Abstract

The Energy Accounts of China for the years of 1987,1995 and 1997 were compiled based on available statistics and accounting data under the technique help of experts from Statistics Norway. In accordance with Input-Output Table and energy statistics, the accounts cover 33 industrial sectors and 2 household sectors including 25 major energy carriers. The accounts consist of energy balance sheet, energy supply table, energy demand table and energy end-use table. The energy accounts give a complete picture of energy production, consumption, use and future trend in China in the decade, as well as supply and demand of energy carrier, energy consumption by industry and by household, etc in China. Therefore the compilation of Energy Accounts is in any case a very important and essential work, which is also a part of Environmental and Economic Accounting that recommended by the UNSD.

Compilation of Energy Accounts of China

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Introduction

According to the arrangements of the Sino-Norwegian Cooperation project, the Chinese Energy Accounting group started up the compilation of energy accounts 1995 of China in March 1998, and finished the work in October of the same year in consultation with the experts from Statistics Norway. On account of the further plan of the project, we compiled the energy accounts of 1987 and 1997 subsequently by the year 2000 and made some comparisons among the three years' energy accounts whereafter. There are a lot of technical works in data collecting, framework designing, and data processing during the compilation of the three years' Energy Accounts. In principle, from the sector classification to data process, we do the work mainly in accordance with the Input-Output Table in corresponding years. The detailed expression of the compilation of China Energy Accounts is in the following text.

1. Purpose of Compilation of energy Accounts

1.1 Providing Basic Data to Air Emission Inventory

Since each of the energy carriers has different process of combustion in different type of use, the emissions to the air are dissimilar. As the basic data of air emission inventory, energy accounts of three years have been provided to energy emission group from energy accounting group.

1.2 Providing Information to Economic Modeling Analysis

Energy Accounts is also the database in economic modeling analysis. Due to the detailed data of energy consumption, further analysis can be done to reflect the energy input in sectors. After the establishment of energy-economic modeling, people forecast the demand of energy from 1995 to 2020, and analyze the possible demand structure of commercial energy carriers by sectors in 2020.

2. Data Source

During the work, we tried to get more data consulted as many experts as possible. The main data sources were:

(1) Energy Balance Table compiled by the Department of Industry and Transport of NBS；

(2) Input-output Table in China in corresponding years compiled by the Department of National Accounts of NBS；

(3) Statistics Yearbook in China compiled by NBS；

(4) Energy Statistics Yearbook 1991 compiled by the Department of Industry and Transport of NBS；

(5) Data provided by other ministries, such as Ministry of Transport, Ministry of Railway, Ministry of Agriculture, etc.

3. Classification of Economic Sectors

Since the energy accounts of 1995 were compiled at first, the sectors are classified into 33 according to the Input-Output Table 1995, which follows the China National Economic Industrial Classification Standards established in 1984. Then adjustment and merger of sectors were done on the basis of sector classification of Energy Balance Table even though it follows new classification standards. Considering the consistency of Energy Accounts among 1987, 1995 and 1997, we adopted the some sector classification as in the Energy Accounts of 1995 when we compiled the Accounts of 1987 and 1997.

The sector classification in Energy Accounts is as follows:

Agriculture sector (1)
Manufacturing sectors (23)
Construction sector (1)
Tertiary sectors (8)
Households (2)

In Energy Balance Table, there are only three sectors in tertiary industry, which are (1) transportation, storage, post and telecommunication, (2) wholesale, retail trade and catering services, and (3) others. However, there are eight sectors included in tertiary industry in Energy Accounts. The breakdown of sectors is according to information from other ministries and Input-Output Table. The sector of transport and communication is divided into freight transport and communication and passenger transport. Those are further divided into railway, highway, water, air, pipeline, and others, etc.

Households include rural households and urban households. The energy consumption is quite different from urban area to rural area since the different living standards and customs. That is the reason to estimate energy consumption separately in household sector.

4. Energy Carriers

The types of energy carriers are mainly determined in accordance with the Energy Balance Table compiled by the Department of Industry and Transport. In order to reflect energy consumption by sectors and by types as detail as possible, some energy carriers, such as municipal waste and industrial waste, are newly introduced into energy accounts on the basis of statistics from other ministries. Thus, energy carriers include totally 25 types not only commercial energy but also non-commercial energy,

e.g. bioenergy.

