Draft proposed core tables for energy

Alessandra Alfieri and Sokol Vako

UNSD

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1. The United Nations Statistical Commission at its 44th session in March 2013 adopted the implementation strategy for the System of Environmental-Economic Accounting (SEEA) Central Framework and, among others, urged the United Nations Committee of Experts on Environmental-Economic Accounting (UNCEEA) to develop a core set of tables and accounts. This note discusses the proposed core tables for energy.

2. Energy is integral to human existence and the way we use energy is an essential element to improved well being. It is an important input in the production of goods, including food, and, among others, is used for transportation and heating. Energy is also one of the three components of the energy-water-food security nexus. As such, energy policy has implications on water and food security and vice versa.

3. The effect of energy supply and use on the environment has also emerged as a critical policy issue. There is a growing concern about the impact of each country's energy use and of related emissions upon global and local environments. On the other hand, there is a recognition that continuing human welfare and development are dependent upon the benefits obtained from the use of energy.

4. The proposed core tables for energy are structured so as to provide relevant information on a number of areas including accessibility and affordability of energy, use and production patterns of energy, and the impact of energy production and use on the environment. They are based on the SEEA Central Framework, SEEA Energy and the International Recommendations for Energy Statistics (IRES) (this note will be update once the Energy Statistics Compilers Manual (ESCM) is completed). The core tables provide an aggregated set of data which provides enough information to derive relevant indicators. Each country is encouraged to further disaggregate the rows and/or columns of the core tables based on policy needs.

5. The development of core tables was requested by the UN Statistical Commission at its 44th session in February 2013. The core tables for energy, along with other core tables such as those for water, forests, and others, constitute the starting point in the development of common reporting tables in close coordination with international agencies. They will be submitted to the UNCEEA after having gone through extensive consultations with experts, including the London Group on Environmental Accounting, international organizations and national statistical offices.

6. This paper is organized as follows. Part 1 presents the core tables. Part 2 discusses some of the indicators that use information included in the core table. Part 3 lists a set of questions for the consideration of the London Group. A section on compilation issues will be added after the completion of ESCM. The annex provides the definitions of energy products as listed in IRES.

Part I-Proposed Core Tables for Energy

7. The proposed first core table for energy is shown below. It combines information on flows in both monetary and physical terms as well as information from the national accounts and labor statistics to present an overview of the energy situation in a country.

Core table 1

	Industries (by ISIC categories)							Rest of the world	Taxes less subsidies on products, trade and transport margins	Final consumption		Capital Formation	Total
	ISIC A	ISIC B	ISIC C	ISIC D	ISIC H	Other industries	Total industry			Households	Government		
1. Supply of energy products (Currency units)													
Coal													
Peat and peat products													
Oil shale/ oil sands													
Natural gas													
Oil													
Biofuels													
Waste													
Electricity													
Heat													
Nuclear fuels and other fuel nec													
2. Total supply of products(Currency units)													
3. Intermediate consumption and final use (Currency units)													
Energy products													
Total (energy and non-energy products)													
4. Gross value added (Currency units)													
5. Depletion of natural energy resources (currency units)													
Depletion adjusted value added													
6. Employment													
7. Supply of energy products (PJ)													
Coal													
Peat and peat products													
Oil shale/ oil sands													
Natural gas													
Oil													
Biofuels													
Waste													
Electricity													
Heat													
Nuclear fuels and other fuel nec													
8. End-use of energy products (PJ)													
Coal													
Peat and peat products													
Oil shale/ oil sands													
Natural gas													
Oil													
Biofuels													
Waste													
Electricity													
Heat													
Nuclear fuels and other fuel nec													
9. Closing stocks of natural energy resources (currency units / PJ)													
Oil resources													
Natural gas resources													
Coal and peat resources													
Uranium													
10. Depletion of natural energy resources (PJ)													
11. Gross fixed capital formation (currency units)													
For extraction of energy resources													
For supply of energy products													
12. Closing Stocks of fixed assets for extraction of energy resources (currency units)													
For extraction of mineral and energy resources													
For capture of energy from renewable sources													
For distribution of energy products													

8. The first core table can be conceptualized as the integration of 3 smaller tables. While countries should strive to populate the first core table to the greatest extent possible, they might wish to initially focus on one or more of the smaller tables shown in turn below. The decision on which tables to first populate should take into account policy demands and data availability. Even if the initial exercise of populating the smaller tables results in largely incomplete table, such information is important in and of itself in providing a

partial view of the energy situation and in determining data gaps. Furthermore, in the first phase it may be possible to make estimates using existing information and relationships between the variables. Finally it should be noted that for many countries only a small number of cells in the tables presented here have significantly large values. For example, in most cases, energy in physical terms is supplies from only a few ISIC divisions for only a few energy products. Countries are encourages to focus their initial efforts in measuring those flows that are most significant.

