculture, forestry, animal husbandry and fishery | 1 | 1.28 | 1.22 | 1 | 0.99 | 0.96 |
| Coal mining and washing | 1 | 1.29 | 1.33 | 1 | 1.52 | 1.35 |
| Extraction of crude petroleum and natural gas | 1 | 0.88 | 0.73 | 1 | 1.31 | 1.36 |
| Metals mining and dressing | 1 | 1.24 | 1.00 | 1 | 1.40 | 1.42 |
| Non-metallic minerals and other mining | 1 | 0.82 | 0.60 | 1 | 1.10 | 0.90 |
| Food manufacturing and tobacco processing | 1 | 0.68 | 0.52 | 1 | 0.86 | 0.78 |
| Textile | 1 | 0.85 | 0.67 | 1 | 0.91 | 0.83 |
| Clothing, leather and feather products | 1 | 0.76 | 0.62 | 1 | 0.85 | 0.81 |
| Wood processing and furniture manufacturing | 1 | 1.03 | 0.67 | 1 | 0.92 | 0.78 |
| Papermaking, printing and educational and sports goods | 1 | 0.84 | 0.66 | 1 | 0.92 | 0.78 |
| Petroleum processing, coking and nuclear fuel | 1 | 0.99 | 0.84 | 1 | 0.98 | 0.96 |
| Chemical industry | 1 | 0.84 | 0.68 | 1 | 0.92 | 0.82 |
| Non-metallic mineral products | 1 | 0.63 | 0.48 | 1 | 0.76 | 0.63 |
| Metal smelting and rolling | 1 | 1.30 | 0.97 | 1 | 1.24 | 1.03 |
| Fabricated metal products | 1 | 0.79 | 0.60 | 1 | 0.98 | 0.81 |
| General, special equipment manufacturing | 1 | 0.77 | 0.61 | 1 | 0.97 | 0.78 |
| Transport equipment manufacturing | 1 | 0.60 | 0.38 | 1 | 0.86 | 0.66 |
| Electrical machinery and equipment manufacturing | 1 | 0.61 | 0.52 | 1 | 0.95 | 0.88 |
| Communications equipment, computers and other electronic equipment manufacturing | 1 | 0.61 | 0.51 | 1 | 0.80 | 0.54 |
| Measuring instruments and office machinery manufacturing | 1 | 0.43 | 0.39 | 1 | 0.82 | 0.58 |
| Artwork and other manufacturing | 1 | 0.67 | 0.42 | 1 | 0.85 | 0.73 |
| Electricity, heat power production and supply | 1 | 0.68 | 0.50 | 1 | 0.76 | 0.75 |
| Gas production and supply | 1 | 0,70 | 0,58 | 1 | 0,75 | 0,56 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Water production and supply | 1 | 0.85 | 0.89 | 1 | 0.95 | 0.90 |
| Construction | 1 | 1.05 | 0.93 | 1 | 1.02 | 1.02 |
| Transport and storage | 1 | 0.94 | 0.96 | 1 | 0.93 | 0.86 |
| Post | 1 | 0.89 | 1.22 | 1 | 0.83 | 0.76 |
| Wholesale and retail trade | 1 | 1.14 | 0.91 | 1 | 1.04 | 0.74 |
| Accommodation and catering | 1 | 0.98 | 1.19 | 1 | 0.90 | 0.90 |
| Financial intermediations | 1 | 0.83 | 0.88 | 1 | 0.99 | 0.80 |
| Real estate | 1 | 0.65 | 0.79 | 1 | 0.81 | 0.65 |

From 2002 to 2007, industries that had most rapidly increased direct energy consumption intensity were coal mining and washing, 33%, and agriculture, forestry, animal husbandry and fishery, 22%. The industries that had most rapidly decreased direct energy consumption intensity were gas production and supply, 72.7%; non-metallic mineral products, 52.2%; and electricity, thermal power production and supply, 50.3%. Industries that had most rapidly increased complete energy consumption intensity were metals mining and dressing, 42%; extraction of crude petroleum and natural gas, 36%; and coal mining and washing, 35%. Industries that had most rapidly decreased complete energy consumption intensity were gas production and supply, 58%; non-metallic mineral products, 37%; and electricity, thermal power production and supply, 25%.

### 4.2.5. Households' Energy Consumption

**Table 4.11 Households' Direct Energy Consumption, 2002**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 50,212 | 2,160.8 | 4.30 |
| Rural households | 78,241 | 9,065.9 | 11.6 |

**Table 4.12 Households' Direct Energy Consumption, 2005**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 56,212 | 3,092.9 | 5.50 |
| Rural households | 74,544 | 9,903.1 | 13.3 |

**Table 4.13 Households' Direct Energy Consumption, 2007**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 59,379 | 3,844.6 | 6.48 |
| Rural households | 72,750 | 9,876.5 | 13.6 |

Urban households' direct energy consumption was 2,161 PJ in 2002. In 2005, it rose to 3,093 PJ,a 43.1% increase from 2002, with an average annual growth of 12.7%. Consumption in 2007 was 3,845 PJ, up 24.3% from 2005, with an average annual growth of 11.5%. Rural households' direct energy consumption was 9,066 PJ in 2002. In 2005, it rose to 9,903 PJ, a 9.2% increase from 2002, with an average annual growth of 3.0%. Consumption in 2007 was 9,877 PJ, down 0.3% from 2005, with an average annual decrease of 0.1%.

Urban households' direct energy consumption per capita was 4.30 GJ in 2002. By 2005, it rose 27.9% to 5.50 GJ, for an average annual growth of 8.5%. Consumption in 2007 was 6.48 GJ, up a 17.7% from 2005, with an average annual growth of 8.5%. Rural households' direct energy consumption per capita was 11.6 GJ in 2002. In 2005, it rose 13.3 GJ, up 14.7% from 2002, with an average annual growth of 4.7%. Consumption in 2007 was 13.6 GJ, down 2.2% from 2005, an average annual decrease of 1.1%.

### 4.2.6. Energy Consumption of Final Uses

**Table 4.14 Energy Consumption, Final Uses, Petajoules, 2002-2007**

| Final uses | 2002 | 2005 | 2007 |
|---|---|---|---|
| Final uses | 26,873.53 | 31,510.0 | 34,752.1 |
| Households' consumption | 23,661.57 | 27,031.6 | 29,630.9 |
| Rural households' consumption | 12,442.36 | 13,236.0 | 13,551.8 |
| Urban households' consumption | 11,219.21 | 13,795.6 | 16,079.1 |
| Government consumption | 3,211.962 | 4,478.4 | 5,121.2 |
| Capital formation | 13,806.68 | 20,988.5 | 26,843.6 |
| Fixed capital formation | 13,244.8 | 19,646.2 | 25,652.4 |
| Changes of Inventories | 561.8765 | 1,342.3 | 1,191.2 |
| Exports | 9,508.511 | 18,393.7 | 22,112.4 |
| Others | 1,409.59 | 2,380.1 | 1,499.9 |

Fixed capital formation accounted for the largest percentage: it also increased somewhat from 2002 to 2007. By contrast, the shares of rural household consumption and urban household consumption continuously decreased from 2002 to 2007, by 8% and 3%, respectively. The share of exports increased from 18% in 2002 to 26% in 2007. The share of government consumption stabilized at about 6%.

**Figure 4.3 Allocation of Energy Consumption to Final Uses, 2002**

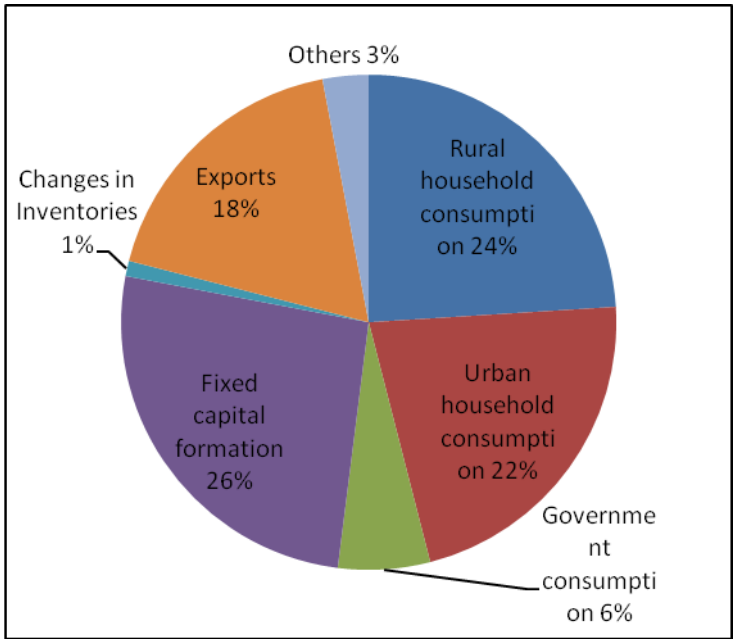


**Figure 4.4 Allocation of Energy Consumption to Final Uses, 2005**

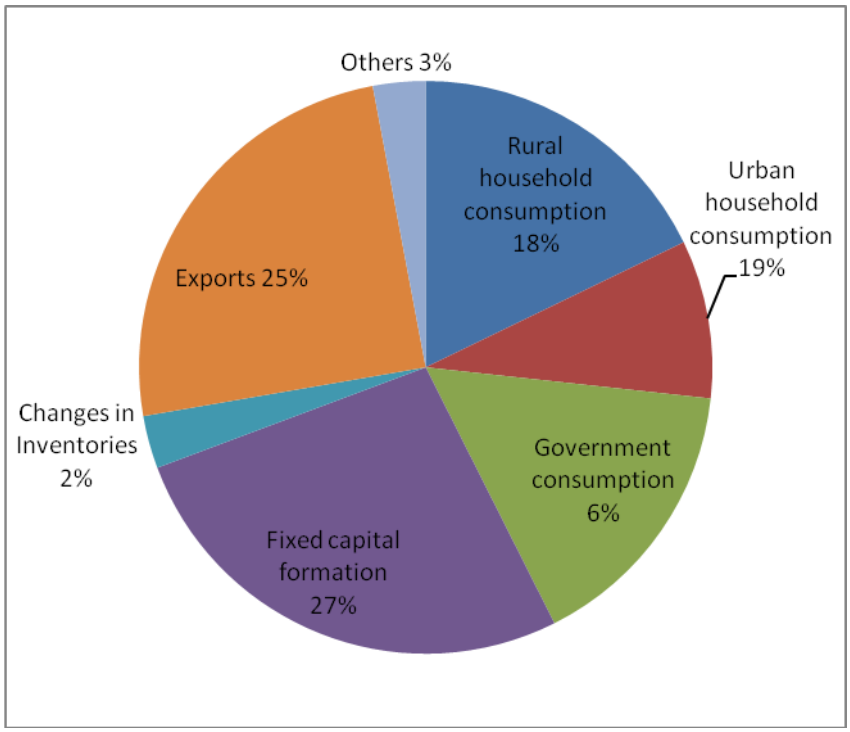
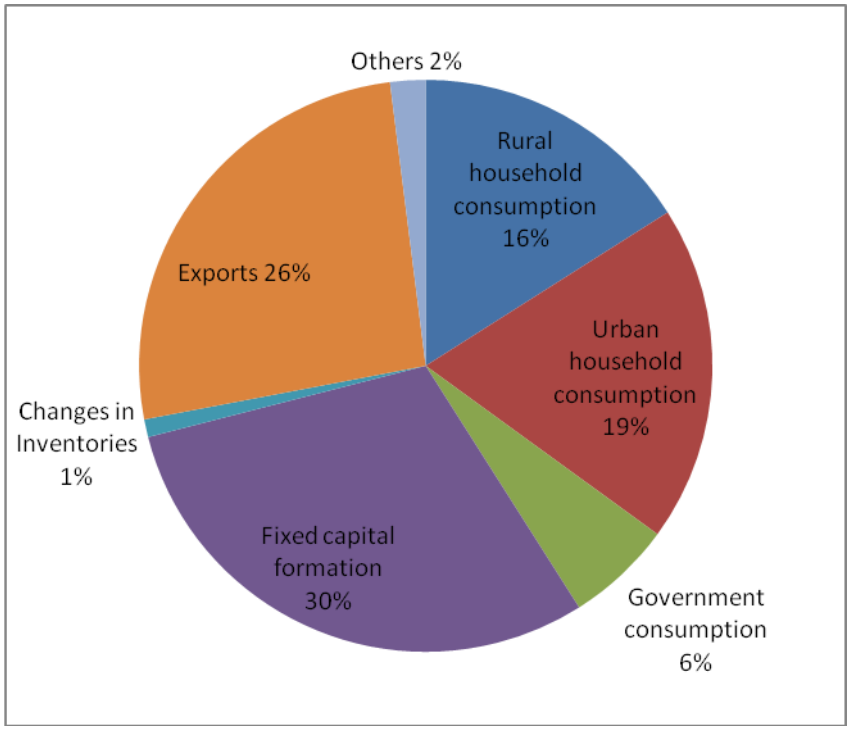



**Figure 4.5 Allocation of Energy Consumption to Final Uses, 2007**



### 4.2.7. Energy Consumption Intensity of Final Uses

From 2002 to 2007, only the energy consumption intensity of government consumption posted an increase (8%); other components of final uses decreased by various amounts. The energy consumption intensity of exports had a relatively large decrease of 21%. The energy consumption intensity of urban household consumption fell 14% and rural household consumption dropped 10%. The energy consumption intensity of fixed capital formation decreased 10%.

**Table 4.15 Energy Consumption Intensity, Final Uses, 2002-2007**

**(index 2002 = 1)**

| Final uses | 2002 | 2005 | 2007 |
|---|---|---|---|
| Final uses | 1.00 | 0.97 | 0.85 |
| Households consumption | 1.00 | 0.95 | 0.82 |
| Rural households consumption | 1.00 | 1.03 | 0.90 |
| Urban households consumption | 1.00 | 0.96 | 0.86 |
| Government consumption | 1.00 | 1.11 | 1.08 |
| Capital formation | 1.00 | 0.95 | 0.91 |
| Fixed capital formation | 1.00 | 0.96 | 0.90 |
| Changes of inventories | 1.00 | 0.78 | 0.96 |
| Exports | 1.00 | 0.91 | 0.79 |
| Others | 1.00 | 0.97 | 0.50 |

The above analysis revealed China's energy consumption situation from different perspectives, and suggests the following focuses for energy saving.

Total energy consumption and net energy consumption data show the industry with the highest consumption intensity is electricity, thermal power production and supply: this is a result of using thermal power as the main type of electricity generation in China. Thermal power generation has relatively low energy conversion efficiency because a large amount of energy is wasted during production in the form of waste heat, waste gas, etc., which is not environmentally sound. Therefore, the electricity, thermal power production and supply industry needs special attention.

There are two ways to improve this industry's energy consumption efficiency.

- Use scientific and technological innovation to improve energy conversion efficiency in the process of thermal power generation, and make the best use of waste heat and waste gas to reduce energy loss during the production process.
- Develop new energy for solar, nuclear, geothermal and tidal powers, which have high energy conversion efficiency and are clean and green power sources. Energy consumption intensity and pollution can be significantly reduced by raising the share of these new types of power production in the total production of the electricity, thermal power production and supply industry.

The time series of energy consumption intensity suggests that, for most industries, energy consumption intensity is declining. However, some industries are showing an upward trend of energy consumption intensity, in particular large energy-consuming industries such as coal mining and washing and extraction of crude petroleum and natural gas. In this regard, the policy to encourage the closure of small mines should be continuously enforced.

In terms of energy consumption of final uses, fixed capital formation accounts for the largest percentage and exports present the highest growth rate, which suggest that energy saving should be focused on these two perspectives. For fixed capital formation, it is important to improve investment quality by avoiding redundant construction. For exports, the focus should be on improving the structure of exports by raising the technological content of exported commodities, enhancing energy efficiency.

In terms of household energy consumption intensity, rural household energy consumption intensity is apparently higher than that of urban households. This is mainly because in rural areas most of the energy consumed is primary bio-energy such as firewood and straw, which are low in energy conversion efficiency and high in pollutant discharge. To substitute primary energy consumption with modern and efficient ways requires modernization of rural life with enhanced infrastructure construction.

## 4.3. Pollutant Flow Accounts

For the main Pollutant Flow Accounts in SIMP II, NBS chose to estimate COD and $SO_2$. The estimation results are presented in the following sections.

### 4.3.1. COD Emission Accounts

Table 4.16 presents emissions of COD.

Total COD generation by all industries was 72.07 million tonnes in 2005. Of all the industries, agriculture is the main source of COD generation, at 46.28 million tonnes in 2005, or 64% of total COD generation. Because of the uncertainty of the agricultural pollutant discharge channel and the mixed discharge of different types of pollutants, it is very difficult to produce regular statistics on agricultural waste water discharge. In the future, agricultural data will be included in environmental statistics, agricultural pollutant statistics will be strengthened and agricultural pollution will be reduced by improving the techniques for measuring chemical fertilizer and applying pesticide.

Among industrial sectors, the industries with relatively high COD generation were papermaking, printing and educational and sports goods; food manufacturing and tobacco processing; and textiles. To reduce industrial COD discharge, effective measures should be adopted, such as using water-saving devices to improve water efficiency.

**Table 4.16 COD Generation, Emissions and Removal, 10,000 tonnes, 2005**

| Industry | Generation | Emission | Removal |
|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 4,627.47 | 1,288.43 | 666.64 |
| Coal mining and washing | 28.65 | 6.46 | 22.19 |
| Extraction of crude petroleum and natural gas | 16.12 | 1.88 | 14.24 |
| Metals mining and dressing | 15.47 | 8.46 | 7.01 |

| | | | |
|---|---|---|---|
| Non-metallic minerals and other mining | 2.98 | 2.33 | 0.65 |
| Food manufacturing and tobacco processing | 316.89 | 115.28 | 201.62 |
| Textiles | 122.56 | 33.59 | 88.97 |
| Clothing, leather and feather products | 45.40 | 10.85 | 34.56 |
| Wood processing and furniture manufacturing | 5.75 | 3.24 | 2.51 |
| Papermaking, printing and educational and sports goods | 582.34 | 180.26 | 402.07 |
| Petroleum processing, coking and nuclear fuel | 66.40 | 9.37 | 57.03 |
| Chemicals | 264.43 | 91.81 | 172.62 |
| Non-metallic mineral products | 10.31 | 5.94 | 4.36 |
| Metal smelting and rolling | 47.48 | 23.68 | 23.79 |
| Fabricated metal products | 11.05 | 2.27 | 8.78 |
| General, special equipment manufacturing | 7.03 | 3.71 | 3.32 |
| Transport equipment manufacturing | 7.97 | 4.29 | 3.68 |
| Electrical machinery and equipment manufacturing | 4.26 | 1.08 | 3.18 |
| Communications equipment, computers and other electronic equipment manufacturing | 5.48 | 1.88 | 3.60 |
| Measuring instruments and office machinery manufacturing | 2.33 | 1.05 | 1.28 |
| Artwork and other manufacturing | 34.78 | 28.63 | 6.15 |
| Wastes | 0.10 | 0.07 | 0.03 |
| Electricity, thermal power production and supply | 29.97 | 14.87 | 15.11 |
| Gas production and supply | 6.22 | 1.06 | 5.15 |
| Water production and supply | 9.03 | 2.66 | 6.36 |
| Construction | 0.00 | 0.00 | 0.00 |
| Transport and storage | 29.80 | 29.80 | 0.00 |
| Post | 1.74 | 1.74 | 0.00 |
| Wholesale and retail trade | 32.11 | 32.11 | 0.00 |
| Accommodation and catering | 29.92 | 29.92 | 0.00 |
| Financial intermediations | 10.89 | 10.89 | 0.00 |
| Real estate | 3.71 | 3.71 | 0.00 |
| Other services | 142.19 | 142.19 | 0.00 |
| Urban households | 609.07 | 609.07 | 0.00 |
| Rural households | 77.35 | 77.35 | 0.00 |
| Total | 7,207.26 | 2,779.96 | 1,754.90 |

Pollutant flow accounts can be analyzed from several perspectives, outlined below.

#### *4.3.1.1. Analysis of the relationship between pollutant emission, value added and output of various industries*

**Table 4.17 COD Emission Indicators, 2005**

| Industry | Value-added (100 million yuan) | Output (100 million yuan) | COD emission/ value-added (kg per 10,000 yuan) | COD emission/ output (kg per 10,000 yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 23,081 | 39,357 | 55.82 | 32.74 |
| Coal mining and washing | 3,225 | 7,924 | 2.00 | 0.82 |
| Extraction of crude petroleum and natural gas | 4,042 | 6,037 | 0.47 | 0.31 |
| Metals mining and dressing | 1,108 | 3,182 | 7.64 | 2.66 |
| Non-metallic minerals and other mining | 699 | 2,327 | 3.33 | 1.00 |
| Food manufacturing and tobacco processing | 7,364 | 25,878 | 15.66 | 4.45 |
| Textiles | 3,357 | 15,860 | 10.01 | 21,18 |
| Clothing, leather and feather products | 3,093 | 12,222 | 3.51 | 0.89 |
| Wood processing and furniture manufacturing | 1,427 | 6,024 | 2.27 | 0.54 |
| Papermaking, printing and educational and sports goods | 2,729 | 10,852 | 66.04 | 16.61 |
| Petroleum processing, coking and nuclear fuel | 2,408 | 12,620 | 3.89 | 0.74 |
| Chemicals | 8,913 | 40,032 | 10.30 | 2.29 |
| Non-metallic mineral products | 4,296 | 15,360 | 1.38 | 0.39 |
| Metal smelting and rolling | 6,557 | 31,434 | 3.61 | 0.75 |
| Fabricated metal products | 2,349 | 10,632 | 0.97 | 0.21 |
| General, special equipment manufacturing | 6,069 | 25,096 | 0.61 | 0.15 |
| Transport equipment manufacturing | 3,863 | 17,574 | 1.11 | 0.24 |
| Electrical machinery and equipment manufacturing | 3,476 | 16,571 | 0.31 | 0.07 |
| Communications equipment, computers and other electronic equipment manufacturing | 4,558 | 28,049 | 0.41 | 0.07 |
| Measuring instruments and office machinery manufacturing | 825 | 3,596 | 1.27 | 0.29 |
| Artwork and other manufacturing | 1,009 | 3,737 | 28.37 | 7.66 |
| Wastes | 1,228 | 1,228 | 0.06 | 0.06 |

| | | | | |
|---|---|---|---|---|
| Electricity, thermal power production and supply | 6,357 | 18,453 | 2.34 | 0.81 |
| Gas production and supply | 195 | 744 | 5.43 | 1.42 |
| Water production and supply | 435 | 965 | 6.12 | 2.76 |
| Construction | 10,884 | 42,564 | 0.00 | 0.00 |
| Transport and storage | 10,569 | 24,458 | 2.82 | 1.22 |
| Post | 305 | 655 | 5.70 | 2.66 |
| Wholesale and retail trade | 12,562 | 23,807 | 2.56 | 1.35 |
| Accommodation and catering | 4,225 | 10,283 | 7.08 | 2.91 |
| Financial intermediations | 6,314 | 10,262 | 1.72 | 1.06 |
| Real estate | 8,247 | 10,250 | 0.45 | 3,62 |
| Other services | 30,488 | 68,730 | 4.66 | 20,69 |

Industries' emission intensity varied significantly. Emissions were mainly from key industries such as papermaking, printing and educational and sports goods; artwork and other manufacturing; food manufacturing; and tobacco processing. These industries generated more waste water in their production processes because of relatively large amounts of water consumption. COD pollution treatment should focus on managing and monitoring these industries' waste water discharges.

#### *4.3.1.2. Households' Pollutant Discharge*

**Table 4.18 Households' Pollutant Emission Indicators, 2005**

| Households | Average annual population (10,000) | Households emissions (10,000 tonnes) | Average emissions per capita (kilograms per person) |
|---|---|---|---|
| Urban | 55,248 | 609.07 | 11.02 |
| Rural | 75,125 | 77.35 | 1.03 |

Urban households' discharges were much higher than rural households'. Therefore, it is more important to target reducing urban household emissions in order to reduce total pollutant emissions.

#### *4.3.1.3. Direct and Complete Emission Intensity*

Like hybrid energy accounts, pollutant emission intensity can be analyzed through major pollutant emission accounts combined with an input–output table. Table 4.19 presented direct and indirect emission intensities.

**Table 4.19 Hybrid COD Emission Intensity Indicators, Gram per Yuan, 2005**

| Industry | Direct emission intensity | Indirect emission intensity |
|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 3.2737 | 4.1487 |
| Coal mining and washing | 0.0815 | 0.3580 |
| Extraction of crude petroleum and natural gas | 0.0312 | 0.1508 |
| Metals mining and dressing | 0.2658 | 0.5324 |
| Non-metallic minerals and other mining | 0.1003 | 0.4183 |
| Food manufacturing and tobacco processing | 0.4455 | 2.3505 |

| | | |
|---|---|---|
| Textiles | 0.2118 | 1.4571 |
| Clothing, leather and feather products | 0.0888 | 0.9469 |
| Wood processing and furniture manufacturing | 0.0538 | 0.9610 |
| Papermaking, printing and educational and sports goods | 1.6611 | 2.6187 |
| Petroleum processing, coking and nuclear fuel | 0.0743 | 0.2054 |
| Chemicals | 0.2293 | 0.8034 |
| Non-metallic mineral products | 0.0387 | 0.3823 |
| Metal smelting and rolling | 0.0753 | 0.3176 |
| Fabricated metal products | 0.0214 | 0.3102 |
| General, special equipment manufacturing | 0.0148 | 0.2915 |
| Transport equipment manufacturing | 0.0244 | 0.2995 |
| Electrical machinery and equipment manufacturing | 0.0065 | 0.3614 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.0067 | 0.2484 |
| Measuring instruments and office machinery manufacturing | 0.0293 | 0.3104 |
| Artwork and other manufacturing | 0.7660 | 1.6831 |
| Wastes | 0.0058 | 0.0058 |
| Electricity, thermal power production and supply | 0.0806 | 0.2939 |
| Gas production and supply | 0.1430 | 0.4276 |
| Water production and supply | 0.2761 | 0.5070 |
| Construction | 0.0000 | 0.5566 |
| Transport and storage | 0.1218 | 0.3731 |
| Post | 0.2657 | 0.6843 |
| Wholesale and retail trade | 0.1349 | 0.5147 |
| Accommodation and catering | 0.2910 | 1.5016 |
| Financial intermediations | 0.1062 | 0.3289 |
| Real estate | 0.0362 | 0.1317 |
| Other services | 0.2069 | 0.5932 |

Measured by direct and complete emission intensities, emissions were mainly from agriculture, forestry, animal husbandry and fishery; food manufacturing; papermaking, printing and educational and sports goods; and textiles. The results from this analysis are consistent with that of value-added intensity analysis.

#### *4.3.1.4. Emission Intensity of Final Uses*

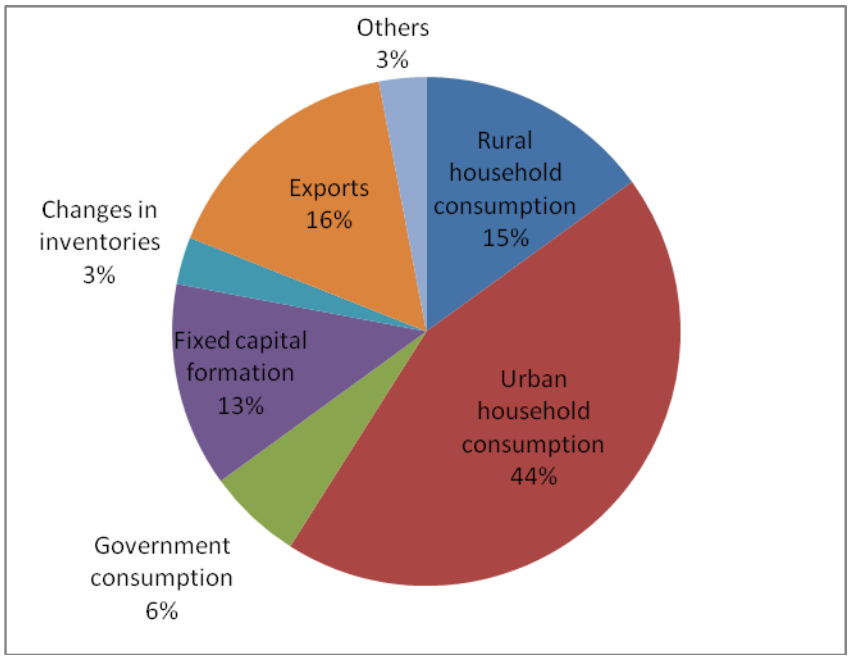
**Table 4.20 Final Uses, Related COD Emission Indicators, 2005**

| | Emission quantity (10,000 tonnes) | Emission (%) | Emission intensity |
|---|---|---|---|
| Rural household consumption | 405.36 | 15 | 0.23 |
| Urban household consumption | 1219.43 | 44 | 0.25 |
| Government consumption | 161.06 | 6 | 0.33 |
| Fixed capital formation | 357.73 | 13 | 0.05 |

| | | | |
|---|---|---|---|
| Changes of Inventories | 85.80 | 3 | 0.14 |
| Exports | 455.09 | 16 | 0.07 |
| Others | 95.49 | 3 | 0.13 |

The main pollutant sources, measured by final use, are urban household consumption, rural household consumption and exports and fixed capital formation. Therefore, efforts to reduce final-use emissions should focus on reducing the emission share of these components.

**Figure 4.6 Final Demand Ratios in COD Emissions**




## 4.3.2. SO2 Emission Accounts

**Table 4.21 $SO_2$ Generation, Emissions and Removal, 10,000 tonnes, 2005**

| Industry | Generation | Emissions | Removal |
|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 40.38 | 40.38 | 0.00 |
| Coal mining and washing | 28.76 | 23.05 | 5.71 |
| Extraction of crude petroleum and natural gas | 15.16 | 3.54 | 11.63 |
| Metals mining and dressing | 20.29 | 12.07 | 8.22 |
| Non-metallic minerals and other mining | 17.42 | 6.49 | 10.93 |
| Food manufacturing and tobacco processing | 54.65 | 40.41 | 14.23 |
| Textiles | 41.15 | 32.43 | 8.72 |
| Clothing, leather and feather products | 5.20 | 4.00 | 1.20 |
| Wood processing and furniture manufacturing | 6.84 | 5.64 | 1.20 |
| Papermaking, printing and educational and sports | 64.43 | 47.79 | 16.64 |

| | | | |
|---|---|---|---|
| goods | | | |
| Petroleum processing, coking and nuclear fuel | 166.99 | 77.57 | 89.41 |
| Chemicals | 276.05 | 153.76 | 122.29 |
| Non-metallic mineral products | 245.10 | 195.28 | 49.82 |
| Metal smelting and rolling | 712.09 | 233.15 | 478.94 |
| Fabricated metal products | 3.39 | 2.79 | 0.60 |
| General, special equipment manufacturing | 13.37 | 9.66 | 3.71 |
| Transport equipment manufacturing | 5.99 | 4.49 | 1.50 |
| Electrical machinery and equipment manufacturing | 3.88 | 2.98 | 0.90 |
| Communications equipment, computers and other electronic equipment manufacturing | 2.56 | 1.86 | 0.70 |
| Measuring instruments and office machinery manufacturing | 1.62 | 1.42 | 0.20 |
| Artwork and other manufacturing | 30.92 | 29.42 | 1.50 |
| Wastes | 0.04 | 0.04 | 0.00 |
| Electricity, thermal power production and supply | 1539.25 | 1277.92 | 261.32 |
| Gas production and supply | 2.86 | 2.06 | 0.80 |
| Water production and supply | 0.78 | 0.58 | 0.20 |
| Construction | 14.38 | 14.38 | 0.00 |
| Transport and storage | 120.28 | 120.28 | 0.00 |
| Post | 0.47 | 0.47 | 0.00 |
| Wholesale and retail trade | 12.15 | 12.15 | 0.00 |
| Accommodation and catering | 12.88 | 12.88 | 0.00 |
| Financial intermediations | 1.23 | 1.23 | 0.00 |
| Real estate | 2.35 | 2.35 | 0.00 |
| Other services | 33.76 | 33.76 | 0.00 |
| Urban households | 45.67 | 45.67 | 0.00 |
| Rural households | 97.45 | 97.45 | 0.00 |
| Total | 3,639.79 | 2,549.40 | 1,090.37 |

The generation of $SO_2$ in 2005 was 36 million tonnes and came mainly from industrial production activities. Some key industries were metal smelting and rolling; non-metallic mineral products; petroleum processing, coking and nuclear fuel; and chemicals. China's main energy source is coal. Along with economic development, coal consumption and industrial $SO_2$ emissions continuously increase. Coal consumption needs to be reduced and consumption of non-fossil fuels needs to be increased to reduce $SO_2$ emissions and to improve energy consumption efficiency.

