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The Dutch energy accounts

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Abstract - The energy accounts represent a system in which energy data, in both monetary and physical terms, have been integrated into the national accounting framework. The supply and use tables, part of the system of National Accounts, provide an overall accounting structure for the energy accounts in values and quantities. The energy accounts can be used, either directly or via calculations using economic modelling, to analyse energy use and production in relation to different economic activities in society. The energy accounts constitute an integrated part of the System of Environmental and Economic Accounts (SEEA). In this study a new methodology is presented to compile the energy accounts for the Netherlands. Physical data, derived from the energy statistics, have been combined with price information to calculate the monetary energy values. These energy values have subsequently been implemented into the System of National Accounts. By combining these two data sources, a systematic framework is created containing consistent and harmonised monetary and physical energy data.

1. Introduction

Energy is essential for the economy because nearly all economic activities consume either directly or indirectly energy products. The global demand for energy is ever increasing. Upcoming new economies like China, India and Brazil need ever more quantities of energy, and thus the demand for natural resources like oil and gas is increasing. The last few years, energy prices have gone up sharply, which have put the national economies under stress. Security of energy supply is becoming a more important issue for many countries. Furthermore, energy use is closely related to the emission of greenhouse gasses. The increasing concerns about climate change more attention for issues related to energy consumption and energy savings. Thus, there is an increasing demand for good statistics on energy, in order to monitor the monetary and physical demand and supply of energy within and between countries.

Traditionally, most countries compile two kinds of energy statistics. First of all, the energy balances provide in the form of energy flow tables a complete overview of the supply and use of energy on a national level. On a detailed level by industry and by energy source the receipts, the aim of use and the total deliverance of the energy source is recorded. Secondly, countries compile the National Accounts, which record all monetary flows associated with energy (production of energy, intermediate use by industries, final use by households, etc.). Ideally, data from the physical energy statistics (energy balances) should be consistent with the monetary data from the National accounts. However, there are two main reasons why this is not the case. First of all, differences in classifications and definitions make a direct comparison between the two data sets impossible. Secondly, the source information for these two statistics usually originate from two different and separate data flows. This causes all kinds of inconsistencies, for example because of differences in the sample size of the underlying survey, up scaling factors, consistency procedures etc.

In order to circumvent these problems the so-called *energy accounts* have been developed. The energy accounts represent a consistent framework in which energy data, both in monetary and physical terms, have been integrated into the national accounting framework. The supply and use tables, part of the system of National Accounts, provide an overall accounting structure for the energy accounts in values and quantities. The energy accounts provide a complete overview of the supply and use of energy commodities of the Dutch economy. Figures are presented for 58 industries, covering the whole economy, households, stock changes and imports and exports. The energy accounts are based on the international framework called the System of Environmental and Economic Accounts (SEEA2003). This framework is an extension of the System of National accounts (SNA).

Energy accounts have been compiled by a number of countries, among others Denmark, Finland, Norway, United Kingdom, Germany, South Africa, Australia and New Zealand. In addition, Eurostat has included a table on the physical energy use into the NAMEA-air standard tables from 2003 onwards (see NAMEA-air compilation guide Eurostat)[2]. This table covers only the demand side and focuses on the energy use that causes emissions to air, i.e. only energy combusted. Energy products transformed in another form of energy or used as raw material are not taken into consideration.

At present, there is a lot of confusion in the international community on the exact nature of the energy accounts. Until now energy accounts are not well defined in any statistical standard or compilation guide. In SEEA-2003 energy accounts are mentioned only briefly. Energy accounts are part of the material flow accounts (chapter 3), but are not discussed separately. In chapter 4.2 (hybrid flow accounts) the energy accounts of one country, namely Denmark, are discussed and illustrated with some tables (4-45 to 4.73). The focus is mainly on the how the energy accounts can be used for the compilation of the air emission accounts. In some countries energy balances. As a result, every country is at present is compiling its own energy accounts according to different concepts and methodologies. Consequently, the results from different countries cannot be used for international comparability. Part of the confusion is caused by the fact that there are different kinds of energy accounts that can be compiled. For example, Statistics Netherlands at present compiles and publishes two kinds of energy accounts, in addition to the energy balances that are also published.

Recently, several new initiatives have been undertaken to develop new standards or compilation guides for energy. The UN Statistical Commission acknowledged the importance of energy statistics and noted the need for further methodological development. As a result, the Oslo Group on Energy Statistics was established in 2006 with the objective of addressing issues related to energy statistics and contributing to improved international standards and improved methods for official energy statistics by pooling expertise in the energy community. In addition, energy accounts have been identified by the UN Committee of Experts on Environmental-Economic Accounting (UNCEEA) as an important domain of the international statistical standard on environmental-economic accounting – the revised SEEA-2003. In response to the increasing demand from the international community to develop a coherent methodology with harmonized definitions, classifications and tables for energy accounts and related statistics, the United Nations Statistics Division (UNSD) has embarked on the drafting of an international statistical standard on energy

[2] In 2006 Eurostat proposed to exclude the energy accounts from the standard tables for NAMEA-air, in order to simplify the questionnaire. However, after discussions among member states the tables were reinserted into the questionnaire, and can now be filled in on a voluntary basis

accounts, the *System of Environmental-Economic Accounting for Energy* (SEEA-E) as part of its work programme. The status of these different standards / handbooks and their relation to each other is still under discussion.