9. Each of these smaller tables contains sufficient information in and of themselves to derive a number of useful aggregates and indicators as is discussed in Part 2. Should countries be interested in a more detailed presentation of information, the data can be further disaggregated; in particular data could be presented at the ISIC group level (3 digits) for certain ISIC divisions as needed and/or additional data item could be added to the rows of the tables to provide a finer level of details. For example, if the generation of electric power is important, data corresponding to ISIC 351 can be presented as an “of which” column within Section D.

10. Table 1.1 below provides monetary data on the supply and use of energy products in monetary terms. It provides information related to the top third of the core table. Note that some of the monetary data items for the core table come from the national accounts. Further note that while the core table only has the aggregated total intermediate consumption and final use, in table 1.1 this aggregated total is separated over the different energy products. Countries could further disaggregate the data by showing intermediate consumption separately from final use. Table 1.1 provides a good starting platform for those countries interested in better understanding the relationship between the energy sector and the economy at large.

11. Table 1.2 on the other hand is the part of the core table focusing on physical flows, in particular the supply and end use of energy products. For each energy product (definitions of which are provided in the annex), the top half of table 1.2 provides information on what industry is supply what energy product; the bottom half shows end use of energy products by industries and households. It should be noted that “End-use of energy products” records the use of energy products to produces goods and services other that energy products. Furthermore the difference between supply of energy and end use of energy as shown in table 1.2 is equal to transformation of energy products from one form to another (e.g. coal into electricity) and end use of energy products for non-energy purposes (e.g. use of oil as a lubricant) with the later usual being not significant in most cases. Countries who are interested in how energy is distributed among the different energy products and industries/households should commence work on compiling table 1.2.

12. Last but not least, table 1.3 focuses on the stocks of natural energy resources. This table is particularly relevant for energy resource rich countries. The table not only has information on the stocks of natural energy resources in monetary and physical terms, but also on the value of the fixed assets and fixed capital formation. The information on investments and available infrastructure for the

extraction/capture and delivery of energy products can guide policy makers into devising better policies for meeting energy related development goals. This table also contains information on the depletion of natural energy resources in physical terms which is closely linked to depletion in monetary terms in table 1.1.

Table 1.1 Supply and use of energy products and other data in monetary terms

	Industries (by ISIC categories)							Rest of the world	Taxes less subsidies on products, trade and transport margins	Final consumption		Capital Formation	Total
	ISIC A	ISIC B	ISIC C	ISIC D	ISIC H	Other industries	Total industry			Households	Government		
Supply of energy products (Currency units)													
Coal													
Peat and peat products													
Oil shale/ oil sands													
Natural gas													
Oil													
Biofuels													
Waste													
Electricity													
Heat													
Nuclear fuels and other fuel nec													
Use of energy products (Currency units)													
Intermediate consumption and final use (Currency units)													
Coal													
Peat and peat products													
Oil shale/ oil sands													
Natural gas													
Oil													
Biofuels													
Waste													
Electricity													
Heat													
Nuclear fuels and other fuel nec													

Table 1.2 Supply and use of energy products in physical terms

Physical supply table for energy

	Production (including household production on own-account); Generation of residuals							Accumulation	Flows from the rest of the	Flows from the environment	Total supply
	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other industries	Households		Imports		
	ISIC A	ISIC B	ISIC C	ISIC D	ISIC H						
Energy from natural inputs											
Natural resource inputs											
Inputs of energy from renewable sources											
Other natural inputs											
Energy products											
Production of energy products by SIEC class											
Coal											
Peat and peat products											
Oil shale/ oil sands											
Natural gas											
Oil											
Biofuels											
Waste											
Electricity											
Heat											
Nuclear fuels and other fuels nec											
Energy residuals											
Total energy residuals											
Other residual flows											
Residuals from end-use for non-energy purposes											
Energy from solid waste											
Total supply											

Physical use table for energy

	Intermediate consumption; Use of energy resources; Receipt of energy losses						Final consumption	Accumulation	Flows to the rest of the world	Flows to the environment	Total use
	Agriculture, forestry and fishing	Mining and quarrying	Manufacturing	Electricity, gas, steam and air conditioning supply	Transportation and storage	Other industries	Households		Exports		
	ISIC A	ISIC B	ISIC C	ISIC D	ISIC H						
Energy from natural inputs											
Natural resource inputs											
Inputs of energy from renewable sources											
Other natural inputs											
Energy products											
Transformation of energy products by SIEC class											
Coal											
Peat and peat products											
Oil shale/ oil sands											
Natural gas											
Oil											
Biofuels											
Waste											
Electricity											
Heat											
Nuclear fuels and other fuels nec											
End-use of energy products by SIEC class											
Coal											
Peat and peat products											
Oil shale/ oil sands											
Natural gas (extracted)											
Oil (oil products)											
Biofuels											
Waste											
Electricity											
Heat											
Nuclear fuels and other fuels nec											
End-use of energy products for non-energy purposes											
Energy residuals											
Total energy residuals											
Other residual flows											
Residuals from end-use for non-energy purposes											
Energy from solid waste											
Total use											