$SO_2$ emissions can be analyzed from several perspectives.

#### *4.3.2.1. Relationship between pollutant emission, value added and output of various industries*

Table 4.22 presents indicators that related to emissions by industry. The industry that had the largest direct (201.02 g/yuan) and indirect (69.25 g/yuan) intensity coefficients was electricity, thermal power production and supply. All other industries—except non-metallic mineral products; metal smelting and rolling; and petroleum processing, coking and nuclear fuel—had

similar intensity coefficients. To reduce industrial $SO_2$ emissions, the output share of these industries among all industries should be reduced.

**Table 4.22 $SO_2$ Emission Indicators, 2005**

| Industry | Value-added (100 million yuan) | Total output (100 million yuan) | $SO_2$ Emission/value-added (kg per 10,000 yuan) | $SO_2$ Emission/total output (kg per 10,000 yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 23,081 | 39,357 | 1.75 | 1.03 |
| Coal mining and washing | 3,225 | 7,924 | 7.15 | 2.91 |
| Extraction of crude petroleum and natural gas | 4,042 | 6,037 | 0.88 | 0.59 |
| Metals mining and dressing | 1,108 | 3,182 | 10.89 | 3.79 |
| Non-metallic minerals and other mining | 699 | 2,327 | 9.28 | 2.79 |
| Food manufacturing and tobacco processing | 7,364 | 25,878 | 5.49 | 1.56 |
| Textiles | 3,357 | 15,860 | 9.66 | 2.04 |
| Clothing, leather and feather products | 3,093 | 12,222 | 1.29 | 0.33 |
| Wood processing and furniture manufacturing | 1,427 | 6,024 | 3.95 | 0.94 |
| Papermaking, printing and educational and sports goods | 2,729 | 10,852 | 17.51 | 4.40 |
| Petroleum processing, coking and nuclear fuel | 2,408 | 12,620 | 32.21 | 6.15 |
| Chemicals | 8,913 | 40,032 | 17.25 | 3.84 |
| Non-metallic mineral products | 4,296 | 15,360 | 45.46 | 12.71 |
| Metal smelting and rolling | 6,557 | 31,434 | 35.56 | 7.42 |
| Fabricated metal products | 2,349 | 10,632 | 1.19 | 0.26 |
| General, special equipment manufacturing | 6,069 | 25,096 | 1.59 | 0.38 |
| Transport equipment manufacturing | 3,863 | 17,574 | 1.16 | 0.26 |
| Electrical machinery and equipment manufacturing | 3,476 | 16,571 | 0.86 | 0.18 |
| Communications equipment, computers and other electronic equipment manufacturing | 4,558 | 28,049 | 0.41 | 0.07 |
| Measuring instruments and office machinery manufacturing | 825 | 3,596 | 1.72 | 0.39 |
| Artwork and other manufacturing | 1,009 | 3,737 | 29.16 | 7.87 |
| Wastes | 1,228 | 1,228 | 0.03 | 0.03 |
| Electricity, thermal power production and supply | 6,357 | 18,453 | 201.02 | 69.25 |
| Gas production and supply | 195 | 744 | 10.56 | 2.77 |
| Water production and supply | 435 | 965 | 1.33 | 0.60 |
| Construction | 10,884 | 42,564 | 1.32 | 0.34 |
| Transport and storage | 10,569 | 24,458 | 11.38 | 4.92 |
| Post | 305 | 655 | 1.55 | 0.72 |

| | | | | |
|---|---|---|---|---|
| Wholesale and retail trade | 12,562 | 23,807 | 0. 97 | 0. 51 |
| Accommodation and catering | 4,225 | 10,283 | 3. 05 | 1. 25 |
| Financial intermediations | 6,314 | 10,262 | 0. 20 | 0. 12 |
| Real estate | 8,247 | 10,250 | 0. 28 | 0. 23 |
| Other services | 30,488 | 68,730 | 1. 11 | 0. 49 |

$SO_2$-related indicators are presented in Table 4.22. Electricity, thermal power production and supply has the largest direct intensity coefficient and complete (direct and indirect) intensity coefficient, 201.02g/yuan and 69.25g/yuan, respectively. The intensity coefficients of other industries—except non-metallic mineral products; metal smelting and rolling; and petroleum processing, coking and nuclear fuel—showed little difference. To reduce $SO_2$ emissions, China needs to lower the output (value-added) percentage of these industries out of total industries.

#### *4.3.2.2. Analysis of Households' Pollutant Discharge*

**Table 4.23 Households' $SO_2$ Emission Indicators, 2005**

| **Households** | Average annual **p**opulation **(10,000)** | **Household emissions (10,000 tonnes)** | **Average emissions per capita (kilograms per person)** |
|---|---|---|---|
| Urban | 55,248 | 45.67 | 0.83 |
| Rural | 75,125 | 97.45 | 1.30 |

Table 4.23 shows that the $SO_2$ emissions are different from COD emissions. Urban households and rural households had similar per capita $SO_2$ emission intensity. Therefore, both urban and rural households would need to make efforts to reduce $SO_2$ emissions.

#### *4.3.2.3. Direct and Complete Emission Intensity*

**Table 4.24 Hybrid $SO_2$ Emission Intensity Indicators, grams per Yuan, 2005**

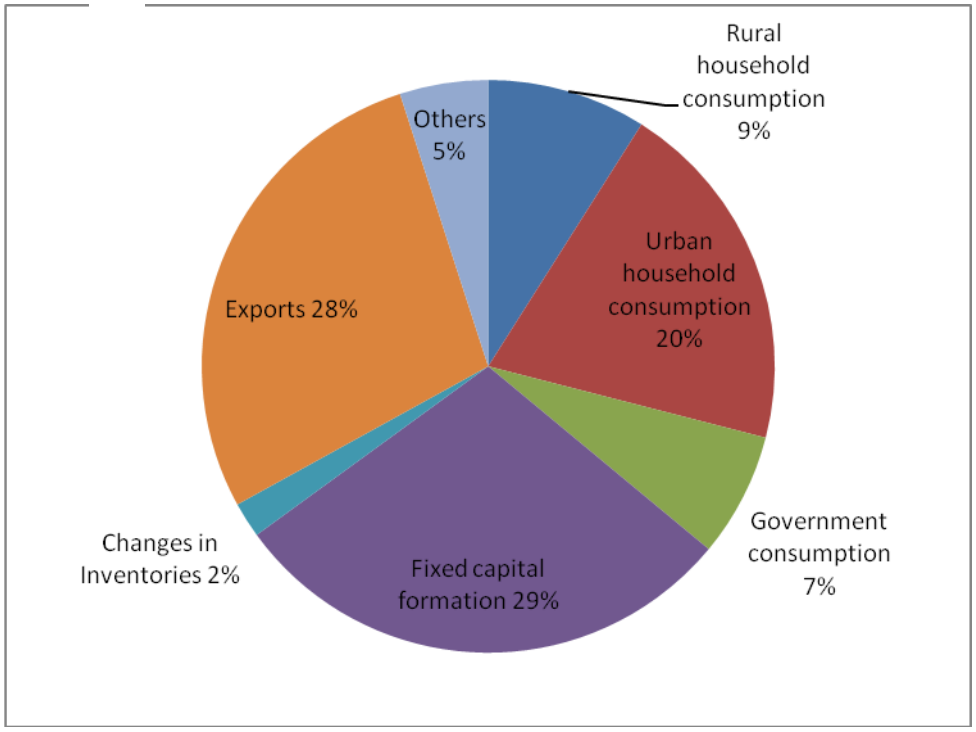
| Industry | Direct intensity | Indirect intensity |
|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.1026 | 0.5046 |
| Coal mining and washing | 0.2909 | 1.7572 |
| Extraction of crude petroleum and natural gas | 0.0586 | 0.9926 |
| Metals mining and dressing | 0.3792 | 2.0128 |
| Non-metallic minerals and other mining | 0.2791 | 1.5015 |
| Food manufacturing and tobacco processing | 0.1562 | 0.7136 |
| Textiles | 0.2045 | 1.0916 |
| Clothing, leather and feather products | 0.0327 | 0.7292 |
| Wood processing and furniture manufacturing | 0.0936 | 0.9809 |
| Papermaking, printing and educational and sports goods | 0.4404 | 1.4142 |
| Petroleum processing, coking and nuclear fuel | 0.6147 | 1.3599 |
| Chemicals | 0.3841 | 1.6931 |
| Non-metallic mineral products | 1.2714 | 2.7998 |
| Metal smelting and rolling | 0.7417 | 2.2875 |
| Fabricated metal products | 0.0263 | 1.5263 |
| General, special equipment manufacturing | 0.0385 | 1.1704 |
| Transport equipment manufacturing | 0.0255 | 0.9985 |
| Electrical machinery and equipment manufacturing | 0.0180 | 1.1646 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.0066 | 0.7176 |
| Measuring instruments and office machinery manufacturing | 0.0396 | 0.8552 |
| Artwork and other manufacturing | 0.7872 | 1.7365 |
| Wastes | 0.0036 | 0.0036 |
| Electricity, thermal power production and supply | 6.9252 | 8.1359 |
| Gas production and supply | 0.2766 | 1.4260 |
| Water production and supply | 0.0601 | 2.1369 |
| Construction | 0.0338 | 1.2549 |
| Transport and storage | 0.4901 | 1.1428 |
| Post | 0.1355 | 0.7429 |
| Wholesale and retail trade | 0.0296 | 0.6337 |
| Accommodation and catering | 0.1749 | 0.6907 |
| Financial intermediations | 0.0118 | 0.3593 |
| Real estate | 0.0232 | 0.2311 |
| Other services | 0.0491 | 0.6897 |

Table 4.24 shows that the hybrid $SO_2$ emission intensity, like COD, is concentrated in several major industries such as electricity, thermal power production and supply and non-metallic mineral products. Reducing the proportion of the emissions of these industries in the total economy can help reduce $SO_2$ emissions as well as COD generation.

#### *4.3.2.4. Analysis of Emission Intensity of Final Uses*

In terms of pollutant emissions by components of final uses, the main pollutant sources were gross fixed capital formation, exports and urban household consumption.

**Figure 4.7 Final Demand Ratio in $SO_2$ Emissions**




## 4.4. Estimation Results in Pilot Regions

Chongqing and Xinjiang are the two pilot regions for the SIMP II Environment Accounts Project. Chongqing compiled Mineral and Energy Resources Stock Accounts, Hybrid Energy Accounts and Pollutant Flow Accounts. Xinjiang compiled Mineral and Energy Resources Stock Accounts.

### 4.4.1. Chongqing Mineral and Energy Resources Stock Accounts

Chongqing chose coal and manganese to compile Mineral and Energy Resource Stock Accounts.

#### *4.4.1.1. Profile of Coal Reserve in Chongqing*

Chongqing has a wide coal resource distribution. All of its districts or counties except Yuzhong District, Dadukou District and Tongnan County have coal reserves or mines. Among the identified

reserves, 65% of the pits are located in the Nantong, Huarongshan and Yongrong coalfields; the remaining 35% are distributed in Yudong, Yudongnan and Dabashan coal-bearing areas.

The coal seams in Chongqing's coal-bearing strata are mainly mid-thick and thin coal seams with a wide variety of coal types, from gas coal to anthracite. The coal seams contain both low- and high-sulphur-content coal. In the coal seams, high-sulphur-content coal is the main component, with energy content from 4,000 to 7,000 kcal/kg.

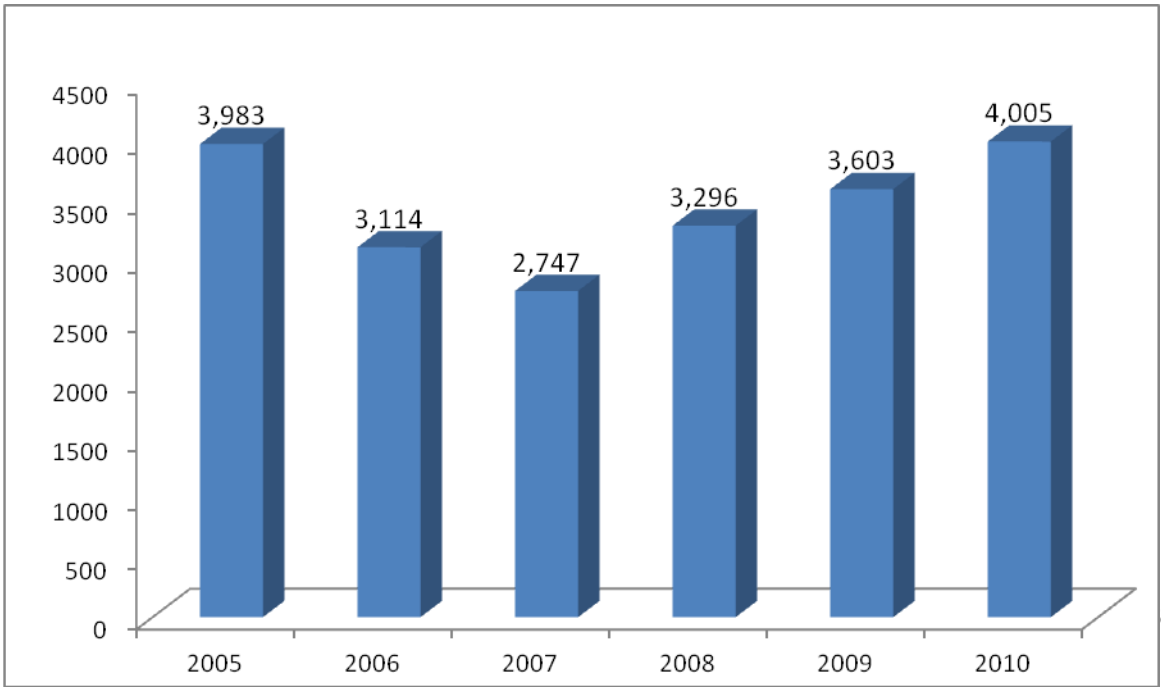
During the period of the Eleventh Five-year Plan, 154 coal exploration projects were conducted, with a total investment of 412.6 million yuan. The newly discovered reserve was 356.3 million tonnes, which increased Chongqing's coal reserve to 3.25 billion tonnes. The value of the newly discovered coal is 142.5 billion yuan.

**Table 4.25 Extraction, Reserve and Reserve Life of Coal in Chongqing during the Eleventh Five-year Plan, 2005-2010**

| Date | Extraction (10,000 tonnes) | Reserve (10,000 tonnes) | Reserve life (years) |
|---|---|---|---|
| 2005 | 3,983 | 182,300 | 46 |
| 2006 | 3,114 | 181,963 | 58 |
| 2007 | 2,747 | 202,562 | 74 |
| 2008 | 3,296 | 209,705 | 64 |
| 2009 | 3,603 | 194,373 | 54 |
| 2010 | 4,005 | 224,933 | 56 |

**Figure 4.8 Chongqing Coal Extraction, 2005 to 2010**

(10,000 tonnes)

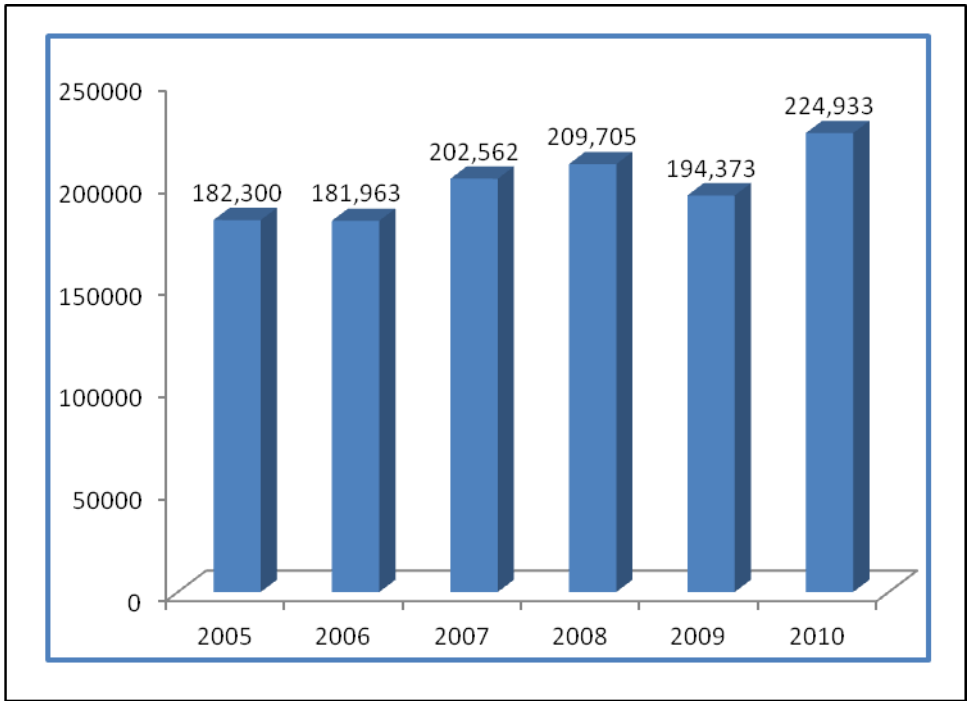


In terms of extraction, the coal extraction volume during the period of the Eleventh Five-year Plan presented a *V* shape. Before 2007, extraction volume declined gradually; after 2007, it increased gradually. The lowest extraction volume came in 2007, 27.47 million tonnes. The extraction volume in 2010 was over 40 million tonnes, the highest since 2005.

Reserves were relatively stable during the period of the Eleventh Five-year Plan, maintaining a level over 1.8 billion tonnes (see Chart 4.9). The 2006 coal reserve was the lowest at 1.82 billion tonnes, and the 2010 coal reserve was the highest at 2.249 billion tonnes.

**Figure 4.9 Chongqing Coal Reserves, 2005 to 2010**

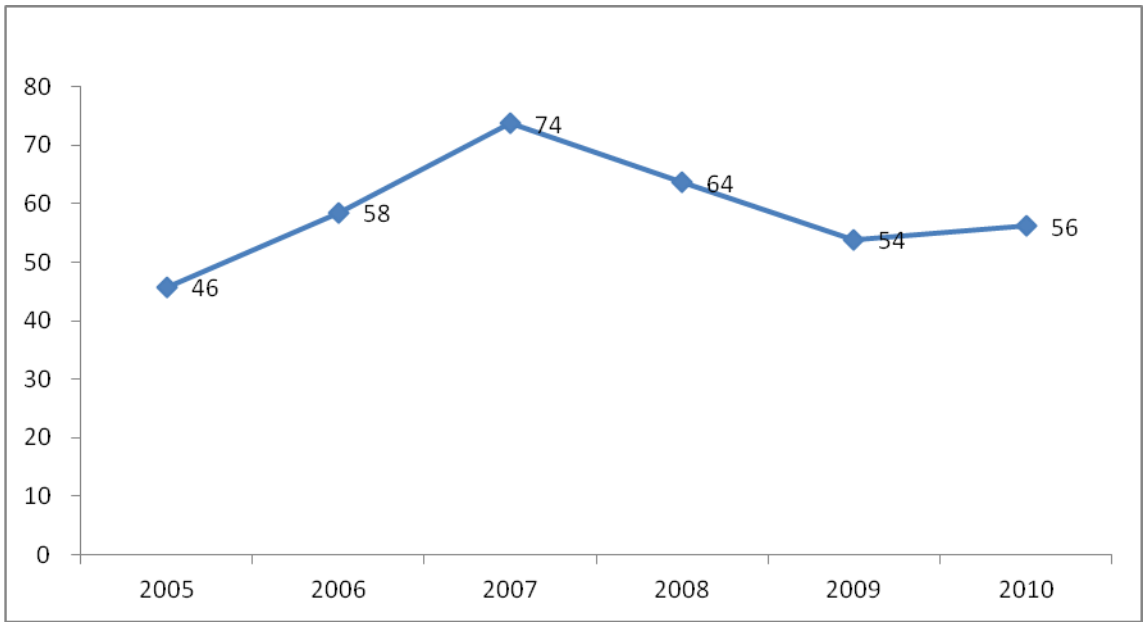
(10,000 tonnes)




In terms of the reserve life for extraction, there is an inverse V-shape during the Eleventh Five-year Plan. Because of the high reserve and low extraction in 2007, coal had the longest reserve life of extraction, 74 years, compared with 46 years in 2005 because of relatively low reserves and high extraction.

**Figure 4.10 Chongqing Coal Reserve Life, 2005 to 2010**

(Years)




#### *4.4.1.2. Profile of Manganese Reserves in Chongqing*

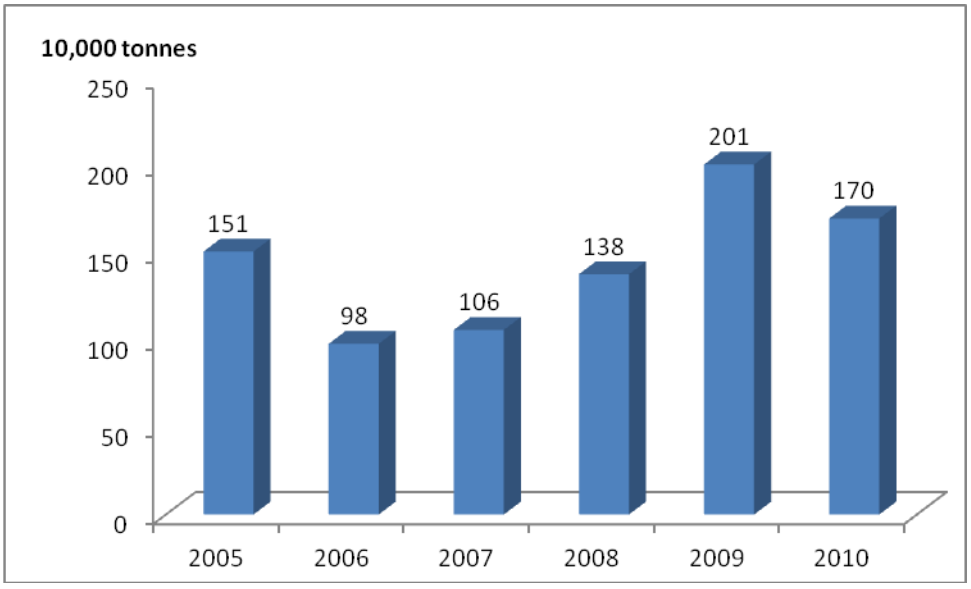
Manganese is a scarce mineral in China, giving Chongqing the advantage of possessing it. The distribution of manganese resources within Chongqing is limited, mainly in Chengkou County, in the northeast, and Xiushan County, in the southeast. After decades of exploration, six manganese deposits have been identified in Chongqing, totalling 47.424 million tonnes. This ranks Chongqing seventh in manganese reserves across China.

The government plans to boost manganese exploration in Chongqing to ensure sustainable development for the south and north manganese areas. During the period of the Eleventh Five-year Plan, manganese exploration in Chengkou and Xiushan was carried out, with a total investment of 11.91 million yuan. The newly discovered reserve had 6.92 million tonnes, valued at nearly 4.1 billion yuan. The results were especially good in the Gaoyanmeng and Xiuqi mining areas of Chengkou County. This further exploration was expected to add 5.2 million tonnes of manganese resources, which would bring new opportunities for developing Chengkou's manganese industry.

**Table 4.26 Extraction, Reserve and Reserve Life of Manganese in Chongqing during the Eleventh Five-year Plan, 2005-2010**

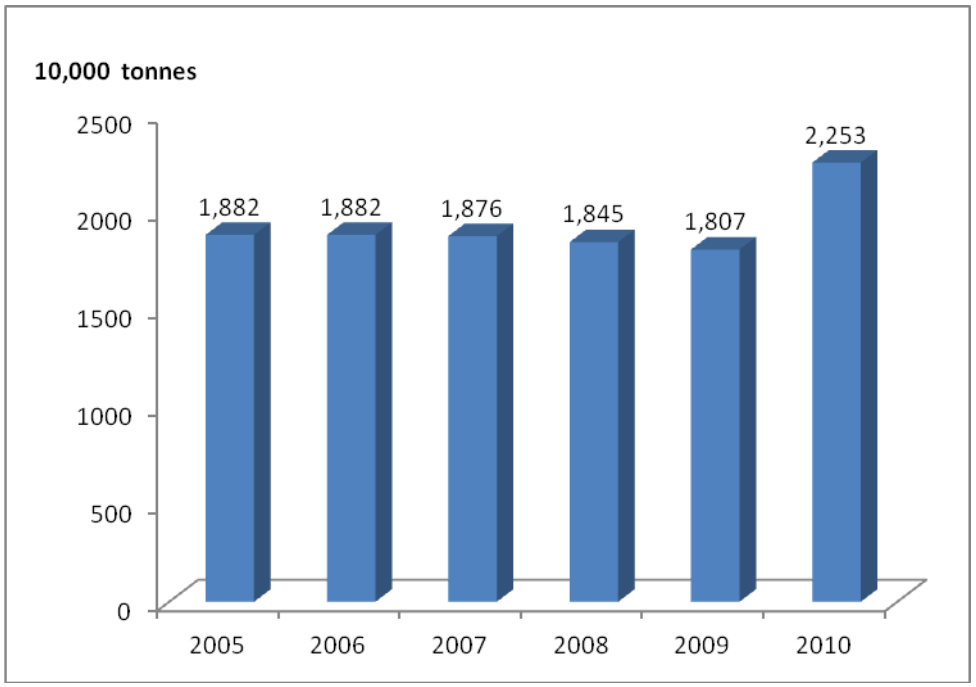
| Year | Extraction (10,000 tonnes) | Remaining reserve (10,000 tonnes) | Reserve life (years) |
|---|---|---|---|
| 2005 | 151 | 1,882 | 12 |
| 2006 | 98 | 1,882 | 19 |
| 2007 | 106 | 1,876 | 18 |
| 2008 | 138 | 1,845 | 13 |
| 2009 | 201 | 1,807 | 9 |
| 2010 | 170 | 2,253 | 13 |

**Figure 4.11 Chongqing Manganese Extraction, 2005 to 2010**



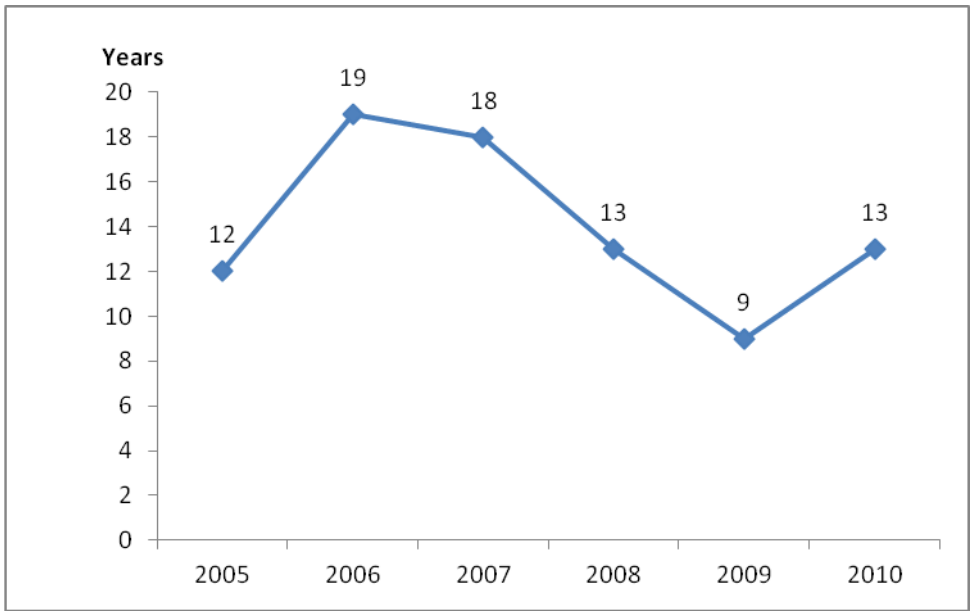

Extraction was relatively erratic during the Eleventh Five-year Plan, from the lowest volume, 980 tonnes in 2006, to the highest, 2.01 million tonnes in 2009.

**Figure 4.12 Chongqing Manganese Reserves, 2005 to 2010**




Manganese reserves were relatively stable during the Eleventh Five-year Plan, holding steady at more than 18 million tonnes. The lowest reserve was 18.07 million tonnes in 2009; the highest, over 20 million tonnes in 2010.

**Figure 4.13 Chongqing Manganese Reserve Life, 2005 to 2010**




Manganese's extraction reserve life showed a very similar pattern to that of coal. Extraction gradually declined, then gradually rose. The highest extraction reserve life was 19 years in 2006 because of the low extraction. The lowest extraction reserve life was 9 years in 2009, when reserves were lowest and extraction highest. The manganese extraction reserve life in all years is fewer than 20 years, almost one-third of the iron extraction reserve life. This shows that manganese is a scarce mineral that needs to be explored further.

Chongqing compiled the 2005 mineral stock accounts in monetary terms for coal and manganese using the appropriation method. The results are presented Table 4.27.

**Table 4.27 Mineral Resource Stock Accounts, 2005**

| Resource | Average Annual Extraction (10,000 tonnes) | Reserve (10,000 tonnes) | Reserve Life of Extraction (Years) | Discount rate (%) | Resource value (10,000 yuan) |
|---|---|---|---|---|---|
| Coal | 3,983.2 | 182,300.0 | 46.0 | 4.57 | 623,334.9 |
| Manganese | 151.2 | 1,881.5 | 12.0 | 4.57 | 5,342.9 |

### 4.4.2. Chongqing Hybrid Energy Accounts

Like NBS, Chongqing compiled hybrid energy accounts for 2002, 2005 and 2007.