In this paper the Dutch energy accounts are described. In chapter 2 the general concepts of the energy accounts are discussed. In chapter 3 an overview is given of the methodology of the Dutch energy accounts. In chapter 4 some important indicators that can be derived from the energy accounts are discussed. Chapter 5 rounds up with some conclusions.

2. Concepts of the energy accounts

In this paragraph we will summarize the main concepts of the energy accounts, the differences with the energy balances, and the different kinds on energy accounts that can be compiled.

2.1 General concepts of the energy accounts

The energy accounts are supply and use tables for energy products. The supply table shows how much energy products are produced or extracted within a country and how much energy products are imported from abroad. The use table shows the total intermediate use and the final use by households of energy products and the exports of energy products abroad. In principle the total of the supply table should equal the total of the use table (see however also section 2.2).

The energy accounts can be compiled both in physical and monetary terms. These are so called *hybrid accounts,* which are an integral part of the system of integrated economic and environmental accounts (SEEA2003 4-6). In the physical dimension energy can be recorded in both units of weight (mln kg, mln ae, mln kWh) and energetic equivalents (PJ).

The main characteristic of the energy flow accounts is that they are, like all other environmental accounts, compiled according to the definitions of the National Accounts (SNA93). Therefore, the energy flow accounts give a complete overview of the total energy supply and energy consumption of a national economy. Accordingly, there are some fundamental differences with regard to the energy statistics, or energy balances, as they are usually called. These main differences are described below:

1. **Resident principle**

   The National accounts are based on the resident principle, whereas the energy statistics are based on the territory principle. Accordingly, in the energy accounts all economic agents of a country are included regardless whether they are operating within the national territory or abroad. The resident principle guarantees that macroeconomic indicators such as Domestic Product and National income are comparable between countries and can be summated straightforwardly over countries. Accordingly, energy purchase by residents for mobile sources that occurs abroad is taken into account. This includes bunkering of gasoline and fuel oil by ships and the purchase of motor fuels by tourists. In the National accounts these purchases are recorded as imports. In addition, the energy purchases by non-residents is not part of the domestic use and is recorded as export. Both energy use by residents abroad as the energy use by non residents is shown separately from respectively the total import en export in the energy accounts.

2. **Production concept**

   The supply and use tables of the National accounts show how much energy products are sold and purchased. Similarly, the energy accounts show the physical energy flows of energy products that are sold and purchased. This is not always equal to the amounts that are produced and used within a business unit or an industry, as is recorded in the energy balances. Internal use (i.e. energy produced and used within the same business unit) is not recorded in the National accounts, as there is no complementary monetary flow associated with it. Accordingly, there is a difference in definition with regard to the “use” and “production” concept. This is particularly important for renewable energy sources, as these are often first applied for own use purposes.

3. **Bunkering**

   In the energy balances, bunkering is the supply of petroleum products to ships and aircrafts in the international transport. Accordingly, these are the purchases of jet fuel to airline companies and of fuel oil and gasoline to shipping companies. In bunkering no distinction is made to the supply to national companies, which are part of the national economy, and foreign companies. Bunkering as such is not recorded as a separate category in the energy accounts. Supply to national companies is part of the use figures of and air transport Supply to foreign companies (sea vessels, airplanes) are part of the export figures. This is in accordance to the concepts of the National accounts.

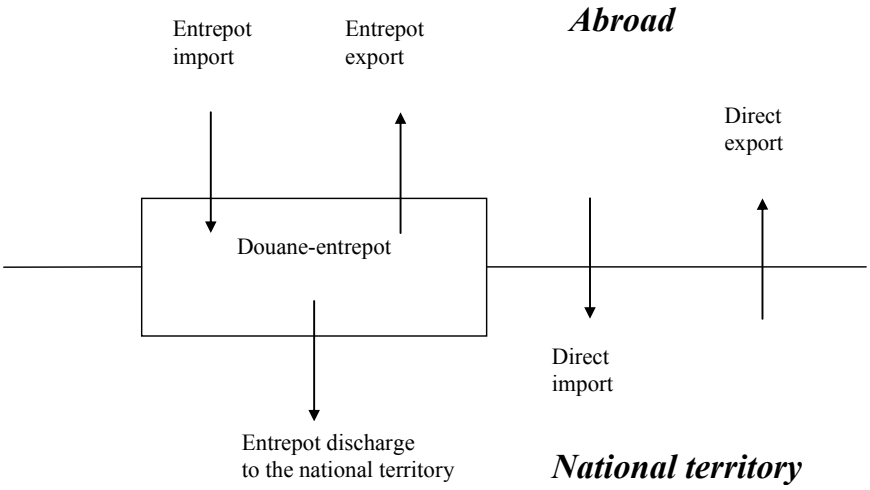
4. **Differences in classification of industries**