4.1 Solid energy carriers: coal, coke, waste

Based on the information provided by relevant institutes, industrial solid waste is listed in the Energy Balance. Another part of solid waste, municipal solid waste, is also listed in Energy Balance for its significance. There is, as far as we know at that time, only one commercial plant which generates electricity by incinerating urban waste, the plant is in Shenzhen City of Guangdong Province.

4.2 Bioenergy: crop residuals, wood, biogas

The information of bioenergy consumption in rural households is from the Ministry of Agriculture.

In the grassland of China, rural households combust part of dry cattle dung for heating and cooking. Because households live far apart and because dung isn't considered as commercial energy, the data is inconvenient and there is no special survey for it. Therefore, we did not get any data of dung in Energy Accounts.

4.3 Gas: natural gas, coke-oven gas, refinery gas, other gas

4.4 Liquid energy carriers: crude oil, LPG, gasoline, fuel oil, diesel oil, kerosene, other petroleum products, other coking products

4.5 Others: electricity, heat, other energy

5. Types of Energy Accounts

5.1 According to energy carriers, energy accounts are compiled in physical terms, in thermal terms, and in monetary terms.

Energy Accounts are compiled in physical terms at first according to the convenient basic data. Then we compiled the Energy Accounts in thermal terms, which is PJ (10^{15} Joule). We totally adopt the convert coefficient in China energy statistics when we convert Energy Accounts from physical terms to thermal terms in order to let the energy consumption data being close to practice.

Energy Accounts in monetary terms are compiled mainly for the purpose of economic modeling analysis. For this reason, the estimate is not published.

5.2 According to the purpose of energy use, Energy Accounts includes Energy Balance, Energy Supply, Energy Demand, Energy Demand (Feedstock), Energy Demand (Transport), Energy Demand (Heating).

5.2.1 Energy Balance contains the final use of energy (including commercial energy, bio-energy, waste and others) by sectors in national economy. Total consumption of commercial energy carriers used by the 33 industrial sectors in addition to rural households and urban households, is equal to the final energy consumption listed in Energy Balance Table compiled by the Department of Industry and Transport. For energy product sectors, the part of energy consumption as feedstock is included in Energy Supply and not in this table.

5.2.2 Energy Supply

Energy Supply is compiled according to the information of energy demand and supply in the five energy product industries, including energy import and export data by energy carriers. It presents the total supply of each energy carriers. The five energy product sectors are (1) coal mining, (2) petroleum and natural gas production, (3) electricity, steam and hot water production and supply, (4) petroleum refineries, and (5) coking, manufacture of gas and coal products.

5.2.3 Energy Demand

Energy Demand describes final energy consumption in 28 non-energy product industries including households.

5.2.4 Energy Demand on different purposes

Purpose of energy use varies between sectors. Based on the Energy Demand, it can be compiled into three kinds of tables that reflect energy use in different purposes. The three main categories are divided into: Feedstock, Transport, and Heating. Thus the Energy Demand is separated into three tables: Energy used for feedstock, Energy used for transport, and Energy used for heating. All the three tables have the same framework as Energy Demand.

In compiling the Energy Demand in different purposes, we use a lot of information from other ministries as references.

6. Compilation Process of Energy Accounts[1]

6.1 Data adjustment between sectors

As presented above, sector classification in Energy Accounts follows the

[1]To get more detailed contents of this part, please see Techniques Used in Compiling the Energy Accounts 1995 of China, which is written by Wang Yixuan and Wei Taoyuan.

classification in Input-Output Table in 1995, which is differ from the Energy Balance Table. So we were facing the work of data separation and adjustment.

6.1.1 Treatment on petroleum refineries and coking, manufacture of gas and coal products.

In the 1995 input-output table, petroleum refineries is a single sector, while coking, manufacture of gas and coal products is another sector. On the other hand, in the Energy Balance provided by the Department of Industry and Transport of NBS, petroleum refineries and coking are included in one sector, while manufacture of gas is another sector, and coal products belongs to manufactures not elsewhere classified. Manufacture of coal products is an energy transformation sector where most of energy is used as feedstock. The output of coal products accounts for a small percentage of the sector manufactures not elsewhere classified. The final use of energy is therefore omitted here.

