



**2nd meeting of the Oslo Group on Energy Statistics
5 – 7 February 2007, New Delhi, India**

United Nations Statistics Division Energy Statistics Manuals

**Károly Kovács
Chief of Energy Statistics Section
United Nations Statistics Division**

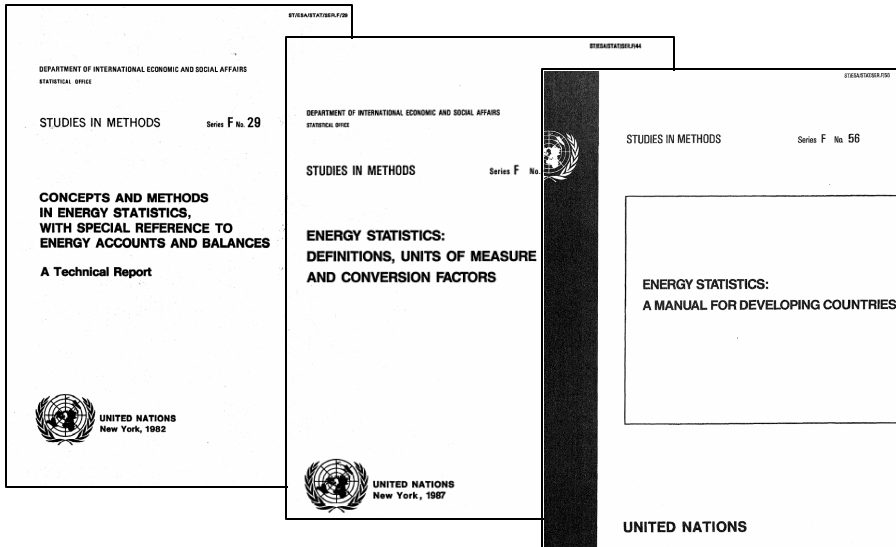


How it Began?

“At its 19th session, the Statistical Commission proposed the convening of an expert group to consider the preparation of an international classification of energy and the adoption of a common unit of measurement for interfuel comparison. ...”

Energy Statistics: Definitions, Units of
Measure and Conversion Factors, F.44

UNSD Energy Statistics Manuals



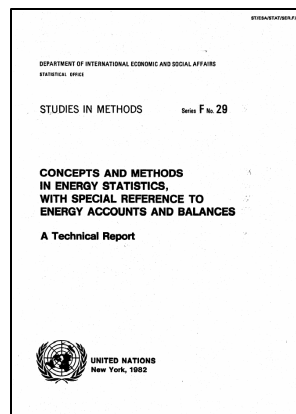
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Outline of the Concepts and Methods in Energy Statistics, ... (F.29)



- Nature of Energy & Energy Statistic
- Boundary Problems
- Accounting
- Energy Balances
- Classifications
- Other Energy Statistics



To download: http://unstats.un.org/unsd/publication/SeriesF/SeriesF_29E.pdf

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F29 Defined the Nature and Forms of Energy...



- Energy: the capacity to do work or produce heat
- Work: mechanical, thermal, electrical...
- Energy commodities are heterogeneous: solid, liquids, gases, or electricity
- Origin of energy resources:
 - Biochemical: fossil, biomass
 - Mechanical: hydro, tidal, wind
 - Thermal: solar, geothermal
- Two types of energy:
 - primary energy (involves only extraction or capture)
 - secondary energy (transformation of primary sources)
- Conversion of one form of energy into another occurs with inevitable losses (Second Law of thermodynamics)

...And the Boundary Problems: System, Stocks & Flows



Definition of the **system boundaries** is problematic:

energetic flows ? non-energetic flows
commercial sources ? non-commercial sources
energy industries ? other industries
production ? distribution

Boundaries between **flows and stocks**:

production ? waste
(e.g. gas flaring associated with crude oil)
production ? stocks
(e.g. re-injecting gas associated with crude oil)
production ? consumption ? waste
(for nuclear processes)

Compilation of the Energy Balances



- **From primary to secondary energy:**
the balance should show all flows at each level: the relationship between primary energy inputs to transformation, secondary energy outputs from transformation and transformation losses can be clearly seen
- **Conversion losses are represented by conventional fuel equivalent factors**
For non fossil energy sources the heat that could be gained is taken as primary energy equivalent
- **Energy trade:**
 - Visible: imports and exports shall be taken into account
 - Invisible: not necessary for overall balance