An important characteristic of the energy accounts (and the national accounts) is that energy production and energy use is attributed to the appropriate institutional units. In the energy balances, activities are mainly classified by sector. The two main differences are:

a) Transport: in the energy balances all energy use related to transport activities are placed under a separate item. In the National accounts the consumption of fuels by transport activities is attributed to the industry that is actually using it.
b) Service industries: in the energy balances only one sector for the service industries is identified. In the energy accounts, this sector is disaggregated into many different industries.

5. Import and export of energy products

Import and export of energy products is treated differently in the energy balances and the National accounts. The energy balances record all energy commodities entering or leaving the national territory (general trade system). This includes energy goods entering the customs entrepot. For a country such as the Netherlands, that has an important distribution function within Europe, this is very important. In the national accounts goods entering and leaving the customs entrepot are excluded from the international trade balance, as the customs entrepot is considered not to be part of the national economy (special trade system)(see figure 2). Accordingly, the physical import / export data as obtained from the energy balances have to be corrected for the energy accounts to make them correspond to NA definitions.



2.2 Three different energy accounts

The energy accounts can be compiled on three different levels, namely a) gross energy accounts, b) net energy accounts, c) emission related energy accounts. Each energy account is compiled according to some different principles, and has its own specific applications.

2.2.1 Gross energy accounts

The gross energy accounts show all energy flows that occur within the economy. For each energy commodity, they show how much is imported and produced domestically, and how much is used within a country (by intermediate and final consumption) and exported. The energy flows are shown both in physical as monetary terms. The gross energy accounts are thus hybrid accounts as described in SEEA-2003. So, the gross energy accounts are fully consistent with the National accounts.

The supply of energy products is defined as domestic production plus import of the various energy products. The use of energy commodities is defined as intermediate use by industries (classified by NACE), plus household consumption, inventory changes and exports. Like in the supply and use tables of the National accounts, the supply and use of each energy product are balanced.

However, the gross energy accounts have several disadvantages. Firstly, as primary energy sources are converted into secondary energy sources, for example the conversion of coal into electricity, this causes double counting. The total gross energy use by industry is therefore not equal to the total "final" or "net" energy consumption. This double counting makes the gross energy accounts unsuitable for the analysis of the final energy use by industries or for the whole economy. Also for IO-analysis and decomposition analysis, the final energy consumption is more interesting than the total gross energy consumption. Secondly, the gross energy accounts cannot be used to derive the air emission accounts because of the double counting problem. For this purpose, energy use tables have to be derived which only relates energy use to combustion processes.

The main characteristics of the gross energy accounts:

- Supply and use tables for energy product by industry in physical and monetary terms
- Supply equals use for each energy commodity
- Compiled according to the resident principle
- Internal use of energy is not part of the energy consumption (= energy consumption of products produced within the same company unit)
- Direct link with the monetary accounts: fully consistent with National accounts
- Includes energy consumption for energetic and non-energetic purposes
- Gives total energy production and total energy use by industry
- Both physical and monetary accounts (which are consistent)
- Double counting (as energy products are converted into other energy products)
- Imports and exports according to the special trade system
- The physical accounts can be used to improve the monetary data (from the National accounts)

2.2.2 Net energy accounts

The net energy accounts show all energy that is actually consumed for final purposes and imported (use table) and all energy that is extracted within a country and is imported (supply table). In contrast to the gross energy accounts, there is no double counting. The net energy accounts are still compiled according to the resident principle. However, internal use of energy, which was excluded from the gross accounts, is included, as this is part of the energy use for final purposes. In addition, a column has to be added for energy losses that occur upon conversion processes (which are also calculated from the energy balances). The net energy accounts can only be compiled in physical terms, as not every energy flow has a corresponding monetary transaction.

The net energy accounts are most suitable for analytical purposes. They can easily be combined with monetary data from the National accounts to determine the energy intensity or the energy productivity of an economy or an industry. In addition, the data from net energy can be used for IO-analyses and decomposition analyses.

The net energy accounts (as defined in this paper) include both final energy use for energetic as non-energetic purposes.