#### *4.4.2.1. Total Energy Consumption*

Complete data for Chongqing's total energy consumption in 2002, 2005 and 2007 are presented in Appendix 5.

Total energy consumption for the five energy-transformable sectors in 2002 is:

- coal mining and washing, 119.21 PJ
- extraction of crude petroleum and natural gas, 0.89 PJ
- petroleum processing, coking and nuclear fuel, 52.62 PJ
- electricity, thermal power production and supply, 264.02 PJ
- gas production and supply, 0.73 PJ.

Among the non-energy-transformable sectors, some notable high total energy consumption industries were

- metal smelting and rolling, 137.33 PJ
- chemicals, 108.04 PJ
- non-metallic mineral products, 83.66 PJ
- agriculture, forestry, animal husbandry and fishery, 56.44 PJ.

Total energy consumption in the five energy-transformable sectors in 2005:

- coal mining and washing, 183.13 PJ, a 53.6% increase from 2002 and an average annual growth of 15.4%
- extraction of crude petroleum and natural gas, 3.1 PJ, up 249.3% from 2002, average annual growth, 51.7%
- petroleum processing, coking and nuclear fuel, 89.03 PJ, up 69.2% from 2002, average annual growth, 19.2%
- electricity, thermal power production and supply, 275.01 PJ, up 4.2% from 2002, average annual growth, 1.4%
- gas production and supply, 0.16 PJ, down 78.1% from 2002, average annual decrease, 39.7%.

Among the non-energy-transformable sectors, several high total energy consumption industries in 2005 were

- non-metallic mineral products, 199.38 PJ, up 138.3% from 2002, average annual growth, 33.6%
- chemicals, 137 PJ, up 26.8% from 2002, average annual growth, 8.2%
- metal smelting and rolling, 98.17 PJ, down 28.5% from 2002, average annual decrease, 10.6%
- transport and storage, 93.37 PJ, up 562% from 2002, average annual growth, 87.8%.

Total energy consumption of the five energy-transformable sectors in 2007:

- coal mining and washing, 270.18 PJ, up 47.5% from 2005, average annual growth, 21.5%

- extraction of crude petroleum and natural gas, 5.78 PJ, up 86.4% from 2005, average annual growth, 36.5%
- petroleum processing, coking and nuclear fuel, 103.94 PJ, up 16.8% from 2005, average annual growth, 8.1%
- electricity, thermal power production and supply, 432.49 PJ, up 57.3% from 2005, average annual growth, 25.4%
- gas production and supply, 0.31 PJ, up 96.6% from 2005, average annual growth, 40.2%.

Among the non-energy-transformable sectors, several high total energy consumption industries in 2007:

- non-metallic mineral products, 205.83 PJ, up 3.2% from 2005, an average annual growth, 1.6%
- chemicals, 144.2 PJ, up 5.3% from 2005, average annual growth, 2.6%
- metal smelting and rolling, 123.56 PJ, up 25.9% from 2005, average annual growth, 12.2%
- transport and storage, 121.82 PJ, up 30.5% from 2005, average annual growth, 14.2%.

#### *4.4.2.2. Net Energy Consumption*

Like NBS, Chongqing compiled net energy consumption accounts, presented in Table 4.28.

Total net energy consumption for 2002 was 880.75 PJ. Of the five energy-transformable sectors, the total net energy consumption of coal mining and washing was 77.12 PJ; extraction of crude petroleum and natural gas, 0.89 PJ; petroleum processing, coking and nuclear fuel, 15.23 PJ; electricity, thermal power production and supply, 201.92 PJ; and gas production and supply, 0.73 PJ.

The total net energy consumption for 2005 was 1449.47 PJ, up 64.6% from 2002 and an average annual growth of 18.1%. The total net energy consumption for the five energy-transformable industries:

- coal mining and washing, 83.2 PJ, up 7.9% from 2002, average annual growth, 2.6%
- extraction of crude petroleum and natural gas, 3.1 PJ, up 248.3% from 2002, average annual growth, 51.6%
- petroleum processing, coking and nuclear fuel, 28.76 PJ, up 88.8% from 2002, average annual growth, 23.6%
- electricity, thermal power production and supply, 195.65 PJ, down 3.1% from 2002, average annual decrease, 1.0%
- gas production and supply, -0.38 PJ .

Total net energy consumption for 2007 was 1,546.7 PJ, up 6.7% from 2005 and an average annual growth of 3.3%. Total net energy consumption for the five energy-transformable sectors:

- coal mining and washing, 116.13 PJ, up 39.6% from 2005, average annual growth, 18.1%
- extraction of crude petroleum and natural gas, 5.78 PJ, up 86.5% from 2005, average annual growth, 36.5%
- petroleum processing, coking and nuclear fuel, 17.39 PJ, down 39.5% from 2005, average annual decrease, 22.2%
- electricity, thermal power production and supply, 306.89 PJ, up 56.9% from 2005, average annual growth, 25.2%
- gas production and supply, -3.22 PJ.

**Table 4.28 Chongqing Net Energy Consumption Accounts, Petajoules, 2002-2007**

| Industry | 2002 | 2005 | 2007 |
|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 56.44 | 59.38 | 64.63 |
| Coal mining and washing | 77.12 | 83.20 | 116.13 |
| Extraction of crude petroleum and natural gas | 0.89 | 3.10 | 5.78 |
| Metals mining and dressing | 3.00 | 20.10 | 5.95 |
| Non-metallic minerals and other mining | 4.42 | 7.51 | 6.00 |
| Food manufacturing and tobacco processing | 5.72 | 13.44 | 15.22 |
| Textiles | 6.62 | 9.20 | 10.88 |
| Clothing, leather and feather products | 0.36 | 0.57 | 0.76 |
| Wood processing and furniture manufacturing | 0.76 | 0.99 | 1.08 |
| Papermaking, printing and educational and sports goods | 4.24 | 7.12 | 7.48 |
| Petroleum processing, coking and nuclear fuel | 15.23 | 28.76 | 17.39 |
| Chemicals | 108.04 | 137.00 | 144.20 |
| Non-metallic mineral products | 83.66 | 199.38 | 205.83 |
| Metal smelting and rolling | 137.33 | 98.17 | 123.56 |
| Fabricated metal products | 1.89 | 3.78 | 3.68 |
| General, special equipment manufacturing | 4.28 | 17.88 | 19.10 |
| Transport equipment manufacturing | 14.10 | 28.50 | 34.36 |
| Electrical machinery and equipment manufacturing | 1.75 | 1.75 | 2.37 |
| Communications equipment, computers and other electronic equipment manufacturing | 1.53 | 0.21 | 0.35 |
| Measuring instruments and office machinery manufacturing | 0.50 | 1.11 | 1.27 |
| Artwork and other manufacturing | 3.90 | 1.53 | 1.45 |
| Wastes | | | 0.29 |
| Electricity, thermal power production and supply | 201.92 | 195.65 | 306.89 |
| Gas production and supply | 0.73 | -0.38[1] | -3.22 |
| Water production and supply | 1.31 | 1.73 | 1.70 |
| Construction | 11.45 | 12.76 | 15.17 |
| Transport and storage | 36.64 | 93.37 | 121.82 |
| Post | 0.60 | 0.94 | 0.91 |
| Wholesale and retail trade | 5.85 | 4.67 | 7.08 |
| Accommodation and catering | 2.33 | 7.86 | 17.29 |
| Financial intermediation and Insurance | 0.54 | 1.66 | 1.85 |
| Real estate | 0.65 | 0.37 | 0.45 |
| Other services | 4.26 | 7.68 | 13.00 |
| Urban households | 38.53 | 46.80 | 52.43 |
| Rural households | 44.19 | 353.67 | 223.55 |

| | | | |
|---|---|---|---|
| Total | 880.75 | 1,449.47 | 1,546.70 |

#### *4.4.2.3. Energy Consumption Intensity Analysis*

**Table 4.29 Energy Consumption Intensity, 2002**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption / output (megajoules/ yuan) | Direct and indirect consumption intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 4,787,848 | 56.4 | 1.2 | 2.5 |
| Coal mining and washing | 401,345 | 77.1 | 19.2 | 21.6 |
| Extraction of crude petroleum and natural gas | 59,811 | 0.9 | 1.5 | 2.0 |
| Metals mining and dressing | 116,012 | 3.0 | 2.6 | 6.3 |
| Non-metallic minerals and other mining | 96,327 | 4.4 | 4.6 | 7.7 |
| Food manufacturing and tobacco processing | 1,937,851 | 5.7 | 0.3 | 2.4 |
| Textiles | 505,685 | 6.6 | 1.3 | 4.7 |
| Clothing, leather and feather products | 166,075 | 0.4 | 0.2 | 1.8 |
| Wood processing and furniture manufacturing | 83,887 | 0.8 | 0.9 | 2.9 |
| Papermaking, printing and educational and sports goods | 380,214 | 4.2 | 1.1 | 3.0 |
| Petroleum processing, coking and nuclear fuel | 73,917 | 15.2 | 20.6 | 23.7 |
| Chemicals | 3,174,946 | 108.0 | 3.4 | 7.4 |
| Non-metallic mineral products | 1,175,556 | 83.7 | 7.1 | 11.8 |
| Metal smelting and rolling | 2,123,719 | 137.3 | 6.5 | 10.9 |
| Fabricated metal products | 384,126 | 1.9 | 0.5 | 4.1 |
| General, special equipment manufacturing | 2,034,368 | 4.3 | 0.2 | 2.2 |
| Transport equipment manufacturing | 9,338,599 | 14.1 | 0.2 | 2.3 |
| Electrical machinery and equipment manufacturing | 765,660 | 1.7 | 0.2 | 3.9 |
| Communications equipment, computers and other electronic equipment manufacturing | 255,486 | 1.5 | 0.6 | 1.4 |
| Measuring instruments and office machinery manufacturing | 478,319 | 0.5 | 0.1 | 2.0 |
| Artwork and other manufacturing | 67,336 | 3.9 | 5.8 | 8.4 |
| Wastes | 0 | 0.0 | 0.0 | 0.0 |

| | | | | |
|---|---|---|---|---|
| Electricity, thermal power production and supply | 1,197,357 | 201.9 | 16.9 | 19.7 |
| Gas production and supply | 61,712 | 0.7 | 1.2 | 2.9 |
| Water production and supply | 141,619 | 1.3 | 0.9 | 3.9 |
| Construction | 7,676,000 | 11.4 | 0.1 | 3.4 |
| Transport and storage | 1,880,728 | 36.6 | 1.9 | 3.0 |
| Post | 73,012 | 0.6 | 0.8 | 1.7 |
| Wholesale and retail trade | 4,226,200 | 5.8 | 0.1 | 1.6 |
| Accommodation and catering | 848,139 | 2.3 | 0.3 | 2.0 |
| Financial intermediations | 1,036,100 | 0.5 | 0.1 | 0.6 |
| Real estate | 2,121,500 | 0.6 | 0.0 | 1.9 |

Table 4.29 shows 2002's energy consumption intensity. That year, the top five industries of the highest direct energy consumption intensity were petroleum processing, coking and nuclear fuel, 20.6 MJ/yuan; coal mining and washing, 19.2 MJ/yuan; electricity, thermal power production and supply, 16.9 MJ/yuan; non-metallic mineral products, 7.1 MJ/yuan; and metal smelting and rolling, 6.5 MJ/yuan.

The top five industries of the highest complete energy consumption intensity were petroleum processing, coking and nuclear fuel, 23.7 MJ/yuan; coal mining and washing, 21.6 MJ/yuan; electricity, thermal power production and supply, 19.7 Mj/yuan; non-metallic mineral products, 11.8 MJ/yuan; and metal smelting and rolling, 10.9 MJ/yuan.

**Table 4.30 Chongqing Energy Consumption Intensity, 2005**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption/ output (megajoules/ yuan) | Direct and indirect consumption intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 6,621,900 | 59.4 | 0.9 | 1.6 |
| Coal mining and washing | 1,181,611 | 83.2 | 7.0 | 8.3 |
| Extraction of crude petroleum and natural gas | 16,928 | 3.1 | 18.3 | 18.8 |
| Metals mining and dressing | 143,728 | 20.1 | 14.0 | 15.6 |
| Non-metallic minerals and other mining | 802,832 | 7.5 | 0.9 | 2.7 |
| Food manufacturing and tobacco processing | 2,686,089 | 13.4 | 0.5 | 1.9 |
| Textiles | 1,710,602 | 9.2 | 0.5 | 2.4 |
| Clothing, leather and feather products | 472,669 | 0.6 | 0.1 | 1.3 |
| Wood processing and furniture manufacturing | 933,416 | 1.0 | 0.1 | 2.3 |
| Papermaking, printing and educational and sports goods | 977,676 | 7.1 | 0.7 | 2.5 |
| Petroleum processing, coking and nuclear fuel | 226,387 | 28.8 | 12.7 | 14.3 |

| | | | | |
|---|---|---|---|---|
| Chemicals | 3,796,339 | 137.0 | 3.6 | 6.1 |
| Non-metallic mineral products | 3,007,020 | 199.4 | 6.6 | 9.4 |
| Metal smelting and rolling | 1,854,353 | 98.2 | 5.3 | 7.5 |
| Fabricated metal products | 941,944 | 3.8 | 0.4 | 2.4 |
| General, special equipment manufacturing | 1,961,958 | 17.9 | 0.9 | 2.8 |
| Transport equipment manufacturing | 9,220,600 | 28.5 | 0.3 | 2.0 |
| Electrical machinery and equipment manufacturing | 1,267,430 | 1.7 | 0.1 | 2.3 |
| Communications equipment, computers and other electronic equipment manufacturing | 1,712,041 | 0.2 | 0.0 | 1.3 |
| Measuring instruments and office machinery manufacturing | 566,226 | 1.1 | 0.2 | 2.0 |
| Artwork and other manufacturing | 546,450 | 1.5 | 0.3 | 2.2 |
| Wastes | 0 | 0.0 | 0.0 | 0.0 |
| Electricity, thermal power production and supply | 1,822,808 | 195.7 | 10.7 | 12.7 |
| Gas production and supply | 205,572 | 0.2 | 0.1 | 1.7 |
| Water production and supply | 274,120 | 1.7 | 0.6 | 3.0 |
| Construction | 9,471,700 | 12.8 | 0.1 | 3.3 |
| Transport and storage | 3,946,000 | 93.4 | 2.4 | 3.3 |
| Post | 102,000 | 0.9 | 0.9 | 1.9 |
| Wholesale and retail trade | 4,107,900 | 4.7 | 0.1 | 0.6 |
| Accommodation and catering | 1,981,700 | 7.9 | 0.4 | 1.8 |
| Financial intermediations | 1,450,500 | 1.7 | 0.1 | 0.8 |
| Real estate | 1,729,900 | 0.4 | 0.0 | 0.4 |

Table 4.30 shows 2005 energy consumption intensity. The top five industries of the highest direct energy consumption intensity in 2005 were extraction of crude petroleum and natural gas, 18.3 MJ/yuan; metals mining and dressing, 14.0 MJ/yuan; petroleum processing, coking and nuclear fuel, 12.7 MJ/yuan; electricity, thermal power production and supply, 10.7 MJ/yuan; and coal mining and washing, 7.0 MJ/yuan.

The top five industries of the highest complete energy consumption intensity were extraction of crude petroleum and natural gas, 18.8 MJ/yuan; metals mining and dressing, 15.6 MJ/yuan; petroleum processing, coking and nuclear fuel, 14.3 MJ/yuan; electricity, thermal power production and supply, 12.7 Mj/yuan; and non-metallic mineral products, 9.4 MJ/yuan.

**Table 4.31 Chongqing Energy Consumption Intensity, 2007**

| Industry | Output (10,000 yuan) | Net energy consumption (petajoules) | Energy consumption/ output (megajoules/ yuan) | Direct and indirect consumption intensity (megajoules/ yuan) |
|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 7,207,200 | 64.6 | 0.9 | 1.2 |
| Coal mining and washing | 1,688,022 | 116.1 | 6.9 | 8.7 |
| Extraction of crude petroleum and natural gas | 54,285 | 5.8 | 10.7 | 11.8 |
| Metals mining and dressing | 168,655 | 5.9 | 3.5 | 5.3 |
| Non-metallic minerals and other mining | 183,296 | 6.0 | 3.3 | 4.9 |
| Food manufacturing and tobacco processing | 4,435,214 | 15.2 | 0.3 | 1.1 |
| Textiles | 1,300,355 | 10.9 | 0.8 | 2.3 |
| Clothing, leather and feather products | 692,207 | 0.8 | 0.1 | 1.0 |
| Wood processing and furniture manufacturing | 381,999 | 1.1 | 0.3 | 1.6 |
| Papermaking, printing and educational and sports goods | 1,012,652 | 7.5 | 0.7 | 1.9 |
| Petroleum processing, coking and nuclear fuel | 287,759 | 17.4 | 6.0 | 7.5 |
| Chemicals | 5,631,077 | 144.2 | 2.6 | 4.1 |
| Non-metallic mineral products | 2,960,430 | 205.8 | 7.0 | 9.4 |
| Metal smelting and rolling | 7,786,055 | 123.6 | 1.6 | 3.1 |
| Fabricated metal products | 971,654 | 3.7 | 0.4 | 1.9 |
| General, special equipment manufacturing | 3,644,565 | 19.1 | 0.5 | 1.6 |
| Transport equipment manufacturing | 20,733,349 | 34.4 | 0.2 | 1.1 |
| Electrical machinery and equipment manufacturing | 3,006,250 | 2.4 | 0.1 | 1.4 |
| Communications equipment, computers and other electronic equipment manufacturing | 893,885 | 0.3 | 0.0 | 0.5 |
| Measuring instruments and office machinery manufacturing | 813,762 | 1.3 | 0.2 | 1.1 |
| Artwork and other manufacturing | 94,987 | 1.5 | 1.5 | 2.7 |
| Wastes | 152,609 | 0.3 | 0.2 | 1.7 |
| Electricity, thermal power production and supply | 3,376,069 | 306.9 | 9.1 | 11.9 |
| Gas production and supply | 638,584 | 0.3 | 0.1 | 1.0 |
| Water production and supply | 156,956 | 1.7 | 1.1 | 2.6 |
| Construction | 13,196,800 | 15.2 | 0.1 | 2.5 |

| | | | | |
|---|---|---|---|---|
| Transport and storage | 4,912,300 | 121.8 | 2.5 | 3.1 |
| Post | 131,800 | 0.9 | 0.7 | 1.4 |
| Wholesale and retail trade | 5,366,300 | 7.1 | 0.1 | 0.6 |
| Accommodation and catering | 2,698,500 | 17.3 | 0.6 | 1.4 |
| Financial intermediations | 1,923,200 | 1.8 | 0.1 | 0.6 |
| Real estate | 1,506,100 | 0.5 | 0.0 | 0.2 |

Table 4.31 shows 2007 energy consumption intensity. That year, the top five industries of the highest direct energy consumption intensity were extraction of crude petroleum and natural gas, 10.7 MJ/yuan; electricity, thermal power production and supply, 9.1 MJ/ yuan; non-metallic mineral products, 7.0 MJ/yuan; coal mining and washing, 6.9 MJ/yuan; and petroleum processing, coking and nuclear fuel, 6.0 MJ/yuan.

The top five industries of the highest complete energy consumption intensity were electricity, thermal power production and supply, 11.9 MJ/yuan; extraction of crude petroleum and natural gas, 11.8Mj/yuan; non-metallic mineral products, 9.4 MJ/yuan; coal mining and washing, 8.7 MJ/yuan; and petroleum processing, coking and nuclear fuel, 7.5 MJ/yuan.

#### *4.4.2.4. Time series of Energy Consumption Intensity*

From 2002 to 2007, the major energy consumption industries whose direct energy consumption intensity grew relatively rapidly were extraction of crude petroleum and natural gas; general, special equipment manufacturing; and accommodation and catering. Industries that had relatively rapid decreases for direct energy consumption intensity were communications equipment, computers and other electronic equipment manufacturing, artwork and other manufacturing, and metal smelting and rolling. Almost all industries saw declines in complete energy consumption intensity, except extraction of crude petroleum and natural gas, which saw rapid growth; financial intermediations remained stable. Real estate, communications equipment, computers and other electronic equipment manufacturing, and metal smelting and rolling were among the industries that had the most rapidly declining complete energy consumption intensity.

**Table 4.32 Chongqing Time Series of Energy Consumption Intensity, 2002-2007**

**(index, 2002 = 1)**

| Industry | Direct | | | Direct & Indirect | | |
|---|---|---|---|---|---|---|
| | 2002 | 2005 | 2007 | 2002 | 2005 | 2007 |
| Agriculture, forestry, animal husbandry and fishery | 1 | 0.97 | 1.01 | 1 | 0.81 | 0.64 |
| Coal mining and washing | 1 | 0.6 | 0.64 | 1 | 0.63 | 0.73 |
| Extraction of crude petroleum and natural gas | 1 | 12.94 | 9.57 | 1 | 9.65 | 7.75 |
| Metals mining and dressing | 1 | 14.04 | 3.76 | 1 | 6.46 | 2.33 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Non-metallic minerals and other mining | 1 | 0.22 | 0.77 | 1 | 0.37 | 0.69 |
| Food manufacturing and tobacco processing | 1 | 1.87 | 1.4 | 1 | 0.9 | 0.56 |
| Textile | 1 | 0.51 | 0.82 | 1 | 0.64 | 0.63 |
| Clothing, leather and feather products | 1 | 0.65 | 0.61 | 1 | 0.83 | 0.65 |
| Wood processing and furniture manufacturing | 1 | 0.12 | 0.35 | 1 | 0.84 | 0.63 |
| Papermaking, printing and educational and sports goods | 1 | 0.65 | 0.67 | 1 | 0.83 | 0.65 |
| Petroleum processing, coking and nuclear fuel | 1 | 0.91 | 0.51 | 1 | 0.89 | 0.55 |
| Chemical industry | 1 | 1.15 | 0.88 | 1 | 0.9 | 0.65 |
| Non-metallic mineral products | 1 | 0.98 | 1.11 | 1 | 0.84 | 0.91 |
| Metal smelting and rolling | 1 | 1.07 | 0.37 | 1 | 0.9 | 0.43 |
| Fabricated metal products | 1 | 0.87 | 0.85 | 1 | 0.63 | 0.51 |
| General, special equipment manufacturing | 1 | 4.72 | 2.79 | 1 | 1.37 | 0.81 |
| Transport equipment manufacturing | 1 | 1.91 | 1.03 | 1 | 0.8 | 0.43 |
| Electrical machinery and equipment manufacturing | 1 | 0.7 | 0.48 | 1 | 0.68 | 0.49 |
| Communications equipment, computers and other electronic equipment manufacturing | 1 | 0.02 | 0.06 | 1 | 0.82 | 0.28 |
| Measuring instruments and office machinery manufacturing | 1 | 1.85 | 1.46 | 1 | 1 | 0.55 |
| Artwork and other manufacturing | 1 | 0.06 | 0.36 | 1 | 0.32 | 0.43 |
| Wastes | 1 | 0.64 | 0.58 | 1 | 0.64 | 0.65 |
| Electricity, heat power production and supply | 1 | 0.68 | 0.62 | 1 | 0.69 | 0.7 |
| Gas production and supply | 1 | 0.07 | 0.05 | 1 | 0.62 | 0.42 |
| Water production and supply | 1 | 0.83 | 1.51 | 1 | 0.94 | 0.85 |
| Construction | 1 | 1.02 | 0.94 | 1 | 1.08 | 0.88 |
| Transport and storage | 1 | 1.41 | 1.32 | 1 | 1.28 | 1.09 |
| Wholesale and retail trade | 1 | 0.85 | 1.04 | 1 | 0.42 | 0.39 |
| Accommodation and catering | 1 | 1.51 | 2.6 | 1 | 0.93 | 0.79 |
| Financial intermediations | 1 | 2.38 | 2.14 | 1 | 1.31 | 1.08 |
| Real estate | 1 | 0.87 | 1.34 | 1 | 0.27 | 0.18 |

#### *4.4.2.5. Households' Energy Consumption*

**Table 4.33a Chongqing Households' Direct Energy Consumption, 2002**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 1,123.12 | 38.53 | 3.43 |
| Rural households | 1,691.71 | 389.6 | 23.08 |

**Table 4.33b Chongqing Households' Direct Energy Consumption, 2005**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 1,266.50 | 46.80 | 3.70 |
| Rural households | 1,532.05 | 353.67 | 23.09 |

**Table 4.33c Chongqing Households' Direct Energy Consumption, 2007**

| Sector | Population (10,000) | Energy consumption (petajoules) | Energy consumption per person (gigajoules) |
|---|---|---|---|
| Urban households | 1,361.35 | 52.43 | 3.85 |
| Rural households | 1,454.65 | 223.55 | 15.37 |

Urban households' direct energy consumption totalled 38.53 PJ in 2002 and 46.8 PJ in 2005, a 21.5% increase from 2002 and an average annual growth of 6.7%. Urban households' direct energy consumption in 2007 totalled 52.43 PJ, up 12.0% from 2005 and an average annual growth of 3.9%. Urban households' direct energy consumption per capita totalled 3.43 GJ in

2002 and 3.70 GJ in 2005, a 7.8% increase from 2002 and an average annual growth of 3.5%. Urban households' direct energy consumption per capita in 2007 totalled 3.85 GJ, a 4.2% increase from 2005 and an average annual growth of 1.4%.

With the transfer of rural population to urban areas, rural households direct energy consumption decreased between 2002 and 2007, an average annual decrease of 10.5%; the fluctuation was mainly caused by the variation in the consumption of straw, firewood and biogas.

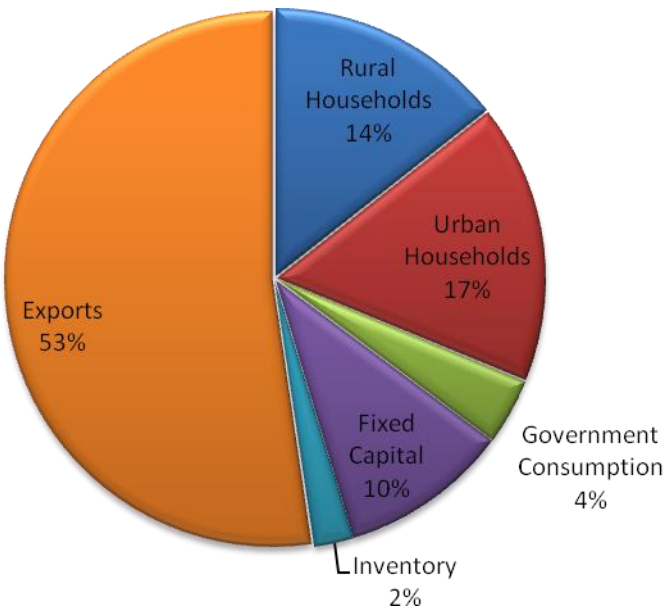
#### *4.4.2.6. Energy Consumption of Final Uses*

**Table 4.34 Chongqing Energy Consumption, Final Uses, Petajoules, 2002-2007**

| Final uses | 2002 | 2005 | 2007 |
|---|---|---|---|
| Final uses | 655.1 | 641.7 | 523.2 |
| Households' consumption | 620.3 | 608.7 | 490.2 |
| Rural households' consumption | 472.0 | 414.4 | 271.2 |
| Urban households' consumption | 148.3 | 194.3 | 219 |
| Government consumption | 34.8 | 33 | 33 |
| Capital formation | 110.2 | 343.4 | 345.7 |
| Fixed capital formation | 89.6 | 322.5 | 332.2 |
| Changes of inventories | 20.6 | 20.9 | 13.5 |
| Exports | 460.8 | 464.9 | 672.3 |
| Others | | | 8.9 |

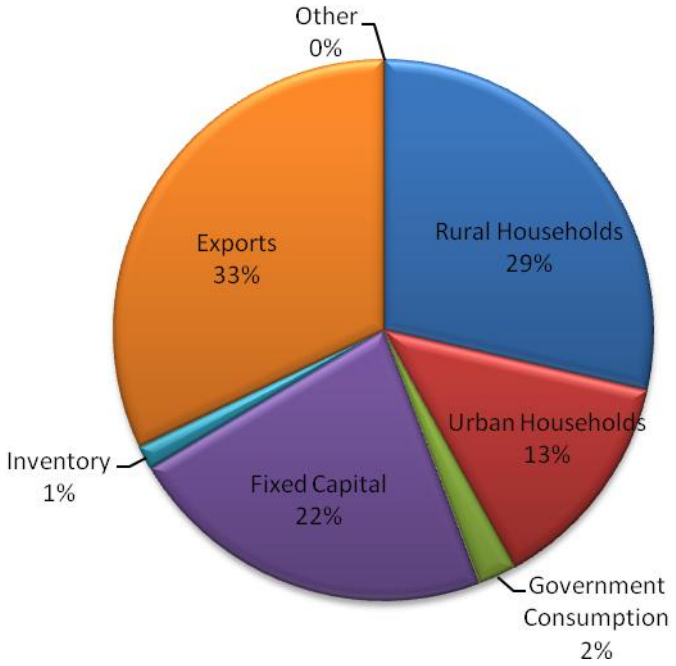
The composition of energy consumption of final uses in 2002 is presented in Figure 4.14.

**Figure 4.14 Chongqing Energy Final Use Ratio, 2002**



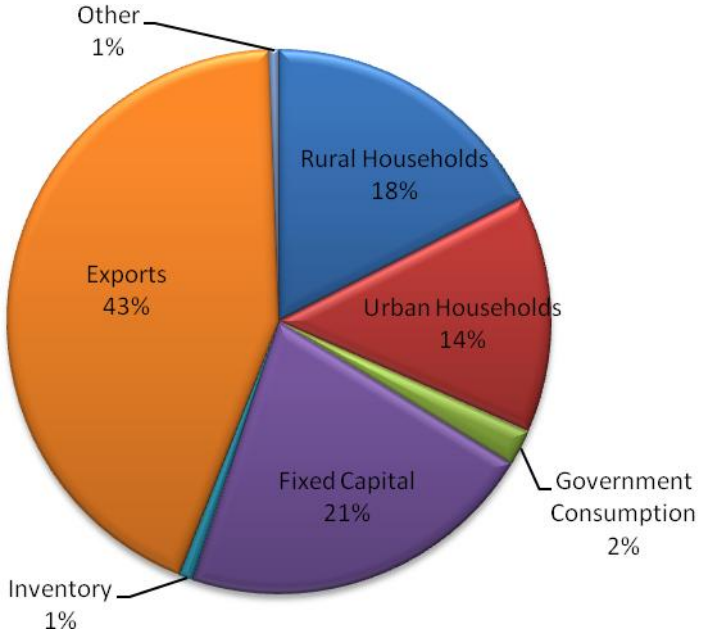
The composition of energy consumption of final uses in 2005 is presented in Figure 4.15.

**Figure 4.15 Chongqing Energy Final Use Ratio, 2005**




The composition of energy consumption of final uses in 2007 is as follows.

**Figure 4.16 Chongqing Energy Final Use Ratio, 2007**



Exports accounted for the largest percentage of final energy use, which also had a relatively larger variation from 2002 to 2007. Rural and urban households' consumptions and fixed capital formation also fluctuated over these years. The share of government consumption and changes of inventories were two relatively stable items that stayed at about 2% and 1%, respectively.