Table 1.3 Stocks and related data in monetary and physical terms

	Industries (by ISIC categories)							Rest of the world	Taxes less subsidies on products, trade and transport margins	Final consumption		Capital Formation	Total
	ISIC A	ISIC B	ISIC C	ISIC D	ISIC H	Other industries	Total industry			Households	Government		
9. Closing stocks of natural energy resources (currency units / PJ)													
Oil resources													
Natural gas resources													
Coal and peat resources													
Uranium													
10. Depletion of natural energy resources (PJ)													
11. Gross fixed capital formation (currency units)													
For extraction of energy resources													
For supply of energy products													
12. Closing Stocks of fixed assets for extraction of energy resources (currency units)													
For extraction of mineral and energy resources													
For capture of energy from renewable sources													
For distribution of energy products													

Part II: Indicators

13. Following the general structure of the "Energy Indicators for Sustainable Development: Guidelines and Methodologies" [1], energy indicators can be grouped along 3 dimensions: social, economic and environmental. Table 2 shows how the data in the core table can be used in deriving certain indicators.

Table 2: Energy Indicators linked to the social dimension

Theme	Sub-theme	Energy Indicator	Components	Energy core table
Equity	Affordability	Share of household income spent on fuel and electricity	– Household income spent on fuel and electricity – Household income (total and poorest 20% of population)	Household expenditures on energy (see table 1.1)
	Disparities	Household energy use for each income group and corresponding fuel mix	– Energy use per household for each income group (quintiles) – Household income for each income group (quintiles) – Corresponding fuel mix for each income group (quintiles)	Household expenditures on energy (see table 1.1)
Health	Safety	Accident fatalities per energy produced by fuel chain	– Annual fatalities by fuel chain – Annual energy produced	Supply of energy products (see table 1.3)

Table 2 (continued): Energy Indicators linked to the economic dimension

Theme	Sub-theme	Energy Indicator	Components	Energy core table
Use and Production Patterns	Overall Use	Energy use per capita	– Energy use (total primary energy supply, total final consumption and electricity use) – Total population	Use of energy products (see table 1.2)

[1] IAEA, UNDESA, IEA, Eurostat and EEA (2005). *Energy Indicators for Sustainable Development: Guidelines and Methodolgies.* Available from http://www-pub.iaea.org/MTCD/publications/PDF/Pub1222_web.pdf

	Overall Productivity	Energy use per unit of GDP	– Energy use (total primary energy supply, total final consumption and electricity use) – GDP	Use of energy products (see table 1.2)
	Production	Reserves-to-production ratio	– Proven recoverable reserves – Total energy production	Proven recoverable reserves (see table 1.3)
	End Use	Industrial energy intensities	– Energy use in industrial sector and by manufacturing branch – Corresponding value added	Supply and use of energy products (see table 1.2)
		Agricultural energy intensities	– Energy use in agricultural sector – Corresponding value added	Use of energy products (see table 1.2); added value (see table1.3)
		Service/ commercial energy intensities	– Energy use in service/ commercial sector – Corresponding value added	Use of energy products (see table 1.2); added value (see table1.3)
		Household energy intensities	– Energy use in households and by key end use – Number of households, floor area, persons per household, appliance ownership	Use of energy products (see table 1.2).
		Transport energy intensities	– Energy use in passenger travel and freight sectors and by mode – Passenger-km travel and tonne-km freight and by mode	Use of energy products (see table 1.2).
	Prices	End-use energy prices by fuel and by sector	– Energy prices (with and without tax/subsidy)	Price information (see table 1.1)
	Imports	Net energy import dependency	– Energy imports – Total primary energy supply	Supply and use of energy products (see table 1.2)
Security	Strategic Fuel Stocks	Stocks of critical fuels per corresponding fuel consumption	– Stocks of critical fuel (e.g., oil, gas, etc.) – Critical fuel consumption	Stocks of energy products (see table 1.3)

Table 2 (continued): Energy Indicators linked to the environmental dimension

Theme	Sub-theme	Energy Indicator	Components	Energy core table
Atmosphere	Climate Change	GHG emissions from energy production and use per capita and per unit of GDP	– GHG emissions from energy production and use – Population and GDP	Supply and use of energy products provide energy use by ISIC which play a key role in determining emissions
		Air pollutant emissions from energy systems	– Air pollutant emissions	Supply and use of energy products provide energy use by ISIC which play a key role in determining emissions

14. The social dimension includes a number of important indicators related to energy access such as share of households without electricity and share of income spent on fuel and electricity. The core table can inform a number of important elements that are necessary to properly understand the policy implications of such social indicators. For example, energy accounts contain a wealth of information on the efficiency of production and consumption of energy, capital investments by industry (in particular the energy sector) and stocks, flows and depletion of mineral and energy resources such as coal and gas.