The main characteristics of the gross energy accounts:

- Supply and use tables for energy product by industry in physical terms
- Supply does not equal use for each energy commodity, only for the economy as a whole
- Compiled according to the resident principle
- Internal use of energy is part of the energy consumption (= energy consumption of products produced within the same company unit)
- No direct link with monetary accounts : only physical accounts
- Includes energy consumption for energetic and non-energetic purposes
- Gives total energy extraction and total energy use by industry
- No double counting (net energy use and net energy supply)
- Imports and exports according to the special trade system

Table 1: The gross and net energy use for the Netherlands (2003). The net energy use can be split into use for energetic and non-energetic purposes and conversion energy.

	Gross energy use	Net energy use	Net energy use for energetic purposes	Net energy use for non-energetic purposes	Conversion losses
Agriculture, forestry and fishing	187,8	194,5	194,0	0,5	0,0
Mining and quarrying	248,4	56,3	56,1	0,0	0,2
Manufacture of petroleum products	2699,7	190,3	125,8	0,3	64,2
Manufacture of basic chemicals and man-made fibres	1189,1	730,9	369,1	338,0	23,8
Manufacture of basic metals	175,7	143,5	51,9	77,2	14,3
Other manufacturing	283,9	291,0	274,0	7,5	9,5
Electricity, gas and water supply	776,3	381,1	28,1	0,0	353,0
Construction	32,3	32,3	19,8	12,5	0,0
Trade, hotels, restaurants and repair	198,9	122,4	120,9	1,5	0,0
Transport, storage and communication	397,3	397,3	394,0	3,3	0,0
Financial and business activities	85,2	85,2	85,2	0,0	0,0
General government	70,0	70,0	69,3	0,7	0,0
Care and other service activities	101,1	143,1	102,9	0,0	40,1
Households	677,7	677,7	676,8	0,9	0,0
Total	**7123,5**	**3515,7**	**2568,1**	**442,5**	**505,1**

2.2.3 Net energy accounts for air emissions

This third category of energy accounts has the same characteristics as the net energy accounts, except for the following:

- The net energy accounts for air emissions only record energy use for energetic purposes, i.e. energy use that causes air emissions. Non combustion use over energy is thus excluded.
- Energy carriers not related to air emissions (electricity, steam and hot water, wind energy, solar energy, nuclear energy) are excluded from the accounts

The Net energy accounts for air emissions only consists of a use table. As export of energy products in itself does not cause air emissions, this item is excluded from the use table. Using emission conversion factors, the air emission accounts can be easily derived from the Net energy accounts for air emissions.

2.3 Bridge tables

In order to clarify the difference between the energy balances and energy accounts, bridge tables can be developed. For gross energy supply and gross energy use, no bridge table can be compiled because of the double counting problems. Only a table can be constructed showing the differences between the accounts and energy balances. This, however, is not a true bridge table in a sense that all the differences can be fully explained.

For the net energy balances a bridge table can be compiled for the energy use (see table 2 and 3). The first table describes the differences between energy use according to the energy balances and the net energy accounts. The three causes for the difference are the use of non residents, the use of residents abroad and bunkering. The second table shows the differences for supply and use according to the energy balances and the net energy accounts. This tables quantifies the differences in import/ export, the final use plus conversion losses, differences due to the resident principle and inventory changes.

Table 2: Bridge table for energy use (2006)

	PJ
Final use (energy balances)	2 750
Conversion losses (energy balances)	482
Total energy use in the Netherlands (energy balances)	3 232
Use residents abroad (+)	166
Use non residents (-)	12
Bunkering Dutch companies in the Netherlands (+)	142
Total net energy use Dutch economy (net energy accounts)	3 527

Table 3: Differences between the net energy flow accounts and the energy balances for the supply and use of energy (2006)

	Energy balances	Energy accounts	Difference
	PJ		
Supply			
Extraction	2 579	2 579	
Imports	8 983	5 585	3 398
Bunkering Dutch companies aboad		166	- 166
Total	11 562	8 330	3 232
Use			
Final domestic use plus conversion losses	3 232	3 527	- 295
Exports	7 406	4 839	2 567
use non residents		12	- 12
Bunkering in the Netherlands	898		898
inventory changes	26	- 49	75
Total	11 562	8 330	3 232

3. Methodology

3.1 Compilation of the gross energy accounts

In the Netherlands, the compilation of the gross energy accounts is closely connected with the compilation of the National accounts. The physical data is used as an input to calculate the monetary values for the national accounts. Accordingly, consistent monetary supply and use tables are created at a detailed industry level (i.e.58 industries).

The gross energy accounts are compiled in three subsequent steps (Figure 1):

1. The calculation of the physical supply and use tables from the ESN
2. The calculation of the monetary supply and use tables for the National accounts
3. Completion of the physical accounts

In these steps different data sources are integrated to construct a harmonised data system. In de following section, these individual steps are discussed.