#### *4.4.2.7. Energy Consumption Intensity of Final Uses*

**Table 4.35 Chongqing Energy Consumption, Intensity of Final Uses, 2002-2007**

**(index, 2002 = 1)**

| Final uses | 2002 | 2005 | 2007 |
|---|---|---|---|
| Final uses | 1.00 | 0.72 | 0.51 |
| Households' consumption | 1.00 | 0.62 | 0.43 |
| Rural households' consumption | 1.00 | 0.90 | 0.63 |
| Urban households' consumption | 1.00 | 0.64 | 0.57 |
| Government consumption | 1.00 | 1.01 | 0.89 |
| Capital formation | 1.00 | 1.28 | 1.18 |
| Fixed capital formation | 1.00 | 1.40 | 1.30 |
| Changes of inventories | 1.00 | 0.73 | 0.53 |
| Exports | 1.00 | 1.02 | 0.76 |
| Others | | | |

From 2002 to 2007, the only increase in energy consumption intensity is found in the fixed capital formation (18%). The energy consumption intensity for the rest of components of final uses dropped at varying rates.

### 4.4.3. Chongqing Pollutant Flow Accounts

**Table 4.36 Chongqing Main Pollutant Accounts, 2005**

| Industry | COD (10,000 tonnes) | | | $SO_2$ (10,000 tonnes) | | |
|---|---|---|---|---|---|---|
| | Generation | Removal | Emissions | Generation | Removal | Emissions |
| Agriculture, forestry, animal husbandry and fishery | 77.73 | 13.22 | 25.35 | 3.12 | 0 | 3.12 |
| Coal mining and washing | 0.27 | 0.02 | 0.25 | 1.79 | 0.64 | 1.15 |
| Extraction of crude petroleum and natural gas | 0.02 | 0.01 | 0.01 | 5.61 | 5.44 | 0.16 |
| Metals mining and dressing | 0.02 | 0 | 0.02 | 0.11 | 0 | 0.11 |
| Non-metallic minerals and other mining | 0.29 | 0.19 | 0.1 | 0.14 | 0 | 0.14 |
| Food manufacturing | 1.93 | 0.85 | 1.08 | 0.9 | 0.28 | 0.63 |
| Textiles | 0.94 | 0.73 | 0.21 | 0.7 | 0.27 | 0.43 |
| Clothing, leather and feather products | 0 | 0 | 0 | 0.01 | 0 | 0.01 |
| Wood processing and furniture manufacturing | 0 | 0 | 0 | 0.02 | 0 | 0.02 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Papermaking, educational and sports goods | 1.18 | 0.34 | 0.85 | 0.23 | 0 | 0.23 |
| Electricity, steam and hot water production and supply | 2.03 | 0.83 | 1.19 | 60.4 | 24.7 | 35.69 |
| Petroleum processing and coking | 0.04 | 0.03 | 0.01 | 0.57 | 0.32 | 0.26 |
| Gas production and supply | 0 | 0 | 0 | 0 | 0 | 0 |
| Chemicals | 5.78 | 3.3 | 2.48 | 7.68 | 2.1 | 5.58 |
| Construction materials and other non-metallic mineral products | 0.73 | 0.21 | 0.53 | 17.33 | 4.55 | 12.78 |
| Metal smelting and rolling | 0.34 | 0.02 | 0.32 | 0.22 | 0.04 | 0.18 |
| Metallic products | 0.08 | 0.02 | 0.06 | 0.03 | 0 | 0.03 |
| Machinery | 0.47 | 0.2 | 0.27 | 0.86 | 0.08 | 0.78 |
| Transport equipment manufacturing | 1.51 | 0.21 | 1.3 | 0.2 | 0.06 | 0.15 |
| Electrical machinery and equipment manufacturing | 0.06 | 0 | 0.05 | 0 | 0 | 0 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.01 | 0 | 0 | 0.02 | 0 | 0.02 |
| Measuring instruments and office Machinery manufacturing | 0.01 | 0 | 0.01 | 0 | 0 | 0 |
| Tap water production and supply | 0.14 | 0.02 | 0.12 | 0 | 0 | 0 |
| Other industries | 3.56 | 0.53 | 3.03 | 11.5 | 1.58 | 9.93 |
| Construction | | | | 0.3 | 0 | 0.3 |
| Tertiary | 5.04 | 1.52 | 3.52 | 2.68 | 0 | 2.68 |
| Transport and storage | | | | 2.6 | 0 | 2.6 |
| Post | | | | 0.01 | 0 | 0.01 |
| Wholesale and retail trade | | | | 0 | 0 | 0 |
| Accommodation and catering | | | | 0.06 | 0 | 0.06 |
| Finance and insurance | | | | 0 | 0 | 0 |
| Real estate | | | | 0 | 0 | 0 |
| Other services | | | | 0.01 | 0 | 0.01 |
| Urban households | 16.49 | 4.98 | 11.51 | 0.02 | 0 | 0.02 |
| Rural households | 22.87 | 21.04 | 1.83 | 2.2 | 0 | 2.2 |

Table 4.36 shows that industrial pollutant discharge is much higher than households' pollutant discharges. In 2005, production-based COD discharge was 400,000.76 tonnes, accounting for more than 75% of the total discharge, and was 274,000.2 tonnes more than households' discharges. Production-based $SO_2$ was 743,000.8 tonnes and accounted for 97.1% of the total discharge; household emissions were only 22,000.2 tonnes.

Primary industry is the main pollution source for bodies of water. In 2005, COD discharge was at its highest volume, 253,000.5 tonnes, and accounted for 46.9% of the total COD discharge. The

second-largest pollution source is secondary industry, with a discharge of 118,000.9 thousand tonnes, accounting for 22.0% of the total COD discharge. The discharge of tertiary industry and urban households was 150,000.3 thousands tonnes, accounting for 27.8%.

By industry, industrial and other manufacturing had the greatest COD discharge at 30,000.3 tonnes. It was followed by chemicals, 24,000.8 tonnes, and transport equipment manufacturing, 13,000 tonnes. The total discharge of these three industries accounted for 57.3% of total industrial discharge.

Industrial pollution is the main source of air pollution. In 2005, $SO_2$ emissions were 682,000.8 tonnes and accounted for nearly 90% of the total $SO_2$ emissions. For $SO_2$ emissions, electricity, steam and hot water production and supply had the highest discharge level, 356,000.9 tonnes, and accounted for 52.3% of total industrial emissions. Following were non-metallic mineral products, with 127,000.8 tonnes, accounting for 18.7% of total industrial emissions, and artwork and other manufacturing, 99,000.3 tonnes, accounting for 14.5% of total industrial emissions. These three industries accounted for 85.5% of the total industrial $SO_2$ discharge and 76.2% of the total $SO_2$ discharge of Chongqing.

Discharge intensity analysis can be applied to pollutant discharge. The results are as follows.

In terms of COD discharge per value-added unit, the primary industry has the highest volume. Its discharge amounted to 0.055 tonnes/10,000 yuan and was followed by the secondary industry at 0.009 tonnes/10,000 yuan and the tertiary industry at 0.003 tonnes/10,000 yuan.

For industrial sectors, the top industries for discharge per value-added unit were artwork and other manufacturing (0.182 tonnes/10,000 yuan); papermaking, printing and educational and sports goods (0.054 tonnes/10,000 yuan); chemicals (0.024 tonnes/10,000 yuan); tap water production and supply (0.017 tonnes/10,000 yuan); electricity and thermal power production and supply (0.015 tonnes/10,000 yuan) and food manufacturing and tobacco processing (0.013 tonnes/10,000 yuan).

In terms of $SO_2$ emissions per value-added unit, the secondary industry has the highest volume. Its discharge amounted to 0.054 tonnes/10,000 yuan and was followed by the primary industry at 0.007 tonnes/10,000 yuan and the tertiary industry at 0.002 tonnes/10,000 yuan.

For industrial sectors, the top industries for discharge per value-added unit were artwork and other manufacturing, 0.597 tonnes/10,000 yuan; electricity and thermal power production and supply, 0.454 tonnes/10,000 yuan; non-metallic mineral products, 0.196 tonnes/10,000 yuan; and extraction of crude petroleum and natural gas, 0.118 tonnes/10,000 yuan.

**Table 4.37 Chongqing COD and $SO_2$ Emissions per Unit, Value-added by Industry, 2005**

| Industry | COD emissions (10,000 tonnes) | $SO_2$ emissions (10,000 tonnes) | Value-added (10,000 yuan) | COD/GDP (tonne/ 10,000 yuan) | $SO_2$/GDP (tonne/ 10,000 yuan) |
|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 25.35 | 3.12 | 4,634,000 | 0.055 | 0.007 |
| Coal mining and washing | 0.25 | 1.15 | 673,518 | 0.004 | 0.017 |

| | | | | | |
|---|---|---|---|---|---|
| Extraction of crude petroleum and natural gas | 0.01 | 0.16 | 13,543 | 0.007 | 0.118 |
| Metals mining and dressing | 0.02 | 0.11 | 55,448 | 0.004 | 0.020 |
| Non-metallic minerals and other mining | 0.1 | 0.14 | 280,991 | 0.004 | 0.005 |
| Food manufacturing and tobacco processing | 1.08 | 0.63 | 832,688 | 0.013 | 0.008 |
| Textiles | 0.21 | 0.43 | 312,613 | 0.007 | 0.014 |
| Clothing, leather and feather products | 0 | 0.01 | 70,044 | 0.000 | 0.001 |
| Wood processing and furniture manufacturing | 0 | 0.02 | 147,463 | 0.000 | 0.001 |
| Papermaking, printing and educational and sports goods | 0.85 | 0.23 | 156,624 | 0.054 | 0.015 |
| Petroleum processing, coking and nuclear fuel | 0.01 | 0.26 | 41,281 | 0.002 | 0.063 |
| Chemicals | 2.48 | 5.58 | 1,044,494 | 0.024 | 0.053 |
| Non-metallic mineral products | 0.53 | 12.78 | 651,841 | 0.008 | 0.196 |
| Metal smelting and rolling | 0.32 | 0.18 | 646,456 | 0.005 | 0.003 |
| Fabricated metal products | 0.06 | 0.03 | 212,379 | 0.003 | 0.001 |
| General, special equipment manufacturing | 0.27 | 0.78 | 561,674 | 0.005 | 0.014 |
| Transport equipment manufacturing | 1.3 | 0.15 | 2,623,839 | 0.005 | 0.001 |
| Electrical machinery and equipment manufacturing | 0.05 | 0 | 287,034 | 0.002 | 0.000 |
| Communications equipment, computers and other electronic equipment manufacturing | 0 | 0.02 | 396,457 | 0.000 | 0.001 |
| Measuring instruments and office machinery manufacturing | 0.01 | 0 | 137,931 | 0.001 | 0.000 |
| Artwork and other manufacturing | 3.03 | 9.93 | 166,282 | 0.182 | 0.597 |
| Wastes | 0 | 0 | 0 | 0 | 0 |
| Electricity, thermal power production and supply | 1.19 | 35.69 | 785,967 | 0.015 | 0.454 |
| Gas production and supply | 0 | 0 | 63,951 | 0.000 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| Water production and supply | 0.12 | 0 | 71,182 | 0.017 | 0.000 |
| Construction | 0 | 0.3 | 2,357,700 | 0.000 | 0.001 |
| Tertiary | 3.52 | 2.68 | 13,479,700 | 0.003 | 0.002 |
| Transport and storage | | 2.6 | 2,145,000 | | 0.012 |
| Post | | 0.01 | 44,700 | | 0.002 |
| Wholesale and retail trade | | 0 | 2,776,800 | | 0.000 |
| Accommodation and catering | | 0.06 | 665,600 | | 0.001 |
| Financial intermediations | | 0 | 929,800 | | 0.000 |
| Real estate | | 0 | 1,438,800 | | 0.000 |
| Other services | | 0.01 | 5,479,000 | | 0.000 |
| Urban households | 11.51 | 0.02 | | | |
| Rural households | 1.83 | 2.2 | | | |
| Total | 54.1 | 76.6 | | | |

**Table 4.38 Chongqing Emission per Unit Output by Industry, Tonnes per 10,000 Yuan, 2005**

| Industry | $SO_2$ | COD |
|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.00853 | 0.046265 |
| Coal mining and washing | 0.01739 | 0.00427 |
| Extraction of crude petroleum and natural gas | 0.09854 | 0.006733 |
| Metals mining and dressing | 0.01515 | 0.00304 |
| Non-metallic minerals and other mining | 0.01287 | 0.003603 |
| Food manufacturing and tobacco processing | 0.01149 | 0.018734 |
| Textiles | 0.01382 | 0.025805 |
| Clothing, leather and feather products | 0.00674 | 0.007931 |
| Wood processing and furniture manufacturing | 0.01015 | 0.002738 |
| Papermaking, printing and educational and sports goods | 0.01280 | 0.016563 |
| Petroleum processing, coking and nuclear fuel | 0.01687 | 0.001006 |
| Chemicals | 0.03085 | 0.011417 |
| Non-metallic mineral products | 0.05817 | 0.004593 |
| Metal smelting and rolling | 0.01448 | 0.002956 |
| Fabricated metal products | 0.00787 | 0.002494 |
| General, special equipment manufacturing | 0.01835 | 0.004019 |
| Transport equipment manufacturing | 0.00889 | 0.004031 |
| Electrical machinery and equipment manufacturing | 0.00713 | 0.002377 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.00746 | 0.002475 |
| Measuring instruments and office machinery manufacturing | 0.00901 | 0.002625 |
| Artwork and other manufacturing | 0.20836 | 0.067498 |
| Wastes | 0.00000 | 0 |

| | | |
|---|---|---|
| Electricity, thermal power production and supply | 0.20475 | 0.007901 |
| Gas production and supply | 0.00999 | 0.00204 |
| Water production and supply | 0.03346 | 0.007242 |
| Construction | 0.01731 | |
| Transport and storage | 0.01082 | |
| Post | 0.00742 | |
| Wholesale and retail trade | 0.00536 | |
| Accommodation and catering | 0.01231 | |
| Financial intermediations | 0.00493 | |
| Real estate | 0.00257 | |
| Other services | 0.00654 | |

Pollutant emission analysis from the perspective of final demand is presented in the following tables.

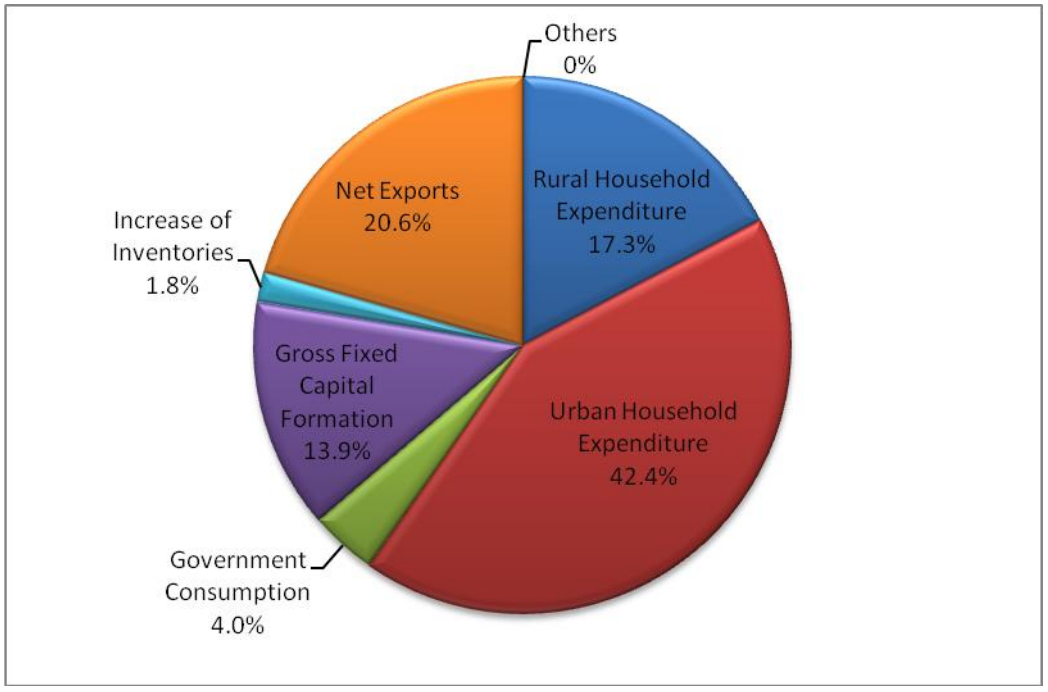
**Table 4.39 Chongqing Households' COD and $SO_2$ Emissions, 2005**

| Households | Residents (10,000) | COD emissions (10,000 tonnes) | $SO_2$ emissions (10,000 tonnes) | COD emissions per capita (kg/person) | $SO_2$ emissions per capita (kg/person) |
|---|---|---|---|---|---|
| Urban | 1,265.95 | 11.51 | 0.02 | 90.9 | 0.2 |
| Rural | 1,532.05 | 1.83 | 2.2 | 11.9 | 14.4 |

**Table 4.40 Chongqing Pollutant Emission of Final Uses, 10,000 Tonnes, 2005**

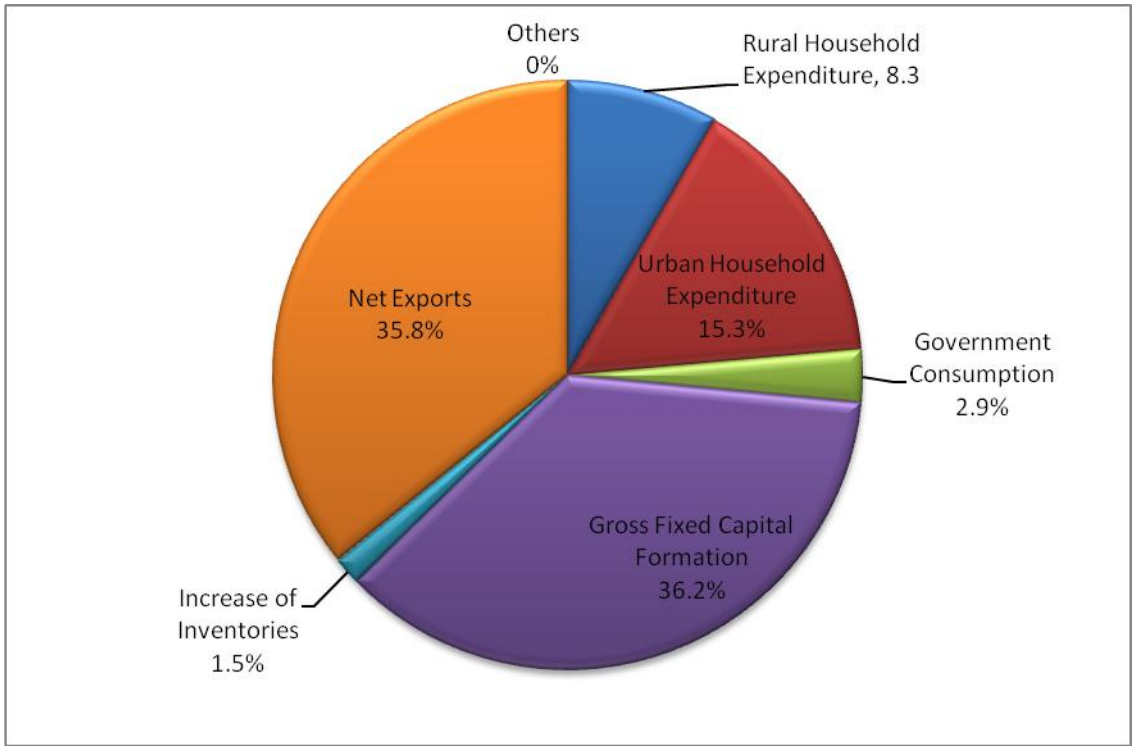
| | $SO_2$ | COD |
|---|---|---|
| Final consumption | 20.24 | 34.45 |
| Household consumption | 18.05 | 32.29 |
| Rural household consumption | 6.33 | 9.35 |
| Urban household consumption | 11.72 | 22.94 |
| Government consumption | 2.18 | 2.16 |
| Capital formation | 28.86 | 8.49 |
| Fixed capital formation | 27.73 | 7.50 |
| Changes of inventory | 1.13 | 0.98 |
| Exports | 27.50 | 11.16 |
| Others | 0.00 | 0.00 |

**Figure 4.17 Composition of COD Discharges by Final Use, Chongqing, 2005**




In terms of final uses, Figure 4.17 shows urban households' consumption-related COD discharges accounted for the largest percentage, 42.4%. Urban households were followed by exports at 20.6%. Government consumption-related and changes of inventory-related COD discharges were relatively small and accounted for 4.0% and 1.8%, respectively.

**Figure 4.18 Composition of $SO_2$ Discharges by Final Use, Chongqing, 2005**




Fixed capital formation-related emissions had the largest SO2 emissions, accounting for 36.2%. Exports-related emissions were also relatively high, 35.8%. Like COD discharge levels, government consumption-related (2.9%) and changes of inventory-related COD discharges (1.5%) were relatively small.

### 4.4.4. Mineral and Energy Resource Stock Accounts of Xinjiang

Xinjiang has a vast territory of 1.66 million square kilometres with 49 sedimentary basins of different sizes. There are more than 30 large sedimentary basins with areas totalling about 900,000 square kilometres and accounting for 56% of Xinjiang's total area and 20% of China's on-shore sedimentary areas. The total area of Tarim Basin, Junggar Basin and Turpan-Hami Basin is 738,000 square kilometres, accounting for 82.9% of Xinjiang's sedimentary basins areas. They are Xinjiang's main oil-bearing basins.

#### *4.4.4.1. Mineral and Energy Resources Stock Accounts of Xinjiang*

The monetary estimates of Xinjiang's selected minerals in 2005 are presented in the following tables.

**Table 4.41 Xinjiang Mineral and Energy Resources Stock Accounts, 2005**

| Mineral | Unit of measure | Reserve | Mineral resource value (10,000 yuan) | | |
|---|---|---|---|---|---|
| | | | Average moving year of discount rate | | |
| | | | 3 years | 4 years | 5 years |
| Crude | 10,000 | 41,378 | 4,245,137 | 4,097,652 | 4,289,229 |

| | | | | | |
|---|---|---|---|---|---|
| petroleum | tonnes | | | | |
| Natural gas | 100 million $m^3$ | 6,024 | 539,665 | 500,612 | 551,911 |
| Copper | 10,000 tonnes | 218 | 18165 | 17,358 | 18,409 |

### *4.4.4.2. Time Series of Petroleum Reserves and Extraction in Xinjiang*

Table 4.42 shows that the available extraction years of crude petroleum are almost constant.

**Table 4.42 Xinjiang Reserves and Extraction Year of Crude Petroleum, 2006 to 2010**

| Date | Extraction (10,000 tonnes) | Reserve (10,000 tonnes) | Reserve life (years) |
|---|---|---|---|
| 2006 | 2,475 | 38,549 | 16 |
| 2007 | 2,604 | 38,238 | 15 |
| 2008 | 2,715 | 40,246 | 15 |
| 2009 | 2,513 | 41,673 | 17 |
| 2010 | 2,558 | 45,288 | 18 |

**Figure 4.19 Xinjiang Petroleum Extraction, 2006 to 2010**

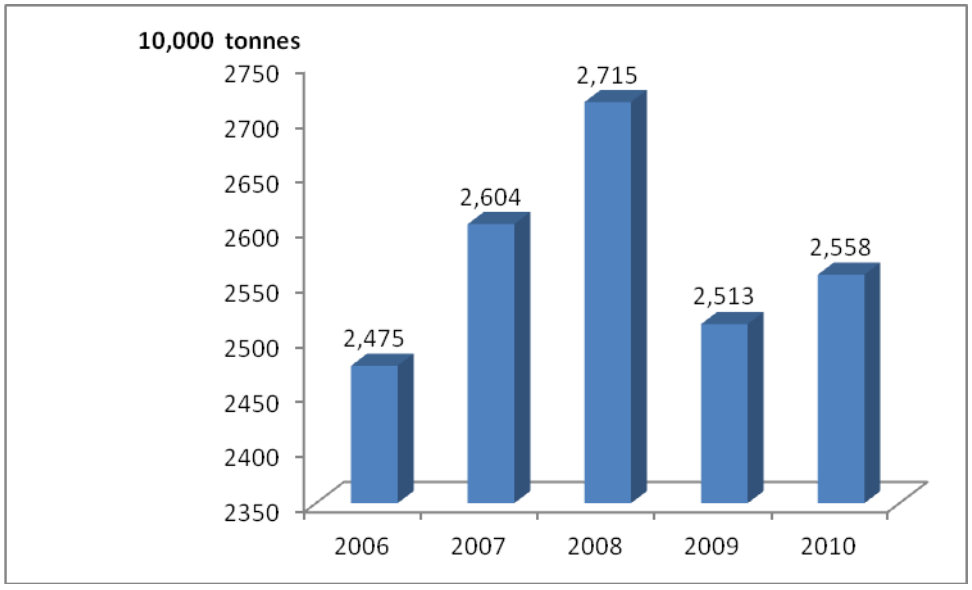



Figure 4.19 shows that oil extraction in Xinjiang follows an *N* pattern. Extraction before 2008 increased gradually, while extraction in 2009 (25.13 million tonnes) fell 27.15 million tonnes from 2008, then starts to rebound in 2010.

**Figure 4.20 Xinjiang Conditions of Petroleum Reserves, 2006 to 2010**

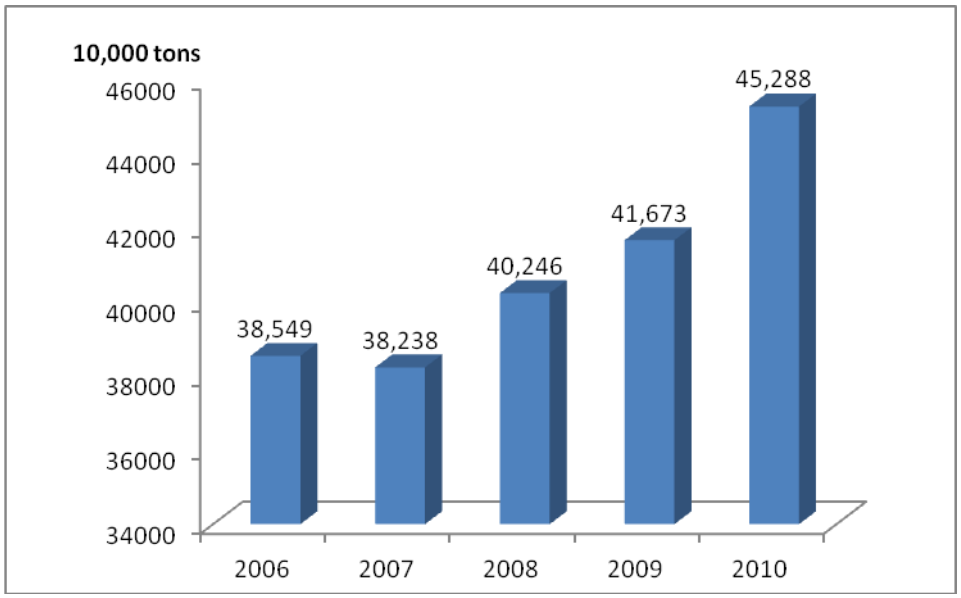



Figure 4.20 shows that Xinjiang's petroleum reserve saw an upward trend. The reserve was lowest in 2007, 382.38 million tonnes.

#### *4.4.4.3. Reserves and Extraction of Natural Gas in Xinjiang*

Data on the reserve and extraction year of Xinjiang's natural gas from 2006 to 2010 are presented in Table 4.43.

**Table 4.43 Xinjiang Reserves and Extraction Year of Natural Gas, 2006 to 2010**

| Year | Extraction (100 million $m^3$) | Reserves (100 million $m^3$) | Reserve life (years) |
|---|---|---|---|
| 2006 | 164.20 | 6,152.67 | 37 |
| 2007 | 210.33 | 6,328.11 | 30 |
| 2008 | 235.89 | 7,192.89 | 30 |
| 2009 | 245.38 | 7,975.50 | 33 |
| 2010 | 249.91 | 8,232.58 | 33 |

From 2006 to 2010, the extraction year is relatively stable because the extraction amount is almost equal to the newly proven amount. Lower extraction in 2006 explains the 37-year reserve life.

**Figure 4.21 Xinjiang Natural Gas Extraction, 2006 to 2010**

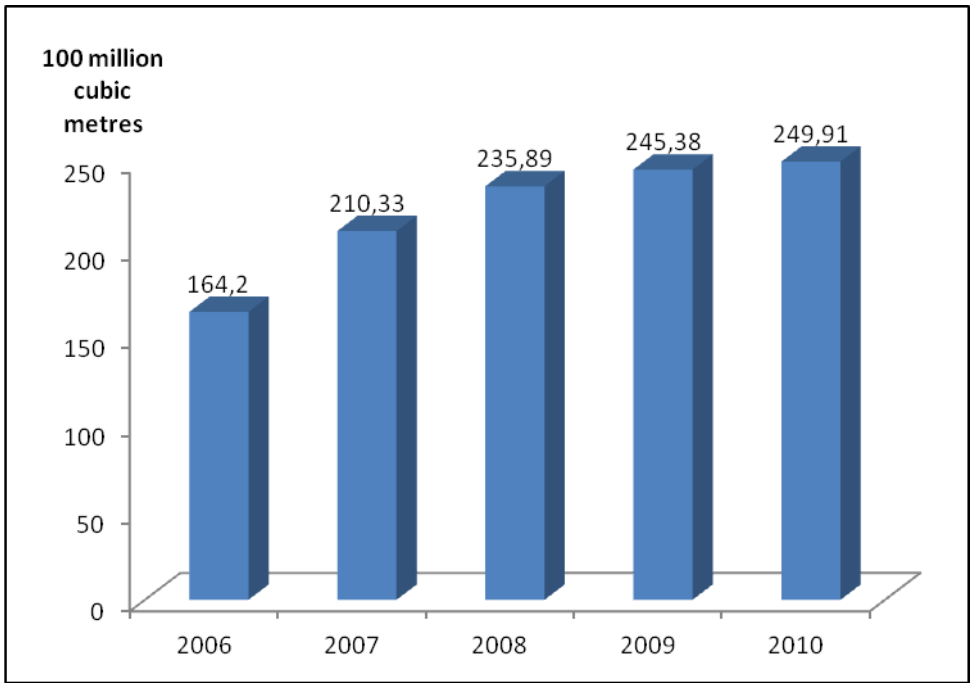
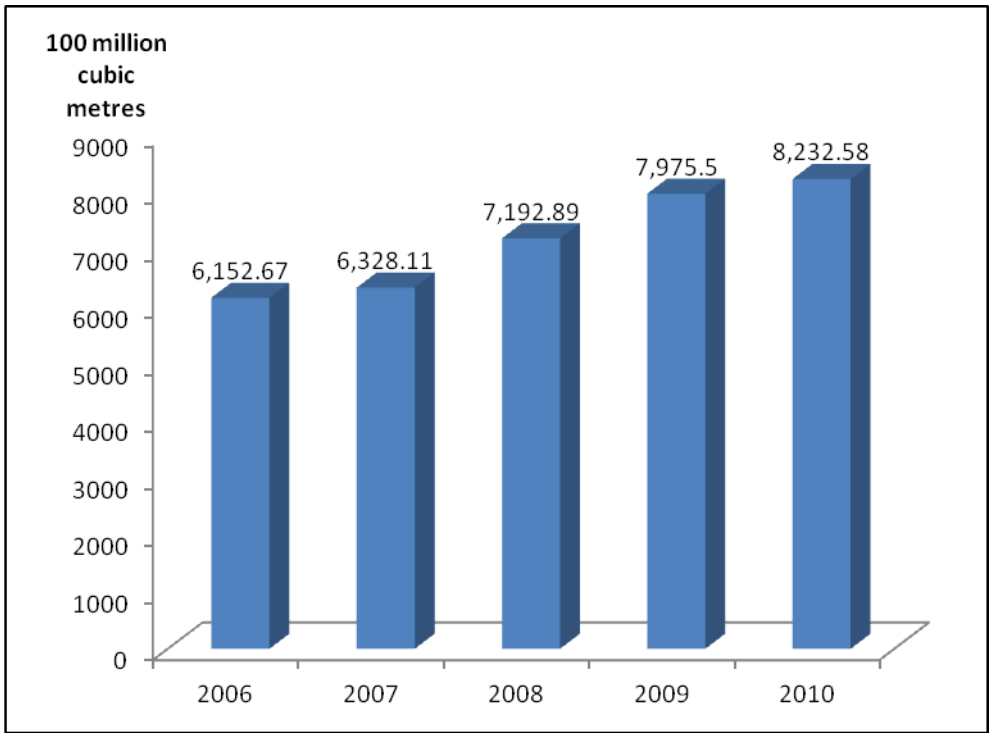



Figure 4.21 shows that, from 2006 to 2008, natural gas extraction saw an upward trend. From 2009 to 2010, the extraction amount began to stabilize.

