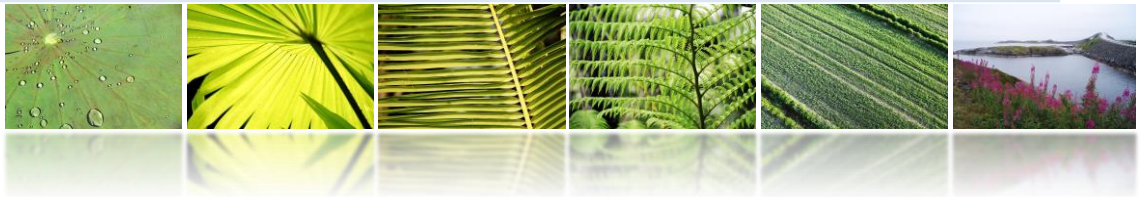
United Nations
Statistics Division

International Recommendations for Energy Statistics - IRES



Leonardo Souza
Chief, Energy Statistics Section

Beirut, Lebanon, 2 July 2019
UNSD/ESCWA Technical Assistance to Lebanon

Overview

- Historical context of energy statistics leading to IRES and the SDGs
- IRES and international methodology on energy statistics
  - Standard International Energy Product Classification (SIEC)
- Conclusion

Importance of energy stats

- Energy is fundamental for socio-economic development.
- Availability/access to energy is essential to poverty reduction
  - And improvements in the standards of living.
- As a result, there is a constantly increasing demand for energy
- Concerns about sustainability & reliability of current production and consumption patterns
  - And the impact of the use of fossil fuels on the environment.
- Taking into account these circumstances, quality energy statistics is of paramount importance
  - So that countries can design effective energy policies toward sustainable development.

Context

- Availability of high-quality energy statistics has always been a matter of concern for the statistical community.
- The United Nations Statistical Commission (UNSC) has discussed issues relevant to energy statistics since its inception (as part of economic statistics).
- Since the 1950's UNSD has been maintaining a database on energy statistics (data from 1950 to latest year available).
  - Accessible from the UNdata Portal (data.un.org/Explorer.aspx?d=EDATA)
- And publishing the Energy Statistics Yearbook
  - Currently in its 60th edition
  - First Edition (1952) was called "World Energy Supplies in selected years, 1929-1950"

