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The introduction of international recommendations for energy statistics and enlightenments for China

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ABSTRACT

The paper introduces background and course of International Recommendations for Energy Statistics (IRES), discusses the mail contents and characteristics of IRES, puts forward energy statistics should be included in the official statistics, and the claims of implementation of international standards as soon as possible, offers some reference for energy statistics researchers of China.

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KEYWORDS

IRES;
Energy Statistics;
Official Statistics;
International comparability.

INTRODUCTION

Energy is fundamental for socio-economic development that is particularly essential to poverty reduction and further improvements in the standards of living. However, at the same time, with the constantly increasing demand for energy, there are growing concerns about the sustainability and reliability of the current energy production and consumption patterns and the impact of the use of energy on environment. Under these circumstances the reliable and timely monitoring of the supply and use of energy becomes indispensable for decision making. This requires the availability of international standards and other necessary guidance to ensure data comparability for policy makers, both at national and international level.

BACKGROUND

Energy plays an important role in socio-economic

development, the availability of high-quality energy statistics data has always been a matter of issue for statistics circles. Energy statistics as part of economic statistics is an issue that has been discussed by United Nations Statistics Commission (UNSC) since its inception. After the energy crisis of the early 1970's, UNSC put energy statistics as a separate item on its agenda and requested a special report to be prepared and presented to it for discussion. The report of the United Nations Secretary-General was prepared and submitted to UNSC at its 19th session in 1976. UNSC agreed that the development of a system of integrated energy statistics should have a high priority in the commission's work. It agreed on the use of energy balances as the key instrument in the coordination of work on energy statistics and the provision of data in a suitable form for understanding and analyzing the role of energy in the economy. UNSC also recommended the preparation of a standard international classification for energy statis-

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tics as part of the global system of integrated energy statistics and considered such a classification as an essential element for the further development of energy statistics at the international level.

Under these circumstances, the United Nations Statistics Division (UNSD) formulated a series of guidelines and recommendations, such as *Concepts and methods in energy statistics, with special reference to energy accounts and balances: a technical report*^[5], *Energy statistics: definitions, units of measure and conversion factors*^[6], and *Energy statistics—a manual for developing countries*^[7]. They are involved in many important topics, including the coverage of energy statistic and the importance of their decision-making, the basic concepts, definitions, units of measurement of energy products and energy flow, energy balance and energy statistics, and the relationships with other economic statistics, including national accounts. In the past 30 years, these publications provided a solid foundation for the compilation of national energy statistics and energy balance worldwide, they were included in the national statistics of many countries, had also been brought in manuals and guides of regional and international organizations, promoted the work of national energy statistics, but with the rapid economic and social development of the world, countries are increasingly demanding high quality energy statistics, these guidelines gradually appeared many problems^[1]

- Energy statistics were not explicitly apart of official statistics. Guidelines related energy statistics should be based on the *Fundamental Principles of Official Statistics*^[8], illustrate the various types of institutional arrangements to ensure compilation of high quality data, the existing standards did not explicitly follow this principle, lead to energy statistics having not been given due attention and reasonable arrangement.
- The scope, classification, measurement units, conversion factors of energy statistics and other related issues were not clear. As the scope of energy statistics vary widely in many countries, the energy statistic should be treated as a completely system, in order to coordinate energy statistics and other relevant statistic relationships, it also should further discuss the feasibility of *International Standard*

Industrial Classification of All Economic Activities(ISIC), *Harmonized Commodity Description and Coding System*(HS) and *Central Product Classification*(CPC), as well as principles of territorial applicability and resident. It needs to review the existing proposals and national practices on unit of energy measure and conversion factors, update the related note about different products units of measurement as appropriate, and also should further clarify the energy flows, stocks and other boundaries between related concepts, provide list of data items to be collected to ensure international comparability of statistics data.

- Data sources, preparation strategy, data quality and other issues on energy statistics were not described in detail. The existing guidelines of energy statistics did not discuss acquisition and pre-post quality evaluation of energy data, lack of international recommendations on energy statistics data dissemination, etc. Therefore, it is Necessary to describe data sources and methods of energy statistics, determine the dimensions of energy data quality assessment and framework, report of energy data dissemination and data schedules.
- Practical application cases of national energy statistics were not provided. Since levels and conditions of national statistics are different, the international standards of energy statistics should be linked with the reality of each country and provide basic cases about the use of energy statistics and energy balance, and how energy statistics be used for environmental statistics, calculation of greenhouse gas emissions, climate change and other international issues should be discussed.