**Figure 4.22 Natural Gas Reserves in Xinjiang from 2006 to 2010**



Xinjiang's natural gas reserves from 2006 to 2010 were relatively stable and showed a steadily rising trend.

#### *4.4.4.4. Reserves and Extraction of Copper in Xinjiang*

**Table 4.44 Xinjiang Reserve and Extraction Year of Copper, 2006 to 2010**

| Year | Extraction (10,000 tonnes) | Reserve (10,000 tonnes) | Reserve life (years) |
|---|---|---|---|
| 2006 | 6 | 224 | 35 |
| 2007 | 12 | 244 | 21 |
| 2008 | 6 | 247 | 40 |
| 2009 | 8 | 247 | 29 |
| 2010 | 12 | 247 | 20 |

China's copper resources are less abundant, with a big gap between production and demand. Recently, China's copper production had a shrinking trend. Copper consumption grows rapidly, which widens the gap between supply and demand. Hama, Altay and Ili-Bo are the top three regions ranked by proven copper reserves.

From 2006 to 2010, copper extraction was relatively intensive; 2007's output was double that of 2006, but in 2008 extraction returned to its low level of 60,000 tonnes. After 2008, extraction increased gradually, but has not changed in the last three years. Therefore, the available years of copper reserves have been declining. Without new discoveries, Xinjiang would have no copper to extract in 20 years.

# 5. Conclusion and Future Activities

The China–Canada SIMP II Environmental Accounting Project was successfully completed in six years with efforts from Canadian experts, with their meticulous guidance and help, and Chinese participants, who are always ready to learn.

Active and efficient communication and co-ordination between China and Canada during the project guarantees a smooth implementation. Because of the two countries' many differences (e.g., statistical systems and data sources), extensive communication was needed while determining which accounts to compile and which methods to use. Implementing the China–Canada SIMP II Environmental Accounting Project also required co-operation and support from China's Ministry of Land and Resources; Ministry of Environmental Protection; several departments of the National Bureau of Statistics (NBS) including the Department of Energy Statistics, the Department of Social Science and Technology Statistics, the Department of Industry Statistics and the Department of Investment Statistics; as well as two pilot regions. Throughout the project, NBS and StatCan worked together to ensure the coordination and general progress of the project, and continuous problem-solving.

## 5.1. Outcomes

The outcomes of this project are a national environmental accounting framework, a strategic plan for China's resources and the framework, an assessment of source data available, and a compilation of pilot accounts.

1- A national environmental accounting framework—China's Resources and Environmental Accounting System Framework—has been developed, in keeping with the concepts of natural capital and the SEEA 2012 handbook.

2- The Strategic Plan for China's Resources and Environmental Accounting System Framework has been developed, a joint effort composed of multiple rounds of discussions and revisions. These discussions identified key roles for the NBS, the Ministry of Environmental Protection (MEP), the Ministry of Land and Resources (MLR) and other government agencies implementing this new system (see Appendix 6).

3- A data assessment for source data was completed. The Template of Metadatabase for China was developed based on Statistics Canada's template for completing or updating the Integrated Metadatabase (IMDB). Based on the Chinese template, staff from the NBS, the MEP and the MLR jointly discussed data availability, quality and gaps in corresponding departmental environmental accounting. Chinese experts have assessed project-related data, such as energy data, mineral data, financial statement indicators and environmental statistics, and prepared the data assessment reports.

4- The NBS collaborated with the MEP, the MLR and other relevant government agencies to compile the following accounts:

- mineral and energy resource stock accounts, including those for coal, oil, natural gas, iron, copper and aluminum, in both physical and monetary terms;

- hybrid energy accounts, which are based on the existing energy statistics and energy flow accounts for oil, coal and natural gas (i.e., hybrid energy accounts compatible with the input–output supply and use table);
- pollutant emissions accounts of $SO_2$ and COD in physical terms.

Chongqing and Xinjiang were the two regions chosen for the pilot survey. Both regions have compiled their stock and flow accounts.

## 5.2. Experience Gained

Statistics Canada's advanced experience and best practices have been crucial to the project's smooth implementation. Through many years of developing environmental statistics and accounts, Statistics Canada has accumulated a rich experience and played a leading role in the world, which has benefitted China who intends to establish the same types of statistics and accounts. During the China–Canada SIMP II Environmental Accounting Project, the NBS has clarified its objectives, tasks and concrete implementation steps by conscientiously learning from Canada's successful cases and outcomes and by carefully listening to the opinions and recommendations of Canadian experts.

Chinese environmental accounting should be established based on China's actual conditions. When Statistics Canada conducted its environmental statistics and accounting, it took the basic principles and methods described in the United Nations' System of Integrated Environmental and Economic Accounts (SEEA) as its framework and adapted it to the Canadian situation. Therefore, Canada selected environmental accounting areas based on their relevance to the interests and concerns of the government and the public, socioeconomic development, as well as data availability and operational feasibility to provide useful information for government decision-making. NBS learned from StatCan by considering both theory applicability and practice operability in selecting statistical and accounting indicators. While implementing the project, the data evaluation template, required accounts and compilation methods were developed, selected and agreed to by both sides, with the help of Canadian experts. As a result, China's environmental accounts are not only in line with international standards but also properly address China's situation.

The smooth implementation of the project is the result of a feasible project plan. At the start, China and Canada together formulated a strategic plan of China's Resources and Environmental Accounting System Framework. The plan defines the project's objectives and main orientation, including the concepts, methods and information sources that the system is being built on. It also outlines project priorities and timelines, identifies the partners and their level of involvement, and establishes the work plan—including the overall project schedule.

Scientific division of labour is a key element for the project's success. The SIMP II Environmental Accounting Project has a wide range of content, including both flow and stock accounting. Some of the source data come from statistical bureaus and some from other government agencies such as the Ministry of Land and Resources and the Ministry of Environmental Protection. Relevant staff participated in the discussions and determined concepts, framework and compilation methods. During the accounts compilation stage, responsible people were designated to improve efficiency by means of clear job division.

## 5.3. Difficulties and Challenges

The greatest difficulty in conducting environmental accounting is incomplete source data. For example, while the appropriation method was used for evaluating the mineral resources, detailed information such as fees for exploration rights and mining rights by mineral were required: these are not available in existing statistics, which show only a total. Therefore, the detailed information required has to be derived by splitting the total based on other relevant indicators. In addition, some coefficients, such as some in pollutant flow accounts, were also difficult to obtain. They have to be determined based on past research outcomes, which was not only difficult but also lowered the accounts' quality.

There are two types of stock accounts: physical and monetary accounts. Some environmental asset values can be difficult to obtain since, in some cases, there are no market transactions—and therefore no market price data available; in which cases environmental accounts are reported in physical measures only. However, during the SIMP II Environmental Accounting Project, resources that were chosen did have market prices, and two valuation methods were applied: the appropriation method and net present value method. Appropriation is relatively simple but less accurate; net present value provides more reliable, realistic results, but requires more source data and is more difficult to operate. Source data must be further evaluated for each method and the advantages and disadvantages of each method must be further assessed to determine the applicable method for China.

The SIMP II Environmental Accounting Project produced three sets of hybrid flow accounts: energy, SO2 emissions and COD emissions. The compilation techniques have been well developed, and the source data are relatively good. Therefore, this type of work can be continued in the future.

## 5.4.Future Activities

Future environmental accounting activities at the NBS include evaluating the possibility of adding annual data from 2005 to 2010 for the stock accounts, data from 2010 for the hybrid energy account and data from 2007 to 2010 for the pollutant accounts. These activities would enable time series analysis—a valuable tool in meeting the policy goals of environmental accounting. The Strategic Plan (appendix 6) lists other targets for future environmental accounting in China.

## 5.5. Conclusion

Resources and environmental accounting is a new area that still faces difficult technical issues. Since the SEEA was first published in 1993 by the United Nations, several countries have conducted useful exploration and practice in this field. The SEEA has been continuously revised by experts from the United Nations and other international organizations to incorporate new progresses in both theory and practice. The latest version, the SEEA 2012, is now a U. N. statistical standard.

China's resources and environmental accounting practice has been developing for more than 10 years. It has explored several areas including energy accounts compilation, pollutant emissions accounting and water accounts compilation. Implementing the SIMP II Environmental Accounts Project has further expanded the environmental accounting practice to include compiling energy stock accounts, hybrid energy accounts and major pollutant accounts, which not only develop

new accounting areas but also provide valuable references for accounting in other areas. Smooth implementation of the SIMP II Environmental Accounting Project will certainly be a step forward for China's resources and environmental accounting.

# Appendix 1: CIMDB Template

## Part I: Survey Overview

In terms of CIMDB in Environmental Statistics Project, metadata refer to data collected from this survey, other surveys, administrative records or a combination of the three.

**1. Survey Status (choose one status from the following options)**

- In process
- On trial
- Termination
- Termination, combined with another survey
- Termination, split into two or more new surveys
- Transfer to external sectors

**2. Survey Objectives (no more than 500 words)**

In 500 words or fewer, briefly state the objectives of this survey. The objectives will help users quickly determine whether they are interested in this survey.

**3. Survey Description**

In 500 words or fewer, illustrate the survey's relevancy and create links for a detailed explanation.

This section will provide a brief introduction to the survey, including survey goals and tasks, research topics, data users and corresponding applications.

## Part II: Survey Time Frame

This section provides only time arrangement related to the survey; no release schedule is involved. Data dissemination is discussed in Part III.

**1. Frequency**

State whether the survey is monthly, annually, biennially, interim, one-time, etc.

**2. Start Time**

Specify the first year covered by the survey. This year might be different from the first year of the existing time series.

**3. End Time**

If necessary, specify the last year covered by the survey.

**4. Reference Period (Reporting Period)**

The time span or time point of a survey (e.g., quantity of pollutant discharge of enterprises from January 1 to December 31, mineral reserves of December 31, 2005).

**5. Data Reporting Schedule**

The time of data collection (e.g., next month of the reporting period, January to June, next April to September of the reporting period, next week of the reporting period, spring, early May to early June, 15 days after the year, 15 days after the month).

## Part III Data Dissemination

### 1. Reference Period

The time span or time point of the data to be released (e.g., January 1 to March 31, 2002).

### 2. Data Submission Time

The submission time of the most recent data (e.g., next month of the reporting period, January to June, next April to September of the reporting period, next week of the reporting period, spring, early May to early June, 15 days after the year, 15 days after the month).

### 3. Data Dissemination Date

The first data release date (e.g., December 7, 2001).

## Part IV Data Sources, Survey Type

Surveys are grouped into four categories. Different categories can be chosen at the same time, but only one type of survey can be specified within a category. Please check (√) the selection box corresponding to the selected survey.

| Category | Selection box | Survey type description |
|---|---|---|
| Category I | | Direct survey: the practice that directly collects data from the survey unit. |
| | | Administrative records: data that are collected by external authorities in the process of administration. These data are collected by external organizations for non-statistical reasons and conducted. |
| | | Derivatives (proxy variables, estimates, etc.): data from other projects, surveys or sources (e.g., media, annual reports) within the statistical system. |
| Category II | | Census: data collection that covers all survey units of the survey population. |
| | | Sample survey: data collection that covers some survey units of the survey population. |
| Category III | | Longitudinal survey: survey with survey units remaining constant over the years. |
| | | Cross-sectional survey: A survey with units being re-classified according to the actual situation during a survey period. |
| | | Panel survey: a combination cross-sectional–longitudinal survey that classifies the statistical units, or respondents, in a given year and keeps them constant in following survey cycles. |
| Category IV | | Mandatory: a survey for which respondents must respond to all survey questions in accordance with the *Statistics Act*. |
| | | Voluntary: a survey for which respondents may refuse to respond some or all questions. |

## Part V Survey Method

Brief Introduction: Briefly describe survey units, their scope and what they represent in about 500 words.

### 1. General Objectives (no more than 2000 words)

Describe survey units covered by the survey and corresponding rules used to specify these survey units (In China, rules such as age 15, age 15 or older, number of employees in non-institutional units, or units of certain industry with revenue over certain amount, etc.).

Summary of Changes (no more than 500 words, optional)

### 2. Sampling Design

This is not applicable to a census, where the goal is to collect data for all units in the survey population. If the number of units surveyed is over a certain threshold, this type of survey can be treated as a census. Once a type of survey is treated as a census, it will remain as a census although very few survey units are not covered.

The description, which is no more than 4,000 words, includes the framework (sampling frame), sampling units, stratification (e.g., large, medium and small sizes of industrial enterprises, different sampling methods for different stratification), sampling method, sample size, etc.

Summary of changes (no more than 500 words, optional)

### 3. Data Sources

Data sources apply to all types of surveys and are to be no more than 4,000 words. Elaborate on how to collect data, what types of survey tools and methods are used in data collection, direct survey methods, proxy responses and post-survey spot checks. Provide data sources for administrative records and some derivatives.

**Table A.1.1 Data Sources**

| **Name of Survey** | | |
|---|---|---|
| **Table of Data Sources** | | |
| **Questionnaire** | **Administrative records** | **Derivatives (e.g., media, annual reports)** |
| | | |
| | | |
| | | |
| | | |

Summary of changes (no more than 500 words, optional)

**Table A.1.2 Data-collection Tools and Methods**

| Select one of the following data-collection methods, and estimate the percentage of each method used in the survey | % |
|---|---|
| Directly from survey units | |
| Electronic data exchange | |
| Survey unit response, written | |
| Survey unit response, telephone | |
| Computer-assisted telephone interview | |
| Computer-assisted personal interview | |
| Administrative records | |
| Data from other surveys | |
| Other (please specify) | |

**4. Error Detection**

Applicable to all types of surveys. Text should be no more than 4,000 words, covering questionnaire data editing, modifying method. Briefly introduce error detection methods, identifying missing data, incorrect data, data inconsistencies and other possible errors. Briefly highlight errors in administrative records, including detailed information on verification type (e.g., verification ratio, equally, unequally), verification amount (e.g., small number, larger number), software, error detection time (e.g., whole-process editing or editing at certain stage).

Summary of changes (no more than 500 words, optional)

**5. Imputation (optional)**

Introduce the imputation process for finding substitution data for missing data and register process of inconsistent data. Provide information on whether imputation is used (yes/no), imputation ratio, imputation type (manual/automatic), imputation method (historical, hot deck, donor etc.), and imputation software. Text should be no more than 4,000 words.

Summary of changes (no more than 500 words, optional)

**6. Estimation**

Illustrate how to use collected data to derive population estimates.

Summary of changes (no more than 500 words, optional)

**7. Data Evaluation**

Data evaluation is applicable to all types of surveys. Briefly introduce the pre-dissemination data quality control process and the final product quality assessment methods based on initial survey objectives. Text should be no more than 4,000 words.

Summary of changes (No more than 500 words, optional)

**8. Confidentiality Measures**

Article 15 of the *Statistics Act* of the People's Republic of China: Statistical institution and statistical staff have obligations to keep confidential the private information of survey units collected during the survey.

In addition, specific measures to prevent disclosing survey data should be described (no more than 3,350 words). These measures include

- microdata (business, households): hidden survey units, simplify survey contents, modification
    - outlier: sensitive data (e.g., special industry or enterprise) treatment such as entry aggregation or hiding .

### 9. Revisions and Seasonal Adjustment (optional, no more than 4000 words)

For any revision or adjustment, describe its benchmarking test, calendarization (data movement during the spring festival) or seasonal adjustment and the corresponding impact.

Summary of changes (no more than 500 words, optional)

## Part VI Data Accuracy

Data accuracy insurance measures, including statistical error, coefficient of variance of key variables, response rate, other indicators that reflect data accuracy, and bias and error detection.

## Part VII Documentation (supplementary documents and notes)

Prepare a file on concepts, definitions, methods and survey data quality, such as a guide or manual, standards and lists. Include any appropriate supplementary documents and notes.

## Part VIII Survey Questionnaire (see tables in Appendix 1)

Attach an example of the questionnaire.

# Appendix 2: Data Evaluation Report

Six resources and environmental accounts will be compiled in accordance with the SIMP II project plan: physical pollutant flow accounts, physical mineral stock accounts, monetary mineral stock accounts, physical energy stock accounts, monetary energy stock accounts and monetary energy flow accounts (hybrid energy accounts). NBS started to evaluate the existing data, either from subject matter statistics or from administrative records, for compiling the above six accounts in 2006. The evaluation process and the preliminary considerations for filling the data gap are presented as follows.

## 1. Data Evaluation Process

The process of evaluating data can be divided into three stages: preliminary evaluation, detailed evaluation and data gap determination. The first two stages have now been completed.

In the preliminary evaluation stage, NBS organized a seminar for relevant ministries and organizations on evaluating data energy, mineral and pollutant emissions. A report titled *Data Evaluation Report on SIMPI II Environmental Statistics Project* was submitted.

The general evaluation reports

- analyzed energy-production and –consumption statistics and pointed out key problems
- described data sources for mineral resource reserves statistics, statistical coverage and definitions for statistical indicators
- described reference periods, statistical coverage, reporting times, data resources and statistical coverage of environmental statistics: data relevance, availability, timeliness, completeness, accuracy, and consistency were commented, and possible problems for future's compilation were discussed
- commented on data relevance, availability, timeliness, completeness, accuracy and consistency: possible problems for future compilation were discussed for data sources and reference periods.

Statistics Canada commented on the report and raised several specific points.

In April 2007, a Canadian group of experts visited NBS. The two teams of experts began a detailed evaluation of resources and environmental statistics related to the project, covering topics such as mineral and energy reserve data, corresponding financial indicators of industrial enterprises and environmental statistics. Meanwhile, a detailed review was given to China's First National Pollution Census and the input–output survey.

From June 22 to 23, 2007, the environmental statistics project team organized a meeting on data evaluation with participants from the NBS, Ministry of Environmental Protection and Ministry of Land and Resources. IMDB, the Canadian metadata template, was discussed during the meeting and a Chinese version of the IMDB was developed based on the actual situation of surveys, data collection and dissemination in China's land and resources and environmental statistics. A data evaluation plan and operational arrangement was also prepared for the next step.

From the end of June to early August 2007, seven reports were written by experts.. The reports were

1. Data Evaluation Report on Metadata of Mineral (including Energy) Resource Stocks
2. Data Evaluation Report on Metadata of Energy Statistics
3. Data Evaluation Report on Metadata of Financial Indicators of Industrial Enterprises
4. Data Evaluation Report on Metadata of Environmental Statistics
5. Data Evaluation Report on Metadata of Investment Statistics
6. Data Evaluation Report on Metadata of input–output Accounting
7. Data Gaps for Compiling Pollutant Flow Accounts.

## 2. Data Gaps and Recommended Solutions

A relatively clear understanding of existing data for compiling mineral, energy and pollutant emission accounts has been formed through the detailed review of existing resources and environmental statistics. Evaluating various aspects, the most problematic data gap is the stock data of produced assets needed to compile monetary mineral and energy stock accounts. In terms of the net present value method recommended in the early stages of the project by Statistics Canada, produced assets classified at the ISIC 4-digit level, were needed to calculate resource rents. Currently, the internationally accepted method for measuring capital stock is the perpetual inventory method, which requires the following source data:

- time series of fixed capital investment (fixed capital formation) at historical prices
- net present value of the fixed capital stock of base year at historical prices
- service life for different types of fixed assets by industry
- time series of price indexes of fixed capital investment (1990=100)
- depreciation rates of different types of fixed assets.
- In some instances, a capital stock valuation by type of mineral is unavailable because of a lack of time series of fixed capital investments by industry at the ISIC 4-digit level. Thus, it is impossible to use the net present value method to valuate the stocks of mineral and energy resources. Through multiple round discussions with Canadian experts, Statistics Canada provided some new documents on August 10, 2007, where different stock valuation methods adopted by different counties were introduced

# Appendix 3: Concordance between ISIC and IO Classifications

**Table A.2.1 Concordance between ISIC and IO Classifications**

| | Industries in pollutant flow accounts (Same as 2005 input–output classification) | Industries in environmental statistics |
|---|---|---|
| 1 | Agriculture, forestry, animal husbandry and fishery | |
| 2 | Coal mining and washing | Coal mining and washing |
| 3 | Extraction of crude petroleum and natural gas | Extraction of crude petroleum and natural gas |
| 4 | Metals mining and dressing | Ferrous metal ore mining and dressing |
| | | Non-ferrous metal ore mining and dressing |
| 5 | Non-metallic minerals and other mining | Non-metallic minerals mining and dressing |
| | | Other mining |
| 6 | Food manufacturing and tobacco processing | Agro-food processing |
| | | Food |
| | | Beverage manufacturing |
| | | Tobacco products |
| 7 | Textiles | Textiles |
| 8 | Clothing, leather and feather products | Clothing, footwear, headgear manufacturing |
| | | Leather, fur, feather and its products |
| 9 | Wood processing and furniture manufacturing | Wood processing and wood, rattan, palm and grass products |
| | | Furniture manufacturing |
| 10 | Papermaking, printing and educational and sports goods | Paper making and paper products |
| | | Printing and record medium reproducing |
| | | Cultural, educational and sporting goods manufacturing |
| 11 | Petroleum processing, coking and nuclear fuel | Petroleum processing, coking and nuclear fuel |
| 12 | Chemicals | Chemicals and chemical products |
| | | Pharmaceutical manufacturing |
| | | Chemical fibres manufacturing |
| | | Rubber products |
| | | Plastic products |
| 13 | Non-metallic mineral products | Non-metallic mineral products |
| 14 | Metal smelting and rolling | Ferrous metal smelting and rolling |
| | | Non-ferrous metal smelting and rolling |
| 15 | Fabricated metal products | Fabricated metal products |
| 16 | General, special equipment manufacturing | General equipment manufacturing |
| | | Special equipment manufacturing |
| 17 | Transport equipment manufacturing | Transport equipment manufacturing |
| 18 | Electrical machinery and equipment manufacturing | Electrical machinery and equipment manufacturing |
| 19 | Communications equipment, computers and other electronic equipment manufacturing | Communications equipment, computers and other electronic equipment manufacturing |
| 20 | Measuring instruments and office machinery manufacturing | Measuring instruments and office machinery manufacturing |

| | | |
|---|---|---|
| 21 | Other manufacturing | Artwork and other manufacturing |
| | | Other industries |
| 22 | Wastes | Waste resources and materials recycling and processing |
| 23 | Electricity, thermal power production and supply | Electricity, thermal power production and supply |
| 24 | Gas production and supply | Gas production and supply |
| 25 | Water production and supply | Water production and supply |

## Appendix 4: China's Total Energy Consumption

**Table 4.3a Total Energy Consumption, Petajoules, 2002**

| Industry | Raw coal | Fine washed coal | Other coal | Shaped coal | Coke | Coke oven gas |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 192.35 | 0.00 | 1.34 | 0.00 | 20.95 | 0.00 |
| Coal mining and washing | 4,889.67 | 31.13 | 15.47 | 0.00 | 13.67 | 1.07 |
| Extraction of crude petroleum and natural gas | 34.03 | 0.00 | 0.21 | 0.00 | 1.43 | 0.00 |
| Metals mining and dressing | 38.29 | 0.11 | 1.09 | 0.00 | 22.99 | 0.00 |
| Non-metallic minerals and other mining | 84.90 | 0.46 | 0.06 | 0.00 | 9.45 | 0.00 |
| Food manufacturing and tobacco processing | 538.18 | 12.00 | 7.90 | 0.00 | 9.39 | 0.43 |
| Textiles | 318.68 | 0.63 | 0.65 | 0.00 | 1.30 | 0.52 |
| Clothing, leather and feather products | 47.01 | 0.10 | 0.00 | 0.00 | 1.06 | 0.00 |

**Table 4.3b Total Energy Consumption, Petajoules, 2002**

| Industry | Other gas | Other coking products | Crude oil | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Papermaking, printing and educational and sports goods | 338.31 | 2.83 | 4.10 | 0.00 | 1.06 | 0.05 |
| Petroleum processing, coking and nuclear fuel | 1,546.80 | 3,166.28 | 6.44 | 0.00 | 13.15 | 22.58 |
| Chemicals | 1,534.69 | 21.07 | 18.40 | 0.00 | 342.52 | 20.81 |
| Non-metallic mineral products | 1,879.90 | 28.99 | 175.50 | 0.00 | 106.47 | 5.62 |
| Metal smelting and rolling | 913.04 | 85.76 | 28.78 | 0.00 | 2,714.42 | 277.87 |
| Fabricated metal products | 54.51 | 2.73 | 0.11 | 0.00 | 43.70 | 0.25 |
| General, special equipment manufacturing | 131.95 | 18.37 | 1.08 | 0.00 | 85.02 | 1.04 |
| Transport equipment manufacturing | 138.62 | 0.55 | 0.20 | 0.00 | 12.42 | 0.20 |
| Electrical machinery and equipment manufacturing | 38.33 | 0.30 | 0.17 | 0.00 | 3.00 | 0.55 |
| Communications equipment, computers and other electronic equipment manufacturing | 15.01 | 0.22 | 0.01 | 0.00 | 0.14 | 0.80 |
| Measuring instruments and office machinery manufacturing | 7.06 | 0.01 | 0.00 | 0.00 | 1.63 | 0.00 |
| Artwork and other manufacturing | 62.45 | 0.07 | 0.77 | 28.02 | 8.04 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wastes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity, thermal power production and supply | 16,439.58 | 36.09 | 136.10 | 0.00 | 0.00 | 30.96 |
| Gas production and supply | 168.78 | 99.73 | 1.23 | 0.00 | 39.06 | 10.74 |
| Water production and supply | 6.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Construction | 104.54 | 0.86 | 0.86 | 0.00 | 6.65 | 0.00 |
| Transport and storage | 146.44 | 0.88 | 0.88 | 0.11 | 3.23 | 0.00 |
| Post | 3.66 | 0.02 | 0.02 | 0.00 | 0.01 | 0.00 |
| Information transmission, computer services and software | 24.48 | 0.15 | 0.15 | 0.02 | 0.01 | 0.00 |
| Wholesale and retail trade | 114.64 | 0.01 | 0.37 | 1.04 | 10.62 | 2.49 |
| Accommodation and catering | 144.62 | 0.01 | 0.47 | 1.32 | 1.49 | 0.35 |
| Financial intermediations | 3.10 | 0.00 | 0.06 | 0.01 | 0.27 | 0.34 |
| Real estate | 33.39 | 0.00 | 0.59 | 0.13 | 0.23 | 0.29 |
| Leasing and business services | 5.74 | 0.00 | 0.10 | 0.02 | 0.18 | 0.23 |
| Tourism | 0.04 | 0.00 | 0.00 | 0.00 | 0.03 | 0.04 |
| Scientific research | 4.97 | 0.00 | 0.09 | 0.02 | 0.09 | 0.11 |
| Comprehensive technical services | 8.50 | 0.00 | 0.15 | 0.03 | 0.16 | 0.21 |
| Other social services | 66.81 | 0.00 | 1.19 | 0.27 | 1.13 | 1.44 |
| Education | 83.69 | 0.00 | 1.49 | 0.34 | 0.26 | 0.33 |
| Health, social security and social welfare | 15.35 | 0.00 | 0.27 | 0.06 | 0.11 | 0.14 |
| Culture, sports and entertainment | 1.97 | 0.00 | 0.03 | 0.01 | 0.16 | 0.21 |
| Public administration and social organizations | 29.32 | 0.00 | 0.52 | 0.12 | 0.88 | 1.12 |
| Agriculture, forestry, animal husbandry and fishery | 0.00 | 0.00 | 0.00 | 43.74 | 0.60 | 349.33 |
| Coal mining and washing | 0.62 | 1.69 | 0.50 | 14.73 | 3.17 | 25.59 |
| Extraction of crude petroleum and natural gas | 0.00 | 0.00 | 187.41 | 19.14 | 0.21 | 84.28 |
| Metals mining and dressing | 0.00 | 0.00 | 0.00 | 5.41 | 0.71 | 13.67 |
| Non-metallic minerals and other mining | 0.00 | 0.51 | 0.00 | 11.67 | 0.22 | 21.19 |
| Food manufacturing and tobacco processing | 0.10 | 0.00 | 0.56 | 40.54 | 0.29 | 32.11 |
| Textiles | 0.16 | 0.00 | 0.02 | 17.34 | 2.30 | 17.22 |
| Clothing, leather and feather products | 0.01 | 0.00 | 0.05 | 6.30 | 0.35 | 13.05 |
| Papermaking, printing and educational and sports goods | 0.02 | 0.00 | 0.25 | 12.25 | 5.34 | 22.66 |
| Petroleum processing, coking and nuclear fuel | 3.34 | 7.11 | 9,070.48 | 7.77 | 9.00 | 35.19 |
| Chemicals | 2.64 | 16.99 | 30.70 | 43.70 | 5.96 | 85.64 |
| Non-metallic mineral products | 6.72 | 7.45 | 4.05 | 27.26 | 0.91 | 138.97 |
| Metal smelting and rolling | 320.68 | 49.26 | 6.10 | 20.67 | 3.75 | 57.46 |
| Fabricated metal products | 0.25 | 0.03 | 0.02 | 9.68 | 1.15 | 20.40 |
| General, special equipment manufacturing | 5.00 | 0.20 | 0.14 | 24.28 | 2.49 | 20.11 |
| Transport equipment | 1.07 | 0.10 | 0.02 | 9.69 | 3.51 | 19.66 |

| | | | | | | |
|---|---|---|---|---|---|---|
| manufacturing | | | | | | |
| Electrical machinery and equipment manufacturing | 0.40 | 0.00 | 0.21 | 8.90 | 0.17 | 11.76 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.08 | 0.00 | 0.00 | 4.75 | 0.13 | 27.59 |
| Measuring instruments and office machinery manufacturing | 0.02 | 0.00 | 0.00 | 1.48 | 0.17 | 5.36 |
| Artwork and other manufacturing | 0.38 | 0.00 | 0.19 | 6.33 | 6.03 | 11.13 |
| Wastes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity, thermal power production and supply | 108.96 | 0.06 | 38.63 | 11.92 | 0.26 | 126.62 |
| Gas production and supply | 1.06 | 0.80 | 0.00 | 0.72 | 0.00 | 5.14 |
| Water production and supply | 0.00 | 0.00 | 0.00 | 1.19 | 0.02 | 1.10 |
| Construction | 0.00 | 0.00 | 1.76 | 48.38 | 0.00 | 103.21 |
| Transport and storage | 0.15 | 0.00 | 6.54 | 686.54 | 306.88 | 1,553.86 |
| Post | 0.01 | 0.00 | 0.00 | 2.69 | 1.20 | 6.09 |
| Information transmission, computer services and software | 0.03 | 0.00 | 0.00 | 1.40 | 0.63 | 3.17 |
| Wholesale and retail trade | 1.07 | 0.00 | 0.00 | 28.03 | 4.91 | 41.44 |
| Accommodation and catering | 2.34 | 0.00 | 0.05 | 3.93 | 0.69 | 5.82 |
| Financial intermediations | 0.00 | 0.00 | 0.00 | 28.59 | 1.32 | 24.19 |
| Real estate | 0.00 | 0.00 | 0.00 | 24.12 | 1.11 | 20.40 |
| Leasing and business services | 0.00 | 0.00 | 0.03 | 19.57 | 0.90 | 16.55 |
| Tourism | 0.00 | 0.00 | 0.00 | 3.69 | 0.17 | 3.12 |
| Scientific research | 0.00 | 0.00 | 0.01 | 9.11 | 0.42 | 7.70 |
| Comprehensive technical services | 0.00 | 0.00 | 0.01 | 17.18 | 0.79 | 14.53 |
| Other social services | 0.00 | 0.00 | 0.21 | 120.38 | 5.56 | 101.83 |
| Education | 0.00 | 0.00 | 0.00 | 27.74 | 1.28 | 23.46 |
| Health, social security and social welfare | 0.00 | 0.00 | 0.03 | 11.98 | 0.55 | 10.14 |
| Culture, sports and entertainment | 0.00 | 0.00 | 0.08 | 17.29 | 0.80 | 14.63 |
| Public administration and social organizations | 0.00 | 0.00 | 0.17 | 93.47 | 4.32 | 79.07 |