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Statistics

Motor Gasoline Search glossaries

Source: Energy Statistics Database | United Nations Statistics Di

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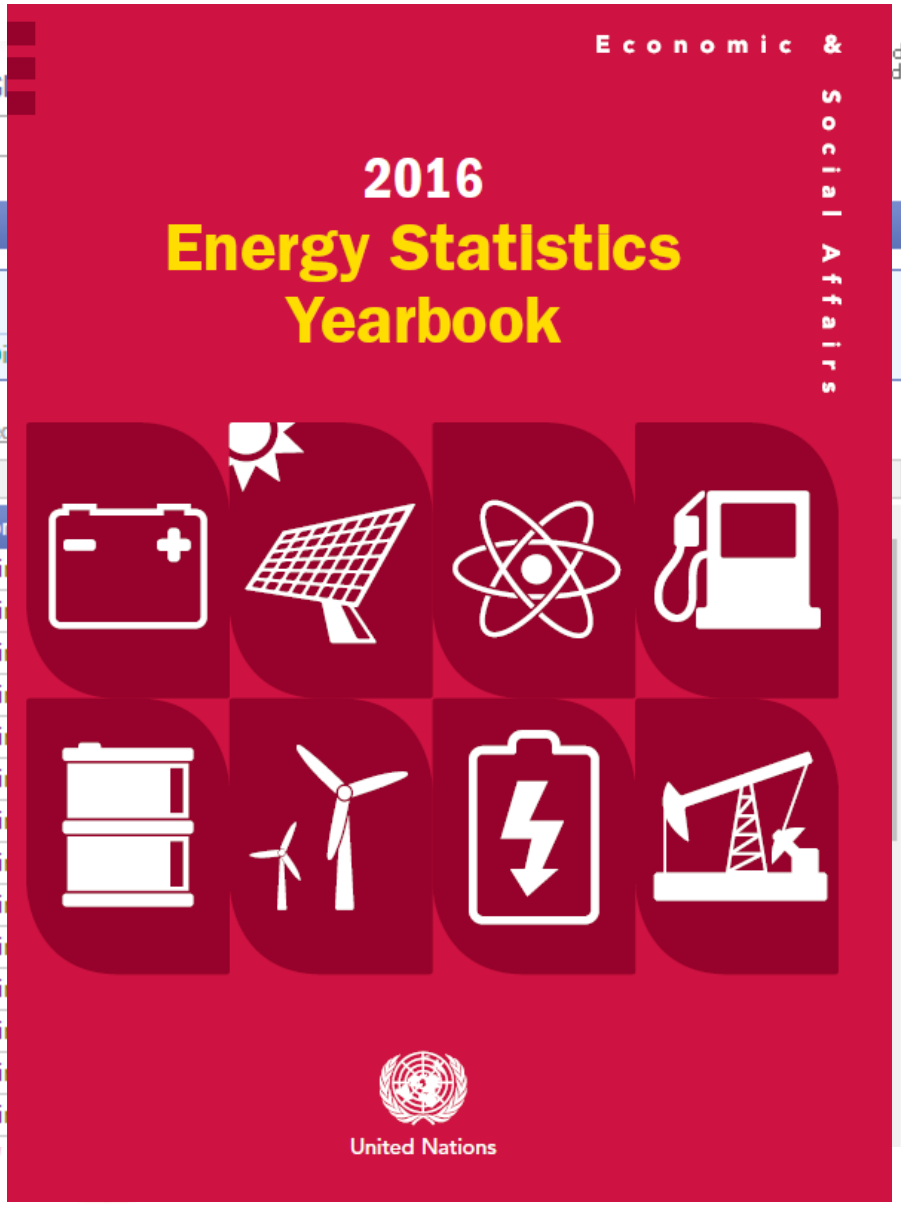
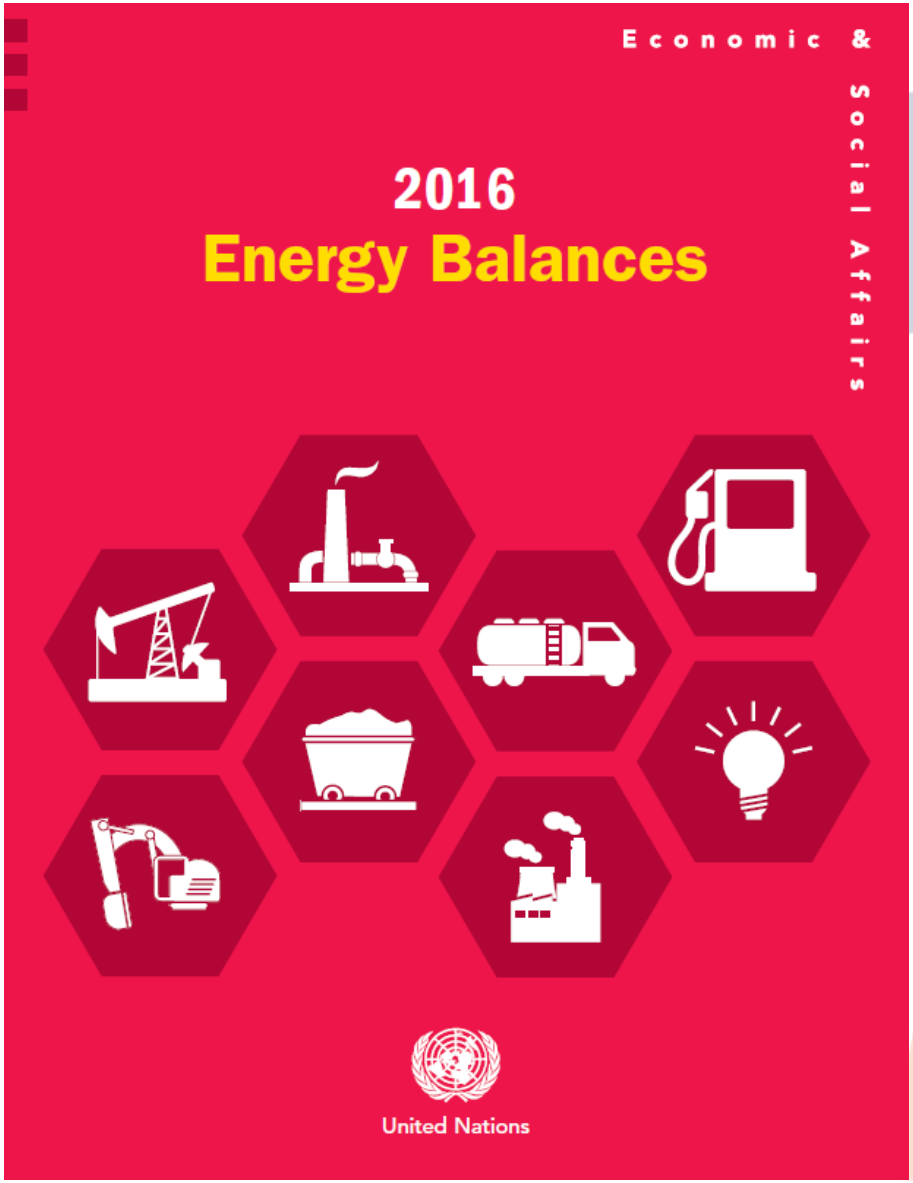
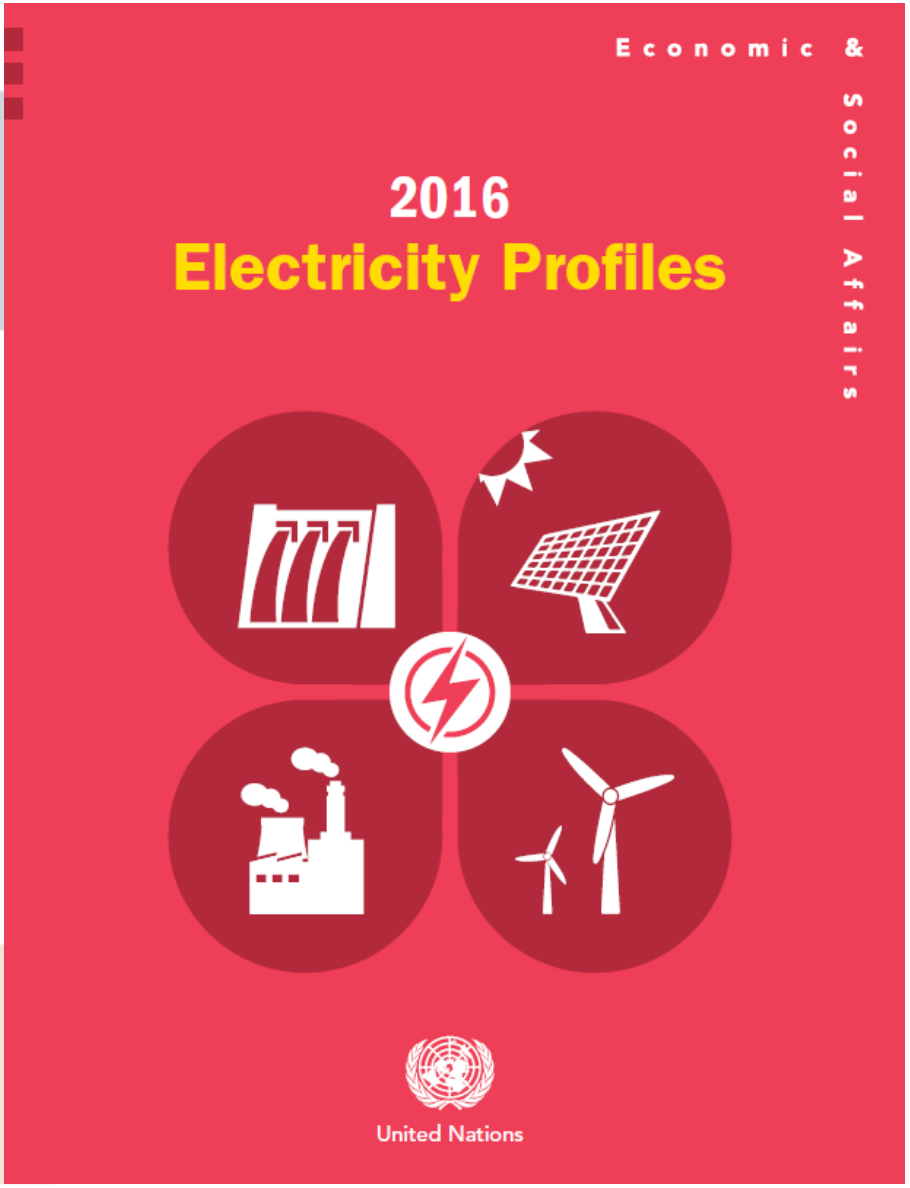


Context (cont.)