Considered these problems, UNSC reviewed project on the 36th Session in 2005 based on a report of Norway Statistics, the commission recognized the need to make energy statistics as part of official statistics to develop, the need to revise and update the existing problem of energy statistics publications, and provide guidance in some cases not covered previously, IRES come into being.

As part of follow-up actions, UNSD convened an expert group on energy statistics in May 2005 which recommended the further work on energy statistics should be carried on by two working groups—a city group

and an inter-secretariat working group. The city group's task was to improve methods and international standards for national official energy statistics, and the other group was requested to enhance inter-agency coordination, especially in harmonization of the definitions of energy products.

The commission commended the progress at its 37th session in 2006 established the Oslo Group and the Inter-secretariat Working Group on Energy Statistics (InterEnerStat), requested them to build proper coordination mechanisms. While the Oslo Group concentrated on developing conceptual framework of IRES, also the data compilation and dissemination strategies, InterEnerStat focused on the harmonization of definitions of energy products and flows.

Through the efforts of UNSD, two Energy Working Group and other relevant international organizations, IRES draft^[9] was formally adopted by UNSC at its 42nd session in February 2011, two global consultations^[10] and energy experts convened meeting^[11] were held during this period, and IRES had been modified based on feedback from the global discussion.

PURPOSE, PRINCIPLES AND USERS OF THE IRES

As an important international energy statistics guidelines, the preparation and revision process of IRES always follow certain objectives and principles to ensure the entire amendments working smoothly.

Purpose

The main purpose of IRES is to provide recommendations on concepts and definitions, classifications, data sources, data compilation methods, institutional arrangements, approaches to data quality assessment, metadata and dissemination policies. IRES also will make these statistics more consistent with other fields of economic statistics such as standard international classifications of activities and products, as well as with the recommendations for other economic statistics. In addition, IRES will serve as a reference document in support of the maintenance and development of national energy statistics programs. It provides a common, flexible framework for energy statistics collection, compilation, analysis and dissemi-

nation that meet the demands of energy statistics data timely, reliable, and internationally comparable.

Principle

To ensure intended objectives that IRES should achieve, UNSD and OGES have always being following 5 principles to guide the preparation of IRES^[2]:

- Needs of major users should be considered as a starting point to ensure the data compiled according to IRES are policy relevant, meets the needs of the energy producers and users, and provides foundation for energy statistics taken into a broader accounting framework;
- The revision should be consulted by both national statistics offices and energy agencies, as well as with the relevant international organizations;
- While providing recommendations on data items and definitions, the work of collecting data items should not create significant additional burden and are available by most countries, to ensure international comparability;
- The revision should be in the background of promoting an integrated approach in national statistics system, to the extent possible, uses harmonized concepts, classifications, and standardized data compilation methods to achieve maximum efficiency and minimize burden.

Users

Energy statistics are a specialized field of statistics whose scope is broadly covering extraction, production, transformation, distribution, storage, trade and final consumption of energy products. Therefore, in the preparation of international recommendations for these statistics, the needs of the various user groups are taken into account, the main user groups are:

- Compilers of national energy statistics. Irrespective of whether they are located in national statistics offices, energy agencies, or other governmental institutions, who can collectively strengthen the national energy statistics as a part of official statistics by IRES;
- Policy makers. IRES will help them to better assess the strategic importance of energy statistics, the complexity of the issues energy statistics face;
- International and regional organizations. IRES as a

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reference document which will be based by whom dealing with energy-related issues;

- Research institutions and energy analysts. They will use IRES to better assess the quality of data and provide valuable suggestion to energy statistics compilers;
- The public. They will find much essential information for better understanding energy statistics and formulating judgments of energy policy issues by IRES.

CONTENT AND REVIEW OF IRES

In accordance with the objectives and purposes, the main structure of IRES consists of 11 chapters and 3 annexes, where the main part of the IRES can be divided into 5 parts according to its contents.

Introduction

This part is the Chapter 1 of IRES that introduces background information, goals and users of IRES, emphasizing its main objective is to strengthen energy statistics as a part of official statistics of United Nation, and provides solid foundation for long-term development of energy statistics, identifies needs of users, and describes how to deal with these requirements in the following sections. This chapter also describes the relationships between IRES and *Energy Statistics Manual (ESM)* and the forthcoming *System of Environmental-Economic Accounting for Energy (SEEA-E)*, IRES is a suggested criteria and therefore contains a lot of advice and encouragement on energy statistics data collection, compilation and publication, from the introductory part, IRES provides total of 92 recommendations, the most part is in Chapter 8, a total of 20 recommendations, the appendix has two suggestions.