**Table 4.3c Total Energy Consumption, Petajoules, 2002**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal power |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.46 |
| Coal mining and washing | 0.00 | 0.04 | 0.00 | 1.14 | 0.00 | 6.61 |
| Extraction of crude petroleum and natural gas | 60.94 | 16.10 | 29.26 | 14.93 | 230.91 | 47.14 |
| Metals mining and dressing | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 |
| Non-metallic minerals and other mining | 0.44 | 0.02 | 0.00 | 0.00 | 0.04 | 14.35 |
| Food manufacturing and tobacco processing | 11.03 | 3.15 | 0.00 | 4.69 | 1.48 | 54.88 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Textiles | 26.95 | 3.67 | 0.10 | 2.53 | 3.07 | 84.28 |
| Clothing, leather and feather products | 7.41 | 1.09 | 0.00 | 0.76 | 0.00 | 3.12 |
| Wood processing and furniture manufacturing | 1.51 | 0.25 | 0.00 | 0.03 | 0.00 | 11.63 |
| Papermaking, printing and educational and sports goods | 9.56 | 1.30 | 0.15 | 2.27 | 1.40 | 64.99 |
| Petroleum processing, coking and nuclear fuel | 110.26 | 102.88 | 180.27 | 918.35 | 43.79 | 245.42 |
| Chemicals | 166.39 | 62.58 | 49.73 | 540.22 | 391.24 | 387.12 |
| Non-metallic mineral products | 141.34 | 40.32 | 2.76 | 11.21 | 13.28 | 15.86 |
| Metal smelting and rolling | 127.65 | 1.27 | 0.00 | 12.58 | 11.23 | 212.13 |
| Fabricated metal products | 5.40 | 6.12 | 0.00 | 1.34 | 3.11 | 3.00 |
| General, special equipment manufacturing | 7.66 | 1.99 | 0.00 | 3.66 | 9.26 | 21.80 |
| Transport equipment manufacturing | 4.54 | 0.98 | 0.00 | 1.69 | 6.79 | 28.02 |
| Electrical machinery and equipment manufacturing | 5.16 | 6.23 | 0.04 | 0.62 | 3.87 | 7.47 |
| Communications equipment, computers and other electronic equipment manufacturing | 6.04 | 1.95 | 0.09 | 0.34 | 18.33 | 3.20 |
| Measuring instruments and office machinery manufacturing | 0.06 | 0.06 | 0.00 | 0.22 | 0.11 | 1.52 |
| Artwork and other manufacturing | 2.80 | 1.42 | 0.00 | 18.51 | 4.97 | 18.96 |
| Wastes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity, thermal power production and supply | 538.82 | 1.03 | 61.53 | 27.79 | 110.11 | 67.15 |
| Gas production and supply | 8.30 | 8.63 | 0.03 | 0.53 | 7.32 | 3.80 |
| Water production and supply | 0.01 | 0.00 | 0.00 | 0.25 | 0.08 | 0.40 |
| Construction | 7.99 | 6.40 | 0.00 | 274.41 | 2.65 | 1.82 |
| Transport and storage | 354.20 | 13.47 | 0.00 | 0.00 | 45.00 | 4.61 |
| Post | 1.39 | 0.05 | 0.00 | 0.00 | 0.00 | 0.28 |
| Information transmission, computer services and software | 0.72 | 0.03 | 0.00 | 0.00 | 0.00 | 3.22 |
| Wholesale and retail trade | 4.51 | 27.54 | 0.00 | 0.00 | 0.00 | 9.71 |
| Accommodation and catering | 0.63 | 3.87 | 0.00 | 0.00 | 23.75 | 4.95 |
| Financial intermediations | 0.61 | 1.23 | 0.00 | 0.00 | 0.00 | 2.92 |
| Real estate | 0.52 | 1.04 | 0.00 | 0.00 | 0.00 | 1.87 |
| Leasing and business services | 0.42 | 0.84 | 0.00 | 0.00 | 0.00 | 1.76 |
| Tourism | 0.08 | 0.16 | 0.00 | 0.00 | 0.00 | 0.12 |
| Scientific research | 0.19 | 0.39 | 0.00 | 0.00 | 0.00 | 0.64 |
| Comprehensive technical services | 0.37 | 0.74 | 0.00 | 0.00 | 0.00 | 1.00 |
| Other social services | 2.58 | 5.17 | 0.00 | 0.00 | 0.00 | 2.91 |
| Education | 0.59 | 1.19 | 0.00 | 0.00 | 0.00 | 8.38 |
| Health, social security and social welfare | 0.26 | 0.51 | 0.00 | 0.00 | 0.00 | 2.27 |
| Culture, sports and entertainment | 0.37 | 0.74 | 0.00 | 0.00 | 0.00 | 0.75 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Public administration and social organizations | 2.00 | 4.01 | 0.00 | 0.00 | 0.00 | 4.97 |

**Table 4.3d Total Energy Consumption, Petajoules, 2002**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 218.00 | 0.00 | 0.00 | 0.00 | 0.00 | 826.95 |
| Coal mining and washing | 187.30 | 0.00 | 0.00 | 0.00 | 0.00 | 5,192.39 |
| Extraction of crude petroleum and natural gas | 131.23 | 0.00 | 0.00 | 0.00 | 0.00 | 857.22 |
| Metals mining and dressing | 61.41 | 0.00 | 0.00 | 0.00 | 0.00 | 143.88 |
| Non-metallic minerals and other mining | 43.55 | 0.00 | 0.00 | 0.00 | 0.00 | 186.85 |
| Food manufacturing and tobacco processing | 153.18 | 0.00 | 0.00 | 0.00 | 0.00 | 869.91 |
| Textiles | 170.51 | 0.00 | 0.00 | 0.00 | 0.00 | 649.91 |
| Clothing, leather and feather products | 35.55 | 0.00 | 0.00 | 0.00 | 0.00 | 115.86 |
| Wood processing and furniture manufacturing | 18.32 | 0.00 | 0.00 | 0.00 | 0.00 | 107.36 |
| Papermaking, printing and educational and sports goods | 131.72 | 0.00 | 0.00 | 0.00 | 0.00 | 598.27 |
| Petroleum processing, coking and nuclear fuel | 124.14 | 22.15 | 0.00 | 0.00 | 0.00 | 15,635.40 |
| Chemicals | 718.04 | 0.00 | 0.00 | 0.00 | 0.00 | 4,438.43 |
| Non-metallic mineral products | 330.28 | 0.00 | 0.00 | 0.00 | 0.00 | 2,936.90 |
| Metal smelting and rolling | 806.12 | 0.00 | 0.00 | 0.00 | 0.00 | 5,648.78 |
| Fabricated metal products | 105.92 | 0.00 | 0.00 | 0.00 | 0.00 | 257.73 |
| General, special equipment manufacturing | 114.29 | 0.00 | 0.00 | 0.00 | 0.00 | 448.35 |
| Transport equipment manufacturing | 97.07 | 0.00 | 0.00 | 0.00 | 0.00 | 325.16 |
| Electrical machinery and equipment manufacturing | 48.80 | 0.00 | 0.00 | 0.00 | 0.00 | 135.98 |
| Communications equipment, computers and other electronic equipment manufacturing | 56.38 | 0.00 | 0.00 | 0.00 | 0.00 | 135.06 |
| Measuring instruments and office machinery manufacturing | 12.03 | 0.00 | 0.00 | 0.00 | 0.00 | 29.73 |
| Artwork and other manufacturing | 85.80 | 90.97 | 0.00 | 0.00 | 0.00 | 346.84 |
| Wastes | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Electricity, thermal power production and supply | 541.53 | 75.45 | 0.00 | 0.00 | 0.00 | 18,352.60 |
| Gas production and supply | 13.87 | 0.00 | 0.00 | 0.00 | 0.00 | 369.74 |
| Water production and supply | 52.52 | 0.00 | 0.00 | 0.00 | 0.00 | 61.76 |
| Construction | 55.43 | 0.00 | 0.00 | 0.00 | 0.00 | 614.94 |
| Transport and storage | 61.94 | 0.00 | 0.00 | 0.00 | 0.00 | 3,184.73 |
| Post | 3.72 | 0.00 | 0.00 | 0.00 | 0.00 | 19.15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Information transmission, computer services and software | 43.29 | 0.00 | 0.00 | 0.00 | 0.00 | 77.29 |
| Wholesale and retail trade | 119.11 | 0.00 | 0.00 | 0.00 | 0.00 | 365.50 |
| Accommodation and catering | 60.69 | 0.00 | 0.00 | 0.00 | 0.00 | 254.98 |
| Financial intermediations | 27.75 | 0.00 | 0.00 | 0.00 | 0.00 | 90.38 |
| Real estate | 17.73 | 0.00 | 0.00 | 0.00 | 0.00 | 101.42 |
| Leasing and business services | 16.74 | 0.00 | 0.00 | 0.00 | 0.00 | 63.09 |
| Tourism | 1.15 | 0.00 | 0.00 | 0.00 | 0.00 | 8.61 |
| Scientific research | 6.04 | 0.00 | 0.00 | 0.00 | 0.00 | 29.77 |
| Comprehensive technical services | 9.47 | 0.00 | 0.00 | 0.00 | 0.00 | 53.14 |
| Other social services | 27.60 | 0.00 | 0.00 | 0.00 | 0.00 | 337.07 |
| Education | 79.60 | 0.00 | 0.00 | 0.00 | 0.00 | 228.36 |
| Health, social security and social welfare | 21.56 | 0.00 | 0.00 | 0.00 | 0.00 | 63.25 |
| Culture, sports and entertainment | 7.14 | 0.00 | 0.00 | 0.00 | 0.00 | 44.18 |
| Public administration and social organizations | 47.20 | 0.00 | 0.00 | 0.00 | 0.00 | 267.16 |

**Table 4.4a Total Energy Consumption, Petajoules, 2005**

| Industry | Raw coal | Fine washed coal | Other washed coal | Shaped coal | Coke | Coke oven gas |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 311.19 | 0.00 | 2.12 | 0.00 | 18.05 | 0.00 |
| Coal mining and washing | 10,202.84 | 46.16 | 24.45 | 0.00 | 10.46 | 1.88 |
| Extraction of crude petroleum and natural gas | 35.57 | 0.01 | 0.00 | 0.00 | 0.08 | 0.00 |
| Metals mining and dressing | 48.37 | 3.38 | 0.43 | 0.00 | 28.44 | 0.91 |
| Non-metallic minerals and other mining | 94.47 | 2.81 | 0.28 | 0.00 | 3.66 | 0.00 |
| Food manufacturing and tobacco processing | 582.01 | 7.26 | 6.50 | 0.00 | 4.24 | 0.06 |
| Textiles | 412.60 | 3.00 | 0.71 | 0.00 | 0.85 | 0.56 |
| Clothing, leather and feather products | 66.40 | 1.03 | 0.17 | 0.00 | 0.47 | 0.05 |
| Wood processing and furniture manufacturing | 94.87 | 0.90 | 0.19 | 0.00 | 0.81 | 0.00 |
| Papermaking, printing and educational and sports goods | 422.72 | 8.46 | 4.87 | 0.00 | 2.29 | 0.30 |
| Petroleum processing, coking and nuclear fuel | 1,417.39 | 7,279.54 | 9.92 | 0.00 | 18.69 | 79.34 |
| Chemicals | 1,986.34 | 97.57 | 15.21 | 0.00 | 503.31 | 15.03 |
| Non-metallic mineral products | 3,243.35 | 89.87 | 317.61 | 0.00 | 59.22 | 6.42 |
| Metal smelting and rolling | 1,415.04 | 223.28 | 18.44 | 0.00 | 6,164.06 | 552.57 |
| Fabricated metal products | 63.72 | 2.19 | 0.46 | 0.00 | 22.27 | 0.52 |
| General, special equipment manufacturing | 166.04 | 11.20 | 0.67 | 0.00 | 149.11 | 2.64 |
| Transport equipment manufacturing | 134.55 | 1.86 | 0.37 | 0.00 | 26.70 | 0.55 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical machinery and equipment manufacturing | 34.66 | 1.05 | 0.10 | 0.00 | 4.76 | 0.53 |
| Communications equipment, computers and other electronic equipment manufacturing | 22.81 | 0.48 | 0.02 | 0.00 | 0.19 | 0.13 |
| Measuring instruments and office machinery manufacturing | 4.91 | 0.01 | 0.10 | 0.00 | 0.78 | 0.02 |
| Artwork and other manufacturing | 64.50 | 3.24 | 0.39 | 38.08 | 1.08 | 0.01 |
| Wastes | 1.06 | 0.01 | 0.17 | 0.00 | 0.66 | 0.00 |
| Electricity, thermal power production and supply | 24,646.42 | 24.97 | 181.20 | 0.00 | 1.74 | 89.30 |
| Gas production and supply | 184.33 | 125.55 | 1.35 | 0.00 | 65.29 | 12.69 |
| Water production and supply | 7.82 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Construction | 124.30 | 0.90 | 0.47 | 0.00 | 5.23 | 0.00 |
| Transport and storage | 166.43 | 0.00 | 0.07 | 0.00 | 0.30 | 0.00 |
| Post | 2.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wholesale and retail trade | 154.46 | 0.00 | 0.41 | 1.33 | 16.06 | 4.32 |
| Accommodation and catering | 190.96 | 0.00 | 0.51 | 1.64 | 2.17 | 0.58 |
| Financial intermediation and Insurance | 3.87 | 0.00 | 0.06 | 0.01 | 0.15 | 0.37 |
| Real estate | 26.82 | 0.00 | 0.40 | 0.06 | 0.08 | 0.20 |
| Other services | 314.57 | 0.00 | 4.70 | 0.68 | 1.93 | 4.81 |

**Table 4.4b Total Energy Consumption, Petajoules, 2005**

| Industry | Other gas | Other coking products | Crude oil | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.00 | 0.00 | 0.00 | 68.74 | 0.69 | 548.65 |
| Coal mining and washing | 2.42 | 0.99 | 0.00 | 6.27 | 1.40 | 26.40 |
| Extraction of crude petroleum and natural gas | 0.00 | 0.00 | 210.61 | 11.07 | 0.07 | 79.27 |
| Metals mining and dressing | 0.06 | 0.00 | 0.00 | 3.40 | 0.93 | 19.94 |
| Non-metallic minerals and other mining | 0.00 | 0.00 | 0.00 | 1.58 | 0.35 | 26.44 |
| Food manufacturing and tobacco processing | 0.27 | 0.00 | 0.28 | 12.18 | 0.56 | 40.67 |
| Textiles | 0.04 | 0.00 | 0.08 | 7.21 | 0.88 | 17.04 |
| Clothing, leather and feather products | 0.06 | 0.00 | 0.11 | 5.85 | 0.46 | 17.89 |
| Wood processing and furniture manufacturing | 0.01 | 0.00 | 0.06 | 3.21 | 0.57 | 8.28 |
| Papermaking, printing and educational and sports goods | 0.06 | 0.00 | 0.25 | 7.92 | 0.86 | 17.95 |
| Petroleum processing, coking and nuclear fuel | 4.66 | 14.16 | 12,208.26 | 8.98 | 0.89 | 21.54 |
| Chemicals | 5.34 | 49.54 | 81.08 | 30.85 | 3.50 | 85.25 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Non-metallic mineral products | 15.04 | 13.39 | 5.93 | 10.35 | 1.32 | 107.86 |
| Metal smelting and rolling | 502.03 | 52.24 | 0.19 | 11.76 | 1.83 | 61.59 |
| Fabricated metal products | 0.25 | 0.00 | 0.03 | 7.38 | 1.14 | 22.25 |
| General, special equipment manufacturing | 12.87 | 0.00 | 0.11 | 18.11 | 3.23 | 35.35 |
| Transport equipment manufacturing | 0.69 | 0.00 | 0.06 | 15.04 | 4.77 | 29.09 |
| Electrical machinery and equipment manufacturing | 0.70 | 0.00 | 0.11 | 8.88 | 0.69 | 19.63 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.11 | 0.00 | 0.17 | 4.54 | 0.35 | 19.81 |
| Measuring instruments and office machinery manufacturing | 0.00 | 0.00 | 0.02 | 1.49 | 0.49 | 3.55 |
| Artwork and other manufacturing | 0.14 | 0.00 | 0.00 | 2.96 | 0.30 | 4.92 |
| Wastes | 0.19 | 0.00 | 0.00 | 0.14 | 0.02 | 0.49 |
| Electricity, thermal power production and supply | 184.39 | 0.47 | 9.11 | 8.77 | 0.14 | 178.96 |
| Gas production and supply | 3.68 | 0.60 | 0.11 | 1.02 | 0.01 | 4.12 |
| Water production and supply | 0.00 | 0.00 | 0.00 | 1.27 | 0.01 | 1.02 |
| Construction | 0.00 | 0.00 | 0.00 | 74.14 | 0.00 | 164.91 |
| Transport and storage | 0.19 | 0.00 | 0.00 | 1,043.97 | 409.17 | 2,506.01 |
| Post | 0.00 | 0.00 | 0.00 | 2.65 | 1.04 | 6.37 |
| Wholesale and retail trade | 1.64 | 0.00 | 0.00 | 49.10 | 1.39 | 43.61 |
| Accommodation and catering | 3.64 | 0.00 | 0.00 | 6.62 | 0.19 | 5.88 |
| Financial intermediation and insurance | 0.00 | 0.00 | 0.00 | 29.88 | 1.08 | 26.53 |
| Real estate | 0.00 | 0.00 | 0.00 | 16.36 | 0.59 | 14.53 |
| Other services | 0.00 | 0.00 | 0.00 | 383.68 | 13.91 | 340.70 |

**Table 4.4c Total Energy Consumption, Petajoules, 2005**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal power |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.28 | 1.75 | 0.00 | 0.00 | 0.00 | 0.54 |
| Coal mining and washing | 2.07 | 0.13 | 0.00 | 0.45 | 6.10 | 2.95 |
| Extraction of crude petroleum and natural gas | 11.36 | 1.41 | 17.99 | 8.04 | 189.94 | 51.83 |
| Metals mining and dressing | 0.35 | 0.05 | 0.00 | 0.03 | 0.14 | 0.01 |
| Non-metallic minerals and other mining | 0.25 | 0.03 | 0.00 | 0.06 | 0.10 | 12.69 |
| Food manufacturing and tobacco processing | 17.73 | 3.43 | 5.27 | 1.08 | 9.01 | 82.80 |
| Textiles | 16.71 | 1.39 | 0.08 | 0.89 | 2.17 | 146.47 |
| Clothing, leather and feather products | 7.32 | 0.44 | 0.00 | 0.31 | 0.45 | 7.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wood processing and furniture manufacturing | 1.14 | 0.64 | 0.00 | 0.04 | 0.57 | 5.30 |
| Papermaking, printing and educational and sports goods | 12.78 | 5.15 | 0.00 | 0.14 | 2.69 | 99.69 |
| Petroleum processing, coking and nuclear fuel | 100.67 | 85.51 | 311.80 | 1,423.39 | 52.55 | 284.40 |
| Chemicals | 148.73 | 52.29 | 27.37 | 631.99 | 547.96 | 552.08 |
| Non-metallic mineral products | 207.12 | 36.86 | 0.96 | 16.73 | 92.69 | 6.25 |
| Metal smelting and rolling | 108.80 | 8.54 | 0.00 | 33.40 | 53.08 | 229.44 |
| Fabricated metal products | 6.16 | 6.07 | 0.00 | 0.22 | 2.67 | 2.03 |
| General, special equipment manufacturing | 6.26 | 3.74 | 0.00 | 1.49 | 17.57 | 22.89 |
| Transport equipment manufacturing | 4.59 | 4.08 | 0.00 | 1.06 | 18.80 | 26.17 |
| Electrical machinery and equipment manufacturing | 5.30 | 6.88 | 0.27 | 0.84 | 4.81 | 7.54 |
| Communications equipment, computers and other electronic equipment manufacturing | 10.79 | 5.03 | 0.00 | 0.03 | 18.58 | 8.51 |
| Measuring instruments and office machinery manufacturing | 0.08 | 0.12 | 0.00 | 0.19 | 0.32 | 1.12 |
| Artwork and other manufacturing | 1.11 | 1.42 | 0.00 | 0.93 | 0.16 | 5.49 |
| Wastes | 0.36 | 0.02 | 0.00 | 0.04 | 0.00 | 0.04 |
| Electricity, thermal power production and supply | 547.10 | 0.09 | 55.24 | 94.36 | 214.52 | 104.56 |
| Gas production and supply | 6.24 | 43.23 | 0.64 | 0.04 | 16.34 | 2.18 |
| Water production and supply | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.64 |
| Construction | 5.93 | 3.17 | 0.00 | 385.92 | 5.80 | 4.65 |
| Transport and storage | 525.97 | 23.55 | 0.00 | 0.00 | 119.79 | 10.22 |
| Post | 1.34 | 0.06 | 0.00 | 0.00 | 0.00 | 0.40 |
| Wholesale and retail trade | 10.14 | 43.79 | 0.00 | 0.00 | 0.00 | 16.75 |
| Accommodation and catering | 1.37 | 5.91 | 0.00 | 0.00 | 42.01 | 5.31 |
| Financial intermediation and insurance | 0.40 | 0.90 | 0.00 | 0.00 | 0.00 | 3.00 |
| Real estate | 0.22 | 0.49 | 0.00 | 0.00 | 0.09 | 1.24 |
| Other services | 5.19 | 11.56 | 0.00 | 0.00 | 35.42 | 37.14 |

**Table 4.4d Total Energy Consumption, Petajoules, 2005**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 279.17 | 0.00 | 0.00 | 0.00 | 0.00 | 1,231.18 |
| Coal mining and washing | 211.99 | 0.00 | 0.00 | 0.00 | 0.00 | 10,546.95 |
| Extraction of crude petroleum and natural gas | 138.57 | 0.00 | 0.00 | 0.00 | 0.00 | 755.84 |
| Metals mining and dressing | 130.64 | 0.00 | 0.00 | 0.00 | 0.00 | 237.09 |
| Non-metallic minerals and other mining | 51.13 | 0.00 | 0.00 | 0.00 | 0.00 | 193.84 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Food manufacturing and tobacco processing | 172.82 | 0.00 | 0.00 | 0.00 | 0.00 | 946.17 |
| Textiles | 296.15 | 0.00 | 0.00 | 0.00 | 0.00 | 906.84 |
| Clothing, leather and feather products | 51.23 | 0.00 | 0.00 | 0.00 | 0.00 | 160.09 |
| Wood processing and furniture manufacturing | 46.70 | 0.00 | 0.00 | 0.00 | 0.00 | 163.30 |
| Papermaking, printing and educational and sports goods | 183.75 | 0.00 | 0.00 | 0.00 | 0.00 | 769.90 |
| Petroleum processing, coking and nuclear fuel | 112.73 | 10.40 | 0.00 | 0.00 | 0.00 | 23,444.80 |
| Chemicals | 1,096.02 | 0.00 | 0.00 | 0.00 | 0.00 | 5,929.50 |
| Non-metallic mineral products | 510.45 | 0.00 | 0.00 | 0.00 | 0.00 | 4,741.42 |
| Metal smelting and rolling | 1,446.88 | 0.00 | 0.00 | 0.00 | 0.00 | 10,883.17 |
| Fabricated metal products | 182.41 | 0.00 | 0.00 | 0.00 | 0.00 | 319.78 |
| General, special equipment manufacturing | 189.75 | 0.00 | 0.00 | 0.00 | 0.00 | 641.02 |
| Transport equipment manufacturing | 108.14 | 0.00 | 0.00 | 0.00 | 0.00 | 376.53 |
| Electrical machinery and equipment manufacturing | 88.39 | 0.00 | 0.00 | 0.00 | 0.00 | 185.13 |
| Communications equipment, computers and other electronic equipment manufacturing | 117.91 | 0.00 | 0.00 | 0.00 | 0.00 | 209.46 |
| Measuring instruments and office machinery manufacturing | 15.29 | 0.00 | 0.00 | 0.00 | 0.00 | 28.48 |
| Artwork and other manufacturing | 99.11 | 152.94 | 0.00 | 0.00 | 0.00 | 376.79 |
| Wastes | 2.39 | 0.00 | 0.00 | 0.00 | 0.00 | 5.58 |
| Electricity, thermal power production and supply | 716.25 | 87.28 | 0.00 | 0.00 | 0.00 | 27,144.86 |
| Gas production and supply | 10.74 | 0.00 | 0.00 | 0.00 | 0.00 | 478.15 |
| Water production and supply | 67.32 | 0.00 | 0.00 | 0.00 | 0.00 | 78.33 |
| Construction | 84.12 | 0.00 | 0.00 | 0.00 | 0.00 | 859.55 |
| Transport and storage | 148.96 | 0.00 | 0.00 | 0.00 | 0.00 | 4,954.64 |
| Post | 5.79 | 0.00 | 0.00 | 0.00 | 0.00 | 20.65 |
| Wholesale and retail trade | 205.39 | 0.00 | 0.00 | 0.00 | 0.00 | 548.39 |
| Accommodation and catering | 65.14 | 0.00 | 0.00 | 0.00 | 0.00 | 331.93 |
| Financial intermediation and insurance | 34.95 | 0.00 | 0.00 | 0.00 | 0.00 | 101.22 |
| Real estate | 14.40 | 0.00 | 0.00 | 0.00 | 0.00 | 75.49 |
| Other services | 432.84 | 0.00 | 0.00 | 0.00 | 0.00 | 1587.13 |

**Table 4.5a Total Energy Consumption, Petajoules, 2007**

| Industry | Raw coal | Fine washed coal | Other coal | Shaped coal | Coke | Coke oven gas |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 313.36 | 0.00 | 1.74 | 0.00 | 16.27 | 0.00 |
| Coal mining and washing | 12,345.91 | 45.69 | 25.92 | 0.00 | 12.54 | 1.92 |
| Extraction of crude petroleum and natural gas | 36.49 | 0.01 | 0.00 | 0.00 | 0.10 | 0.00 |
| Metals mining and dressing | 51.50 | 3.33 | 0.42 | 0.00 | 36.27 | 1.03 |
| Non-metallic minerals and other mining | 104.51 | 2.76 | 0.35 | 0.00 | 4.52 | 0.00 |
| Food manufacturing and tobacco processing | 625.91 | 6.99 | 6.94 | 0.00 | 4.63 | 0.06 |
| Textiles | 454.25 | 3.20 | 0.75 | 0.00 | 1.02 | 0.58 |
| Clothing, leather and feather products | 70.13 | 1.09 | 0.18 | 0.00 | 0.57 | 0.05 |
| Wood processing and furniture manufacturing | 96.80 | 0.87 | 0.19 | 0.00 | 0.96 | 0.00 |
| Papermaking, printing and educational and sports goods | 430.28 | 8.37 | 4.78 | 0.00 | 3.06 | 0.31 |
| Petroleum processing, coking and nuclear fuel | 1,513.15 | 8,858.27 | 10.00 | 0.00 | 23.27 | 85.30 |
| Chemicals | 2,181.25 | 96.65 | 15.74 | 0.00 | 657.12 | 16.00 |
| Non-metallic mineral products | 3,384.61 | 86.07 | 337.65 | 0.00 | 74.45 | 6.63 |
| Metal smelting and rolling | 1,533.06 | 227.64 | 19.16 | 0.00 | 7,073.10 | 597.31 |
| Fabricated metal products | 64.66 | 2.17 | 0.48 | 0.00 | 27.42 | 0.48 |
| General, special equipment manufacturing | 169.62 | 11.05 | 0.71 | 0.00 | 186.85 | 2.62 |
| Transport equipment manufacturing | 137.88 | 1.84 | 0.39 | 0.00 | 33.57 | 0.66 |
| Electrical machinery and equipment manufacturing | 35.17 | 1.04 | 0.10 | 0.00 | 5.39 | 0.58 |
| Communications equipment, computers and other electronic equipment manufacturing | 23.14 | 0.48 | 0.02 | 0.00 | 0.23 | 0.15 |
| Measuring instruments and office machinery manufacturing | 4.98 | 0.01 | 0.10 | 0.00 | 0.96 | 0.02 |
| Artwork and other manufacturing | 65.45 | 3.21 | 0.40 | 51.04 | 1.18 | 0.01 |
| Wastes | 1.07 | 0.01 | 0.17 | 0.00 | 0.73 | 0.00 |
| Electricity, thermal power production and supply | 30,431.53 | 12.94 | 312.72 | 0.00 | 2.12 | 155.42 |
| Gas production and supply | 205.25 | 156.51 | 1.35 | 0.00 | 76.80 | 11.54 |
| Water production and supply | 7.93 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Construction | 126.64 | 0.79 | 0.56 | 0.00 | 4.97 | 0.00 |
| Transport and storage | 143.88 | 5.83 | 1.29 | 0.00 | 0.15 | 0.00 |
| Post | 2.03 | 0.08 | 0.02 | 0.00 | 0.00 | 0.00 |
| Information transmission, computer services and software | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wholesale and retail trade | 180.89 | 0.00 | 0.66 | 2.09 | 11.81 | 2.74 |
| Accommodation and catering | 202.73 | 0.00 | 0.74 | 2.35 | 8.38 | 1.94 |
| Financial intermediations | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 | 0.39 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Real estate | 3.72 | 0.00 | 0.09 | 0.01 | 0.20 | 0.43 |
| Leasing and business services | 25.90 | 0.00 | 0.62 | 0.09 | 0.52 | 1.11 |
| Research and development | 3.66 | 0.00 | 0.09 | 0.01 | 0.02 | 0.04 |
| Comprehensive technical services | 9.30 | 0.00 | 0.22 | 0.03 | 0.13 | 0.27 |
| Water conservation, environment and public facilities management industry | 15.32 | 0.00 | 0.37 | 0.05 | 0.10 | 0.20 |
| Household services and other services | 67.79 | 0.00 | 1.63 | 0.23 | 0.26 | 0.56 |
| Education | 75.94 | 0.00 | 1.83 | 0.25 | 0.26 | 0.55 |
| Health, social security and social welfare | 108.59 | 0.00 | 2.61 | 0.36 | 0.09 | 0.19 |
| Culture, sports and entertainment | 5.65 | 0.00 | 0.14 | 0.02 | 0.04 | 0.10 |
| Public administration and social organizations | 86.14 | 0.00 | 2.07 | 0.29 | 0.54 | 1.15 |