- In the aftermath of early 1970s energy crisis, UNSC put energy statistics on its agenda as a separate item
  - and requested a special report on energy statistics to be prepared and presented to it for discussion.

- One of the outcomes was that UNSC 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 analysing the role of energy in the economy.
  - Since then UNSD has been publishing Energy Balances (and Electricity Profiles)


Economic & Social Affairs
2016
Energy Balances
United Nations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Context

- Guidance documents existed:
  - *UN **Concepts and Methods in Energy Statistics** (1982)* [Focused on Energy Accounts and Balances]
  - *UN **Energy Statistics: Definitions, Units of Measure and Conversion Factors** (1987)*
  - *UN **Energy Statistics: A Manual for Developing Countries** (1991)*
  - *IEA/EUROSTAT **Energy Statistics Manual** (2005)*
- They were rich in information and influenced country methodologies,
- but were descriptive in nature, not focusing on harmonisation.

Oslo Group & InterEnerStat

In this context, in 2005, UNSC recognised need for further development of energy statistics guidance and set up:

- Oslo City Group on Energy Statistics (Oslo Group)
  - to "contribute to the development of improved methods and international standards for national official energy statistics".

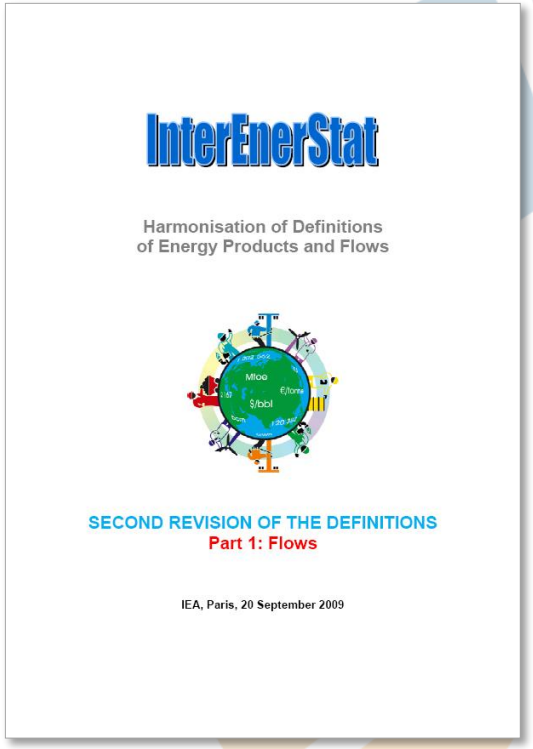
- Intersecretariat Working Group on Energy Statistics (InterEnerStat).
  - to harmonise differing definitions across organisations as close as possible

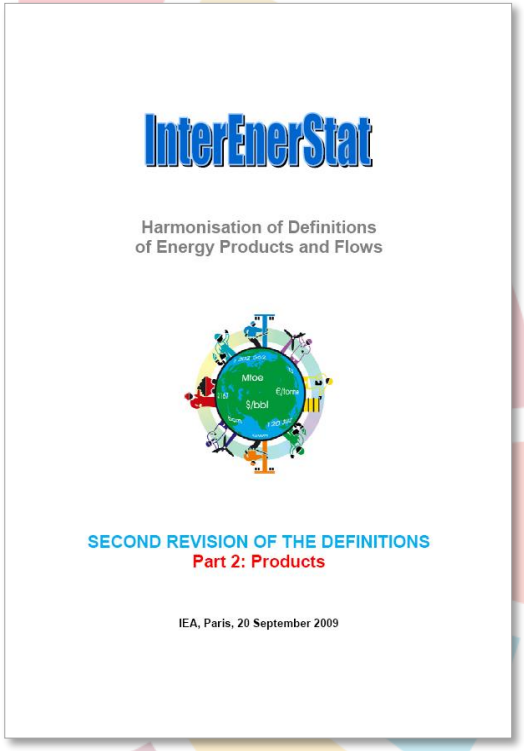
Oslo Group & InterEnerStat

- In the Oslo Group the main actors are the countries, working under UNSD supervision

- InterEnerStat is a group of over 20 international organisations working in the field of energy statistics, headed by the IEA
  - It published a harmonised list of energy products and flows in 2010.

Harmonised definitions reached at the end of 2010 after 5 years of negotiations





Agreed at the end of 2010 after 5 years of negotiations.

These definitions were incorporated in the IRES and agreed by UN Statistical Commission in February 2011

Flows

- It is what we want to measure in respect to the energy products:
  - Production
  - Imports, exports
  - Transformation
  - Own use by energy industries
  - Consumption by sector
  - Etc.