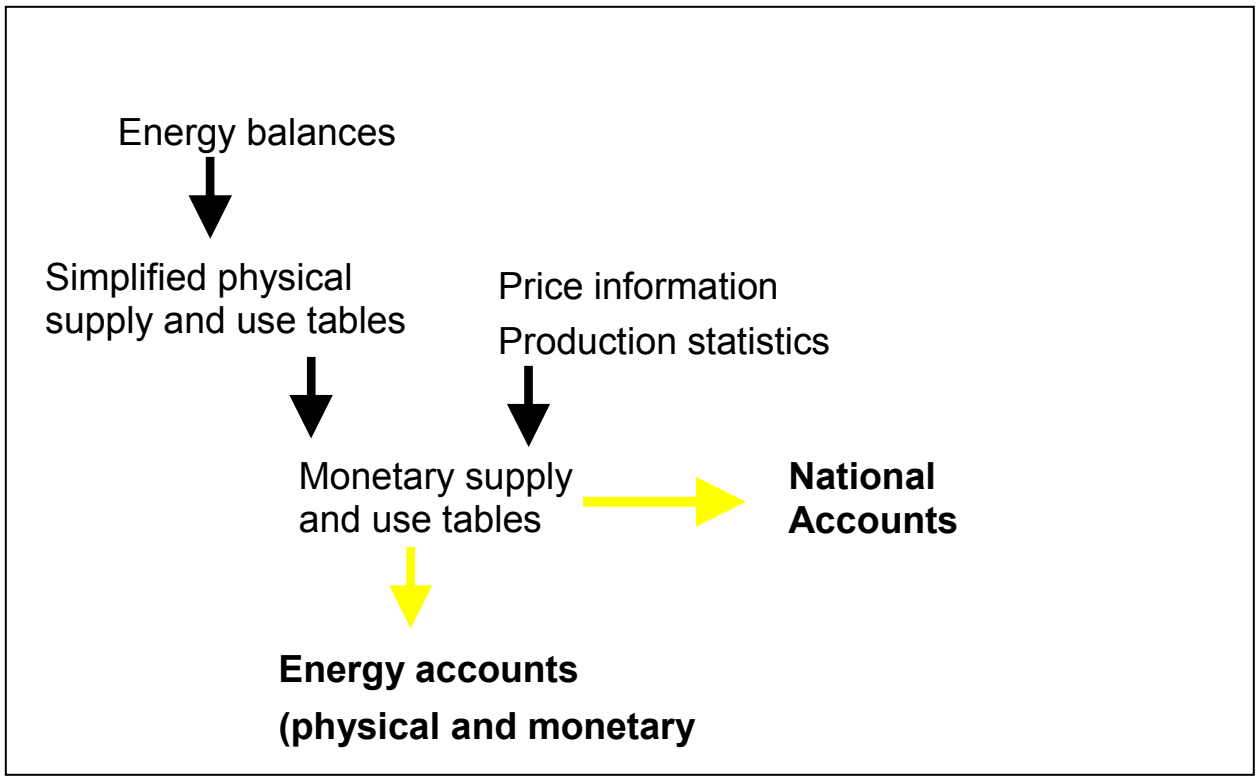


Figure 1: overview of the methodology

3.1.1 The calculation of the physical supply and use tables from the ESN

The energy balances are the most important source for the derivation of the energy accounts. The energy balances provide in the form of energy flow accounts a complete overview of the supply and use of energy in the Netherlands. On a detailed level by industry and by energy source the receipts, the aim of use and the total deliverance of the energy source is recorded. The main parameter in the ESN is the consumption balance, which is computed on two levels. The first one is calculated on micro level (as a result of a survey) as extraction + receipts – deliveries + stock changes. The second one is computed on macro level: extraction + imports – exports – bunkering + stock changes. The ESN covers all energy commodities in the Netherlands. Renewable energy sources (solar energy, water power, biofuels), which are until now of relative little importance for total energy use in the Netherlands, are not listed separately but are included as electricity or steam production.

Thanks to its comprehensive description of energy production and use, as well as its depth of breakdown, the ESN is a highly suitable source of data for drawing up NA supply and use tables. However, due to the differences in definitions, concepts and classifications some adaptations of the ESN are essential to make up supply and use tables in terms of the NA. The following steps can be distinguished in the translating procedure:

1. Harmonisation of industry and energy source classifications
2. Conceptual translation of the ESN into NA supply and use tables
3. Conceptual translation of import / export data from ESN data into NA

3.1.2 Harmonisation of industry and energy source classifications

The used industry classification in the ESN was not uniquely transformable to the classification used in the NA. However, it was possible to aggregate both classification to a common level. As a result groups of industry branches of both systems were made comparable. These groups were denoted with a special code and name. The same problem did arise with the classification of energy resources. Also in this case a common level of aggregation was necessary.

