**ENERGY STATISTICS COMPILERS’ MANUAL**

**CHAPTER 1: INTRODUCTION**

**BACKGROUND**

Energy plays an essential role in almost all forms of human activity. A successful economy is typically characterised by a reliable and efficient supply of energy that meets the full range of its social and economic needs. Ideally, all households should have access to clean, affordable and reliable energy while businesses should have access to energy that enables them to produce goods and services in a competitive marketplace. Businesses that supply energy should also be viable and ongoing. However, growing worldwide demand for energy gives rise to concerns about the sustainability of supply and the impacts on the environment.

In this modern context, it is essential for countries to monitor and manage their energy resources and various aspects of energy production and use. In order to do this well, it is important to ensure that policy decisions are informed by reliable and appropriate data. The development of systems to produce quality and consistent energy information should be based on internationally agreed-upon standards, classifications and other frameworks as these will enable cross-country comparability and consistency over time.

There is a broad range of contemporary energy issues that must be addressed. These include: ensuring a sustainable supply of energy resources for the future; developing and maintaining the infrastructure for the transport of energy products to market; managing energy price volatility; encouraging investment, innovation and efficiency in the energy sector; ensuring emergency preparedness; and managing environmental impacts of energy production and use. Relevant and timely energy information is necessary to support evidence-based policy and decision-making, to monitor and assess programs, to enable research and analysis and to inform the public. Information should be compiled on energy production, supply, transformation and distribution by product, and on energy use by industry, households, and other sectors. The geographic location of energy supply and the accessibility of this energy is also important – accessibility in terms of both the physical and economic capacity of users to access energy.

Purpose of the Energy Statistics Compilers Manual (ESCM)

The *Energy Statistics Compiler’s Manual* (ESCM) has been prepared in accordance with the recommendation of the United Nations Statistical Commission at its forty-second session (2011) which requested that in relation to energy statistics, the ESCM must contain clear guidelines on data sources, on the use of administrative data, and on best practices applicable to a wider range of countries.

The primary purpose of the ESCM is to assist countries in strengthening official energy statistics by providing guidance on energy concepts and definitions, the legal foundation and institutional arrangements for the collection of energy data, classification systems, data sources and compilation methods, energy balances and accounts, energy indicators, practices for assuring data quality, metadata requirements, and dissemination policies and practices. Such guidance relies on precedents in the field of energy statistics and assists in resolving challenges that are encountered in the compilation of energy statistics. For example, the timing of the data should reflect its intended uses so that information related to rapidly-changing energy flows of high policy interest would be required sooner and more frequently than more stable structural information.

The ESCM is directed towards all institutions that play a role in the collection, compilation and dissemination of energy statistics – the term “compiler” as used in the ESCM refers to those institutions. In addition, the ESCM provides data users with a richer understanding of energy statistics and therefore a heightened capacity both to analyse this information and to communicate with data compilers on such things as data quality.

The ESCM is intended to be a practical and relevant guide to all countries, irrespective of size, stage of economic development, energy resource endowments or institutional arrangements. Country-specific experiences and practices are provided as examples to illustrate how energy data can be compiled in a variety of circumstances.

**CONCEPTUAL FRAMEWORK**

The Energy Statistics Compiler’s Manual (ESCM) focuses on the compilation of energy statistics and energy balances as defined in IRES. Throughout the ESCM, use of the terms ‘energy statistics’ and ‘energy balances’ denotes statistical measures subject to the direction of IRES.

This section describes the conceptual framework - or basic organising structure - for energy statistics and energy balances. This conceptual framework defines the scope and boundaries of what is to be measured, that is, it defines key concepts and definitions; it describes key classifications; and it notes the links to other relevant conceptual and statistical frameworks, in particular SEEA-Energy, the Central Framework of the *System of Environmental-Economic Accounts* (SEEA) and the 2008 edition of the *System of National Accounts* (2008 SNA). In doing so, the conceptual framework sets out the dimensions of what is to be measured and assists in guiding data collection, organisation and communication among various stakeholders.

Scope and boundaries

IRES was developed largely to address concerns regarding data availability and international comparability for energy statistics. A key element in improving these aspects of energy statistics relates to the clarification and standardisation of the scope and boundaries of energy products. IRES essentially defines the scope of energy products as being those products contained within the *Standard International Energy Product Classification* (SIEC). This classification reflects an historically agreed-upon identification of the products needed to provide a comprehensive and analytically useful picture of the production, transformation and consumption of energy within the economy. The identification of energy products within SIEC in turn facilitates the integration of these product measures with the *International Standard Industrial Classification of All Economic Activities, Rev. 4* (ISIC).

