

## **Comparing terminology between accounts and statistics.**

### **A note on energy, statistics, balances and accounts.**

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#### **1. Introduction.**

Energy as a commodity is extremely important to understand society. It is important in official statistics. It is however fair to say that the role of official statistics in this field is surprisingly unclear. The Oslo Group is established to improve this.

Energy is included in the discussion in other City Groups and it is important to discuss coordination of concepts and terminology.

#### **2. How to measure energy in statistics**

The concept of Energy is taken from the science of physics. Energy may be measured in energy terms e.g. in Joule.

Energy is carried by different carriers as oil and electricity. Commodities may be labelled as energy carriers or energy bearers. If energy is a prevalent characteristic of a commodity, we may talk about energy commodities.

The energy carriers may be measured in physical terms as tons, litres or kwh. The energy content may be as mentioned measured in Joule or other units. If energy is measured by different units - the figures may be compared by the use of conversion factors.

#### **3. The totality – and boundaries**

Energy is involved in many processes in society – inside and outside the observed part in other statistics, normally the market economy. Energy and the use and cost of energy is of course included in National Accounts.

The use (including consumption) and production of energy has significant environmental effects – and is accordingly very relevant for the environment. A major input in calculation of emission of climate gases, will be use of energy.

The concept of production is crucial in National Accounts. Production is defined with reference to the market economy. This may for economic policy be a practical distinction and limitation. For environmental effects it may be of little relevance to only include energy that is brought into market economy. Flaring in oil drilling and production may be a relevant example to illustrate this. Flaring is not included in “economic” energy production but is relevant for energy statistics for environmental purposes.

#### **4. Transformation of energy**

Energy may be primary or secondary energy. When primary energy is transformed to another form of energy, we may talk about primary and secondary energy. Linked to this, is the fact that some energy

carriers as oil and coal (fossil fuels) may be transformed to other energy carriers as other forms of fossil fuels or electricity.

## **5. Relevant handbooks**

A crucial document is the UN handbook from 1982. In this document it is referred to national practices and an OECD document. At present the crucial publication for many energy statisticians is the “Energy Statistics Manual” IEA/OECD and Eurostat 2005.

Energy as a commodity has been included in National Accounts and discussed in SNA. The SEEA handbook from 2003 includes several chapters relevant for energy statistics (Integrated Environmental and Economic Accounting 2003, Draft).

The plans will be to have a complete set of energy handbooks/guidelines. IRES will be one corner stone in this strategy. SEEA-E will also cover important energy topics.

## **6. Official statistics**

Official statistics should be a full system with consistency or coherence. This means that estimates of production, consumption, export and import and stock changes should be a part of a consistent system. This is also the basic ideas behind accounts and balances. The national accounts are one system where a common value principle for products has been implemented and put into a full accounting scheme.

Statistics is a wide concept and covers many types of data. A single survey will be called statistics. Sometimes it is called primary statistics. In energy context basic statistics has been introduced – to avoid confusion with statistics for primary energy.

Statistics may use data from various sources, and put together in broader systems of data. Some will use derived statistics or accounts. National Accounts are built on the use of a lot of sources. National Accounts is a part of official statistics. National Accounts is statistics.

In the field of energy statistics – systems that put together data both for supply and demand side – will be a part of energy statistics. These systems may be labelled balances or accounts.

In these overall systems it is important to establish a conceptual framework that gives a common understanding of production, consumption, use and stocks and changes in stocks.

## **7. Reserves and stocks**

Important sources for energy production and use will be extraction from non renewable resources. In some contexts it will be crucial to build an information system how energy production will have effects on the non renewable energy sources. These types of accounts may be presented in various ways. At the present these types of accounts are not a fundamental part of energy statistics. Energy balances as they are normally defined – there is no reserve side. Stocks of produced (previous extracted) will however be important for energy statistics.

## **8. The Concept of Production**

The definition of production is also important. In UN 1982 (§70) it is said that production may reflect the rate at which a finite reserve or source is being depleted and it reflects at the same time the physical flow directly attributable to the stock of fixed investment in machinery and equipment specifically installed to make that production possible.

It may be important to observe that the most relevant definition of production may differ between energy statistics for economic purposes and energy statistics for environment purposes.

## 9. Units.

The term unit seems to be used in two distinct interpretations. *Accounting units* are discussed – and this is the measuring unit for energy. Another topic that is very important in all economic statistics is the *reporting or observation unit*. For production and business statistics it is important if the unit is enterprise or establishment (local kind of activity unit). National accounts is in principle based on establishment as reporting unit but the scope of national economy – residence principle has the enterprise as the building brick. For the treatment of energy production that enters the market – the choice of reporting unit will have some influence.