Flows

Products

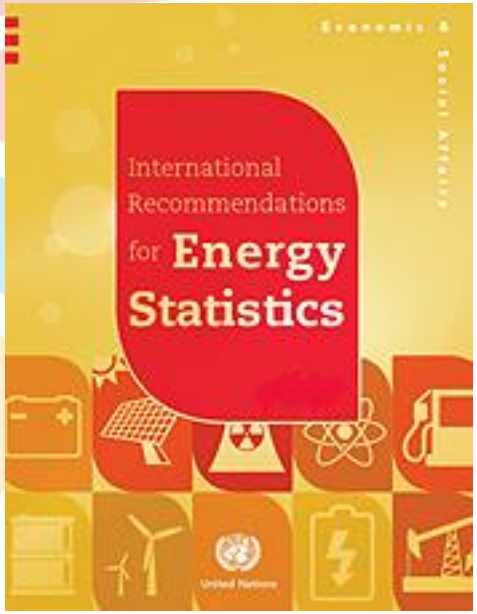
Lebanon

Terajoules

	Primary coal and peat	Coal and peat products	Primary Oil	Oil Products	Natural Gas	Biofuels and waste	Nuclear	Ele
2016								
Primary production	..	..	..	..	..	4971	..	
Imports	7112	..	..	314020	..	413	..	
Exports	..	..	..	..	..	..	..	
International marine bunkers	..	..	..	-1293	..	..	..	
International aviation bunkers	..	..	..	-10408	..	..	..	
Stock changes	..	..	..	..	..	..	..	
Total energy supply	7112	..	..	302320	..	5384	..	
Statistical difference	0	..	..	0	..	0	..	
Transfers	..	..	..	..	..	..	..	
Transformation	..	..	..	-170103	..	-585	..	
Electricity plants	..	..	..	-170103	..	..	..	
CHP plants	..	..	..	..	..	..	..	
Heat plants	..	..	..	..	..	..	..	
Coke ovens	..	..	..	..	..	..	..	

IRES

- Building on the harmonisation work achieved by InterEnerStat, the Oslo Group helped draft the *International Recommendations for Energy Statistics* (IRES)
- With the main goal of providing standards and guidance to national compilers covering:
  - relevant concepts and definitions,
  - classifications,
  - data sources and compilation methods,
  - institutional arrangements,
  - data quality assurance,
  - metadata and dissemination policies.
- IRES was endorsed by UNSC in 2011 .



Energy statistics and the 2030 Agenda for Sustainable Development, SDGs

- IRES's endorsement was a timely one, since one of the major outcomes from the Rio+20 Conference was the development of a set of Sustainable Development Goals (SDGs) in which SDG7 is a dedicated stand-alone SDG on energy
- SDG7 has three major targets and two additional targets representing means of implementation.
- The set of SDGs is an essential element of the 2030 Agenda for Sustainable Development to be implemented for the 2016-2030 period, including a total of 17 SDGs, 169 targets and 241 indicators.

SDG 7 - Ensure access to affordable, reliable, sustainable and modern energy for all

Target	Indicator
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Proportion of population with access to electricity
	7.1.2 Proportion of population with primary reliance on clean fuels and technology
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption
7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity measured in terms of primary energy and GDP
7.a By 2030, enhance international cooperation… (means of implementation)	7.a.1 Mobilized amount of US$ …
7.b By 2030, expand infrastructure and upgrade technology… (means of implementation)	7.b.1 Investments in energy efficiency …

Based on detailed balances compiled according to IRES

IRES in other official UN languages

- IRES has been translated to:
  - Arabic (thanks to ESCWA)
  - Spanish (thanks to Mexico)

- It is being translated to the other official UN languages (thanks to IEA):
  - French
  - Chinese
  - Russian

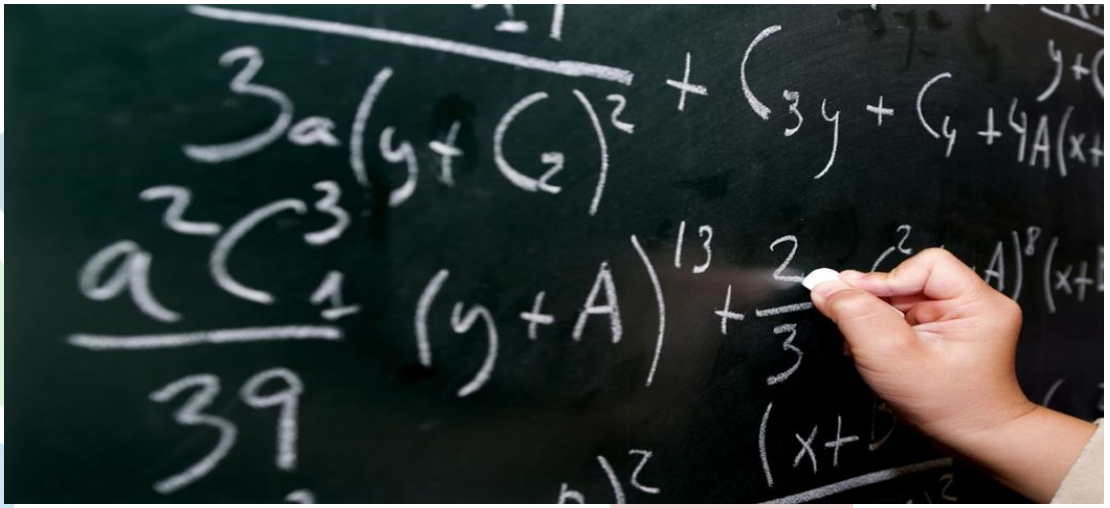
IRES

- *International Recommendations for Energy Statistics* improves comparability across products, flows & countries
- By defining:
  - What an energy product is;
  - Concept of production (and all other flows to be measured);
  - Scope of energy statistics.
- By providing:
  - Standard International Energy Product Classification (SIEC), with links to CPC and HS;
  - Harmonized definitions;
  - List of renewable products;
  - And much more (https://unstats.un.org/unsd/energy/ires)
- ESCM the accompanying compilers' manual (w/ country examples)

IRES and ESCM

- As a practical companion to the more theoretical IRES, the *Energy Statistics Compilers Manual* (ESCM):
- bountiful with country examples, was drafted and is undergoing final edition and formatting.
- White cover edition available (in English only) on: https://unstats.un.org/unsd/energy/ESCM.htm

IRES is about definitions of flows/products: **THEORETICAL**



ESCM is about practical guidance and country examples: **PRACTICAL**

ESCM - Some Examples

Austria: Adding an energy module to Labor Force Survey increased the response rate and reduced costs

Bulgaria: NSO's metadata policy

Norway: lessons from publishing preliminary monthly statistics and balances

South Africa: experience with social media and dissemination in a developing country

UK: Energy Efficiency Data framework measures the result of energy efficiency

Azerbaijan: producing full commodity balances for all products

FAO guidance on fuelwood surveys

Confidentiality practices for many countries

Legal frameworks for many countries

And many more!