Calorific Values



- **Gross Calorific Value (GCV):**
including the enthalpy of evaporation/
condensation of water present in the fuel
 - **Net Calorific Value (NCV):**
excluding the enthalpy of evaporation/
condensation of water present in the fuel
- => NCV should be preferred over GCV

Units



The main energy sources have different original accounting units but can be transformed into equivalents:

- Joule – the only SI unit
- Tons of Coal Equivalent (TCE)
- Tons of Oil Equivalent (TOE)

=> Joules are recommended, TCE and TOE can be used but should be clearly defined

Energy Balance Is a Conservation Concept



Input = Output

or

Input – Output = 0

Energy Balance Is a Mass (Commodity) Balance



Input

Production + Imports + Stock Depletion =

Exports + Consumption + Stock Accumulation

Output

Energy Balance



Production + Imports + Stock Fall =
Exports + Consumption + Stock Rise

Production + (Imports – Exports) + (Stock
Fall - Stock Rise) - Consumption = 0

Energy Balances – Two Approaches



- TOP-DOWN

Production
 + Imports
 - Exports
 + Stock fall
 - Stock rise
 = Consumption

- BOTTOM-UP

Consumption
 + Exports
 - Stock fall
 + Stock rise
 - Production
 = Imports

Energy Balances - Example



Flow \ Source	Coal	Crude Oil	Natural Gas	Petroleum Products	Other Secondary Fuels	Electricity		Total
						Primary	Secondary	
Production								
Imports								
Exports								
Stock change								
Total supply of primary sources and equivalents								
Oil refining								
Electricity generation								
Other transformation industries								
Final use								

Efficiencies of Conversion



The efficiencies of the conversion processes have to be taken into account when calculating the useful energy:

Fuel	Percentage efficiency	
	Range	Mean
Solids	10-60	35
Liquids	15-65	40
Gases	25-65	45
Electricity	85-95	90

National statistical offices should consider constructing end-use analyses.

International Classifications



Standard international classifications are envisaged for:

Commodities: ICGS

Industries: ISIC

Trade: SITC, CCCN

National classifications

Recommendation: Existing classifications and definitions of crude oil and petroleum products should be examined with a view to establishing an agreed international set of designations, groupings and definitions.

Other Energy Statistics



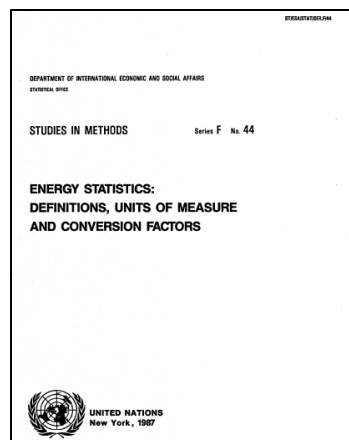
- Shorter period / regional balances:
big influence of the weather
- National accounts terminology
- Flow-charts can be used to visualize a statistical statement
- Energy and environment
emissions can be taken into account

Energy Statistics: Definitions, Units of Measure and Conversion Factors, F.44



“... discovery of the inadequacy of most energy data ... It also became apparent that there was little standardization in the methodologies for the collection and compilation of basic {energy} data. There were problems with definitions.

There was debate as to what should be the common units... One of the foremost problems was and continues to be the diversity of systems adopted by countries for collection and assemblage of energy data.”



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Energy Statistics: Definitions, Units of Measure ... (continued)



Chapters:

- I. Definitions**
 - A. Energy sources and commodities**
 - B. Energy transactions**
 - C. Energy resources**
- II. Units of measure**
 - A. Mass**
 - B. Volume**

Energy Statistics: Definitions, Units of Measure ... (continued)



Chapters:

- II. Units of measure**
 - C. Specific gravity and density**
 - D. Viscosity**
 - E. Energy, heat, work and power**
 - F. Energy units**
 - G. Calorific value of fuels**
 - H. Accounting units (TCE, TOE, J, BTU, Calorie)**

Energy Statistics: Definitions, Units of Measure ... (continued)



Chapters:

III. Conversion factors

A. International units of mass, volume, energy, work and power

B. Conversion from original to common units (solid, liquid, gaseous fuel, electricity, biomass and animate power)

Energy Statistics: Definitions, Units of Measure ... (continued)



Energy commodities/products:

- **Solid fuels (hard coal, brown coal/lignite, peat, patent fuel, lignite briquettes, peat briquettes, coke, brown coal coke, oil shale, bituminous sands, bitumens, extra heavy crude oils.**
- **Liquid fuels (crude petroleum, alcohol, natural gas liquids, plant condensate, natural gasoline, petroleum products [aviation gasoline, motor gasoline, jet fuel, kerosene, gas-diesel oil, residual fuel oil, LPG, refinery gas, feedstocks, naphtha, white spirit/industrial spirit, lubricating oils, bitumen, petroleum wax, petroleum coke, other petroleum products])**

Energy Statistics: Definitions, Units of Measure ... (continued)



Energy commodities/products:

- **Gaseous fuels (natural gas, gaswork gas, coke-oven gas, blast furnace gas, biogas)**
- **Electricity**
- **Traditional forms of energy (fuelwood, charcoal, bagasse, vegetal wastes, animal wastes, other wastes, draft animal power)**

Energy Statistics: Definitions, Units of Measure ... (continued)



Energy transactions

- **Production of primary energy**
- **Import/export**
- **Marine/aviation bunkers**
- **Stock change**
- **Energy converted**
- **Net transfers**
- **Consumption by energy sector**
- **Losses in transport and distribution**
- **Consumption by industry and construction**
- **Consumption by transport**
- **Consumption by households and other consumer**

Energy Statistics: Definitions, Units of Measure ... (continued)



Energy resources:

- **Hard coal, lignite and peat**
- **Crude oil and natural gas liquids**
- **Oil shale and bituminous sands**
- **Raw natural gas**
- **Uranium**
- **Falling water**
- **Woody biomass**
- **Non-woody biomass**

Energy Statistics: Definitions, Units of Measure ... (continued)



Units of measure

- **Mass**
- **Volume**
- **Specific gravity and density**
- **Viscosity**
- **Energy, heat, work and power**
- **Energy units**
- **Calorific values of fuels**
- **Units used in the energy balances: TCE, TOE, J, BTU, C**

Energy Statistics: Definitions, Units of Measure... (continued)



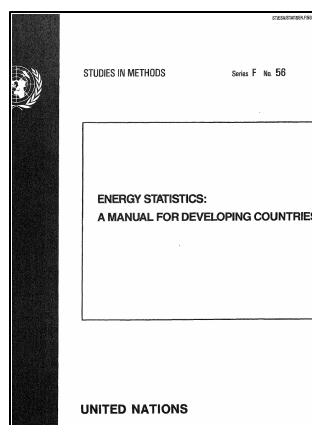
Treatment of primary electricity in energy balances

- Nuclear electricity
- Hydro-electricity
- Geothermal electricity
- Solar, wind and tidal electricity

Energy Statistics: A Manual for Developing Countries



“Considerable advances have been made by developing countries during the last 20 years in the collection and compilation of energy statistics. The pace of development has not been the same in all countries, and while many now produce regular and comprehensive publications, making use of sophisticated compilation and analysis techniques, others still have a long way to go. ...”



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Energy Statistics: Definitions, Units of Measure ... (continued)



Cont'd:

“The generally accepted aim is for countries to be able to compile statistics annually on the main characteristics shown for each fuel, and for energy in total. ... The initial task of collecting data from the energy industries ... may well fall to a number of ministries or other organizations. ... Good statistics depends on good working relationships ...”

Energy: Sources, Types, Definition



- There are three conventional sources of energy:
 - Energy supply industries (including importers)
 - Other industries and organizations producing energy
 - Consumers
- Two types of energy:
 - primary energy (from sources that involve only extraction or capture) and
 - secondary energy (result from transformation of primary sources)
- Definition of energy: power to do work which a body possesses.

Energy Statistics



- Statistics cover production and consumption of primary and secondary fuels.
- For best results, data should be collected with great frequency.
- Conversion units should be used to represent data in common units of measurement.

Agency Responsible for the Statistics



- Ideally, one organization should be in charge of collecting energy data.
- In practice, several agencies could be responsible for the collection of data.
- Preferably, the ministry or agency in charge of the energy sector in the country should produce data.
- Energy surveys should be designed to get the most data and the most cooperation from those taking the survey.