As recommended in the SEEA (4-15) a distinction was made between primary energy sources (fossil fuels, renewable energy) and secondary energy sources such as electricity and refined petroleum products which have been formed from the transformation of primary energy sources. Renewable energy sources, such as water power and solar energy, are not considered in the present study. They will be added to the energy accounts in a future project.

Energy sources used as fuel for transport purposes are functionally recorded in the ESN. However, the data are broken-down by type of transport and by type of fuel. For road traffic the total delivery is recorded for the three relevant fuels: motor gasoline, diesel and LPG. For inland and seagoing shipping the total delivery of diesel oil and fuel oil (>= 15 cSt) is recorded. In the case of aviation the total amount of jet fuel is known. Fuel used by air planes and ships delivered in the Netherlands but intended to be used abroad (outside the Dutch boarder) is separately recorded as bunkering. In the system of National Accounts all these total levels of fuels have to be attributed to the various industries/companies consuming the fuel. In this stage of the data adaptations the fuels for transport were allocated the functional “branch of industry” transport.

3.1.3 Calculation of supply and use tables in physical units on the basis of the ESN according to the definitions of the NA

In the drawing up of the physical supply and use tables it is important to stay as close as possible to the conventions of the National accounts. As was already mentioned, the concepts and definitions used in the

ESN differ from the NA. Therefore it is impossible to calculate the supply and use in terms of the NA in a straightforward way.

The supply and use on a business level were calculated as follows:

1. Supply equals production + domestic extraction. The (intermediate) use equals use for energy conversion purposes + final energy use
2. If production is larger than the total delivery, then supply is taken as equal to the total delivery. The (intermediate) use is taken equal to use (final use + use for conversion purposes) + delivery - production
3. When negative values for (intermediate) use are calculated these are corrected for. The (intermediate) use was set to zero and a correction is made in the stock changes to keep the supply / use in balance

Subsequently, the database was aggregated to the industry level and energy source level discussed in section 2.1.1 and a physical supply and use table was created. In addition, a table was made for the stock changes. These three tables constitute the basis for the compilation of the monetary supply and use tables.

3.1.4 Conceptual translation of import / export data from ESN data into NA

Import and export of energy products is differently treated in the ESN and the National accounts. The ESN records all energy commodities entering or leaving the national territory. This includes energy goods entering the customs entrepot. For the Netherlands this is very important. In Rotterdam, one on the largest harbours in the world, are to be exported again. In the national account goods entering and leaving the customs entrepot are excluded from the international trade statistics, as the customs entrepot is considered not to be part of the national economy (see figure 2). Accordingly, the physical import / export data have to be corrected to make them correspond to NA definitions.

The corrected imports and export were added to the physical supply and use tables created in the previous section.

3.1.4 The calculation of the monetary supply and use tables from the physical ESN tables

The compilation of the monetary supply and use tables consist of two step: 1) combining the physical data with price information to calculate the monetary values, 2) balancing the system

3.1.5 Calculating the monetary values

The monetary values for energy production and energy use are calculated by multiplying the physical values obtained from the ESN by the price (producers prices and purchaser's prices) of the commodity. The purchasers' price is the price of a product paid by a buyer, excluding VAT. The producers' price is the purchasers' price minus trade and transport margins and excises. The following data sources on energy prices are available:

1) *Foreign trade statistics.* The foreign trade statistics provide information on imports and exports in both monetary as physical terms. With these information the import and export prices can be calculated. Problems may arise with classification. Furthermore, these prices may not always be used to determine the internal production prices.
2) *Production statistics (PRODCOM).* Average purchase prices for energy carriers for manufacturing companies.
3) *Energy prices derived from the energy statistics*. Within the collection of energy statistics, a large number of prices of energy sources are available for individual producers and users.
4) *Consumer prices for motor fuels.* These prices include taxes and transport and trade margins, but do not include VAT.

3.1.6 Balancing the system

To the supply table, data on taxes (excises and other product related energy taxes) and transport and trade margins have to be added. The supply of an energy product should balance the use of this product. In case of a small difference the prices were re-evaluated. Serious differences were investigated further and if necessary adaptations are made for the imports or exports.

3.1.7 Completing the physical accounts

As a last step, the physical supply and use table have to be completed. First of all, the number of industry branches has to match that of the monetary data. Both the monetary as physical tables are produced for the same economic classification. These industries are broken down into 58 branches, which corresponds to

the publication level for the National Accounts, allowing a direct comparison with all major macro-economic parameters. Households are shown underneath the industries and are broken down into transport and other activities (mainly heating). Secondly, the physical use of motor fuels for the different industries was be calculated by using the monetary distribution over the different industry branches. Finally, the system has to be balanced. It was chosen to correct for the export data to balance the system.