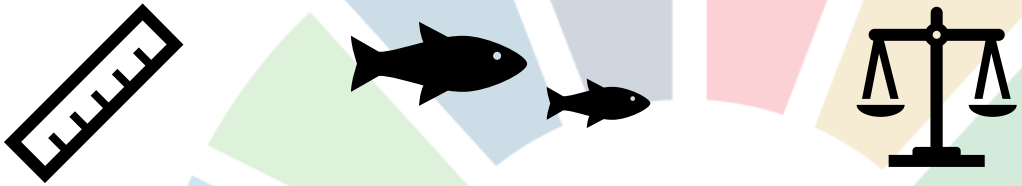
Important concepts, definitions and resources in energy statistics found in IRES

Reference territory

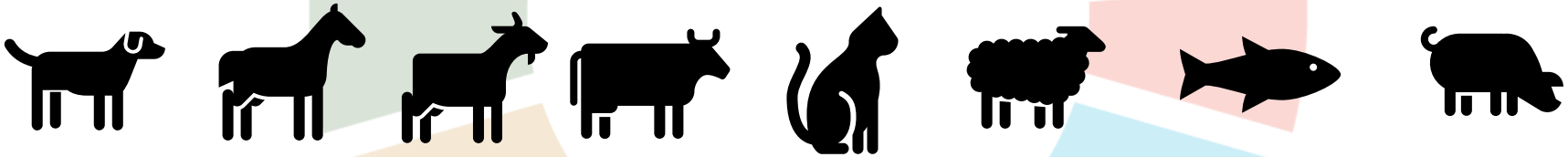
- From IRES 2.14: Energy statistics have historically responded, among others, to the policy concerns of the physical availability of energy and its uses within the territory of a country.
- Thus, the criteria for allocating certain statistics to the country follow the physical location of the units involved.
- The reference territory used in energy statistics and energy balances is the national territory and is defined as the geographic territory under the effective economic control of the national government.

Classifications

- Provide clear definitions of objects to be measured



- Provide a structure to place measured objects in context



- Allow statistics compiled to be comparable across programs
  - Help identify related concepts and objects
  - Help defining relationships

SIEC

- IRES contains the Standard International Energy Product Classification (SIEC), first definitive standard classification for energy products.

Table 3.1

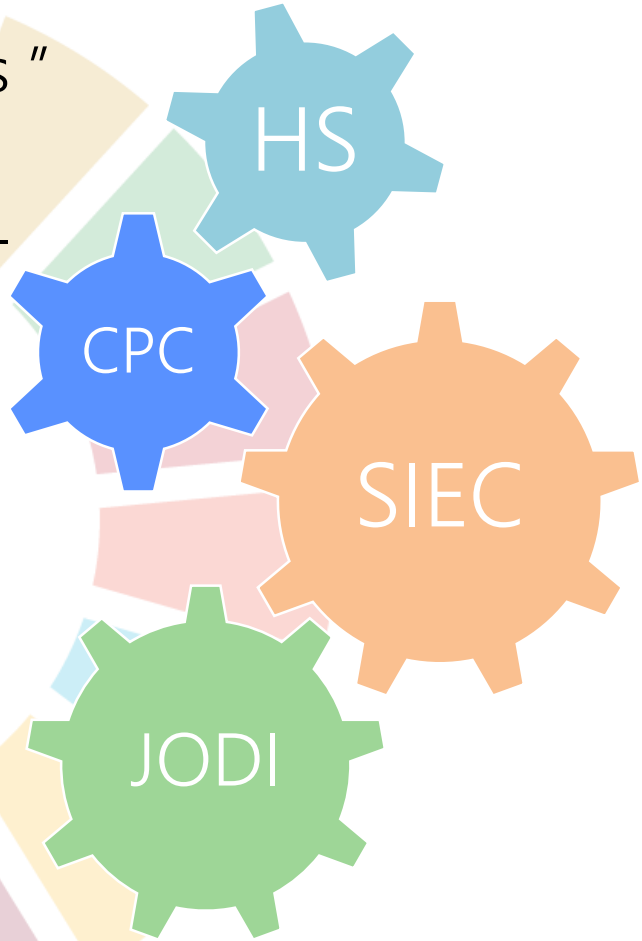
Standard International Energy Product Classification (*SIEC*)

SIEC Headings			Correspondences	
Section/ Division/ Group	Class	Title	CPC Ver.2	HS 2007
0		Coal		
01		Hard coal		
011	0110	Anthracite	11010*	2701.11
012		Bituminous coal		
	0121	Coking coal	11010*	2701.19
	0129	Other bituminous coal	11010*	2701.12
02		Brown coal		
021	0210	Sub-bituminous coal	11030*	2702.10*
022	0220	Lignite	11030*	2702.10*
03		Coal products		
031		Coal coke		
	0311	Coke oven coke	33100*	2704*

SIEC Headings			Correspondences	
Section/ Division/ Group	Class	Title	CPC Ver.2	HS 2007
4		Oil		
41		Conventional crude oil		
410	4100	Conventional crude oil	12010*	2709*
46		Oil products		
461	4610	Refinery gas	33420*	2711.29*
462	4620	Ethane	33420*	2711.19*, 2711.29*
463	4630	Liquefied petroleum gases (LPG)	33410	2711.12, 2711.13
464	4640	Naphtha	33330*	2710.11*
465		Gasolines		
	4651	Aviation gasoline	33310*	2710.11*
	4652	Motor gasoline	33310*	2710.11*
	4653	Gasoline-type jet fuel	33320	2710.11*
466		Kerosenes		

SIEC – relations with other systems

- HS 2710.12: “Light oils and preparations ”
- CPC 33311, 33312 and 33320: “Aviation gasoline”; “Motor gasoline” ; “Gasoline-type jet fuel”
- SIEC 465: “Gasolines”
- JODI: “Motor and aviation gasoline”



HS	2710.12*		
CPC	33312	33311	33320
SIEC	4651	4652	4653
JODI	Motor and aviation gasoline		

Renewables

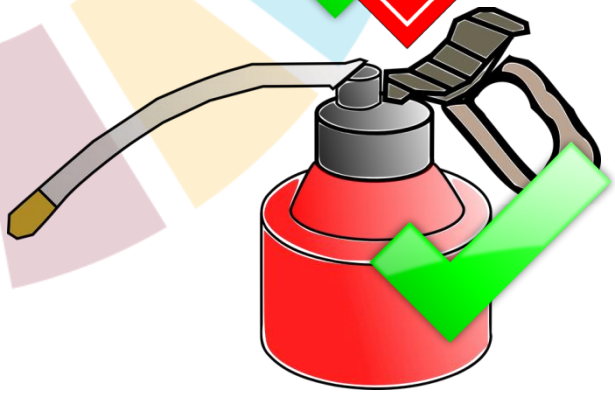
- IRES offers no definition of renewable energy
  - Difficulty to come up with a technically correct definition that includes/excludes all that we want included/excluded
  - Difficulty to disentangle the concepts of renewability and sustainability
- Instead, it offers a list of renewable energy products and sources.