15. The indicators in the economic dimension directly use information contained in the core table. Combining the information in the accounts with supplementary demographic and economic information would make it possible to calculate energy use per capita or per unit of GDP, for example. A major strength of the core table lies in the intuitive presentation of energy use by economic sector which when combined with value added can be used to calculate a number of efficiency and intensity related indicators.

16. On the environmental dimension, the energy accounts again play a key role in filling the information gaps required not only for the derivation of the indicators but also by providing necessary background and contextual information. For example, the core table not only contains information that aids in the calculation of emissions by energy product but also by industries using the ISIC classification. Such information allows for a more complete understanding of emissions not only by energy product but also by industry. It supports the formulation of strategies and policies that target emitters and does so in a way that could address the larger emitters.

Part III: Questions to the London Group

Do you agree with the general structure of the proposed core table?

Should particular rows/columns be added/removed?

What additional indicators do you think should be derivable from the core tables and how should the structure of the tables change given the potential new data required to derive the additional indicators?

Any additional thoughts/suggestions on the consultation process?

Annex: Definitions of energy products

The following is a list of energy products (at the top level-sections) as defined in IRES.

0 Coal
This section includes coal, i.e. solid fossil fuel consisting of carbonized vegetal matter, and coal products derived directly or indirectly from the various classes of coal by carbonization or pyrolysis processes, by the aggregation of finely divided coal or by chemical reactions with oxidizing agents, including water.
Remark: There are two main categories of primary coal, hard coal (comprising medium and high-rank coals) and brown coal (low-rank coals) which can be identified by their Gross Calorific Value - GCV and the Vitrinite mean Random Reflectance per cent - Rr. Peat is not included here.

1 Peat and peat products
This section comprises peat, a solid formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification) and any products derived from it.

2 Oil shale / oil sands
A sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum.
Remark: Oil shale may be burned directly or processed by heating to extract shale oil.

3 Natural gas
A mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some non-combustible gases such as nitrogen and carbon dioxide.

Remark: The majority of natural gas is separated from both "non-associated" gas originating from fields producing hydrocarbons only in gaseous form, and "associated" gas produced in association with crude oil.

The separation process produces natural gas by removing or reducing the hydrocarbons other than methane to levels which are acceptable in the marketable gas. The natural gas liquids (NGL) removed in the process are distributed separately. Natural gas also includes methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas) and shale gas. When distributed it may also contain methane from anaerobic fermentation or the methanation of biomass.

Natural gas may be liquefied (LNG) by reducing its temperature in order to simplify storage and transportation when production sites are remote from centres of consumption and pipeline transportation is not economically practicable.

4 Oil
Liquid hydrocarbons of fossil origins comprising (i) crude oil;(ii) liquids extracted from natural gas (NGL); (iii) fully or partly processed products from the refining of crude oil, and (iv) functionally similar liquid hydrocarbons and organic chemicals from vegetal or animal origins.

5 Biofuels
Fuels derived directly or indirectly from biomass.
Remark: Fuels produced from animal fats, by-products and residues obtain their calorific value indirectly from the plants eaten by the animals.

6 Waste
This section includes waste, i.e. materials no longer required by their holders.

Remark: For the purposes of energy statistics, waste refers to the part of these materials that is incinerated with heat recovery at installations designed for mixed wastes or co- fired with other fuels.

The heat may be used for heating or electricity generation. Certain wastes are mixtures of materials of fossil and biomass origin.

7 Electricity
This section includes electricity, i.e. the transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion.

Remark: Electricity can be generated through different processes such as: the conversion of energy contained in falling or streaming water, wind or waves; the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels.

8 Heat
This section includes heat, i.e. is the energy obtained from the translational, rotational and vibrational motion of the constituents of matter, as well as changes in its physical state.

Remark: Heat can be produced by different production processes.

9 Nuclear fuels and other fuels n.e.c.
This section includes nuclear fuels including uranium, thorium, plutonium and derived products that can be used in nuclear reactors as a source of electricity and/or heat as well as fuels not elsewhere classified.