Definitions



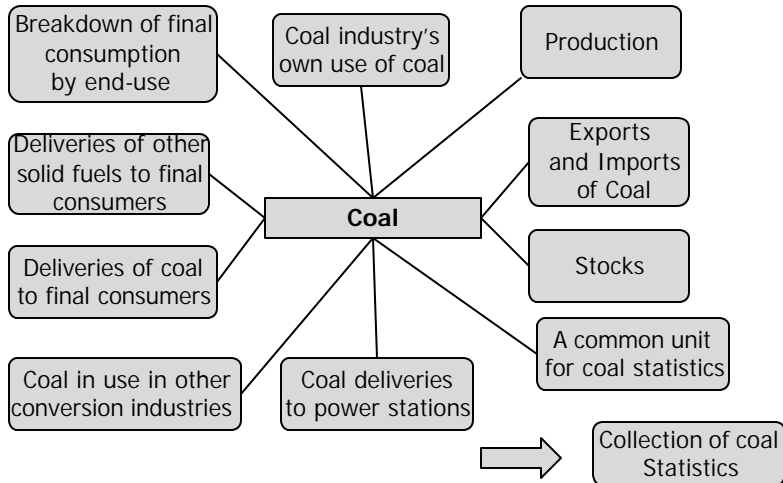
- Production covers the weight of material collected over a period of time (e.g. the weight of coal collected over 1 week excluding impurities).
- Exports and Imports should ideally be collected from customs.
- Stocks designate any material that is not used after extraction or import and put aside.
- Conversion signifies converting the units to international standards (such as TOE)
- Deliveries point to the quantities that are being received by consumers or factories.

Definitions (cont'd)



- Inputs, outputs and losses are recorded by weight over a period of time.
- Flaring and reinjection refer to the quantities of natural gas that were not collected at wellheads.
- Gas liquefaction refer to the quantities of gas that has to be liquefied in order to be transported.
- Distribution losses are the difference between of the quantities supplied and the quantities received.

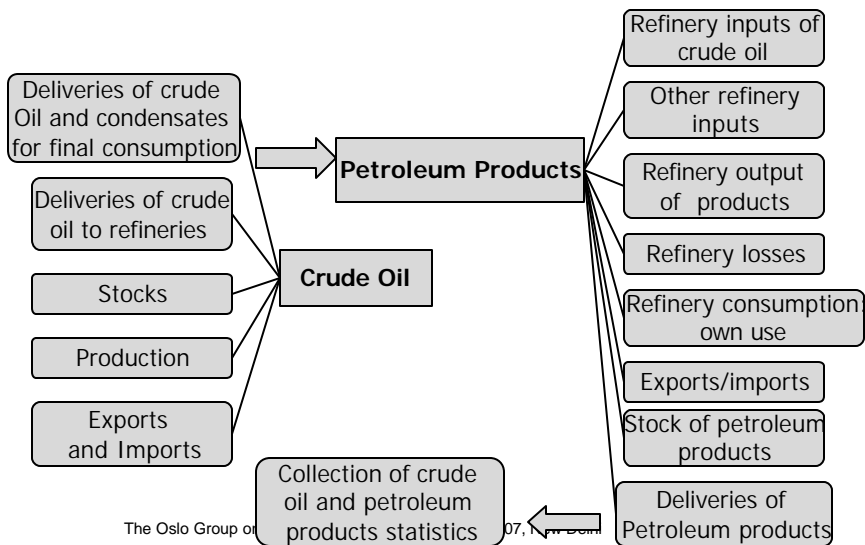
Coal Statistics



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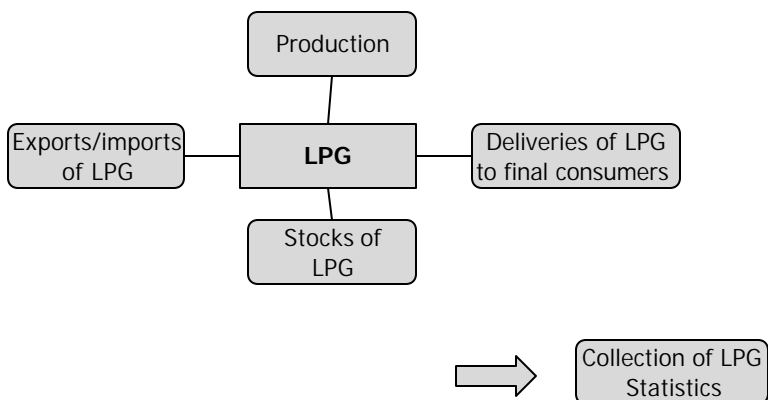
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Crude Oil Statistics