Basic Category of Energy Statistics

This part includes the 2nd, 3rd and 4th chapter of IRES, involves four areas: the range of energy statistics, classification, measurement units and conversion factors.

Chapter 2 defines concepts on boundaries of energy products, energy flow, energy industry, energy consumption, energy resources and reserves, provides a clear range of energy statistics, for example, while using territorial principle in energy balance, using permanent principles in en-

ergy accounts, takes the activities of the energy statistics and the main characteristics of energy sectors as a completely system. Firstly this chapter proposes energy as a broad definition of physical phenomena, and then presents its definition in the context of statistics, so that the physical concept of energy can be used for statistics purposes, in addition, the role of the laws of thermodynamics in energy statistics also can be explained. The differences of terminology between energy statistics and other economic statistics, such as energy use to consumption, have been further explained and their scopes of application clearly defined, this chapter also discusses the ISIC (4th edition).

Chapter 3 introduces *Standard International Energy Product Classification (SIEC)*, develops the internationally agreed definitions of energy products into a hierarchical classification system, and provides a coding system which clearly reflects their relationships between the energy data collection and processing. The classification criterion in SIEC follows the basic physical and chemical properties, clearly labels the energy is the primary energy or secondary energy, renewable energy or non-renewable energy sources. In addition, the chapter describes the relationships between SIEC with the HS (2007) and the CPC (Ver.2).

Energy products are generally measured based on their physical properties, so there will be a variety of different units of measurement when data collation for data compilers in the absence of specific information, it will lead to deviation or even wrong results, so chapter 4 begins with the detailed description of the original unit of different products, and gives recommendation of measurement by the use of common units: joule or other measurement units (tons of oil equivalent, etc.), and then compares and discusses two calculation methods of calorific value in energy products and the conversion factors, it proposes using the measurement of net calorific value (NCV) rather than gross calorific value (GCV), with particular emphasis on the importance of specific conversion factors, the default conversion factor can be used in conversion between different unit of energy in the absence of national, regional specific conversion factors, IRES lists the various energy products conversion factors in the annex.

The compilation of energy balances

This part of the content is mainly related to energy balance, solves the various problems in preparation

of energy balance, such as acquisition methods on concepts of various indicators, definitions, units of measurement and data, of course, includes the most important content: methods and examples of energy balances preparation.

The main purpose of chapter 5 is to clear the boundaries between energy flows and stocks, to indicate the relationships between energy stock and other related concepts (reserves, resources, inventory, etc.), to define the distinctions between energy and non-energy flows, to provide concrete definitions of energy flows, such as energy production, conversion, non-energy use, final energy use and consumption, etc. This chapter introduces a detail classification of energy sector, energy users and households, proposes recommendations on the use of quantity, weight and energy standard units to measure the energy flow and stock, presents and discusses issues related with monetary measures. Overall, the generality of this chapter is to introduce the process of various energy flows from extraction, production to use, consumption in order to help understanding lists of various data items in chapter 6.

Chapter 6 presents the recommendations of relevant statistics units and their characteristics, for the collection of data from the energy and non-energy sector, and also provides reference list and their definitions of the data items to be collected, the list includes: characteristics of statistics units, energy flows and stocks, energy products and reserves, the assessment of economic activity, underground storage of energy resources, etc., the definition of specific data item reflects the characteristics of each energy source. Compared to the chapter 2 and Chapter 5, this chapter is more technical, such as how to collect data items and what or which data items can be collected from each organization, provides a basis for the data collection and collation in Chapter 7 and the preparation of energy balance in chapter 8.

Chapter 7 outlines the source of various types of data such as administrative data, surveys, etc., as well as the data collection, compilation strategies and approaches of energy supply, use and consumption-related, focusing on the main types of data sources and key elements of data compilation strategies, such as the organization of data collection from various sources and merging these data, data projections, estimation, sea-

sonally adjustment and other methods will be detailed elaborated in an upcoming issue of ESCM, in addition, the exact boundaries of IRES and ESCM is also clarified in this chapter, which highlights and promotes the importance of effective institutional arrangements to get energy statistics data.