Primary and secondary energy

- Which energy product is primary and which is secondary is determined by the principle of multiple uses:
  - the primary energy form should be the first energy form downstream in the production process for which multiple energy uses are practical.
- For electricity and heat, the application of this principle leads to the choice of the following primary energy forms:
  - Heat for nuclear, geothermal and solar thermal;
  - Electricity for hydro, wind, tide, wave and other marine, and solar photovoltaic.
- In the absence of measurement of heat input, it is assumed efficiencies of 33.3% for nuclear and solar thermal and 10% for geothermal electricity.

	Primary products	Secondary products
Non-renewables	- Hard coal - Brown coal - Peat - Oil shale - Natural gas - Conventional crude oil - Natural gas liquids (NGL) - Additives and oxygenates - Industrial waste - Municipal waste (partially[1]) - Nuclear Heat - Heat from chemical processes	- Coal products - Peat products - Refinery feedstocks - Oil products - Electricity and heat from combusted fuels of fossil origin - Electricity derived from heat from chemical processes and nuclear heat - Any other product derived from primary/secondary non-renewable products
Renewables	- Biofuels (except charcoal) - Municipal waste (partially[1]) - Heat from renewable sources[2], except from combusted biofuels - Electricity from renewable sources[2], except from geothermal, solar thermal or combusted biofuels	- Charcoal - Electricity and heat from combusted biofuels - Electricity from geothermal and solar thermal - Any other product derived from primary/secondary renewable products

- 2.9 “Energy products” refers to products exclusively or mainly used as a source of energy. Biomass and waste included only when used for energy purposes
  - Wood, ethanol excluded when not used as an energy product.
  - Fossil fuels always included by definition, even when used for non-energy purposes (e.g. lubricants).



- *2.11 Boundary of energy products*. The description of the boundary of the universe of energy products is not always straightforward.

- For example, *corncobs* can be:
  - (1) combusted directly to produce heat;
  - (2) used in the production of ethanol as a biofuel,
  - (3) consumed as food, or
  - (4) thrown away as waste.

- According to the scope of SIEC, corncobs, as such, are considered energy products for the purpose of energy statistics only in case (1) above, that is when they are combusted directly to produce heat (c.f. paragraph 3.10).

- In all other cases, they either do not fall within the boundary of energy statistics (when used as a source of food), or they enter the boundary of energy statistics as a different product (e.g. ethanol).

Biomass and waste according to SIEC

SIEC Headings			Primary (P) / Secondary (S)	Renewable (R) / Non Renewable (NR)
5		Biofuels		R
51		Solid biofuels		R
511		Fuelwood, wood residues and by-products	P	R
	5111	Wood pellets	P	R
	5119	Other Fuelwood, wood residues and by-products	P	R
512	5120	Bagasse	P	R
513	5130	Animal waste	P	R
514	5140	Black liquor	P	R
515	5150	Other vegetal material and residues	P	R
516	5160	Charcoal	S	R
52		Liquid biofuels	P	R
521	5210	Biogasoline	P	R
522	5220	Biodiesels	P	R
523	5230	Bio jet kerosene	P	R
529	5290	Other liquid biofuels	P	R
53		Biogases	P	R
531		Biogases from anaerobic fermentation	P	R
532		Biogases from thermal processes	P	R
6		Waste	P	
61		Industrial waste	P	NR
62		Municipal waste	P	R/NR

The Concept of Production

- 5.10: Primary production is the capture or extraction of fuels or energy… within the national territory in a form suitable for use. Inert matter removed from the extracted fuels and quantities reinjected, flared or vented are not included.

Data for oil and gas production should be NET of reinjected, flared and vented quantities (and water, sand etc.)

Energy industries

- *Energy industries* are defined as consisting of economic units whose principal activity is primary energy production, transformation of energy or distribution.
- Defined based on ISIC economic activity for comparability with other statistics, but underlying concept considers technology.

Table 5.1

Energy industries with reference to the relevant ISIC category

Energy industry	ISIC Rev. 4
Electricity, CHP and heat plants[a]	Division: 35—Electricity, gas, steam and air conditioning supply
Pumped storage plants	
Coal mines	Division: 05—Mining of coal and lignite
Coke ovens	Group: 191—Manufacture of coke oven products
Coal liquefaction plants	Group: 192—Manufacture of refined petroleum products
Patent fuel plants	Group: 192—Manufacture of refined petroleum products
Brown coal briquette plants	Group: 192—Manufacture of refined petroleum products
Gas works[b] (and other conversion to gases)	Group: 352—Manufacture of gas; distribution of gaseous fuels through mains
Gas separation plants	Division: 06—Extraction of crude petroleum and natural gas
Gas-to-liquids (GTL) plants	Group: 192—Manufacture of refined petroleum products
LNG plants/regasification plants	Group: 091—Support activities for petroleum and natural gas extraction Class: 5221—Service activities incidental to land transportation
Blast furnaces	Group: 241—Manufacture of basic iron and steel
Oil and gas extraction	Division: 06—Extraction of crude petroleum and natural gas Group: 091—Support activities for petroleum and natural gas extraction
Oil refineries	Group: 192—Manufacture of refined petroleum products
Charcoal plants[c]	Class: 2011—Manufacture of basic chemicals
Biogas production plants[d]	Group: 352—Manufacture of gas; distribution of gaseous fuels through mains
Nuclear fuel extraction and fuel processing	Class: 0721—Mining of uranium and thorium ores Class: 2011—Manufacture of basic chemicals
Other energy industry not elsewhere specified[e]	Class: 0892—Extraction of peat ….