We separated the amount of energy consumption in the two sectors of petroleum refineries and coking, manufacture of gas and coal products according to Energy Statistics Yearbook 1991 in China. We got the consumption rates of the two sectors according to the amount of each kind of energy consumed. The total amount of energy consumption by the two sectors can be obtained from the Energy Balance. Then we split the total amount by each rate and obtained the coal used of energy consumption by each sector.

6.1.2 Treatment on Freight transport and communication, passenger transport

In the Energy Balance Table, energy consumption for transport sector and communication sector is known. The main work is to split the amount of energy consumption for transport into freight transport and passenger transport.

According to the Energy Balance Table, we worked out the total amount of energy consumption for both transport and communication first. Then we estimated the ratios between freight transport and communication and passenger transport according to the 1995 input-output table in value term. The amount of energy consumption by freight transport and passenger transport can be then calculated in physical term according to the above ratios. It is assumed that the price of each energy carrier is the same in this table.

Pipeline transport is treated as freight transport.

In the end, we adjusted the amount of energy consumption estimated above by comparing with the data provide by the Ministry of Railway and other agencies.

6.1.3 Treatment on maintenance and repair of machinery and equipment

The energy consumption by this sector is actually included in many other sectors. Due to restrictions of data availability and statistical scope, the energy consumption data in this sector is ignored.

6.1.4 Treatment on commerce and restaurants

In the Energy Balance, commerce and restaurants is included in one sector. According to 1995 Input-Output Table in monetary terms, we got the rates of energy use by commerce or restaurants to the total energy use by commerce and restaurants sector as a whole. Then we split the total energy consumption in the Energy Balance Table by using this rate to get the energy use for each sector.

6.1.5 Treatment on public utilities and services to households, cultural, educational, health and scientific research institutions, finance and insurance, and public administration

There is only one single sector "others" for the four sectors in Energy Balance Table. According the estimate of energy use ratios in 1995 Input-Output Table, we got the energy use by each of above sectors in physical term.

6.2 Compilation and checkout of Energy Demand and Energy Supply

Based on the adjusted Energy Balance, it is necessary to finish compiling Energy Demand and Energy Supply and check the data.

6.2.1 Confirmation of reasonable table form

We kept the basic form of Energy Balance Table when we compiled the Energy Accounts. Energy Supply contains primary energy output, import and export, stock changes, and energy transformation in the five energy product sectors. Energy Demand contains all the data of final energy consumption by all the sectors excluding energy product sectors.

6.2.2 Energy Supply

The data of energy used for transformation in Energy Balance is shown as negative figures in the Energy Supply sheet. The energy produced is shown as positive figures in the same matrix.

The final energy used by energy product sectors is shown as negative of energy use by corresponding sectors in Energy Supply.

All the data of energy output including both primary energy and transformed energy are shown as energy products of corresponding sectors in Energy Supply.

After sum up or subtract the categories of energy import and export, net purchases abroad, stock changes, transport loss and errors in Energy Supply, we got the total supply of each energy carrier.

6.2.3 Energy Demand

Energy Demand is got by subtracting the corresponding data in Energy Supply from Energy Balance.

6.3 Compilation of Energy Demand by purposes

According to different purposes, the energy use is broken down into three parts: heating, feedstock and transport.

6.3.1 Feedstock

We considered that besides the energy sectors, energy is only used for feedstock by chemical industry, primary metal manufacturing, and manufacture of building materials and other non-metallic mineral products.

6.3.2 Transport

Energy consumed for transport purpose in all sectors including households. Thus, there is amount of estimate work. Data are adjusted and separated according to the Energy Balance Table and statistics from other agencies.

6.3.3 Heating

Energy Demand for heating purpose is in fact the balances by subtracting feedstock and transport data from total Energy Demand data.

Conclusion

Recur to the sector classification and relevant data information of Input-Output Table, we have compiled China Energy Accounts of 1987, 1995 and 1997. Subsequent compilation of Energy Accounts in the corresponding years of Input-Output Table is now taken into accounts. There are still some problems should be solved, such as (1) sector classification should be reclassified according to new industrial classification standards or not; (2) more detailed statistics and information are available or not; (3) more bioenergy statistics are available or not. However, the compilation of Energy Accounts is indeed a good beginning in China’s Environmental and Economic Accounting.