Chapter 8 describes compilation of energy balance, which is the most important chapter of the IRES. Its main purpose is to emphasize the important role of energy balance for policy makers to organize energy statistics data in a coherent system. This chapter describes the structure of energy balance based on concepts, definitions, classifications and data items described in the previous text chapters, the energy balance proposed is a matrix form that reflects the relationships between the flow of energy and products, although the specific energy balance may be different due to national energy production and consumption patterns and the degree of detail required, IRES provides a recommended framework under consideration of internationally comparable and stability, which is matrix balanced table (TABLE 1).

In TABLE 1, the vertical column describes the case from energy flows to energy products, a horizontal line reflects the conversion between the energy product and the final consumption, contains three block: top block, middle block and the bottom block, the top block mainly represents changes in national energy stocks, reflects the energy supply information based on principle of territoriality in the reference period; the middle block reflects the transformation, use and loss of the country's energy products; the bottom block reflects final consumption and non-energy use of the country's energy products.

Data quality of energy statistics

As an important basis for countries developing economic and social policy, data quality of energy statistics has become a particular concern to international problem, which is described by IRES in two chapters from the aspect of the data quality assessment on energy statistics to methods of data dissemination.

Chapter 9 introduces the major dimensions of energy data quality assessment, provides recommendations on how to establish a national energy data quality assessment framework, the framework should include

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TABLE 1 : Template of an aggregated energy balance in IRES

Block	Item code	Flows	Energy products			
			E1	E2	E3	...
			Total of which: Renewables			
Top block	1.1	Primary production				
	1.2	Imports				
	1.3	Exports				
	1.4	International Bunkers				
	1.5	Stock change (closing-opening)				
Middle block	1	Total energy supply				
	2	Statistics difference				
	3	Transfers				
	4	Transformation processes				
	5	Energy Industries own use				
	6	Losses				
Bottom block	7	Final consumption				
	7.1	Final energy consumption				
	7.1.1	Manufacturing, const. and non-fuel mining industries, Total				
		Iron and steel				
		Chemical and petrochemical				
		Other Industries				
	7.1.2	Transport, total				
		Road				
		Rail				
		Domestic aviation				
7.1.3	Domestic navigation					
	Other Transport					
	Other, total					
7.2	Of which: Agriculture, forestry and fishing					
	Households					
		Non energy use				

a set of evaluation index system which are divided into three categories: key indicators, supportive indicators and indicators for further analysis. The dimensions of assessment include relevance, credibility, accuracy, timeliness, coherence and accessibility. In addition, this chapter introduces a third type of vital statistics data: Metadata, or named data about data, besides

the macro data and microdata, and provides a set of tables that information should accompany statistics dissemination based on metadata, emphasizes the importance of ensuring high quality of energy statistics data, countries are encouraged to put the development of metadata as priority consideration.

Chapter 10 begins with the importance of energy statistics data dissemination, puts forward the mechanism of energy statistics data dissemination should include the range of data, reference period and the effective period, the data revision policy, dissemination format, dissemination of metadata and quality reports, etc. The confidentiality of data dissemination, dissemination plans, data revised format and international reporting were discussed in detail.

Application of IRES

As an international document on energy statistics, practical guidance is indispensable content of IRES, the Chapter 11 in IRES distinguishes energy accounts and energy balance from three aspects of conceptual framework (mainly geographical principle), the terminologies (such as energy supply, use and final consumption, etc.) and forms of expression, Basic energy statistics and energy balances can be used as a data source for the compilation of the physical supply and use tables of the SEEA-E. However, because of the differences in concepts and definitions, adjustments are in need in order to compile the energy accounts. Good country practices in this respect will be described in detail in the forthcoming ESCM. This chapter also provides a lot of examples on energy statistics and balance for other purposes, such as preparation of SEEA-E, climate change and greenhouse emissions and sustainable development, a series of guidelines on the actual operation of energy statistics may encounter for countries to practice better.

IRES contains three attachments: Annex A: primary and secondary products, renewables and non-renewables; Annex B: additional tables on conversion factors, calorific values and measurement units; Annex C: commodity balance.

By analyzing the structure of IRES arrangements and settings of content, we can find the preparation of IRES in accordance with bottom-top from basic concepts to expansion of ideas (Figure 1). The bottom is

the introduction, that plays a commanding role in IRES and introduces a series of background information, following chapters that describe basic issues of energy statistics related and other concepts in detail, and then is the core of IRES, preparation and application of energy balance, the next step is to build a system, completely evaluation system of energy statistics from data quality and the institutional arrangements, in order to enforcing energy statistics smoothly and orderly, the last part of IRES provides cases contacting the reality, the latest and the international energy research to ensure combination of theory and practice, guides the practice of countries for better.

