eurostat

eurostat

PRINCIPLES AND METHODS OF THE ENERGY BALANCE SHEETS

Theme 4

Energy and industry

Series E

Methods

eurostat

OFICINA ESTADÍSTICA DE LAS COMUNIDADES EUROPEAS
DE EUROPÆISKE FÆLLESSKABERS STATISTISKE KONTOR
STATISTISCHES AMT DER EUROPÄISCHEN GEMEINSCHAFTEN
ΣΤΑΤΙΣΤΙΚΗ ΥΠΗΡΕΣΙΑ ΤΩΝ ΕΥΡΩΠΑΪΚΩΝ ΚΟΙΝΟΤΗΤΩΝ
STATISTICAL OFFICE OF THE EUROPEAN COMMUNITIES
OFFICE STATISTIQUE DES COMMUNAUTÉS EUROPÉENNES
ISTITUTO STATISTICO DELLE COMUNITÀ EUROPEE
BUREAU VOOR DE STATISTIEK DER EUROPESE GEMEENSCHAPPEN
SERVIÇO DE ESTATÍSTICA DAS COMUNIDADES EUROPEIAS

L-2920 Luxembourg — Tél. 43011 — Télex : Comeur Lu 3423
B-1049 Bruxelles, bâtiment Berlaymont, rue de la Loi 200 (bureau de liaison) — Tél. 2351111

Las publicaciones de Eurostat están clasificadas por temas y por series. La clasificación se encuentra al final de la obra. Para mayor información sobre las publicaciones, rogamos se pongan en contacto con Eurostat.
Para los pedidos, diríjanse a las oficinas de venta cuyas direcciones figuran en la página interior de la contracubierta.

Eurostats publikationer er klassificeret efter emne og serie. En oversigt herover findes bag i hæftet. Yderligere oplysninger om publikationerne kan fås ved henvendelse til Eurostat.
Bestilling kan afgives til de salgssteder, der er anført på omslagets side 3.

Die Veröffentlichungen von Eurostat sind nach Themenkreisen und Reihen gegliedert. Die Gliederung ist hinten in jedem Band aufgeführt. Genauere Auskünfte über die Veröffentlichungen erteilt Eurostat.
Ihre Bestellungen richten Sie bitte an die Verkaufsbüros, deren Anschriften jeweils auf der dritten Umschlagseite der Veröffentlichungen zu finden sind.

Οι εκδόσεις της Eurostat ταξινομούνται κατά θέμα και κατά σειρά. Η ακριβής ταξινόμηση αναφέρεται στο τέλος κάθε έκδοσης. Για λεπτομερέστερες πληροφορίες σχετικά με τις εκδόσεις, μπορείτε να απευθύνεσθε στην Eurostat.
Για τις παραγγελίες μπορείτε να απευθύνεσθε στα γραφεία πώλησης, των οποίων οι διευθύνσεις αναγράφονται στη σελίδα 3 του εξωφύλλου.

Eurostat's publications are classified according to themes and series. This classification is indicated at the end of the publication. For more detailed information on publications, contact Eurostat.
Orders are obtainable from the sales offices mentioned on the inside back cover.

Les publications de l'Eurostat sont classées par thème et par série. Cette classification est précisée à la fin de l'ouvrage. Pour des informations plus détaillées sur les publications, contactez l'Eurostat.
Pour les commandes, adressez-vous aux bureaux de vente dont les adresses sont indiquées à la page 3 de la couverture.

Le pubblicazioni dell'Eurostat sono classificate per tema e per serie. Tale classificazione è precisata alla fine dell'opera. Per informazioni più dettagliate sulle pubblicazioni rivolgersi all'Eurostat.
Per eventuali ordinazioni rivolgersi a uno degli uffici di vendita i cui indirizzi figurano nella 3ª pagina della copertina.

De publikaties van Eurostat zijn ingedeeld naar onderwerp en serie. Deze indeling is achter in het boek opgenomen. Voor nadere informatie over de publikaties kunt u zich wenden tot Eurostat.
Gelieve bestellingen op te geven bij de verkoopbureaus, waarvan de adressen op bladzijde 3 van de omslag zijn vermeld.

As publicações do Eurostat estão classificadas por tema e por série. Esta classificação está indicada no fim da obra. Para mais informações sobre as publicações é favor contactar Eurostat.
Encomendas: serviços de venda cujos endereços estão indicados na contracapa.

PRINCIPLES AND METHODS OF THE ENERGY BALANCE SHEETS

This publication is also available in the following languages:

ES ISBN 92-825-7960-3
DE ISBN 92-825-7961-1
FR ISBN 92-825-7963-8
IT ISBN 92-825-7964-6

Cataloguing data can be found at the end of this publication

Luxembourg: Office for Official Publications of the European Communities, 1988

ISBN 92-825-7962-X

Catalogue number: CA-49-87-785-EN-C

Printed in the FR of Germany

Introduction

Each year since the beginning of the 1960s the Statistical Office of the European Communities (SOEC) has drawn up an overall energy balance sheet from the 'primary fuel equivalence' standpoint.

In 1979 two other types of balance sheets were drawn up for the first time, namely the 'energy supplied' balance sheet and the 'useful energy' balance sheet. Because of the advantages of these two energy balance sheets the SOEC considers them in most respects to be the instruments best suited for analysing the economics of the energy situation. This is particularly so in the case of the 'useful energy' balance sheet. However, as this balance sheet, due to difficulties in drawing it up and insufficient statistical data, cannot yet be considered sufficiently reliable, the energy statistics of the SOEC are based on the 'energy supplied' balance sheet.

This document will enable users of the energy balance sheets to judge the validity of certain choices and to get a better understanding of the content of the balance sheets. It consists of two parts: the first part explains the different types of overall energy balance sheets whereas the second part provides a description of the matrix of the 'energy supplied' balance sheet.