3.2 Compilation of the net energy accounts

The net energy accounts are compiled separately from the gross accounts. Only some parts are the same as will be discussed below. The main source for the net energy accounts are tables from the energy balances.

3.2.1 The Net Use table

The net energy use table are compiled in five subsequent steps:

1) Compiling the energy use table from the energy balances. These are:

A) **Final energy use table** (energy use for final purposes). In this table the final energy use is given for the energy products en the sector classification from the ESN.

B) **Energy losses by conversion processes**. This table can also be created by subtracting the final energy table from the total energy use table (both from the energy balances). In this table energy conversions losses is given for the sector classification from the ESN. The energy losses can not be given for each energy product!

2) Converting the energy carriers to the NR classification

As described in paragraph for the gross energy accounts, the energy carriers as defined for the energy balances can rather easily be converted into the classification of products National accounts.

3) Converting the energy sectors to the NR classification

In this step the use of energy is distributed over de industry classification (NACE) that is also used in the national accounts. This is done using several monetary distributions form the National accounts:

- *Fuels for road transport* (motor oil, diesel, LPG) are distributed according to the monetary data in the National accounts.

- *Services:* the energy use by the service industries is mainly related to the use of gas and electricity. These are distributed according to the monetary data from the National accounts. The implicit assumption here is that the energy price for the service industries is more or less the same.

4) Correcting for the residence principle

Using several data sources the energy use by residents abroad is added and the energy use by non residents is distracted. These data sources are the same as used for compiling the air emission accounts.

5) Adding data for exports

Like the gross energy accounts, only exports consistent with the special trade system are taken into account. For the net energy accounts the exports are equal as in the gross energy accounts (see paragraph). The exports are therefore directly adopted from the gross energy accounts.

Additional sources

- For defence activities (NACE) a time series is available for jetfuel and oil. This data is directly put into the use table.
- For the total use of jet fuel is obtained from environmental reports from the largest airlines.
- For inland water transport the use of diesel is calculated based on data on transport activities of Dutch vessels.
- For seagoing ships the use of fuel oil and diesel is calculated based on monetary data from the national accounts.
- For fishery a time series is available for the use of diesel oil and fuel oil by Dutch vessels.
- For agriculture information from the economic agricultural institute (LEI) is used. For horticulture a separate calculation is made, as this industry employs a lot of CHP (combined heat and power) to produce electricity and heat. Based on data on total input of natural gas and electricity and the total input for CHP and the production of electricity and heat for own use / for other parties the net energy use is calculated.

3.2.2 The Net Supply table

Compiling the net supply is relatively more easy than the net use table. Net supply consist of domestic extraction and imports. Because this is relevant for less energy products and also less industries are involved, there are no/less classification converting problems. The net energy supply table are compiled in three subsequent steps:

1) Compiling the energy supply table from the energy balances.

Domestic extraction is obtained from the energy balances by energy carrier and industry

2) Converting the energy carriers and energy sectors to the NR classification

As described in paragraph for the gross energy accounts, the energy carriers as defined for the energy balances can rather easily be converted into the classification of products National accounts. The same is true for the industries as only a limited number of industries is involved in energy extraction.

3) Adding data for imports

Like the gross energy accounts, only imports consistent with the special trade system are taken into account. For the net energy accounts the imports are equal as in the gross energy accounts (see paragraph). The imports are therefore directly adopted from the gross energy accounts.

4. Indicators

The total gross energy production and total gross energy consumption as an indicator for the whole economy is probably of less interest because of the double counting. In addition, the average prices for energy are of more interest on the more disaggregated level (for example the average energy price for households) than for the total economy. The gross energy accounts are thus more suitable for analysis on a disaggregated level than for the compilation of (economy-wide) indicators.

From the gross energy accounts the following indicators can be derived:

- **Total gross domestic energy production (physical and monetary):** total domestic energy production for the whole economy.
- **Total gross domestic energy consumption: (physical and monetary):** total domestic energy production for the whole economy.
- **Average price of energy produced:** total energy produced (monetary) divided by total energy produced (physical)
- **Average price of energy consumed:** total energy consumed (monetary) divided by total energy consumed (physical)

From the net energy accounts the following aggregated indicators can be derived:

- **Total domestic energy extraction:** equals the domestic extraction of all primary energy products (renewable and non-renewable).

- **Total energy requirement of the economy:** equals imports of energy products + domestic energy extraction This is also equal to the total net energy consumption + exports of energy products
- **Total net energy consumption:** equals the total net energy consumption of the economy: final energy use + conversion losses
- **Percentage of renewable energy consumption:** Renewable energy consumption as percentage of the total net energy consumption

In addition the following important ratio indicators can be calculated:

- **Total energy intensity for the economy:** equals total net energy consumption / GDP
- **Total energy consumption per capita:** equals total net energy consumption / total population

5. Conclusions

Energy accounts provide detailed physical and monetary information on the energy flows that occur within a national economy. As it is part of an integrated framework, the data can be compared to all kind of macro-economic variables. The energy accounts are compiled according to the definitions of the National accounts. The results can therefore be directly used for IO-analysis. The energy accounts provide three concepts of energy consumption, namely, Gross energy use, net energy use, and net energy use for energetic purposes.