CHARACTERISTICS OF IRES

IRES is the international guidelines on energy sta-

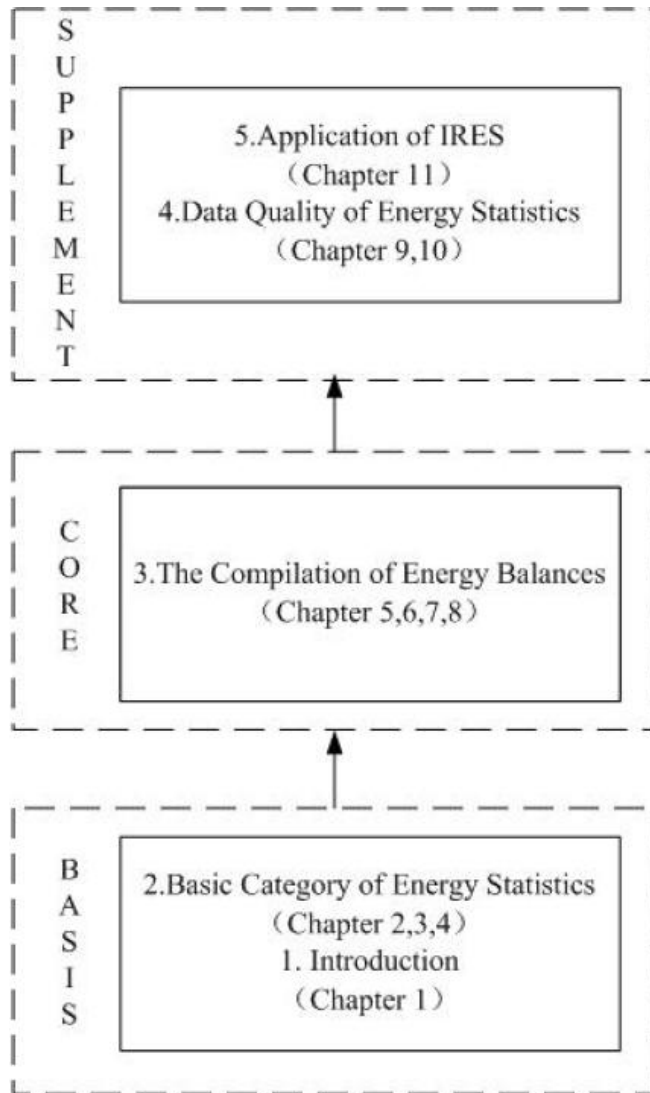


Figure 1 : The structure of IRES

tistics, throughout the standards system and the chapters, it has the following characteristics:

Authoritative

IRES has strong authority, that is jointly developed by UNSD, OGES and InterEnerStat energy statistics experts, and its revision by the world’s most members of UNSC, the government statistics agencies and relevant experts, and adopted by the UNSC. The global consultations of IRES were carried out in two stages with OGES and some energy agency cooperation, received responses from over 70 national bureau of Statistics, more than 30 energy ministries and agencies, and 5 organizations. More than 98% of the responses supported the objectives of the recommendations of strengthening energy statistics as part of official statistics serving for multiple users. It is also widely agreed on the contents of each chapter and the structural arrangements, therefore, IRES is representative widely, will be the international standard for energy statistics.

Integrity

IRES is a comprehensive international guidelines for energy statistics, including the basic concepts, classification, index methods, a series of accounts and the applications. Applications in the last section add some contents, such as the complexity of the energy market, new energy sources and technologies used (such as renewable energy sources) to assess the energy supply and consumption data and the needs for efficiency sustainability, etc., which were never happen in previous energy statistics guidelines. Furthermore, IRES provides effective suggestions on these subjects, data compilation strategies, data quality, metadata, and data dissemination, which were not clear in the existing United Nations publications. In addition, IRES not only lists the indicators framework by three levels of energy and social, economic and environmental, which is binding some work of sustainable development by International Energy Agency (IEA), but also makes † recommendations on the latest issues of energy statistics, such as evaluation of carbon emissions and emission factors, energy prices and taxes. In general, compared to existing energy statistics guidelines, the system of IRES is more completely, the subject discussed timelier and more practical.

