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Danish Energy Accounts and Energy Statistics

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1. Introduction

Security of energy supply, deregulation of energy markets, increasing energy prices and concerns about climate change have all led to an increased demand for data on energy.

However, the fact that different statistical frameworks are used to describe the flows of energy often causes confusion. Few in the community of users of energy data are familiar with the differences between the different statistical frameworks. Among journalists and politicians it is even fewer.

In order to prevent an inappropriate mix of data leading to misinterpretations, it is very important to have tables which provide a description of the connection between the various frameworks.

The purpose of this paper is to describe the connection between the Danish energy accounts and the Danish energy statistics on which the energy accounts are based.

The energy accounts are based on the *System of National Accounts* (SNA) whereas the energy statistics are based on the guidelines for the reporting to the *International Energy Agency* (IEA) and to the *United Nations Framework Convention on Climate Change* (UNFCCC).

The paper briefly describes the methodology to compile the Danish energy accounts and outlines the similarities and differences between energy statistics and energy accounts. Finally, the bridge table illustrates similarities and differences between the Danish energy accounts and the Danish energy statistics.

2. The Danish energy accounts

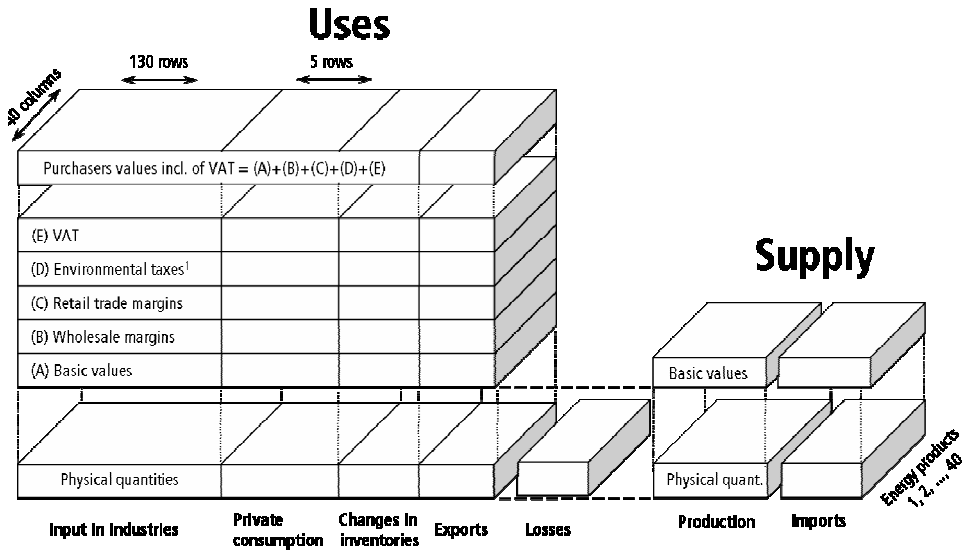
In the Danish energy accounts, input of various energy types are balanced with the use of energy by industry and households for every year since 1975.

The collection of these data is closely connected with the compilation of the national accounts in Denmark. They are organised in such a way that they are directly compatible with the national accounts at the most detailed industry level, i.e. 130 industries. They describe the supply and use of energy in value units (DKK) at different price levels as well as physical units (tonnes or m^3 and joule). The consumption of energy is calculated as both gross energy consumption and net energy consumption. The energy accounts keep account of 40 energy carriers, such as oil, gas, coal, gasoline and wood, straw and wind power.

A number of different energy statistics from the Danish Energy Authority and other sources are used in the compilation of the accounts. The external trade statistics are used to measure imports and exports of energy goods. The commodity statistics are used to measure the production of most of the energy goods. The amount and value of the production of crude oil and natural gas are determined by means of a small-scale questionnaire-based survey. Consumption of energy in Danish manufacturing industries is determined by a census. Information about reimbursement of energy taxes is an important source for the determination of the use of electricity, gas and oil in certain industries of the service industry. Data for determining the size of input in the energy supply sector and other industries stems from the Danish Energy Authority.