**Table 4.5b Total Energy Consumption, Petajoules, 2007**

| Industry | Other gas | Other coking products | Crude oil | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.00 | 0.00 | 0.00 | 74.42 | 0.40 | 519.92 |
| Coal mining and washing | 4.28 | 1.42 | 0.00 | 7.88 | 1.17 | 28.12 |
| Extraction of crude petroleum and natural gas | 0.01 | 0.00 | 238.13 | 13.35 | 0.06 | 84.38 |
| Metals mining and dressing | 0.17 | 0.00 | 0.00 | 4.01 | 0.77 | 21.23 |
| Non-metallic minerals and other mining | 0.00 | 0.00 | 0.00 | 1.85 | 0.28 | 28.16 |
| Food manufacturing and tobacco processing | 0.65 | 0.00 | 0.27 | 14.11 | 0.47 | 42.93 |
| Textiles | 0.07 | 0.00 | 0.08 | 8.61 | 0.74 | 18.35 |
| Clothing, leather and feather products | 0.12 | 0.00 | 0.12 | 6.84 | 0.38 | 19.30 |
| Wood processing and furniture manufacturing | 0.02 | 0.00 | 0.07 | 3.76 | 0.48 | 9.35 |
| Papermaking, printing and educational and sports goods | 0.13 | 0.00 | 0.25 | 8.78 | 0.72 | 19.12 |
| Petroleum processing, coking and nuclear fuel | 13.66 | 24.31 | 13,802.40 | 10.51 | 0.74 | 22.59 |
| Chemicals | 14.82 | 82.33 | 92.09 | 35.44 | 2.49 | 92.36 |
| Non-metallic mineral products | 54.93 | 23.84 | 6.13 | 13.60 | 1.11 | 116.11 |
| Metal smelting and rolling | 1,374.59 | 69.15 | 0.17 | 14.56 | 1.53 | 65.57 |
| Fabricated metal products | 0.60 | 0.00 | 0.02 | 10.23 | 0.95 | 23.70 |
| General, special equipment manufacturing | 46.01 | 0.00 | 0.13 | 23.53 | 2.67 | 37.64 |
| Transport equipment manufacturing | 1.63 | 0.00 | 0.05 | 17.78 | 3.26 | 30.83 |
| Electrical machinery and equipment manufacturing | 1.64 | 0.00 | 0.10 | 9.99 | 0.57 | 21.11 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Communications equipment, computers and other electronic equipment manufacturing | 0.26 | 0.00 | 0.17 | 5.77 | 0.32 | 21.48 |
| Measuring instruments and office machinery manufacturing | 0.02 | 0.00 | 0.01 | 2.01 | 0.40 | 3.78 |
| Artwork and other manufacturing | 0.35 | 0.00 | 0.00 | 2.42 | 0.24 | 5.38 |
| Wastes | 0.42 | 0.00 | 0.00 | 0.15 | 0.01 | 0.55 |
| Electricity, thermal power production and supply | 150.39 | 0.73 | 7.39 | 8.22 | 0.11 | 123.56 |
| Gas production and supply | 12.21 | 0.79 | 0.11 | 1.13 | 0.01 | 4.64 |
| Water production and supply | 0.00 | 0.00 | 0.00 | 1.40 | 0.01 | 1.17 |
| Construction | 0.00 | 0.00 | 0.00 | 77.02 | 0.00 | 185.03 |
| Transport and storage | 0.19 | 0.00 | 0.00 | 1,117.79 | 483.35 | 3,043.28 |
| Post | 0.00 | 0.00 | 0.00 | 4.68 | 2.02 | 12.73 |
| Information transmission, computer services and software | 0.03 | 0.00 | 0.00 | 3.04 | 1.31 | 8.27 |
| Wholesale and retail trade | 1.20 | 0.00 | 0.00 | 33.18 | 1.23 | 33.41 |
| Accommodation and catering | 6.87 | 0.00 | 0.00 | 23.56 | 0.88 | 23.72 |
| Financial intermediations | 0.00 | 0.00 | 0.00 | 38.02 | 1.47 | 33.88 |
| Real estate | 0.00 | 0.00 | 0.00 | 41.75 | 1.61 | 37.20 |
| Leasing and business services | 0.00 | 0.00 | 0.00 | 107.26 | 4.14 | 95.57 |
| Research and development | 0.00 | 0.00 | 0.00 | 3.52 | 0.14 | 3.14 |
| Comprehensive technical services | 0.00 | 0.00 | 0.00 | 26.06 | 1.00 | 23.22 |
| Water conservation, environment and public facilities management industry | 0.00 | 0.00 | 0.00 | 19.68 | 0.76 | 17.54 |
| Household services and other services | 0.00 | 0.00 | 0.00 | 54.48 | 2.10 | 48.55 |
| Education | 0.00 | 0.00 | 0.00 | 53.07 | 2.05 | 47.29 |
| Health, social security and social welfare | 0.00 | 0.00 | 0.00 | 17.94 | 0.69 | 15.99 |
| Culture, sports and entertainment | 0.00 | 0.00 | 0.00 | 9.18 | 0.35 | 8.18 |
| Public administration and social organizations | 0.00 | 0.00 | 0.00 | 111.28 | 4.29 | 99.16 |

**Table 4.5c Total Energy Consumption, Petajoules, 2007**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal power |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.42 | 3.13 | 0.00 | 0.00 | 0.00 | 0.82 |
| Coal mining and washing | 2.06 | 0.12 | 0.00 | 0.74 | 7.83 | 3.77 |
| Extraction of crude petroleum and natural gas | 11.33 | 1.66 | 15.31 | 10.72 | 249.14 | 27.06 |
| Metals mining and dressing | 0.35 | 0.04 | 0.00 | 0.13 | 0.20 | 0.01 |
| Non-metallic minerals and other mining | 0.24 | 0.21 | 0.00 | 0.75 | 0.14 | 16.56 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Food manufacturing and tobacco processing | 15.80 | 3.29 | 4.12 | 0.51 | 10.48 | 108.86 |
| Textiles | 15.65 | 1.28 | 0.10 | 0.88 | 2.69 | 199.67 |
| Clothing, leather and feather products | 7.60 | 0.32 | 0.00 | 0.22 | 0.51 | 10.15 |
| Wood processing and furniture manufacturing | 0.99 | 0.63 | 0.00 | 0.04 | 0.79 | 7.35 |
| Papermaking, printing and educational and sports goods | 12.81 | 3.68 | 0.00 | 0.21 | 3.71 | 118.30 |
| Petroleum processing, coking and nuclear fuel | 103.85 | 63.36 | 344.13 | 1,580.86 | 72.96 | 286.71 |
| Chemicals | 158.45 | 33.62 | 32.70 | 842.61 | 798.67 | 637.65 |
| Non-metallic mineral products | 213.30 | 43.24 | 1.01 | 23.54 | 112.54 | 9.60 |
| Metal smelting and rolling | 92.16 | 10.99 | 0.00 | 51.39 | 72.04 | 271.02 |
| Fabricated metal products | 6.04 | 6.61 | 0.00 | 0.29 | 3.71 | 3.79 |
| General, special equipment manufacturing | 5.12 | 4.09 | 0.00 | 1.97 | 25.21 | 23.57 |
| Transport equipment manufacturing | 4.30 | 4.19 | 0.00 | 1.65 | 25.31 | 27.22 |
| Electrical machinery and equipment manufacturing | 5.30 | 7.99 | 0.27 | 1.42 | 6.46 | 11.02 |
| Communications equipment, computers and other electronic equipment manufacturing | 10.78 | 2.91 | 0.00 | 0.06 | 23.98 | 8.63 |
| Measuring instruments and office machinery manufacturing | 0.08 | 0.18 | 0.00 | 0.17 | 0.46 | 1.14 |
| Artwork and other manufacturing | 0.94 | 1.67 | 0.00 | 1.00 | 0.21 | 5.92 |
| Wastes | 0.29 | 0.03 | 0.00 | 0.04 | 0.00 | 0.05 |
| Electricity, thermal power production and supply | 304.24 | 0.01 | 75.28 | 86.65 | 392.92 | 69.66 |
| Gas production and supply | 2.30 | 35.93 | 0.76 | 0.05 | 22.60 | 2.20 |
| Water production and supply | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.37 |
| Construction | 12.85 | 3.61 | 0.00 | 490.28 | 8.14 | 5.93 |
| Transport and storage | 730.90 | 26.87 | 0.00 | 0.00 | 157.38 | 9.88 |
| Post | 3.06 | 0.11 | 0.00 | 0.00 | 0.00 | 0.29 |
| Information transmission, computer services and software | 1.99 | 0.07 | 0.00 | 0.00 | 0.00 | 6.19 |
| Wholesale and retail trade | 6.06 | 38.60 | 0.00 | 0.00 | 0.00 | 16.65 |
| Accommodation and catering | 4.30 | 27.41 | 0.00 | 0.00 | 66.60 | 14.32 |
| Financial intermediations | 0.39 | 1.34 | 0.00 | 0.00 | 0.00 | 8.96 |
| Real estate | 0.43 | 1.47 | 0.00 | 0.00 | 0.00 | 3.22 |
| Leasing and business services | 1.10 | 3.77 | 0.00 | 0.00 | 5.16 | 5.37 |
| Research and development | 0.04 | 0.12 | 0.00 | 0.00 | 0.66 | 1.32 |
| Comprehensive technical services | 0.27 | 0.92 | 0.00 | 0.00 | 1.77 | 1.49 |
| Water conservation, environment and public facilities management industry | 0.20 | 0.69 | 0.00 | 0.00 | 11.85 | 2.41 |
| Household services and other services | 0.56 | 1.92 | 0.00 | 0.00 | 11.99 | 5.46 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Education | 0.54 | 1.87 | 0.00 | 0.00 | 0.00 | 20.58 |
| Health, social security and social welfare | 0.18 | 0.63 | 0.00 | 0.00 | 7.88 | 9.31 |
| Culture, sports and entertainment | 0.09 | 0.32 | 0.00 | 0.00 | 8.32 | 2.07 |
| Public administration and social organizations | 1.14 | 3.91 | 0.00 | 0.00 | 15.02 | 12.82 |

**Table 4.5d Total Energy Consumption, Petajoules, 2007**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 316.07 | 0.00 | 0.00 | 0.00 | 0.00 | 1246.55 |
| Coal mining and washing | 215.86 | 0.00 | 0.00 | 0.00 | 0.00 | 12,705.22 |
| Extraction of crude petroleum and natural gas | 111.73 | 0.00 | 0.00 | 0.00 | 0.00 | 799.49 |
| Metals mining and dressing | 182.74 | 0.00 | 0.00 | 0.00 | 0.00 | 302.21 |
| Non-metallic minerals and other mining | 61.36 | 0.00 | 0.00 | 0.00 | 0.00 | 221.71 |
| Food manufacturing and tobacco processing | 224.58 | 0.00 | 0.00 | 0.00 | 0.00 | 1,070.59 |
| Textiles | 404.33 | 0.00 | 0.00 | 0.00 | 0.00 | 1,112.24 |
| Clothing, leather and feather products | 71.27 | 0.00 | 0.00 | 0.00 | 0.00 | 188.86 |
| Wood processing and furniture manufacturing | 64.16 | 0.00 | 0.00 | 0.00 | 0.00 | 186.45 |
| Papermaking, printing and educational and sports goods | 199.89 | 0.00 | 0.00 | 0.00 | 0.00 | 814.41 |
| Petroleum processing, coking and nuclear fuel | 147.30 | 1.61 | 0.00 | 0.00 | 0.00 | 26,964.99 |
| Chemicals | 1,392.04 | 0.00 | 0.00 | 0.00 | 0.00 | 7,182.04 |
| Non-metallic mineral products | 667.39 | 0.00 | 0.00 | 0.00 | 0.00 | 5,175.73 |
| Metal smelting and rolling | 2,179.22 | 0.00 | 0.00 | 0.00 | 0.00 | 13,652.66 |
| Fabricated metal products | 243.48 | 0.00 | 0.00 | 0.00 | 0.00 | 394.64 |
| General, special equipment manufacturing | 243.43 | 0.00 | 0.00 | 0.00 | 0.00 | 784.22 |
| Transport equipment manufacturing | 150.20 | 0.00 | 0.00 | 0.00 | 0.00 | 440.77 |
| Electrical machinery and equipment manufacturing | 122.82 | 0.00 | 0.00 | 0.00 | 0.00 | 230.97 |
| Communications equipment, computers and other electronic equipment manufacturing | 172.52 | 0.00 | 0.00 | 0.00 | 0.00 | 270.90 |
| Measuring instruments and office machinery manufacturing | 21.99 | 0.00 | 0.00 | 0.00 | 0.00 | 36.32 |
| Artwork and other manufacturing | 104.06 | 122.35 | 0.00 | 0.00 | 0.00 | 365.82 |
| Wastes | 3.98 | 0.00 | 0.00 | 0.00 | 0.00 | 7.50 |
| Electricity, thermal power production and supply | 913.83 | 144.77 | 0.00 | 0.00 | 0.00 | 33,192.48 |
| Gas production and supply | 16.14 | 0.00 | 0.00 | 0.00 | 0.00 | 550.32 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Water production and supply | 79.27 | 0.00 | 0.00 | 0.00 | 0.00 | 90.47 |
| Construction | 111.12 | 0.00 | 0.00 | 0.00 | 0.00 | 1,026.94 |
| Transport and storage | 115.53 | 0.00 | 0.00 | 0.00 | 0.00 | 5,836.31 |
| Post | 3.39 | 0.00 | 0.00 | 0.00 | 0.00 | 28.42 |
| Information transmission, computer services and software | 72.35 | 0.00 | 0.00 | 0.00 | 0.00 | 93.24 |
| Wholesale and retail trade | 179.75 | 0.00 | 0.00 | 0.00 | 0.00 | 508.26 |
| Accommodation and catering | 154.61 | 0.00 | 0.00 | 0.00 | 0.00 | 538.42 |
| Financial intermediations | 75.42 | 0.00 | 0.00 | 0.00 | 0.00 | 160.06 |
| Real estate | 27.10 | 0.00 | 0.00 | 0.00 | 0.00 | 117.24 |
| Leasing and business services | 45.18 | 0.00 | 0.00 | 0.00 | 0.00 | 295.78 |
| Research and development | 11.09 | 0.00 | 0.00 | 0.00 | 0.00 | 23.83 |
| Comprehensive technical services | 12.53 | 0.00 | 0.00 | 0.00 | 0.00 | 77.21 |
| Water conservation, environment and public facilities management industry | 20.28 | 0.00 | 0.00 | 0.00 | 0.00 | 89.45 |
| Household services and other services | 45.95 | 0.00 | 0.00 | 0.00 | 0.00 | 241.48 |
| Education | 173.18 | 0.00 | 0.00 | 0.00 | 0.00 | 377.41 |
| Health, social security and social welfare | 78.39 | 0.00 | 0.00 | 0.00 | 0.00 | 242.86 |
| Culture, sports and entertainment | 17.43 | 0.00 | 0.00 | 0.00 | 0.00 | 51.89 |
| Public administration and social organizations | 107.86 | 0.00 | 0.00 | 0.00 | 0.00 | 445.68 |

## Appendix 5: Chongqing Total Energy Consumption

| Table 4.45a Chongqing Total Energy Consumption, Petajoules, 2002 | | | | | | |
|---|---|---|---|---|---|---|
| **Industry** | **Raw coal** | **Fine washed coal** | **Other washed coal** | **Shaped coal** | **Coke** | **Coke oven gas** |
| Agriculture, forestry, animal husbandry and fishery | 44.93 | | | | | |
| Coal mining and washing | 104.16 | 4.04 | 2.30 | | 2.02 | |
| Extraction of crude petroleum and natural gas | | | | | | |
| Metals mining and dressing | 0.61 | 0.05 | | | 1.97 | |
| Non-metallic minerals and other mining | 4.06 | | | | | |
| Food manufacturing and tobacco processing | 2.81 | 0.32 | | | 0.00 | |
| Textiles | 4.52 | 0.13 | | | | |
| Clothing, leather and feather products | 0.08 | | | | | |
| Wood processing and furniture manufacturing | 0.52 | | | | | |
| Papermaking, printing and educational and sports goods | 2.90 | | | | | |
| Petroleum processing, coking and nuclear fuel | 4.22 | 43.01 | | | 4.34 | |
| Chemicals | 25.12 | 4.90 | 4.27 | | 0.01 | |
| Non-metallic mineral products | 66.95 | 1.07 | 0.02 | | 0.00 | |
| Metal smelting and rolling | 5.45 | 39.13 | 0.04 | | 43.83 | 0.37 |
| Fabricated metal products | 0.61 | 0.03 | 0.00 | | 0.13 | |
| General, special equipment manufacturing | 0.72 | 0.06 | | | 0.35 | |
| Transport equipment manufacturing | 1.60 | 0.14 | 0.08 | | 1.19 | 0.13 |
| Electrical machinery and equipment manufacturing | 0.17 | | | | 0.03 | |
| Communications equipment, computers and other electronic equipment manufacturing | 0.81 | | | | 0.01 | |
| Measuring instruments and office machinery manufacturing | 0.09 | | | | 0.05 | |
| Artwork and other manufacturing | 1.44 | | | | | |
| Wastes | | | | | | |
| Electricity, thermal power production and supply | 219.55 | 5.31 | 24.93 | | | |
| Gas production and supply | | | | | | |

| | |
|---|---|
| Water production and supply | |
| Construction | 3.24 |
| Transport and storage | 4.16 |
| Post | 0.28 |
| Information transmission, computer services and software | |
| Wholesale and retail trade | |
| Accommodation and catering | 0.17 |
| Financial intermediations | |
| Real estate | 0.00 |
| Leasing and business services | 0.21 |
| Tourism | |
| Scientific research | |
| Comprehensive technical services | |
| Other social services | |
| Education | |
| …… | |
| Public administration and social organizations | |

**Table 4.45b Chongqing Total Energy Consumption, Petajoules, 2002**

| Industry | Other gas | Other coking products | Crude oil | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | | | 1.68 | | 3.76 |
| Coal mining and washing | | | | 0.04 | 0.00 | 0.23 |
| Extraction of crude petroleum and natural gas | | | | 0.01 | 0.00 | 0.01 |
| Metals mining and dressing | | | | 0.01 | 0.00 | 0.05 |
| Non-metallic minerals and other mining | | | | 0.06 | 0.00 | 0.03 |
| Food manufacturing and tobacco processing | | | | 0.09 | | 0.35 |
| Textiles | | | | 0.04 | 0.00 | 0.01 |
| Clothing, leather and feather products | | | | 0.06 | | 0.01 |
| Wood processing and furniture manufacturing | | | | 0.03 | 0.00 | 0.03 |
| Papermaking, printing and educational and sports goods | | | | 0.41 | 0.01 | 0.04 |
| Petroleum processing, coking and nuclear fuel | | | 0.10 | 0.44 | | 0.00 |
| Chemicals | | 0.22 | | 2.51 | 0.08 | 0.47 |
| Non-metallic mineral products | | | | 0.68 | 0.02 | 0.31 |
| Metal smelting and rolling | 28.37 | | | 0.48 | 0.01 | 0.30 |
| Fabricated metal products | | | | 0.04 | 0.00 | 0.06 |

| | | | | | | |
|---|---|---|---|---|---|---|
| General, special equipment manufacturing | | 0.03 | | 0.08 | 0.03 | 0.19 |
| Transport equipment manufacturing | | | | 0.49 | 0.08 | 0.35 |
| Electrical machinery and equipment manufacturing | 0.11 | | | 0.04 | 0.01 | 0.04 |
| Communications equipment, computers and other electronic equipment manufacturing | | | | 0.53 | | 0.04 |
| Measuring instruments and office machinery manufacturing | | | | 0.02 | 0.00 | 0.02 |
| Artwork and other manufacturing | | | | 0.15 | | 0.08 |
| Wastes | | | | 1.07 | | 1.62 |
| Electricity, thermal power production and supply | | | | 0.01 | | 0.26 |
| Gas production and supply | | | | 0.01 | | 0.03 |
| Water production and supply | | | | | | |
| Construction | | | | 1.62 | 0.01 | 1.78 |
| Transport and storage | | | | 10.93 | 2.53 | 16.49 |
| Post | | | | 0.09 | 0.02 | 0.13 |
| Information transmission, computer services and software | | | | 0.00 | 0.00 | 0.00 |
| Wholesale and retail trade | | | | 2.82 | | 1.07 |
| Accommodation and catering | | | | 0.69 | | 0.26 |
| Financial intermediations | | | | 0.38 | | 0.03 |
| Real estate | | | | 0.15 | | 0.01 |
| Leasing and business services | | | | 0.04 | | 0.00 |
| Tourism | | | | 0.07 | | 0.00 |
| Scientific research | | | | 0.01 | | 0.00 |
| Comprehensive technical services | | | | 0.11 | | 0.01 |
| Other social services | | | | 0.19 | | 0.01 |
| Education | | | | 0.14 | | 0.01 |
| Health, social security and social welfare | | | | 0.12 | | 0.01 |
| Culture, sports and entertainment | | | | 0.02 | | 0.00 |
| Public administration and social organizations | | | | 1.34 | | 0.09 |

**Table 4.45c Chongqing Total Energy Consumption, Petajoules, 2002**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal power |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | | | | | |
| Coal mining and washing | | | | | 0.08 | |
| Extraction of crude petroleum and natural gas | | | | | 0.70 | |
| Metals mining and dressing | | | | | | |
| Non-metallic minerals and other mining | | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Food manufacturing and tobacco processing | | 0.01 | | 1.21 | 0.03 |
| Textiles | | | | 0.47 | |
| Clothing, leather and feather products | | | | 0.08 | 0.01 |
| Wood processing and furniture manufacturing | | | | 0.08 | |
| Papermaking, printing and educational and sports goods | | | | 0.27 | |
| Petroleum processing, coking and nuclear fuel | | | | 0.47 | |
| Chemicals | 0.82 | 0.01 | 0.01 | 55.48 | 0.19 |
| Non-metallic mineral products | | 0.01 | | 6.42 | 0.00 |
| Metal smelting and rolling | | | | 6.03 | |
| Fabricated metal products | | | 0.01 | 0.58 | |
| General, special equipment manufacturing | | | 0.02 | 1.67 | 0.00 |
| Transport equipment manufacturing | 0.03 | 0.01 | | 3.89 | |
| Electrical machinery and equipment manufacturing | | | 0.15 | 0.58 | |
| Communications equipment, computers and other electronic equipment manufacturing | | | | 0.04 | |
| Measuring instruments and office machinery manufacturing | | | | 0.08 | |
| Artwork and other manufacturing | | | | 1.09 | |
| Wastes | | | | | |
| Electricity, thermal power production and supply | 0.05 | | | 0.23 | 0.42 |
| Gas production and supply | | | | 0.35 | |
| Water production and supply | | | | 0.04 | |
| Construction | | | | 0.16 | |
| Transport and storage | 0.46 | | | 0.23 | |
| Post | 0.00 | | | | |
| Information transmission, computer services and software | 0.00 | | | | |
| Wholesale and retail trade | | | | | |
| Accommodation and catering | | | | 0.66 | |
| Financial intermediations | | | | | |
| Real estate | | | | | |
| Leasing and business services | | | | | |
| Tourism | | | | 0.19 | |
| Scientific research | | | | | |
| Comprehensive technical services | | | | | |
| Other social services | | | | | |
| Education | | | | | |
| Health, social security and social welfare | | | | | |
| Culture, sports and entertainment | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Public administration and social organizations | | | | | | |

**Table 4.45d Chongqing Total Energy Consumption, Petajoules, 2002**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 6.07 | | | | | 56.44 |
| Coal mining and washing | 2.34 | 3.99 | | | | 119.21 |
| Extraction of crude petroleum and natural gas | 0.16 | | | | | 0.89 |
| Metals mining and dressing | 0.30 | | | | | 3.00 |
| Non-metallic minerals and other mining | 0.26 | | | | | 4.42 |
| Food manufacturing and tobacco processing | 0.89 | | | | | 5.72 |
| Textiles | 1.43 | | | | | 6.62 |
| Clothing, leather and feather products | 0.12 | | | | | 0.36 |
| Wood processing and furniture manufacturing | 0.09 | | | | | 0.76 |
| Papermaking, printing and educational and sports goods | 0.61 | | | | | 4.24 |
| Petroleum processing, coking and nuclear fuel | 0.03 | | | | | 52.62 |
| Chemicals | 13.42 | 0.54 | | | | 108.04 |
| Non-metallic mineral products | 7.21 | 0.97 | | | | 83.66 |
| Metal smelting and rolling | 10.98 | 2.33 | | | | 137.33 |
| Fabricated metal products | 0.42 | | | | | 1.89 |
| General, special equipment manufacturing | 1.13 | 0.01 | | | | 4.28 |
| Transport equipment manufacturing | 6.13 | | | | | 14.10 |
| Electrical machinery and equipment manufacturing | 0.59 | 0.01 | | | | 1.75 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.10 | | | | | 1.53 |
| Measuring instruments and office machinery manufacturing | 0.23 | | | | | 0.50 |
| Artwork and other manufacturing | 1.14 | | | | | 3.90 |
| Wastes | 10.84 | | | | | 264.02 |
| Electricity, thermal power production and supply | 0.11 | | | | | 0.73 |
| Gas production and supply | 1.23 | | | | | 1.31 |
| Water production and supply | 4.64 | | | | | 11.45 |
| Construction | 1.83 | | | | | 36.64 |
| Transport and storage | 0.08 | | | | | 0.60 |
| Post | 0.53 | | | | | 0.53 |
| Information transmission, computer services and software | 1.96 | | | | | 5.85 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wholesale and retail trade | 0.54 | | | | | 2.33 |
| Accommodation and catering | 0.13 | | | | | 0.54 |
| Financial intermediations | 0.49 | | | | | 0.65 |
| Real estate | 0.11 | | | | | 0.37 |
| Leasing and business services | 0.36 | | | | | 0.63 |
| Tourism | 0.02 | | | | | 0.03 |
| Scientific research | 0.04 | | | | | 0.16 |
| Comprehensive technical services | 0.11 | | | | | 0.32 |
| Other social services | 0.13 | | | | | 0.27 |
| Education | 0.09 | | | | | 0.22 |
| Health, social security and social welfare | 0.02 | | | | | 0.05 |
| Culture, sports and entertainment | 0.25 | | | | | 1.68 |

**Table 4.46a Chongqing Total Energy Consumption, Petajoules, 2005**

| Industry | Raw coal | Fine washed coal | Other washed coal | Shaped coal | Coke | Coke oven gas |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 45.16 | | | | 7.11 | |
| Coal mining and washing | 136.42 | 0.00 | 0.06 | 0.01 | 0.02 | |
| Extraction of crude petroleum and natural gas | | | 0.02 | | | |
| Metals mining and dressing | 3.76 | 0.03 | | | 15.66 | |
| Non-metallic minerals and other mining | 3.05 | 0.00 | | | 0.31 | |
| Food manufacturing and tobacco processing | 8.61 | 0.06 | 0.00 | 0.01 | 0.88 | |
| Textiles | 6.36 | 0.09 | 0.01 | 0.00 | 0.02 | |
| Clothing, leather and feather products | 0.09 | | | 0.00 | | |
| Wood processing and furniture manufacturing | 0.71 | 0.00 | | | 0.01 | |
| Papermaking, printing and educational and sports goods | 4.36 | 0.00 | 0.00 | 0.00 | 0.00 | |
| Petroleum processing, coking and nuclear fuel | 19.37 | 68.19 | | | 0.04 | |
| Chemicals | 21.56 | 5.41 | 2.52 | 2.03 | 2.18 | 0.09 |
| Non-metallic mineral products | 140.61 | 6.78 | 0.52 | 0.00 | 0.31 | 0.13 |
| Metal smelting and rolling | 11.22 | 0.19 | 0.03 | 0.00 | 59.92 | 0.04 |
| Fabricated metal products | 0.91 | 0.06 | 0.01 | 0.00 | 0.76 | 0.00 |
| General, special equipment manufacturing | 1.64 | 0.17 | 0.02 | 0.01 | 8.63 | 0.03 |
| Transport equipment manufacturing | 2.79 | 0.39 | 0.01 | 0.01 | 5.76 | |
| Electrical machinery and equipment manufacturing | 0.30 | 0.00 | | 0.00 | 0.03 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Communications equipment, computers and other electronic equipment manufacturing | 0.00 | | | 0.00 | 0.00 | |
| Measuring instruments and office machinery manufacturing | 0.10 | | | | 0.08 | |
| Artwork and other manufacturing | 1.46 | 0.00 | 0.00 | | | |
| Wastes | | | | | | |
| Electricity, thermal power production and supply | 225.44 | | 16.61 | | 4.50 | 0.60 |
| Gas production and supply | 0.01 | | | | | |
| Water production and supply | 0.00 | | | | | |
| Construction | 3.36 | | | | 2.84 | |
| Transport and storage | 4.20 | | | | 0.56 | |
| Post | 0.25 | | | | 0.00 | |
| Wholesale and retail trade | | | | | 0.06 | |
| Accommodation and catering | 0.17 | | | | 0.08 | |
| Financial intermediation and insurance | | | | | 0.06 | |
| Real estate | 0.00 | | | | 0.00 | |
| Other services | 0.22 | | | | 0.22 | |