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International comparability

As growing of the international political and economic cooperation between countries, internationally comparable and representative statistics data are more and more required to people, as internationally comparable statistics data can be helpful for their management decisions, policymaking evaluation and other researches, and these data are the basis for economic analysis^[3]. IRES attaches great importance to the international comparability of energy statistics, the full text of the guidelines involves the word “international comparability” a total of 58 times, an average of 7 times nearly every chapter mentioned, such a high frequency of this word used, IRES can be sufficient to explain that the degree of attention to international comparability of statistics is so high in the preparation process, IRES always pay attention to related energy statistics concepts is consistent with existing energy statistics criteria. IRES also improves integrated methods of energy statistics, aims at improving coordination with other activities international standards and product categories, such as energy statistics classification with SIEC, also pays attention to high degree of articulation with some new recommendations related fields, such as the forthcoming SEEA-2012, SEEA-E, ESCM, etc. In addition, in order to meet needs of the international reports on energy data, such as sustainable development, energy security, climate change and other global challenges, IRES improves coverage of energy statistics database of the United Nations and other regional organizations, which laid a solid foundation for international comparability of energy statistics.

Specific

IRES elaborates some specific operation of energy statistics, especially when is not the same with other criteria (such as SNA, SEEA-E, etc.), provides detailed methods, which has great role in the promotion and development for method of national energy statistics, also makes the work more feasible. SEEA-E in the energy supply-use tables can use the basic energy statistics balance directly, but the concepts and definitions of energy accounts in IRES are different, so it needs further adjustment, therefore, IRES provides specific adjustment methods for some concepts of indicators (e.g. energy import, geographic principles). In addition, it

shows a list on the required additional information in preparation of energy accounts (such as residents and nonresidents in final consumption of energy, residential units and other overseas energy product usage), these detail methods and information greatly refine the actual operation of energy statistics, making it more feasible.

Flexibility

To meet the different levels of users and varying national circumstances requirements, IRES particularly pays attention to differences about energy resources and national statistics system between countries, energy statistics methods which are provided by IRES are flexible to meet the needs of different countries. IRES develops concrete steps for energy statistics from the list of data collection, preparation for recommendations of energy balance to data quality management methods and the applications of energy statistics practice, has made detailed provisions, and various methods are compared, gives the recommended method in energy statistics process, and emphasizes the flexibility of the various methods that countries may follow the key principles, according to the actual situation of each country to improve the methods to ensure the smooth progress of energy statistics, which greatly enhances flexibility of energy statistics in the practical applications of countries.

ENLIGHTENMENTS FOR CHINA

Although the establishment and promotion of a common set of high-quality energy statistics standard is a general trend, there are many differences in the politics, economy, and culture between countries, also has certain difficulty to reach the goal of reunification standards. Under the uncertainty circumstances, China must continue to focus the changes of international energy statistics standards, respond flexibly to the situation and address how to with the international standards for applications of energy statistics^[4].

- It is a general trend for energy statistics of China to be with international standards. After the promulgation of IRES by UNSC, China should make clear objectives of energy statistics for reform and development, energy statistics should be included in the official statistics as soon as possible, not only to meet

the needs of China's economy, energy and statistics development, but also deal with the trend after China's accession to GDDS. Energy statistics with international standards, China should be fully and completely removes the consideration of emphasizing Chinese characteristics and China's national conditions, and also should be actively and steadily in operation that should start from the basis of statistics reform work, make well designed reforms for international standards of energy statistics program.

- Promote scientific of energy statistics methods, collect energy statistics data by variety of methods. Explore the modes of energy statistics information acquisition actively in the new situation, improve investigative techniques and increase work efficiency, and continuously learn advanced survey methodology, establish a set of energy statistics system gradually, that adapting China's national conditions, and also in line with the international general rules, get a timely response to the contradictions between of China environmental change and the backward energy statistics system.
- Introduce a third test institution timely, make good use of social resources on energy statistics. China currently has a huge number of industry associations, research institutions and other organizations, it should accelerate the development of nurturing third party statistics force, to be an effective complement and develop superiority of each service for government energy statistics.
- Strengthen the research and advocacy of IRES. As a new international statistics standard, IRES is linked closely with the forthcoming SEEA-E and ESCM, the public and the industry of energy statistics also know little about it, so we should strengthen study, research and advocacy of IRES and lay the foundation for SEEA-E, ESCM and research energy statistics with international standards, otherwise it will be impossible.

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