IRES: Scope of Energy Statistics

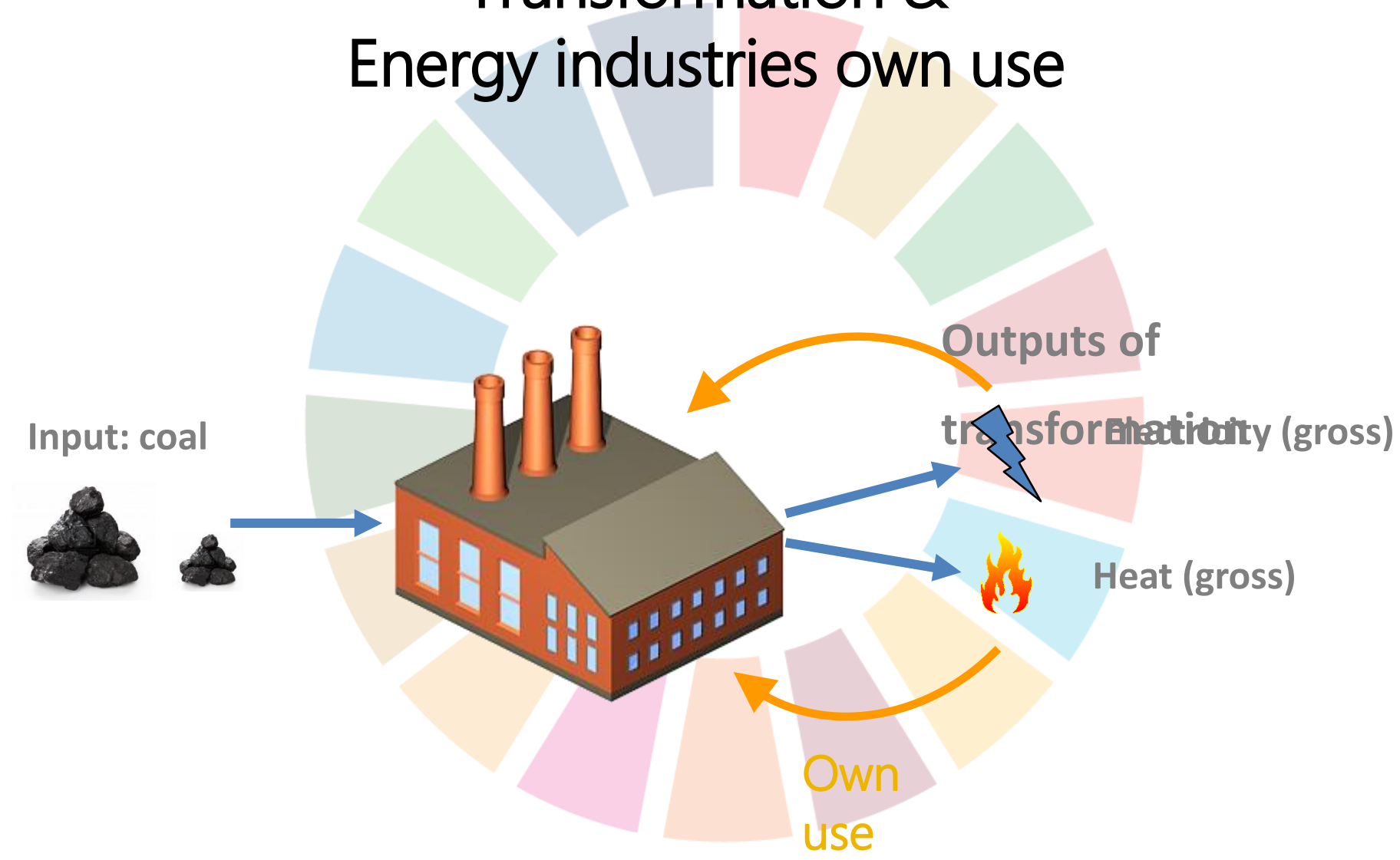
- 2.18: it's important that data on the production of energy outside energy industries is also collected and included in total energy production.
  - Results: fuelwood collected and used non-commercially needs to be properly accounted for;
  - By-products used b energy (e.g., bagass
  - And small "teapot" have their output m included under tran

Transformation & Energy industries own use

- A *transformation process* is the movement of part or all of the energy content of a product entering the process to one or more different products leaving the process. Ex: coal → electricity; crude oil → oil products; fuelwood → charcoal

- *Energy industries own use* refers to the consumption of fuels and energy for the direct support of the production and preparation for use of fuels and energy. Ex: energy used for heating a blast furnace; or electricity used for feeding the auxiliaries of a power plant

Transformation & Energy industries own use



Final consumption

- *Final consumption* refers to all fuel and energy delivered to users for both their energy and non-energy uses, and which do not involve a transformation process*.

- Users identified by ISIC, but exception made for transport (and energy industries)

Table 5.3
Main categories of energy consumers

Energy consumers	Correspondence to ISIC Rev. 4
Manufacturing, construction and non-fuel mining industries	
Iron and steel	ISIC Group 241 and Class 2431. Note that the consumption of energy products in coke ovens and blast furnaces is excluded, as these plants are considered part of the energy industries.
Chemical and petrochemical	ISIC Divisions 20 and 21. Note that the consumption of energy products by plants manufacturing charcoal or carrying out the enrichment/production of nuclear fuels (both classified in ISIC 2011) is excluded, as these plants are considered part of the energy industries.
Non-ferrous metals	ISIC Group 242 and Class 2432
Non-metallic minerals	ISIC Division 23
Transport equipment	ISIC Divisions 29 and 30
Machinery	ISIC Divisions 25, 26, 27 and 28
Mining and quarrying	ISIC Divisions 07 and 08, and Group 099, excluding the mining of uranium and thorium ores (Class 0721) and the extraction of peat (Class 0892).
Food and tobacco	ISIC Divisions 10, 11 and 12
Paper, pulp and print	ISIC Divisions 17 and 18
Wood and wood products (other than pulp and paper)	ISIC Division 16
Textile and leather	ISIC Divisions 13, 14 and 15
Construction	ISIC Divisions 41, 42 and 43
Industries not elsewhere specified	ISIC Divisions 22, 31 and 32
Household	ISIC Divisions 97 and 98
Commerce and public services	ISIC Divisions 33, 36–39, 45–96 and 99, excluding ISIC 8422
Agriculture, forestry	ISIC Divisions 01 and 02
Fishing	ISIC Division 03
Not elsewhere specified (including defence activities)	ISIC Class 8422

Energy consumption for transport

- *Use of energy products for transportation purposes* is defined as the consumption of fuels and electricity used to transport goods or persons between points of departure and destination within the national territory irrespective of the economic sector within which the activity occurs.