References

ABS (Australian Bureau of statistics), 2000, *Energy and emission accounts*

CBS, (Statistics Netherlands) (2005), *National Accounts 2004*, SDU-publishers, The Hague.

Eurostat (2003), *Environmental Accounts 2003 – Present state and future developmen*t, Doc. ENV/072/8, Joint Meeting of the Working Groups "Environmental Statistics" and "Environmental Accounts" Joint Eurostat/EFTA group, 10-12 September 2003, Eurostat (Luxemburg).

Hass, J.L. (2007), Requirements for energy statistics for the development of hybrid/NAMEA data systems. *Paper prepared for the 11th meeting of the London Group, South Africa*

IAEA (2005). *Energy indicators for sustainable development: Methodologies and Guidelines.*

Olsen, T. (2007), Danish energy accounts and energy statistics. *Paper prepared for the 11th meeting of the London Group, South Africa*

Statistics New Zealand. *Energy flow account 1996-1999*

UN (2003). *System of integrated environmental and economic accounting 2003,* Commission of the European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations & World Bank (2003). Final draft circulated for information prior to official editing, United Nations, New York.

UNSD (2007). *System of Environmental-Economic Accounting for Energy (SEEA-E) A project management framework for its drafting*

Verduin, H. (2000), *Integration of energy statistics in the National Accounts.* Statistics Netherlands, Voorburg.

ANNEX 1: Classifications for the Dutch energy accounts

Energy sources

1 **Hard coal and lignite**
2 **Coal Cokes**
3 **Blast furnace gas**
4 **Cokes gas**
5 **Crude oil**
6 **Natural gas condensate**
7 **Other gasses**
8 **LPG, propane, butane**
9 **Liquid gas (LPG) for cars**
10 **Naphtha's**
11 **Oil aromatics**
12 **Jetfuel and kerosine**
13 **Motor gasoline**
14 **petroleum**
15 **Diesel oil (used as raw material)**
16 **Diesel oil (for cars)**
17 **Diesel oil (other uses)**
18 **Fuel oil**
19 **Lubricants and greases**
20 **Bitumen**
21 **Petroleum residuals**
22 **Natural gas**
23 **Electricity**
24 **Steam/hot water**
25 **Biogas**

Industries

Agriculture, forestry and fishing

- **Arable farming**
- **Horticulture**
- **Cattle breeding**
- **Other agriculture**
- **Fisheries**

Mining and quarrying

- **Oil and gas**
- **Other mining and quarrying**

Manufacturing

- **Manufacture of food products, beverages and tobacco**
- **Manufacture of textile and leather products**
- **Manufacture of paper and paper products**
- **Publishing and printing**
- **Manufacture of petroleum products**
- **Manufacture of basic chemicals and man-made fibres**
- **Manufacture of chemical products**
- **Manufacture of rubber and plastic products**
- **Manufacture of basic metals**
- **Manufacture of fabricated metal products**
- **Manufacture of machinery and equipment n.e.c.**
- **Manufacture of electrical and optical equipment**
- **Manufacture of transport equipment**
- **Manufacture of wood products**
- **Manufacture of bulding materials**
- **Other manufacturing**
- **Waste recycling**

Electricity, gas and water supply

- **Electricity supply**
- **Water supply**

Construction

- **Construction of buildings**
- **Civil engineering**
- **Building installation and completion**

Trade, hotels, restaurants and repair

- **Trade and repair of motor vehicles/cycles**
- **Wholesale trade (excl. motor vehicles/cycles)**
- **Retail trade and repair (excl. motor vehicles/cycles)**
- **Hotels and restaurants**

Transport, storage and communication

- **Land transport**
- **Water transport**
- **Air transport**
- **Supporting transport activities**
- **Post and telecommunications**

Financial and business activities

- **Banking**
- **Insurance and pension funding**
- **Activities auxiliary to financial intermediation**
- **Real estate activities**
- **Renting of movables**
- **Computer and related activities**
- **Research and development**
- **Legal and economic activities**
- **Architectural and engineering activities**
- **Advertising**
- **Activities of employment agencies**
- **Other business activities**

General government

- **Public administration and social security**
- **Defence activities**
- **Subsidized education**

Care and other service activities

- **Health and social work activities**
- **Sewage and refuse disposal services**
- **Recreational, cultural and sporting activities**
- **Private households with employed persons**

Consumption of households

- **own transport**
- **other consumption**

export

Supply to non residents

trade stocks