## 10. Residence and territory principle.

One distinction that is crucial for the difference between energy balances and most versions of energy accounts is the distinction between residence and territory principle. National accounts are basically based upon the residence principle. This means that energy used abroad by national enterprises (Units) is included. Energy used inland by foreign units is not included. The territory principle - which is used in Energy Balances - should in principle not include energy used abroad by inland units and should include energy used on the national territory by foreign units. The precise empirical difference between residence and territory may be difficult to measure.

For the national statistical authorities it is a challenge to have relevant information about the population of relevant units. The national use of energy by foreign units may be difficult to measure by the traditional institutional strategy for data capture. This is a challenge - caused by globalisation – which energy statistics shares with other economic statistics. (E.g. IIP and FATS).

It is important to be clear about the difference between residence and territory principle and also to describe the measurement problems. Bridge tables will be important.

## 11. Balances and Accounts

In official statistics the national accounts plays an important role – and this system balances in economic terms production and import with consumption and export. Energy as a commodity is included in NA.

In the UN 1982 handbook the concept of energy balances is used as well as energy accounts. The title is “Concepts and methods in energy statistics, with special reference to energy accounts and balances”.

The concept of energy balance seems to be developed from a vision of linking energy supplied and energy used (final use). Compared to other resources it is notified that energy may be measured in tons (or other volume measures) energy units or money value. What is unique for energy is the possibility to measure in comparable energy units (use of conversion factors).

“It is therefore logically permissible and economically necessary to have an overall accounting framework in which all sources of energy or at least all those relevant to the analysis – can be expressed in a single accounting unit so that the flow of each can be traced from its origin in production or imports through transformation to delivery (with or without transformation) to exports or to inland final energy users.” (UN 1982 §13)

It is said that the overall energy balance shows coherent accounting framework for stocks and flows. The concept stock does not cover reserves.

In UN 1982 there seems to be no clear distinction between the concept of balances and accounts. Chapter F. Essential features of energy balances starts in §44 with the sentence “Any system of energy accounts should be based firmly on the first law of thermodynamics...” In § 45 it says the over-all energy balance is a supply and use account that shows (ideally in a single table) the origins and uses of all sources of energy used in a given country during the year. Such a balance must necessarily express

all forms of energy in a common accounting unit, and will show the relationship between the inputs to and outputs from the energy transformation industries.

In this § it is mentioned “used in a given country”. This wording may lead us to understand that the balance is said to be based on the territory principle. In most paragraphs in UN 1982 there are no discussion of the difference between the residence and territory principle.

UN 1982 defines the concept of *energy commodity balance* as an energy balance for an individual source of energy (e.g. coal). (UN 1982 § 44)

Crucial concepts are primary and secondary energy. Energy balances should cover all energy flows including the non commercial sources. Energy used to produce other energy forms should be identified as well as energy in non energy use.

The basic tabulation of energy balances is described in several alternatives. Columns show energy sources (commodities) and rows shows flows from origins to uses of energy (transactions).

In UN 1982 there are several versions of the energy balance table. The choice should be dependent of the purpose of the balance.

Through history it seems as the term energy accounts has been used in several interpretations. One distinction seems to be between

- Energy Asset accounts (reserves).
- Energy Flow accounts

In a publication from 1980 Statistics Norway (NOS Energy statistics) draws a clear distinction between energy balances and energy accounts. ch. 1.3.3 it says:

The major difference between the Norwegian Energy Accounts and the Norwegian Balance are:

- 1) The energy balance shows energy used for feedstock's as energy used for “non-energy” purposes. Transport purposes are dealt with as own sectors. Energy for other purposes is distributed both by industry and purpose. The main tables show energy goods by industry (according to ISIC) while the additional purpose accounts distribute energy by end use categories (feedstock, transport, machinery, heat etc). The distribution of energy by purpose is necessary to connect the resource accounts and the national accounts. For this reason the number of sectors is much higher in the energy accounts than in the energy balance.
- 2) The energy accounts include (in the contrary to the balance) all energy being consumed by Norwegian industries and household, even if the energy is bought and used abroad. In practice this only affects ocean transport, having an oil consumption of the same size as the rest of the Norwegian society.
- 3) The energy accounts include petrol coke (coke made up in petroleum refineries).

The main difference is the use of energy abroad by Norwegian companies – mainly international sea transport, that is a big industry in Norway.

Both balances and accounts are said to be linked to both National Accounts (NA) and Resource Accounts (RA). We do not find any discussion of the differences in the needs from respectively NA and RA. In NA energy produced and used within an establishment is not measured. In a resource account it is reason to anticipate that we need all energy resources even when produced and consumed within an establishment. It does not seem that it is discussed the importance of the definition of business unit. If we as in NA use the establishment – the level of internal deliveries will be less than if we use the enterprise level as business unit.

A crucial part of improved official energy statistics is to establish a broad understanding of the totality of energy in a society. Energy is produced and imported. The concepts of extraction (of resources) and production have to be sorted out. Production has to be defined – e.g. in connection to net and gross energy. How to treat internal production of energy in the enterprise – reuse of energy, energy saving and heating pumps.