Key concepts and definitions

Energy statistics and energy balances are part of a specialised statistical field that employs a range of specific concepts and related terms that are well-established in both data compilation systems and in disseminated outputs. As such they are well-known to the main users of energy statistics. In some instances, terms used in energy statistics may differ from those used in energy accounts – where this is the case, the difference is acknowledged and explained. A description of the linkages between energy balances and energy accounts is made in Chapter 6, along with an explanation of implications for compilers.

Energy statistics, energy balances and energy accounts are all concerned with the production, transformation and consumption of energy. The following descriptions relate to key concepts within these domains.

The term **products** is understood equally within IRES and in economic statistics. It refers to all goods and services arising as outputs of production – production in this context is understood as **economic production** which is defined in the 2008 SNA (paragraph 6.24) as ‘… an activity carried out under the control and responsibility of an institutional unit that uses inputs of labour, capital and goods and services to produce outputs of goods and services’. **Energy production** in IRES is defined as ‘… the capture, extraction or manufacture of fuels or energy in forms that are ready for general use. This production includes that undertaken by economic units, including households, whether or not the production is (i) their principal, secondary or ancillary activity; and/or (ii) carried out for use of other economic units or for own use’.

**Energy products** are a subset of products and include products exclusively or mainly used as a source of energy. They include energy in forms suitable for direct use (e.g. electricity and heat) and in forms that release energy while undergoing some chemical or other process (e.g. coal or motor gasoline). In addition, products derived from fossil fuels that are used, or intended to be used, for non-energy purposes (e.g. lubricants produced from crude oil) are considered to be energy products, provided that they are produced by energy industries (defined below and including, for example, oil refineries or gas plants).

Since a number of energy products are transformed into other kinds of energy products prior to their consumption, a distinction is made between **primary energy products** and **secondary energy products**. This distinction is necessary to avoid the double-counting of energy production in the energy balances and for various other analytical purposes. Energy products can be obtained from both **renewable** (e.g. solar, biomass, etc.) and **non-renewable** sources (e.g. coal, crude oil, etc.). It is important for policymakers that a distinction is made between renewable and non-renewable energy products, as well as to distinguish **infinite** renewable sources such as solar from **cyclical** renewable sources such as biofuels. For further information on primary, secondary, renewable and non-renewable energy products see Chapter 5 and Annex A of IRES.

The **boundary of energy products** cannot always be determined solely by knowing the physical characteristics of the product – it may also be necessary to know the use of the product. For example, corncobs may be: (1) combusted directly to produce heat; (2) used in the production of the biofuels; (3) consumed as food; or (4) consigned to waste. In order to delineate energy products, Chapter 3 of IRES defines such products and presents a classification of energy products – SIEC. In our example above, the boundary established by IRES and by SIEC determines that corncobs are treated as energy products only when combusted directly to produce heat. Biofuels generated from input of corncobs are also an energy product, but under these circumstances the corncobs themselves do not constitute an energy product. Energy production and related concepts are further discussed in Chapter 5 of IRES.

**Energy flows** are flows taking place in relation to the national boundary and that are associated with various activities of energy industries and energy consumers. For example, flows related to production of energy products, imports and exports of energy products, and consumption of energy products.

Although various economic units can produce energy, not all of these units should be treated as belonging to energy industries. In IRES, **energy industries** are defined as consisting of those economic units whose principal activity is primary energy production, transformation of energy and/or distribution of energy. This means that the value added generated by these activities exceed that of any other activity carried out by the same economic unit.

In order to have a complete picture of the supply and demand for energy in a country it is important that data on the **production of energy outside the energy industries** is collected and included in total energy production. That is, some energy is not produced by energy industries but instead by enterprises engaged in energy production as a secondary or ancillary production. For example, a sugar cane processing plant may use the fibre remaining after juice extraction as a fuel.

**Energy users and energy consumers.** Energy products can be used for various purposes (e.g. for final consumption, or as an input to the production of secondary energy products) and by different users (e.g. various industries and households). Statistics on energy consumption are of great importance, for example, being essential in assessing the efficiency of energy use. Final consumption of energy products represents the last stage in which energy products are utilised and at which point they exit energy statistics. The different types of energy consumers can be grouped according to analytical needs and regulatory requirements. Chapter 5 of IRES discusses how the recording of energy users and energy consumers may be performed.