- International transport is excluded from consumption and reported as bunkers

Bunkers and Non-Energy Use

- IRES 5.14/5: For the purposes of energy statistics, exclude International Marine and Aviation Bunkers from exports and supply
- IRES 5.5: It's important to separately identify the non-energy part of final consumption.
- Why? Both important principles for accurate GHG emission inventories



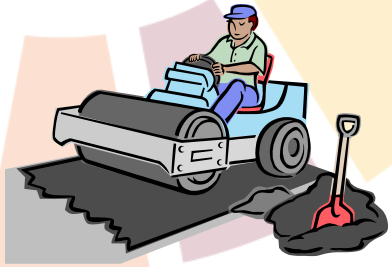



Figure 5.2
Cross classification of uses and users of energy

Users \ Uses	Transformation	Energy industries own use	Energy use (excluding for transport)	Energy use for transport	Non-energy use
Energy industries Electricity and heat Coal mines Coke ovens <Etc.>	(a)	(b)	Not applicable	(d)	(e)
Energy consumers Iron and steel <Etc.> Construction <Etc.> Household <Etc.>			(c)		

Data collection and compilation

Recommendations on:

- Statistical units
- Legal framework
- Institutional arrangements
- Data collection strategies
- Data sources
- Data compilation methods
- Data items

For each major product, IRES provides product-specific flows to collect

	COAL
Item number	Data item
2.1	Production
2.1.1	Of which: Underground
2.1.2	Of which: Surface
2.2	Production from other sources

	ELECTRICITY
5.1	Gross Production (by type of producer, by type of plant and by production process)[a]
5.2	Own Use
5.3	Net Production (by type of producer, by type of plant and by production process) [a]
5.4	Use of energy products (by energy products and by transformation processes)

	NATURAL GAS
Item number	Data item
3.1	Production
3.1.1	Of which: Associated gas
3.1.2	Of which: Non-associated gas
3.1.3	Of which: Colliery and Coal Seam Gas
3.2	Production from other sources
3.3	Extraction losses[a]
3.3.1	Of which: gas flared
3.3.2	Of which: gas vented
3.3.3	Of which: gas re-injected
3.4	Gas flared (except during extraction)
3.5	Gas vented (except during extraction)

	OIL AND OIL PRODUCTS
Item number	Data item
4.1	Backflows from petrochemical industry to refineries
4.2	Refinery intake (by products)
4.3	Refinery losses
4.4	Direct use (of crude oil, NGL, etc.)

Units and Calorific Values

- Units for Dissemination: mass (kt) for coal and oil, Terajoules (GCV) for natural gas, TJ (NCV) for solid biofuels and wastes (IRES 4.29).
- Net calorific values (aka lower heating values) should be used to compile balances in TJ (IRES 4.36), as interest lies in *useful* energy output and TJ is a SI unit.
- Country-specific calorific values should be collected. Default values should only be used as a last resort

Data collection: collect once, use multiple times

- IRES 2.7: The energy data collection should be organized in close collaboration with other data collection activities carried out in a given country* to avoid duplication of efforts and ensure overall coherence of official statistics.
  - * e.g., programmes of enterprise or establishment censuses and surveys based on relevant recommendations from UN Statistical Commission
- That applies to basic energy statistics to be collected for the compilation of energy balances and energy accounts!!!

Metadata on energy stats

- Types of statistical data include microdata, macrodata and metadata:
  - *Microdata* are non-aggregated observations or measurements of characteristics of individual units,
  - *macrodata* are data derived from microdata by grouping or aggregating them, and
  - *metadata* are data that describe the microdata, macrodata or other metadata.
- *Structural metadata* are identifiers and descriptors of the data that are essential for discovering, organizing, retrieving and processing statistical datasets.
- *Reference metadata* describe the content and quality of the statistical data.

Box 9.3
Metadata items for statistical releases[75]

SIMS code	Survey/product name
S.1	Contact (organization, contact person, address, email, phone, fax)
S.2	Introduction
S.3	Metadata update (last certified, last posted and last update)
S.4	Statistical presentation
S.4.1	Data description
S.4.2	Classification system
S.4.3	Sector coverage
S.4.4	Statistical concepts and definitions
S.4.5	Statistical unit
S.4.6	Statistical population
S.4.7	Reference area
S.4.8	Time coverage
S.4.9	Base period
S.5	Unit of measure
S.6	Reference period
S.7	Institutional mandate (legal acts and other agreements, data sharing)

Metadata list goes on, up to 37 items

Data Quality

- *Data quality* most commonly defined in terms of its "fitness for use", or how well the stat'cal outputs meet user needs.
- Quality assurance: all planned and systematic activities that can be demonstrated to provide confidence that the statistical products or services are adequate or fit for their intended uses by clients and stakeholders
- In the context of a statistical office, systematic data quality management typically takes the form of a quality assurance framework
  - Which provides context for a country's quality concerns, activities and initiatives, and explain the relationships between the various quality procedures and tools.
- IRES provides a template for National Quality Assurance Framework (NQAF)

Dimensions of quality

- Relevance
- Accuracy and reliability
- Timeliness and punctuality
- Coherence and comparability
- Accessibility and clarity.

Final remarks

- IRES provides methodology to compile energy statistics that are comparable across products and countries, and consistent with other areas of statistics
- Following international recommendations/standards ensures comparability, particularly for data submitted to international organizations (Eurostat, IEA, UNSD)
- On the other hand, measuring energy should be primarily done to inform development policy
- As such, country needs may call for deviations in the way data are compiled
  - Which should be explained in the metadata
- Thorough coverage of non-traded energy products is important to accurately assess the energy situation