The energy accounts are as already mentioned balanced so that the supply (production + imports) equals demand (input to industries + final consumption of households + inventory changes + exports + losses).

The Danish energy accounts



[1]The environmental taxes on energy are made up of CO_2- SO_2- and energy taxes

3. Connection between energy accounts and energy statistics

As noted above, energy statistics or energy balances[1] serve as one of the main sources of information for energy accounts. For the most part, energy statistics can be used directly for the derivation of energy accounts. There exists, however, two differences which require data manipulation to go from one to the other. These are mainly related to the issues of boundary and classifications.

3.1. Differences in boundaries

Since energy accounts are satellite of the 1993 SNA, they follow the principles of the 1993 SNA and therefore the residence principle is adopted. This implies that all economic activities of a resident unit are within the boundaries of the energy accounts. Energy statistics, on the other hand, follow the territory principle according to which all activities taking place in the national territory are considered within the boundary. This difference in approach has implications mainly on the treatment of energy consumption, especially for transportation.

In energy statistics, all energy consumption for transportation is reported as a total. In energy accounts, it is broken down according to intermediate consumption of industries (transport industries and other industries) and final consumption of households. Further, consumption of energy products bunkered abroad for international sea transport and for international air transport is not included in energy statistics, but it is in the energy accounts. In this case, energy statistics have to

[1] In this paper energy statistics and energy balances are used synonymously. See also Boeng, 2006.

be complemented with additional information to meet the requirements of the energy accounts.

The residence principle also requires that the energy consumption is adjusted for energy used by foreign embassies and foreign tourists. Correspondingly, the energy consumption caused by Danish embassies and Danish tourists abroad should be added to the consumption of energy.

Corrections like these are not carried out in the physical Danish energy accounts, i.e. it is implicitly assumed that the energy consumption caused by Danish residents abroad equals that of the non-residents in Denmark. However, the corrections are carried out in the monetary national accounts by means of special calculations.

3.2. Differences in classifications

The difference in classification entails to a different definition of production. In energy accounts, production is defined according to the 1993 SNA and economic activities are classified according to the International Standard Classification of All Economic Activities (ISIC) of the primary product of the establishment. In energy statistics, activities are mainly classified by sector.

The energy products in the energy accounts are those as classified by the Harmonized System (HS), for trade data, and the Central Product Classification (CPC), for production and consumption data. In most situations, it is not difficult to link the classification of energy products in energy statistics with that used in the accounts.

However, it should be noted that the standard product classifications, HS and CPC, do not provide a very detailed breakdown of energy products. For instance, biomass based products, such as wood pellets etc., are classified in HS, together with sawdust and wood waste, whereas the classification of energy products used in energy statistics would identify wood pellets separately.

3.3. Differences in data sources

Depending on the institutional setup the data sources used to establish the energy accounts and the energy statistics may vary. This is the case in the Danish situation where data on external trade with energy products are collected both by the Danish Energy Authority and by Statistics Denmark. It is especially data on oil products that differ. Data on production in the commodity statistics as published by Statistics Denmark do not always equal data on production in the energy statistics either.

Because the national accounts have to be consistent with the commodity statistics and the external trade statistics the data on production and external trade in the energy accounts may also differ from the energy statistics. Other differences in the data sources are caused by different versions of the data.

Therefore, even though the primary goal of the bridge tables is to describe the connection between the energy statistics and the energy accounts, another purpose of the bridge table is also to have a tool which is instrumental in identifying problems with the quality and the coherence of data.

All the above listed differences cause confusion and should be explained in the bridge table. In order to explain all types of differences, the bridge table has to show supply and use as well as the product dimension.

4. Bridge table linking the energy accounts with the statistics

The bridge table links the Danish energy accounts with the Danish energy statistics in 2004. The bridge table shows the gross energy use. Even though the gross energy consumption involves double counting, it is suitable for the analysis of individual energy products. The bridge table is an aggregation of the individual energy products.