An **energy balance** is an accounting framework for the compilation and reconciliation of data on all energy products entering, exiting and used within the national territory of a given country during a reference period. Such a balance must express all forms of energy in a common accounting unit, and show the relationship between inputs to and outputs from the energy transformation process. In practical terms, the assembling of energy information in an energy balance provides a ready check on the completeness and coherence of energy information and, where data are not initially fully coherent, provides a framework to establish priorities for improvement. A description of the format and the main components making up energy balances is provided in Chapter 5. Chapter 5 also provides a range of important information on energy balances, including: conversion of commodity balances for energy into energy balances; and derivation of energy values for production of primary energy. It also provides guidance on data reconciliation and the estimation of missing data.

SEEA-Energy uses supply and use tables that, in principle, are very similar to energy balances. For each type of energy product, supply and use tables record total supply as the sum of the production and imports. In turn, these energy products are used by households, by government, for export, and by industry - either in the current accounting period (as intermediate consumption), or across multiple accounting periods (for example, as inventory changes). For supply and use tables expressed in monetary terms, the scope of the presentation is restricted to energy products. However, for supply and use tables expressed in physical terms, the scope of the presentation extends to flows of relevant natural resources and residuals (including emissions).

Key classifications

The frameworks governing energy statistics / energy balances and energy accounts cover a range of disciplines and therefore potentially utilise a number of classifications. However, the definition and classification of energy products is of fundamental importance to energy statistics since it essentially determines the scope of both IRES and SEEA-Energy. In practice, IRES and SEEA-Energy use virtually identical notions and classifications of energy products i.e. as set out in the SIEC.

*Standard International Energy Product Classification, SIEC*

 IRES presents a list of internationally agreed definitions of energy products which is presented within the SIEC in IRES. Table 1.1.2 presents the SIEC in abbreviated form.

 Table 1.1.2 Standard International Energy Product Classification (SIEC)



Source: IRES, 2011

Within SIEC the distinctions made between primary and secondary energy products and between renewable and non-renewable energy products are not explicit classification criteria. Nevertheless, in many cases an entire detailed SIEC category can clearly be assigned as either primary or secondary products; and as either renewable or non-renewable products. The list of products considered primary or secondary and renewable or non-renewable is described in Annex A to IRES.

IRES also presents correspondences between SIEC and two important international product classifications, i.e. the Harmonized Commodity Description and Coding System (HS) and the Central Product Classification (CPC) are provided in IRES. The correspondence between SIEC and the CPC becomes relevant when estimates related to energy products are measured in monetary terms. While estimates of energy products expressed in physical terms are classified according to the SIEC, estimates expressed in monetary terms typically use the CPC. The direct comparison of physical and monetary estimates for energy products therefore utilises a correspondence between the SIEC and CPC classifications. This correspondence is set out in Table 3.1 of IRES.

Links to other conceptual/statistical frameworks

The ESCM covers a range of domains: energy statistics and energy balances; and linkages to energy accounts. The energy accounts may be expressed in terms of physical and monetary units and are valuable to those users interested in undertaking integrated analyses covering the fields of energy, environment and economics. The ESCM is therefore a vitally important element in setting up a multi-purpose energy information system. Consequently, it also has relationships to a number of international statistical standards and frameworks – these relationships fall within four main groupings: relationships to IRES; relationships to SEEA-Energy; relationships to the SNA and relationships to standard international classifications. Each of these is described in turn.

*ESCM and IRES*

The primary role of the ESCM is in providing practical support to compilers who want to meet recommendations set out in IRES. As such the ESCM and IRES are documents that fulfil complementary roles. The UNSC in 2006 supported the establishment and mandate of the Oslo Group on Energy Statistics and the Intersecretariat Working Group on Energy Statistics (InterEnerStat) – the latter convened by the International Energy Agency (IEA). The Oslo Group was responsible for coordinating improved methods and international standards for national official energy statistics, and InterEnerStat was charged with improving interagency coordination.

A critical outcome of the work by the Oslo Group and by InterEnerStat is IRES, which was adopted by the UNSC in 2011. The key outcomes achieved by IRES are an overall conceptual framework; harmonised definitions of energy products and energy flows; and guidance on data compilation and data dissemination. Recommendations contained in IRES reflect an internationally agreed position on the statistical production process framework for energy. The ESCM in turn provides guidance of a more practical focus to assist countries in the implementation of IRES, in particular, it provides clear guidance on data sources, on the use of administrative data and on a range of best country practices.