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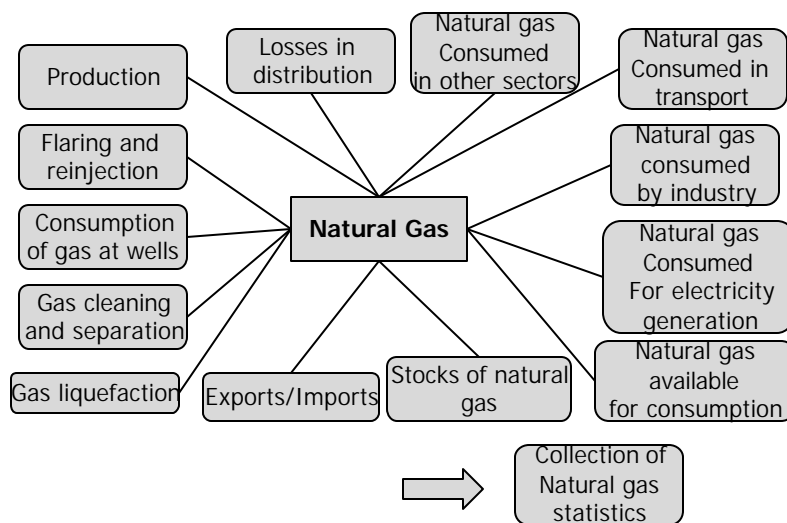
Liquefied Petroleum Gas (LPG)



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Natural Gas



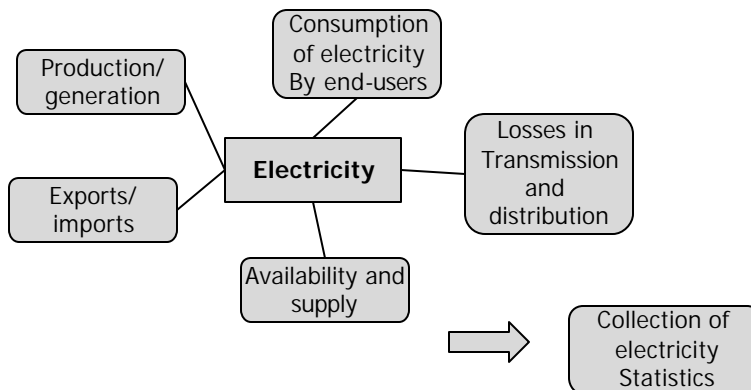
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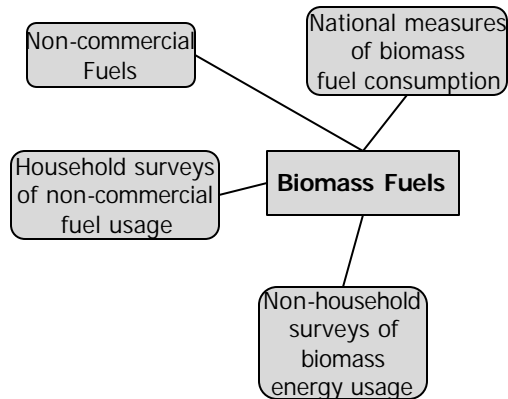
Derived Gases



Electricity



Biomass Fuels



Biomass fuels encountered:

- Primary and secondary fuels
- Fuelwood
- Charcoal
- Vegetal residues
- Animal wastes
- Biogas
- Vegetal liquid fuels

Presentation of Energy Statistics



- Monthly commodity tables
- Annual commodity tables
- Energy and inter-fuel comparison tables
- Energy and the national economy
- Presentation of seasonally adjusted data
- Presentation of temperature corrected data

Energy Balances



- To prepare energy balances, the following components should be available:
 - Conversion of fuel data to common energy units
 - Gross and net calorific values
 - Useful energy
 - Preparation of energy balance components