The differences are calculated as the energy accounts minus the energy statistics, i.e. the difference on production is calculated as the production as recorded in the energy accounts minus the production as recorded in the energy statistics.

The general idea in the bridge table is that the vertical dimension shows what comprises the supply and use in the energy accounts, column (1) and in the energy statistics, column (5).

Whereas the horizontal dimension, columns (2), (3) and (4), explains the differences between the energy accounts and the energy statistics. In other words, the horizontal dimension explains the difference between the SNA/SEEA framework and the IEA/UNFCCC framework.

Column (2) shows the difference between the energy products accounted for in both the energy accounts and the energy statistics. These differences are due to differences in the boundaries. However, in the Danish situation the differences are also due to different data sources. For example, differences in the data on external trade with energy products.

Column (3) shows the differences caused by the non-energy related use of energy products (white spirit, lubricants and bitumen). This use is not accounted for in the Danish energy accounts.

Column (4) shows the differences caused by the other energy products not accounted for in the energy accounts. This group is composed of renewable types of energy (solar energy, geothermal power, liquid bio fuels, fish oil, heat pumps), which are all still of lesser economic relevance, and this is why they are not part of the SNA framework and therefore not accounted for in the Danish energy accounts.

The bridge table should be interpreted in the following way.

Row I shows the production. The total production accounted for in the Danish energy accounts is 1,912,894 TJ. The production accounted for in the Danish energy statistics is 1,920,158 TJ. Thus, the difference is 7,264 TJ. This difference is broken down by the differences in columns (2), (3) and (4).

In the same way, each of the other rows explains the differences between the energy accounts and the energy statistics.

Row II shows the imports. Rows I and II add up to the total supply in row III. The difference in the supply of energy between the Danish energy accounts and the Danish energy statistics is primarily made up of the Danish ships bunkering of fuel oil abroad and the Danish planes bunkering of JP1 abroad.

Row IV shows the exports. The difference in the exports is caused by the foreigners bunkering in Denmark. In the national accounts framework this bunkering is exports, whereas in the energy statistics based on the territorial principle, this bunkering is consumption on the territory.

In order to show the total consumption of energy in the Danish energy accounts and the Danish energy statistics respectively, the energy statistics should first be adjusted for the international sea transport and the international air transport. The energy used for international sea transport and international air transport is included on the supply side it is, however, not part of the total energy consumption[2]. This adjustment is carried out in row V.

Having adjusted the total supply for the exports and for the international sea and air transport, row VI shows the disposable amount of energy within the economy and within the territory.

Row VII shows the amount of energy used by the industries and the households whereas row VIII shows the changes in stocks, the losses and the discrepancy.

Row VII and column (2) show that the major part of the difference between the energy consumption in the energy accounts and in the energy statistics is caused by the fact that the ships and planes bunkering abroad is accounted for in the energy accounts.

The non-energy related use of energy products not accounted for in the energy accounts and the use of other types of renewable energy not accounted for in the energy accounts are of less importance.

[2] The consumption of energy as reported to the IEA does not include international sea transport. Furthermore, the consumption of energy as reported to the UNFCCC does not include international air transport. By international transport is meant from a domestic harbour or airport to a foreign.

Bridge table I **The connection between the Danish Energy Accounts and the Danish Energy Statistics 2004**