*ESCM and SEEA-Energy*

The ESCM plays an important supporting role to SEEA-Energy, primarily by providing practical support in the implementation of IRES. IRES in turn provides valuable input to the production of tables and accounts of SEEA-Energy through its recommended use of harmonised definitions of energy products following a standardised energy product classification (the SIEC) and through guidance on data sources, data compilation and data presentation. Where a country has produced energy statistics and balances according to IRES, the compilation of SEEA-Energy tables and accounts becomes a realistically achievable and complementary extension to the existing body of official energy statistics.

Energy data produced according to IRES are therefore a valuable input to SEEA-Energy. However, these data require a number of important extensions and adjustments before they can be appropriately integrated with monetary data produced according to principles of the SNA. In particular, SEEA-Energy incorporates a number of principles and structures – including the use of the residence principle for determining national boundary, and supply and use tables for various energy products – that are needed to support a wide range of energy-related analyses of the interaction between economy and environment.

The ESCM can therefore play an important part of the implementation process for both IRES and SEEA-Energy. The ESCM will cover the implementation of the recommendations contained in IRES, and the links to SEEA-Energy, to allow countries to set up a multi-purpose energy information system. More detailed information about the compilation of energy accounts in line with SEEA-E guidelines is presented in Chapter 6 of this manual.

*ESCM and SNA*

The 2008 edition of the *System of National Accounts* (2008 SNA) is the statistical standard that provides the overarching framework governing economic statistics. If energy information is to be integrated with economic information it must be relatable to the SNA. This integration of environmental and economic information for energy is one of the roles performed by both the SEEA and SEEA-Energy. Energy accounts follow the principles and structures set out in the SEEA and in SEEA-Energy and the SNA is the primary basis for the concepts, definitions and accounting rules embodied in these frameworks. The ESCM supports the compilation of energy statistics, energy balances and the linking of these measures to energy accounts. It therefore provides practical guidance in producing energy information that is ultimately relatable to the 2008 SNA.

*ESCM and standard international classifications*

International comparability of energy statistics, energy balances and energy accounts is enhanced through the consistent use of standard international classifications. The ESCM has links to a number of standard international classifications.

In the measurement of energy products both IRES and SEEA-Energy use the SIEC. The correspondence of SIEC to the *Central Product Classification* (CPC) and to the *Harmonized Commodity Description and Coding System* (HS) provides two main benefits. Firstly, because SNA and SEEA-Energy monetary estimates for energy products are typically classified using CPC (and/or HS), the correspondence enables direct comparison of physical and monetary estimates for energy products. Secondly, since the CPC and HS are extensively used throughout economic statistics, the SIEC – CPC and SIEC – HS correspondences more broadly assist data users to undertake integrated environmental-economic analyses in the area of energy.

The IRES recommends that energy statistics be produced in respect of the main characteristics and activities of energy industries and in respect of the main groups of energy consumers (both households and industries). The ISIC is used within IRES to understand and classify the statistical units involved. Further, IRES articulates a correspondence to relevant ISIC Rev. 4 divisions/groups for both energy industries and energy consumers. The use of the ISIC is a standard feature throughout the SEEA, SEEA-Energy, the SNA and economic statistics more generally.

**ORGANISATION OF THE ESCM**

The Energy Statistics Compilers Manual (ESCM) details a number of topics that will allow users a step-by-step approach to producing energy statistics. The chapters are as follows:

**Chapter 1: Introduction**

This chapter describes the purpose of the ESCM and outlines the scope and boundaries of energy statistics, its key concepts and definitions, relevant classifications and links to other statistical frameworks such as the International Recommendations for Energy Statistics (IRES), the System of National Accounts (SNA) and the System of Environmental-Economic Accounting (SEEA).

**Chapter 2: Legal foundation and institutional arrangements**

Each country has a legal framework and institutional arrangements that impact on the collection and dissemination of its energy statistics. This chapter examines a range of possible legal and institutional arrangements affecting the design and operation of a national system of official energy statistics. The chapter covers two broad areas:

* Legal framework. The need for a legislative framework as a foundation for energy data collection, to provide authority and direction for the collection, handling and processing of information.
* Institutional arrangements. A discussion is provided on those types of working mechanisms among relevant institutions with the potential to assist or otherwise impact on official energy statistics. For example, the chapter discusses the operation of institutional arrangements between the Ministry of Energy and the National Statistical Office; and the operation of a national statistical committee on energy statistics. The goal of these arrangements is to support the efficient collection and dissemination of cohesive energy statistics.