The IEA Eurostat Energy Statistics Manual from 2005 gives a clear description of a complete energy statistics system.

It is important to understand what is called *commodity flows*. See Figure 1.2. Page 21 IEA2005.

Production, imports Exports and Stock changes – has to be balanced towards Final Use/ Consumption.

It is important to make a distinction between the use of energy for heating and production and when energy is used in a transformation process to produce another energy carrier. This is called energy transformation.

In the IEA 2005 there is in terminology no distinction between consumption and intermediate goods. In National Accounts such a distinction is made.

The IEA 2005 continues the tradition to extract transport work from all industries; this may give us a relevant energy balance for some uses – but makes comparison with business statistics and National Accounts more difficult.

For each energy commodity (carrier) a commodity balance is established. The units may be volume (tons) or energy measure – e.g. terajoule.

Energy Balance- in IEA 2005. page 135 –

From commodity balances in natural units that describes “*the supply and use*” of energy commodities A major characteristics of a energy commodity is the energy content – and with the use of conversion factors volume measure of energy commodities may be converted into energy units.

“The format adopted is termed *the energy balance* and allows users to see the fuel conversion efficiencies and the relative of the different fuel supplies in their contribution to the economy.

There are in IEA 2005 no reference to energy accounts and the distinction between these concepts. There seems also in IEA 2005 to be little said about the difference between territory and residence principle.

The global part is not developed in this m handbook.

UNSD has conducted two global assessment and in this the concepts of balances and accounts are referred to.

*The Global Assessment of Energy Statistics and Balances* has been completed (UNSD) before November 2007.

In the section of energy balances the respondent is asked to fill in the alternatives,

- energy commodity balances,
- overall energy balances, and
- energy accounts.

The format for overall energy balances may be UNSD, Eurostat or IEA. In the explanatory sheet- there are definitions of energy balance and it is referred that energy balances are made based on the territory principle.

Energy accounts are also defined and it is said that these are based on the residence principle. In the comments on energy accounts we see the distinction between consumption and intermediate input.

Energy accounts may be calculated in money terms and physical units. This may be understood as in energy measure/units – not in tons.

Commodity energy balances may be in tons (physical) or energy units while overall energy balances should be in energy units.

*The global assessment of energy accounts*

This was sent from UNSD spring 2008.

The concepts:

- Energy Accounts
- Energy Asset Accounts (are asset accounts such as coal, oil and natural gas. In particular they describe the opening and closing stocks of energy resources and the changes therein. They can be compiled in physical (Do UNSD define this as e.g. tons or terajoule and or monetary units.
- Energy Flow Accounts describe supply of energy products (e.g. production, imports and their use by economic categories (intermediate and final consumption, exports and gross capital formation) in the economic territory of a country. They can be compiled in physical (tons?) and monetary units. It is not clear if these are meant to be one account for each commodity or if these are aggregated for all commodities by the use of conversion factors. Please note that energy accounts may be as satellite accounts of NA. Energy flow accounts should not be confused with energy balances “that describe the overall supply and overall use of an energy product. In the national territory”. It is important – never to confuse – but also to see the similarities between accounts and balances. It is also important to extend energy balances to be not only for one product but for all energy sources. Since a NSI has to produce both energy accounts and balances from the same set of primary data it is important to develop the similarities and the differences between accounts and balances.
- Physical Energy Asset Accounts
- Monetary energy asset accounts
- Physical energy flow accounts
- Monetary flow accounts

The distinction – if a distinction is defined – between energy flow accounts and energy commodity balances seems unclear. In Question 55 in this assessment, about data source – one possible data source for energy flow accounts are Energy Balances.

## **12. Conclusions**

Energy statistics should be strengthened as a part of official statistics. The principles and concepts from official statistics should as far as possible be integrated in energy statistics. Energy statistics is a important statistics by it self, and is also a crucial part of both economic statistics and environmental statistics.

One principle for official statistics is to collect data from respondents once and use many times. Energy data has to be collected to serve energy statistics, economic statistics and environmental statistics. Data has to be stored and documented to serve several purposes.

Globalisation is a challenge for official statistics in general and so also for energy statistics.

The concept of statistics is a wide concept and is meaningful in most contexts. If metadata are linked and relevant description of methods is available there will be no mixing or confusion between single

survey statistics and more advanced systems were use and supply is brought together. Some additional labels as balances and accounts may be instrumental in describing the purpose of the statistics – but may also create confusion.

Energy balances seems at present to be rather well defined and no confusion when we talk about overall energy balances. Energy balances gives basically a total description in energy units of supply and consumption of energy, but we may find several types of balances

Energy accounts seem at the present to be used in various ways. It may be in physical or value (money) units. It may be for flows and stocks. For some user the account concept is linked to reserves. It may be that some misunderstanding has been created by the different use of energy and resource accounts. It is then important to document in an easy and understandable way the type of energy accounts it is referred to.