		Danish Energy Accounts	Differences between the energy accounts and the energy statistics	Non-energy related use of energy not accounted for in the energy accounts	Other renewable energy not accounted for in the Energy Accounts	Danish Energy Statistics
		(1)	(2)	(3)	(4)	(5)=(1)-(2)-(3)-(4)
		TJ				
I	**Production**	**1 912 894**	**169**	**- 76**	**-7 357**	**1 920 158**
II = II.1,.. + ..,II.3	**Imports**	**959 893**	**386 051**	**-12 049**	**-**	**585 892**
II.1	Of which Danish ships bunkering of fuel oil abroad	332 146	332 146	-	-	-
II.2	Of which Danish planes bunkering of JP1 abroad	7 128	7 128	-	-	-
II.3	Of which imports of other energy products	620 619	46 777	-12 049	-	585 892
III = I + II	**Total supply**	**2 872 787**	**386 220**	**-12 126**	**-7 357**	**2 506 050**
IV = IV.1 + IV.2	**Exports**	**1 080 456**	**61 948**	**- 229**	**-2 444**	**1 021 180**
IV.1	Of which foreigners bunkering in Denmark	49 739	49 739	-	-	-
IV.2	Of which other exports	1 030 717	12 210	- 229	-2 444	1 021 180
V = V.1 + V.2	**International transport**	**-**	**67 970**	**83**	**-**	**-68 054**
V.1	Of which international sea transport	-	33 450	83	-	-33 534
V.2	Of which international air transport	-	34 520	-	-	-34 520
VI = III - IV + V (= VII + VIII)	**Disposable within the economy / the territory**	**1 792 331**	**392 242**	**-11 814**	**-4 913**	**1 416 817**
VII	**Total energy consumption**	**1 744 045**	**378 524**	**-12 172**	**-4 913**	**1 382 607**
VIII	**Changes in stocks, losses and discrepancy**	**48 286**	**13 718**	**359**	**-**	**34 209**
IX = IV - V + VII + VIII (= III)	**Total use**	**2 872 787**	**386 220**	**-12 126**	**-7 357**	**2 506 050**

Source: Danish Energy Accounts and Danish Environmental Accounts published by Statistics Denmark (2006). Danish Energy Statistics published by the Danish Energy Authority (2006).

Using row VII in bridge table I as the starting point, bridge table II explains the differences between the various statistical frameworks which are used to describe the physical flows of energy.

Bridge table II shows the difference between the energy consumption as described in the Danish energy accounts and the energy consumption which is reported to the IEA and the UNFCCC.

Bridge table II **The connection between different statistical frameworks 2004**

	Framework	TJ
I	**System of National Accounts (SNA / SEEA)**	**1 744 045**
II = II.1, ..+ ..,II.4	Differences between the energy accounts and the energy statistics	378 524
II.1	Of which Danish ships bunkering of fuel oil abroad	332 146
II.2	Of which Danish planes bunkering of JP1 abroad	7 128
II.3	Of which international sea transport	33 450
II.4	Of which other differences	5 800
III	Non-energy related use of energy not accounted for in the energy accounts	-12 172
IV	Other renewable energy not accounted for in the Energy Accounts	-4 913
V =I- II - III - IV	**International Energy Agency (IEA)**	**1 417 127**
VI	International air transport	34 520
VII = V - VI	**United Nations Framework Convention on Climate Change (UNFCCC)**	**1 382 607**

The difference between the energy consumption as reported to the IEA and the energy consumption as reported to the UNFCCC is the consumption of energy caused by international air transport.

It is important to notice that the bridge table shows the gross energy consumption. Furthermore, the consumption of energy includes non-energy related use of energy as well as renewable types of energy. Therefore, it is not the total consumption of energy posted here as being of the UNFCCC type which is of relevance in relation to the calculation of emissions, e.g. CO_2 emissions.

5. Summary and conclusions

The fact that different statistical frameworks are used to describe the flows of energy causes confusion. Therefore, bridge tables which explain the differences are needed.

The bridge table showed that the major part of the difference between the energy accounts and the energy statistics is caused by the fact that the ships and planes bunkering abroad is accounted for in the energy accounts. This is attributed to the difference in the boundaries as regards the residence or the territory principle. The demarcation of the energy products accounted for is of less importance.

Finally, it should be emphasised that the bridge table is not only a tool that can be used to explain the differences between the energy accounts and the energy statistics. The bridge table is also a tool which can be used for quality control and checks of the energy accounts and the energy statistics. However, this requires that the product dimension is included in the bridge table.

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