**Chapter 3: Classifications**

The use of standard classifications is of paramount importance in the collection, compilation and dissemination of statistics. Standard classifications facilitate data collection as they provide a clear definition, with a unique structure, of the objects that are being measured and collected. This chapter elaborates on the classifications used in energy statistics. In particular, it covers the classification of statistical units providing clear links with the International Standard Industrial Classification of All Economic Activities (ISIC) and the Standard International Energy Product Classification (SIEC) with the links to the Central Product Classification (CPC) and the Harmonized Commodity Description and Coding System (HS). The chapter describes some of the issues that exists in the correspondence between these international classifications and provide examples of country practices throughout the chapter. It also provides the taxonomy of energy uses which is the basis for the energy balances.

**Chapter 4: Data sources and data collection**

The data sources and approaches to data collection that support energy statistics vary between countries. This chapter provides a comprehensive assessment of possible data sources and collection tools including: direct collection surveys; administrative data; metering; and data modelling. It discusses the different stages of the data production process following the Statistical Business Process Model developed by the UNECE. The chapter is illustrated throughout with country-specific examples; in particular, it provides a number of case studies to demonstrate how different collection approaches can be combined to build a strategy that delivers all required energy information with a minimum of resources. The chapter concludes with a comparison of data collection methods, particularly as they apply to certain types of respondents.

**Chapter 5: Compilation of energy balances**

Energy balances are an important basis for informed policy decisions and there are a range of sources and methods underpinning these balances. This chapter provides practical guidance in the compilation of energy commodity balances and energy balances as well as in describing general principles and methods used therein. The chapter commences in Part A with a description of the nature and importance of energy balances and energy commodity balances. Part B provides general information pertinent to both commodity balances and energy balances. Part C describes the compilation energy commodity balances for one, or all, energy products. It also presents various data sources that can be used for the compilation of balances, possible data collection challenges, as well as associated data editing and estimation and reconciliation methods. Part D of the chapter explains the progression from energy commodity balances to energy balances, how to use calorific values, and methods for setting the value of primary energy using physical energy content. Validation rules inherent to the energy balances are also addressed here. Part E provides several country specific examples on how to compile energy balances. The chapter also contains appendixes describing how energy statistics compilers may respond to various specific technical issues, for example, dealing with differences between the physical energy content method and the partial substitution method, and calculating the renewable energy column in the energy balances.

**Chapter 6: Compilation of energy accounts**

~~The System of Environmental-Economic Accounting for Energy (SEEA-Energy) provides an international framework for the development of energy accounts. With examples of how to use primary and secondary data discussed in Chapters 4 and 5, this chapter provides general guidance on how to compile these accounts using energy data, in line with SEEA-E guidelines~~.

**Chapter 7: Energy indicators and greenhouse gas emissions**

The production of good quality energy balances and energy accounts (chapters 5 and 6 respectively) in turn supports the development of good quality energy indicators. This chapter explores the range of objectives motivating the use of energy-related indicators and describes various types of indicators relevant to understanding and managing energy and greenhouse gas emissions. An overview of possible data sources related to these indicators is provided. The chapter concludes with a discussion of the relationship between energy efficiency and energy intensity.

**Chapter 8: Data quality and metadata**

Ensuring that energy statistics are produced to a high quality is a key responsibility and challenge for all statistical offices. This chapter looks at ways in which statistical agencies can ensure data quality by considering quality dimensions when measuring and reporting the quality of statistics and by implementing quality measures related to each stage of the data production process. The chapter contains a section related to statistical metadata. This type of documentation provides a means of assessing the fitness for use of energy data and contributes directly to their interpretability, availability and accessibility. To illustrate the application of quality in energy statistics, examples of country practices on the quality dimensions in energy statistics are presented as well as references to data quality and metadata frameworks from various countries and organizations.

**Chapter 9: Data dissemination**

~~Once statistics are produced it is important that they are disseminated in a consistent, user-orientated manner. The manner in which energy statistics are disseminated varies markedly from agency to agency and this chapter draws on best practice examples for timing, revisions, format, confidentiality and other dissemination topics from a range of countries~~.

**FURTHER INFORMATION AND FUTURE WORK**

* ESCM will be released as a hard copy publication, but will also be maintained in electronic form at < insert details >. It will be periodically updated to reflect the evolution of methodologies and of country practices.