**Table 4.46b Chongqing Total Energy Consumption, Petajoules, 2005**

| Industry | Other gas | Other coking products | Crude petroleum | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | | | 1.72 | | 2.24 |
| Coal mining and washing | 0.05 | | | 0.26 | 0.01 | 0.24 |
| Extraction of crude petroleum and natural gas | | | | 0.01 | 0.00 | 0.00 |
| Metals mining and dressing | | | | 0.02 | 0.00 | 0.14 |
| Non-metallic minerals and other mining | | | | 0.03 | 0.01 | 0.64 |
| Food manufacturing and tobacco processing | | | | 0.13 | 0.01 | 0.26 |
| Textiles | | | | 0.04 | 0.00 | 0.03 |
| Clothing, leather and feather products | | | | 0.06 | 0.00 | 0.02 |
| Wood processing and furniture manufacturing | | | | 0.03 | 0.00 | 0.02 |
| Papermaking, printing and educational and sports goods | | | | 0.23 | 0.00 | 0.82 |
| Petroleum processing, coking | | | 0.15 | 0.01 | 0.00 | 0.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| and nuclear fuel | | | | | | 2 |
| Chemicals | 0.01 | 1.08 | 1.04 | 0.48 | 0.02 | 0.46 |
| Non-metallic mineral products | 0.00 | 0.04 | | 0.17 | 0.03 | 1.74 |
| Metal smelting and rolling | 0.00 | 0.04 | | 0.11 | 0.00 | 0.30 |
| Fabricated metal products | 0.02 | | | 0.07 | 0.01 | 0.39 |
| General, special equipment manufacturing | | 0.03 | | 0.22 | 0.06 | 0.44 |
| Transport equipment manufacturing | | | 0.00 | 0.98 | 0.23 | 1.21 |
| Electrical machinery and equipment manufacturing | | | | 0.07 | 0.00 | 0.04 |
| Communications equipment, computers and other electronic equipment manufacturing | | | | 0.02 | 0.00 | 0.01 |
| Measuring instruments and office machinery manufacturing | | | 0.00 | 0.06 | 0.01 | 0.02 |
| Artwork and other manufacturing | | | | 0.00 | 0.00 | 0.01 |
| Wastes | | | | | | |
| Electricity, thermal power production and supply | 2.74 | | | 0.17 | 0.00 | 0.70 |
| Gas production and supply | | | | 0.03 | 0.00 | 0.01 |
| Water production and supply | | | | 0.02 | | 0.01 |
| Construction | | | | 1.70 | 0.02 | 1.92 |
| Transport and storage | | | | 19.51 | 3.98 | 61.95 |
| Post | | | | 0.13 | 0.03 | 0.42 |
| Wholesale and retail trade | | | | 1.61 | 0.02 | 0.58 |
| Accommodation and catering | | | | 2.15 | 0.02 | 0.78 |
| Financial intermediation and insurance | | | | 0.62 | | 0.04 |
| Real estate | | | | 0.02 | | 0.00 |
| Other services | | | | 2.15 | | 0.14 |

**Table 4.46c Chongqing Total Energy Consumption, Petajoules, 2005**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal powe |
|---|---|---|---|---|---|---|

| | | | | | | r |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | | | | 1.71 | |
| Coal mining and washing | 0.01 | | | 0.02 | 0.00 | 0.00 |
| Extraction of crude petroleum and natural gas | | | | 0.01 | 1.48 | |
| Metals mining and dressing | 0.00 | | | 0.00 | 0.05 | |
| Non-metallic minerals and other mining | 0.00 | | | 0.00 | 0.01 | 2.54 |
| Food manufacturing and tobacco processing | 0.00 | 0.00 | | 0.00 | 1.42 | 0.08 |
| Textiles | | 0.00 | | 0.00 | 0.43 | |
| Clothing, leather and feather products | 0.00 | 0.00 | | 0.00 | 0.25 | |
| Wood processing and furniture manufacturing | | | | | 0.02 | |
| Papermaking, printing and educational and sports goods | 0.00 | 0.00 | | 0.00 | 0.60 | |
| Petroleum processing, coking and nuclear fuel | 0.66 | | | 0.33 | 0.08 | 0.00 |
| Chemicals | 0.02 | 0.02 | 0.00 | 0.08 | 65.92 | 11.32 |
| Non-metallic mineral products | 0.03 | 0.01 | | 0.04 | 12.56 | 0.07 |
| Metal smelting and rolling | 0.01 | 0.00 | | 1.07 | 6.80 | |
| Fabricated metal products | 0.00 | 0.00 | | 0.42 | 0.34 | 0.00 |
| General, special equipment manufacturing | | 0.01 | | 0.78 | 2.04 | 0.62 |
| Transport equipment manufacturing | 0.01 | 0.02 | | 0.45 | 8.20 | 0.00 |
| Electrical machinery and equipment manufacturing | | 0.00 | | 0.13 | 0.46 | |
| Communications equipment, computers and other electronic equipment manufacturing | | 0.00 | | | 0.01 | |
| Measuring instruments and office machinery manufacturing | 0.00 | | | 0.00 | 0.49 | |
| Artwork and other manufacturing | | 0.00 | | 0.00 | 0.00 | |
| Wastes | | | | | | |
| Electricity, thermal power production and supply | 0.74 | | | 0.01 | 2.37 | |
| Gas production and supply | | 0.00 | | | 0.04 | |
| Water production and supply | | | | | 0.00 | |
| Construction | | | | | 0.16 | |
| Transport and storage | | | | | 0.39 | |
| Post | | | | | | |
| Wholesale and retail trade | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Accommodation and catering | | | | | 1.05 | |
| Financial intermediation and insurance | | | | | | |
| Real estate | | | | | | |
| Other services | | | | | 0.19 | |

**Table 4.46d Chongqing Total Energy Consumption, Petajoules, 2005**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 1.44 | | | | | 59.38 |
| Coal mining and washing | 3.47 | 42.56 | | | | 183.13 |
| Extraction of crude petroleum and natural gas | 0.15 | 1.43 | | | | 3.10 |
| Metals mining and dressing | 0.43 | | | | | 20.10 |
| Non-metallic minerals and other mining | 0.92 | 0.00 | | | | 7.51 |
| Food manufacturing and tobacco processing | 1.96 | 0.02 | | | | 13.44 |
| Textiles | 2.23 | | | | | 9.20 |
| Clothing, leather and feather products | 0.14 | | | | | 0.57 |
| Wood processing and furniture manufacturing | 0.21 | 0.00 | | | | 0.99 |
| Papermaking, printing and educational and sports goods | 1.09 | 0.00 | | | | 7.12 |
| Petroleum processing, coking and nuclear fuel | 0.18 | | | | | 89.03 |
| Chemicals | 13.66 | 9.09 | | | | 137.00 |
| Non-metallic mineral products | 11.94 | 24.41 | | | | 199.38 |
| Metal smelting and rolling | 18.28 | 0.16 | | | | 98.17 |
| Fabricated metal products | 0.78 | 0.01 | | | | 3.78 |
| General, special equipment manufacturing | 3.18 | 0.00 | | | | 17.88 |
| Transport equipment manufacturing | 8.46 | 0.01 | | | | 28.50 |
| Electrical machinery and equipment manufacturing | 0.70 | 0.00 | | | | 1.75 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.16 | | | | | 0.21 |
| Measuring instruments and office machinery manufacturing | 0.35 | | | | | 1.11 |
| Artwork and other manufacturing | 0.06 | | | | | 1.53 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wastes | | | | | | |
| Electricity, thermal power production and supply | 4.82 | 16.31 | | | | 275.01 |
| Gas production and supply | 0.07 | | | | | 0.16 |
| Water production and supply | 1.70 | 0.00 | | | | 1.73 |
| Construction | 2.76 | | | | | 12.76 |
| Transport and storage | 2.78 | | | | | 93.37 |
| Post | 0.10 | | | | | 0.94 |
| Wholesale and retail trade | 2.40 | | | | | 4.67 |
| Accommodation and catering | 3.60 | | | | | 7.86 |
| Financial intermediation and insurance | 0.94 | | | | | 1.66 |
| Real estate | 0.34 | | | | | 0.37 |
| Other services | 4.75 | | | | | 7.68 |

**Table 4.47a Chongqing Total Energy Consumption, Petajoules, 2007**

| Industry | Raw coal | Fine washed coal | Other washed coal | Shaped coal | Coke | Coke oven gas |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 48.09 | | 1.34 | | 7.11 | |
| Coal mining and washing | 209.67 | 2.54 | 0.01 | 0.00 | 0.01 | |
| Extraction of crude petroleum and natural gas | | | | | 5.69 | |
| Metals mining and dressing | 1.17 | 0.04 | | | 3.67 | |
| Non-metallic minerals and other mining | 1.51 | 0.00 | | | | |
| Food manufacturing and tobacco processing | 8.57 | 0.02 | 0.00 | 0.03 | 0.41 | |
| Textiles | 7.14 | 0.00 | 0.01 | 0.00 | 0.02 | |
| Clothing, leather and feather products | 0.10 | | | 0.00 | | |
| Wood processing and furniture manufacturing | 0.60 | 0.00 | 0.00 | | 0.01 | |
| Papermaking, printing and educational and sports goods | 5.21 | 0.00 | 0.00 | 0.02 | 0.00 | |
| Petroleum processing, coking and nuclear fuel | 5.83 | 96.64 | | 0.17 | 0.02 | |
| Chemicals | 26.69 | 4.17 | 0.42 | 1.12 | 3.66 | 0.05 |
| Non-metallic mineral products | 133.01 | 11.92 | 0.36 | 0.00 | 0.12 | 0.38 |
| Metal smelting and rolling | 19.61 | 1.74 | 0.06 | 0.00 | 53.20 | 0.59 |
| Fabricated metal products | 1.06 | 0.06 | 0.01 | 0.00 | 0.29 | 0.00 |
| General, special equipment manufacturing | 2.56 | 0.25 | 0.01 | 0.01 | 7.64 | 0.02 |
| Transport equipment manufacturing | 3.25 | 0.38 | 0.02 | 0.08 | 6.41 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical machinery and equipment manufacturing | 0.35 | 0.00 | | 0.00 | 0.02 | |
| Communications equipment, computers and other electronic equipment manufacturing | 0.02 | | | 0.00 | 0.00 | |
| Measuring instruments and office machinery manufacturing | 0.08 | | | 0.00 | 0.05 | |
| Artwork and other manufacturing | 1.37 | 0.00 | 0.00 | | | |
| Wastes | 0.08 | 0.00 | | | 0.06 | |
| Electricity, thermal power production and supply | 351.89 | 3.90 | 14.98 | | | 1.52 |
| Gas production and supply | 0.00 | | | | | |
| Water production and supply | 0.01 | | | | | |
| Construction | 3.88 | | | | 2.85 | |
| Transport and storage | 4.59 | | | | 0.56 | |
| Post | | | | | 0.00 | |
| Information transmission, computer services and software | | | | | 0.00 | |
| Wholesale and retail trade | | | | | | |
| Accommodation and catering | 0.25 | | | | | |
| Financial intermediations | | | | | | |
| Real estate | | | | | | |
| Leasing and business services | | | | | | |
| Research and development | | | | | | |
| Comprehensive technical services | | | | | | |
| Water conservation, environment and public facilities management industry | | | | | | |
| Household services and other services | | | | | | |
| Education | | | | | | |
| Health, social security and social welfare | | | | | | |
| Culture, sports and entertainment | | | | | | |
| Public administration and social organizations | 0.22 | | | | | |

**Table 4.47b Chongqing Total Energy Consumption, Petajoules, 2007**

| Industry | Other gas | Other coking products | Crude petroleum | Gasoline | Kerosene | Diesel |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | | | 1.96 | | 2.52 |
| Coal mining and washing | 0.05 | 0.00 | | 0.17 | 0.01 | 0.51 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Extraction of crude petroleum and natural gas | | | | 0.00 | | 0.00 |
| Metals mining and dressing | 0.22 | | | 0.02 | 0.00 | 0.17 |
| Non-metallic minerals and other mining | | | | 0.02 | 0.01 | 0.73 |
| Food manufacturing and tobacco processing | | | | 0.26 | 0.01 | 0.27 |
| Textiles | | | | 0.10 | 0.00 | 0.05 |
| Clothing, leather and feather products | | | | 0.04 | 0.00 | 0.01 |
| Wood processing and furniture manufacturing | | | | 0.03 | 0.00 | 0.03 |
| Papermaking, printing and educational and sports goods | | | | 0.13 | 0.00 | 0.09 |
| Petroleum processing, coking and nuclear fuel | | | 0.05 | 0.01 | 0.00 | 0.02 |
| Chemicals | 0.12 | 3.45 | | 0.72 | 0.05 | 0.42 |
| Non-metallic mineral products | 0.00 | 0.06 | | 0.19 | 0.03 | 2.65 |
| Metal smelting and rolling | 7.79 | 0.04 | | 0.09 | 0.00 | 3.54 |
| Fabricated metal products | 0.00 | | | 0.09 | 0.01 | 0.11 |
| General, special equipment manufacturing | 0.01 | 0.03 | | 0.29 | 0.09 | 0.36 |
| Transport equipment manufacturing | 0.01 | | 0.00 | 1.26 | 0.19 | 1.26 |
| Electrical machinery and equipment manufacturing | 0.04 | | | 0.14 | 0.01 | 0.06 |
| Communications equipment, computers and other electronic equipment manufacturing | | | | 0.03 | 0.00 | 0.02 |
| Measuring instruments and office machinery manufacturing | | | | 0.08 | 0.00 | 0.03 |
| Artwork and other manufacturing | | | | 0.01 | 0.00 | 0.01 |
| Wastes | | | | 0.00 | | 0.00 |
| Electricity, thermal power production and supply | | | | 0.20 | 0.00 | 1.13 |
| Gas production and supply | | | | 0.03 | 0.00 | 0.01 |
| Water production and supply | | | | 0.02 | | 0.01 |
| Construction | | | | 1.80 | | 2.02 |
| Transport and storage | | | | 22.07 | 10.27 | 80.42 |
| Post | | | | 0.16 | 0.08 | 0.60 |
| Information transmission, computer services and software | | | | 0.01 | 0.00 | 0.02 |
| Wholesale and retail trade | | | | 2.69 | 0.03 | 0.95 |
| Accommodation and catering | | | | 1.26 | 0.01 | 0.45 |
| Financial intermediations | | | | 0.47 | | 0.03 |
| Real estate | | | | 0.07 | | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Leasing and business services | | | | 0.86 | | 0.06 |
| Research and development | | | | 0.09 | | 0.01 |
| Comprehensive technical services | | | | 0.04 | | 0.00 |
| Water conservation, environment and public facilities management industry | | | | 0.19 | | 0.01 |
| Household services and other services | | | | 0.09 | | 0.01 |
| Education | | | | 0.15 | | 0.01 |
| Health, social security and social welfare | | | | 0.05 | | 0.00 |
| Culture, sports and entertainment | | | | 0.10 | | 0.01 |
| Public administration and social organizations | | | | 0.68 | | 0.04 |

**Table 4.47c Chongqing Total Energy Consumption, Petajoules, 2007**

| Industry | Fuel oil | Liquefied petroleum gas | Refinery gas | Other petroleum products | Natural gas | Thermal power |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | | 0.55 | | | 2.34 | |
| Coal mining and washing | 0.00 | | | 0.01 | 0.02 | 0.00 |
| Extraction of crude petroleum and natural gas | | | | 0.01 | 0.04 | |
| Metals mining and dressing | 0.00 | | | 0.00 | 0.09 | |
| Non-metallic minerals and other mining | 0.00 | 0.00 | | 0.00 | 0.02 | 2.55 |
| Food manufacturing and tobacco processing | 0.00 | 0.00 | | 0.01 | 2.03 | 0.57 |
| Textiles | | 0.00 | | 0.00 | 0.72 | 0.19 |
| Clothing, leather and feather products | | | | 0.00 | 0.40 | |
| Wood processing and furniture manufacturing | | 0.00 | | 0.00 | 0.05 | |
| Papermaking, printing and educational and sports goods | 0.00 | 0.00 | | 0.00 | 0.58 | |
| Petroleum processing, coking and nuclear fuel | 0.70 | | | 0.25 | | 0.05 |
| Chemicals | 0.08 | 0.00 | | 0.13 | 71.02 | 16.18 |
| Non-metallic mineral products | 0.00 | 0.01 | | 0.04 | 20.69 | 0.07 |
| Metal smelting and rolling | 0.03 | 0.00 | | 1.09 | 9.43 | 0.33 |
| Fabricated metal products | 0.00 | 0.01 | | 0.42 | 0.69 | 0.00 |
| General, special equipment manufacturing | | 0.01 | | 1.03 | 3.36 | 0.00 |
| Transport equipment manufacturing | 0.00 | 0.03 | | 0.53 | 9.89 | 0.00 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical machinery and equipment manufacturing | | 0.00 | | 0.12 | 0.65 | |
| Communications equipment, computers and other electronic equipment manufacturing | | 0.00 | | 0.00 | 0.02 | |
| Measuring instruments and office machinery manufacturing | 0.00 | | | 0.00 | 0.73 | |
| Artwork and other manufacturing | | 0.00 | | 0.00 | 0.00 | |
| Wastes | | | | | 0.07 | |
| Electricity, thermal power production and supply | 0.28 | | | 0.00 | 1.20 | |
| Gas production and supply | | 0.00 | | | 0.06 | |
| Water production and supply | | | | | 0.00 | 0.00 |
| Construction | | 0.27 | | | 0.19 | |
| Transport and storage | 2.17 | 0.40 | | | | |
| Post | 0.02 | 0.00 | | | | |
| Information transmission, computer services and software | 0.00 | 0.00 | | | | |
| Wholesale and retail trade | | 1.13 | | | | |
| Accommodation and catering | | 0.53 | | | 9.77 | |
| Financial intermediations | | | | | | |
| Real estate | | | | | | |
| Leasing and business services | | | | | | |
| Research and development | | | | | | |
| Comprehensive technical services | | | | | | |
| Water conservation, environment and public facilities management industry | | | | | | |
| Household services and other services | | | | | | |
| Education | | | | | | |
| Health, social security and social welfare | | | | | | |
| Culture, sports and entertainment | | | | | | |
| Public administration and social organizations | | | | | | |

**Table 4.47d Chongqing Total Energy Consumption, Petajoules, 2007**

| Industry | Electricity | Other energy | Straw | Firewood | Biogas | Total |
|---|---|---|---|---|---|---|
| Agriculture, forestry, animal husbandry and fishery | 0.73 | | | | | 64.63 |
| Coal mining and washing | 4.86 | 52.31 | | | | 270.18 |

| | | | |
|---|---|---|---|
| Extraction of crude petroleum and natural gas | 0.04 | | 5.78 |
| Metals mining and dressing | 0.57 | | 5.95 |
| Non-metallic minerals and other mining | 1.16 | 0.00 | 6.00 |
| Food manufacturing and tobacco processing | 2.73 | 0.31 | 15.22 |
| Textiles | 2.65 | 0.00 | 10.88 |
| Clothing, leather and feather products | 0.22 | | 0.76 |
| Wood processing and furniture manufacturing | 0.26 | 0.09 | 1.08 |
| Papermaking, printing and educational and sports goods | 1.43 | 0.00 | 7.48 |
| Petroleum processing, coking and nuclear fuel | 0.21 | | 103.94 |
| Chemicals | 15.85 | 0.06 | 144.20 |
| Non-metallic mineral products | 14.74 | 21.54 | 205.83 |
| Metal smelting and rolling | 26.03 | 0.00 | 123.56 |
| Fabricated metal products | 0.91 | 0.01 | 3.68 |
| General special equipment manufacturing | 3.44 | 0.01 | 19.10 |
| Transport equipment manufacturing | 11.05 | 0.01 | 34.36 |
| Electrical machinery and equipment manufacturing | 0.99 | 0.00 | 2.37 |
| Communications equipment, computers and other electronic equipment manufacturing | 0.26 | | 0.35 |
| Measuring instruments and office machinery manufacturing | 0.29 | | 1.27 |
| Artwork and other manufacturing | 0.06 | | 1.45 |
| Wastes | 0.05 | 0.01 | 0.29 |
| Electricity, thermal power production and supply | 7.25 | 50.14 | 432.49 |
| Gas production and supply | 0.20 | | 0.31 |
| Water production and supply | 1.65 | 0.00 | 1.70 |
| Construction | 4.16 | | 15.17 |
| Transport and storage | 1.34 | | 121.82 |
| Post | 0.04 | | 0.91 |
| Information transmission, computer services and software | 1.49 | | 1.53 |
| Wholesale and retail trade | 2.27 | | 7.08 |
| Accommodation and catering | 5.02 | | 17.29 |
| Financial intermediations | 1.35 | | 1.85 |
| Real estate | 0.37 | | 0.45 |

| | | |
|---|---|---|
| Leasing and business services | 0.77 | 1.69 |
| Research and development | 0.20 | 0.30 |
| Comprehensive technical services | 0.25 | 0.29 |
| Water conservation, environment and public facilities management industry | 0.50 | 0.71 |
| Household services and other services | 0.24 | 0.33 |
| Education | 2.47 | 2.63 |
| Health, social security and social welfare | 0.77 | 0.83 |
| Culture, sports and entertainment | 0.61 | 0.72 |
| Public administration and social organizations | 3.03 | 3.98 |

## Appendix 6: Strategic Plan

**China's Resource and Environmental Accounting Framework**

**Strategic Plan**

Revised May 17, 2012

## Introduction

The National Bureau of Statistics (NBS) has worked with a number of ministries, institutes, international agencies and other countries in recent years, researching environmental accounting in the fields of energy, environment, forests, water, and others. The NBS, working together with various research ministries and institutes, has recently begun developing an environmental information system, including aggregate indicators.

The present document is the strategic plan for this initiative. As such, it defines the objectives and describes the main orientation of the project, including the concepts, methods and sources of information upon which the system is being built; it outlines the project priorities and timelines; it identifies the partners and their level of involvement; and, finally, it establishes the work plan, including the overall project schedule.

During the October 2007 SIMP II meeting in Beijing, both the NBS and STATCAN agreed that the SIMP II Environment Project strategic plan is a document that will evolve over time in response to new information and circumstances.

## Implementation Principles

1. In order to meet the needs of China's resource and environmental management by government, the resource and environmental accounting framework will be implemented based on the SEEA and China's current environmental statistics.
2. In accordance with data availability, staff and user needs, the framework will be implemented in a stepwise manner, with due consideration given to content at each phase.
3. The NBS will collaborate with resource and environment related ministries as it caries out its resource and environmental accounting project.
4. First of all, China's resource and environmental accounting will be carried out at the national level while pilot work is carried out at the provincial level.

## Framework Overview

China's resource and environmental accounting provides a direct means by which the relationship between economic activities, natural resources and the environment can be appraised. Through this accounting, we may prepare a quantitative analysis of resource consumption and emissions to the environment that result from human activities. Environment and resource accounting sheds light on the impact of resource depletion and environmental degradation as well as the relationship between the environment, economy, society and the sustainability of development. The establishment of a resource and environmental accounting system framework will provide a theoretical basis and methodological guidance for the implementation of resource and environment accounting in China.

## Conceptual framework[1]

In traditional economic theory, produced capital is the only capital element required to sustain economic growth over time. However, while deliberation over the sustainable development of economy and society goes deeper, people are paying more and more attention to the important roles that nature, human beings and society play in economic development. Many economists today believe that it is not only produced capital that provides services in the production process, but also natural capital, human capital and social capital — i.e., having characteristics very similar to produced capital. The concept of natural capital is central to this project and the investigation of the contributions made by resources and environmental assets to economic development.

In nature, there are three major types of natural capital: Natural Resources, both non-renewable (such as minerals and fossil fuels) and conditionally renewable (such as water and trees), land (the space for human activities) and ecosystems (the biological and non-biological elements of a natural system which provides various environmental products and services). The measurement framework that is adopted in SIMP II covers all three types.

## Measurement framework[2]

The measurement framework adopted for China's Resource and Environmental Accounting System that is the United Nations' Integrated Environmental and Economic Accounting (SEEA-2003). This framework will be adapted to China's national conditions, taking the actual situation of China's resources, environmental statistics and management into consideration. The experience of Canada and other countries will be drawn upon to establish China's own green national economic accounting system.

The measurement framework allows for the gradual implementation of accounts of stocks and flows of natural resources and environmental assets including minerals, land, forests and water, in either physical or monetary terms. Two sets of accounts will initially be developed: Natural capital stock accounts and material and energy flow accounts.

## Implementation Steps

1. Short-term and Medium-term Objectives

The NBS will develop resource and environmental accounts, in accordance with the theoretical and methodological bases noted above and giving due consideration to data availability from related ministries, in 3 to 5 years. Accounts that have been attempted on an experimental basis at

[1] This description of the conceptual framework is a summary of a component of the document titled "China's Green National Economic Accounting System Framework".

[2] This description of the measurement framework is a summary of a component of the document titled "China's Green National Economic Accounting System Framework".

the national level include energy accounts, forest stock accounts, pollution abatement cost accounts, forestry ecological service valuation accounts, water resource accounts.

2. Long-term Objectives

The NBS will develop resource and environmental accounts for other areas, such as land stock, hybrid timber, environment protection expenditure (EPE), etc., as methods and data sources are developed. Meanwhile, three aspects that need to be further developed include:

- Implementation at the national level: Conventional accounting will be carried out such that the NBS may gain experience in theoretical and methodological accounting aspects and in respect to compilation
- Nationwide Implementation: Pilot compilation can be implemented by the regional levels at their own accord
- Statistical information integration: Advice and guidance will be provided to related ministries and departments and within the NBS on resource and environmental data collection

## Partners

The implementation of China's resource and environmental accounts relies on cooperation between countries and with other ministries. Although the NBS itself is a core agency in the resource and environmental accounting area, it will rely on the cooperation of various partners in the future — including policy makers, ministries, institutes, businesses and households — in order to meet the demands of macroeconomic management.

International agencies and national statistical agencies such as the UNSD, Statistics Norway and Statistics Canada, will continue to provide technical assistance for the implementation China's resource and environmental accounting.

The Ministry of Commerce has promoted cooperation in the Sino-Norway project since 1998. In the subsequent ten years, the Ministry of Environmental Protection, State Forestry Administration, Ministry of Water Resources, Ministry of Land Resources and the Ministry of Housing & Urban-Rural Development have taken part in similar projects. These ministries will continue to be the main partners in the implementation of China's resource and environmental accounts in years to come.

In the past ten years, more than ten of China's provinces have taken part in resource and environmental accounting pilot projects, gaining valuable experience. More and more provinces and ministries are expected to join in this effort in the future.

Additional details with respect to the implementation of China's Resource and Environmental Accounts, including information on timelines for development, partnerships, data needs and data sources, is provided below (see tables 1 and 2).

**Table 1. Existing Elements of China's Resource and Environmental Accounts, 2012**

| code | accounts | Data year | Project partners | Compilation agency | Data source | Publishing schedule |
|---|---|---|---|---|---|---|
| 1 | Physical / monetary mineral and energy stock accounts | 2005 | SIMP II | NBS | MLR | SIMP II Environmental Accounts Technical report (available on demand) |
| 2 | Physical energy flow accounts | 1987，1995，1997，2002，2005 | Sino-Norway project | NBS | NBS | Periodic, following the schedule of the national input-output tables |
| 3 | Energy hybrid accounts | 2002, 2005, 2007 | SIMP II | NBS | NBS | SIMP II Environmental Accounts Technical report (available on demand) |
| 4 | Physical water flow accounts | 2005 | UNSD, NBS, MWR project | MWR | MWR | Uncertain |
| 5 | Physical water stock accounts | 2005 | UNSD, NBS, MWR project | MWR | MWR | Uncertain |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | Water hybrid accounts | 2005 | UNSD, NBS, MWR project | NBS, MWR | NBS, MWR | Uncertain |
| 7 | $SO_2$, COD hybrid emission accounts | 2005 | SIMP II | MEP, NBS | MEP, NBS | SIMP II Environmental Accounts Technical report (available on demand) |

**Table 2 - Short and Medium Term Objectives for the Implementation of China's Resource and Environmental Accounts**

| | Content | | Schedule | | | | | Partners | Status and goals | Data needs |
|---|---|---|---|---|---|---|---|---|---|---|
| | Type | Name | Priority | | | Start date | Target | | | |
| | | | H | M | L | | | | | |
| 1 | Framework | Framework | x | | | 2007 | | NBS, MLR, MEP, STC | Completed | |
| 2 | Stock accounts | Physical mineral stock accounts (national and selected provinces) | x | | | 2008 | 2012 | NBS, MLR, STC | Concepts, sources and methods developed and tested; extend time series and expand scope to other minerals | Mineral statistics |
| 3 | | Monetary mineral stock accounts (national and selected provinces) | x | | | 2008 | 2012 | NBS, MLR, STC | Concepts, sources and methods developed and tested; extend time series and expand scope to other minerals | Mineral statistics |
| 4 | | Physical energy stock accounts (national and selected provinces) | x | | | 2008 | 2012-2015 | NBS, MLR, STC | Concepts, sources and methods developed and tested; extend time series | Mineral statistics |
| 5 | | Monetary energy stock accounts (national and selected provinces) | x | | | 2008 | 2012-2015 | NBS, MLR, STC | Concepts, sources and methods developed and tested; extend time series | Mineral statistics |
| 6 | | Physical timber stock accounts (forest, woodland) (national and selected provinces) | x | | | 2005 | 2013-2015 | NBS, SFA | Concepts, sources and methods developped experimentally; future development to be determined. | Forest survey |
| 7 | | Physical land stock accounts (national and selected provinces) | | x | | | 2014-2016 | NBS, MLR | Concepts, sources and methods developped experimentally; future development to be determined. | Land statistics |
| 8 | | Physical water stock accounts (national and selected provinces) | x | | | 2007 | TBD | NBS, UNSD, MWR | Concepts, sources and methods developed and tested. | Water resource statistics |
| 9 | Flow accounts | Physical energy flow accounts (national and selected provinces) | x | | | 1999 | TBD | NBS, SN | Concepts, sources and methods developed and tested; extend time series on an annual basis. | Energy statistics |

| | | | | | | | | | | |
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| 10 | | Energy hybrid accounts (national and selected provinces) | x | | | 2008 | 2012-2014 | NBS, STC | Concepts, sources and methods developed and tested; extend time series following the Input-Output schedule. | Energy statistics, IOT |
| 11 | | Physical timber flow accounts (national and selected provinces) | | x | | | 2014-2016 | NBS, SFA | Concepts, sources and methods developped experimentally; future development to be determined. | Forest statistics |
| 12 | | Physical water flow accounts (national and selected provinces) | x | | | 2007 | 2012-2015 | NBS, MWR | Concepts, sources and methods developed and tested. | Water resource stats, IOT |
| 13 | | Physical residual emission accounts (national and selected provinces) | x | | | 2008 | 2012-2015 | NBS, MEP, STC | Concepts, sources and methods developed and preliminary testing; refine sources and methods for SO2 and COD; extend time series and range of pollutants. | Environmental statistics, energy statistics |
| 14 | | EPE accounts (national and selected provinces) | | | X | | | NBS, MEP | Concepts, sources and methods to be defined. | Environmental statistics, EPE survey |

Note：

1. Main users of accounts are from resource and environmental management ministries, policy making departments, universities and institutes.

2. Abbreviations：

MEP: Ministry of Environmental Protection MWR: Ministry of Water Resources NBS: National Bureau of Statistics

SFA: State Forestry Administration SN: Statistics Norway