As these comments are by no means exhaustive and may well contain imperfections any remarks, suggestions or criticisms are welcomed.

Part I

The overall energy balance sheets

The overall energy balance sheets are uniform quantitative systems which record energy availabilities on the one hand and their uses on the other.

There would be more justification in drawing up an overall energy balance sheet if complete and direct substitution were possible between all energy sources either at the primary input level or at the final consumption level. However, since technology allocates specific fuels to specific uses, this direct substitutability is in fact only immediately available in certain polyvalent conventional thermal power stations (i. e. stations which are in a position to substitute, as required, one fuel for another) and, in the short and medium term, in most non-specific applications.

However, if only because of these possibilities of partial substitution, the balance sheet is a vital tool in energy analysis. Experience has shown that the different energy sources are difficult to study separately and that they can only be fully understood when taken as a whole.

1. Types of balance sheets

Energy flows from production to consumption are easy to follow and describe when the form of energy in question is consumed in its initial state such as, for example, coal burnt in a boiler or natural gas used in a gas cooker. In such cases the flows are limited to the normal headings found in statement of operating results which relate to production, foreign trade, variations of stocks and conclude with final consumption.

However, energy sources are not normally consumed in the same form as they are produced: they undergo one or more transformations which not only change the form but also the energy content. Accordingly, in energy balance sheets the description of the flows is complicated by the introduction of transformation as an intermediate stage between production and consumption. As a result two supplementary lines must be added to the balance sheet: one to indicate the quantities of energy entering transformation plants and the other to record the outputs in the form of derived production. The difference between these two lines in the balance sheet represents the 'transformation gap' and corresponds, in general, to transformation losses. [1]

The differences between the different types of energy balance sheets are largely the result of different approaches and methods of calculation in respect of this 'transformation gap'.

Contrary to what one might think at first sight, the way this gap is treated is not simply an accounting problem but is a question of principle which relates to how a product is expressed in terms of energy, i. e. the energy volume to be attributed to a derived product. This energy volume may be evaluated either on the basis of the actual energy content of the product after transformation or on the basis of the primary fuel input equivalent prior to transformation.

The options chosen, at the level of the overall balance sheet, have far-reaching consequences, as will be shown in the following paragraphs.

(a) *The energy supplied balance sheet*[2]

The aim of the energy supplied balance sheet is to provide an accurate picture of the operations that take place.

Accordingly, the characteristic of this balance sheet is that it shows all flows (production, foreign trade, stocks, transformation inputs and outputs, consumption, etc.) on the basis of the actual energy content of each source. Thus this balance sheet records the true quantities of available energy which are placed at the disposal of the consumer, taking into account the losses intervening during the transformation operations.

In particular this type of balance sheet shows:

(i) all the operations and energy sources without calculation of the primary fuel input equivalent and without a substitution hypothesis, i.e. it shows energy supply in real terms;

(ii) the 'transformation gap', taking into acount the real losses which take place during the transformation process involved in obtaining derived products.

Thus, it provides:

(i) a complete and homogeneous description of all energy transformation operations;

(ii) the possibility of a very detailed breakdown of energy sources, because the energy content of each product is known;

[1] Accounting problems in connection with 'transformation gaps' arise only at the level of the overall balance sheet, because by definition the transformation inputs and outputs relate to different energy sources.

[2] This is the type of balance sheet recommended by the Statistical Office of the United Nations (see internal document ESA/Stat. Ac 8/11 of 20 March 1978); moreover, the great majority of countries have adopted it.

(iii) the basis for calculating certain technical coefficients, mainly connected with energy transformations;

(iv) a basis for analysing consumption and for studying energy savings;

(v) a useful link with macroeconomic data;

(vi) a link with statistics expressed in value terms where the prices always refer to real quantities.

The point might be raised that this balance sheet does not take into consideration all the losses intervening in the degradation of energy because it is limited to energy supplied to the final consumer and does not therefore record all the losses occurring during this final transformation of energy on his premises. The quality of the energy supplied may thus differ from one form of energy to another. It is the 'useful energy' balance sheet which bridges this gap, as will be seen in the following subsection.

In this context there has been criticism that the 'energy supplied' balance sheet underestimates the contribution of electrical energy because, as it is a more noble energy good and is more efficient from the point of view of the final consumer, its use value, at the final stage, is greater than that of fossil fuels. If these variations in quality are to be taken into account a solution might be to draw up a balance sheet in value terms. However, the only way to take these divergences in efficiency into account at the final consumption level is to draw up a useful energy balance sheet. However, both useful energy balance sheets and balance sheets expressed in value terms can only be drawn up on the basis of a quantitative balance sheet of the 'energy supplied' type.

Moreover, it should be stated clearly that the energy supplied balance sheet contains a number of practical drawbacks, which relate mainly to the practical difficulties encountered in drawing up the balance sheet itself. Thus, the preparation of accurate transformation balance sheets presupposes more complete statistical information and a more detailed knowledge of the characteristics of the energy sources.

(b) *The useful energy balance sheet*

The useful energy balance sheet is derived from the energy supplied balance sheet. In describing the operations it goes beyond the 'energy supplied' in that it takes into account energy recuperated from devices owned by final consumers and indicates, in particular, the losses occurring during this final transformation.

To this end it is necessary to measure effective energy consumption, i. e. useful energy, starting from the quantity of energy supplied to the consumer's door, i.e. energy supplied, and to take into consideration its final transformation by the final consumers.

Such a balance sheet is an indispensable prerequisite for analyses and forecasts of demand and for studies of energy economics.

The useful energy balance sheet, although it is not new from the conceptual point of view, is not considered a feasible proposition because of the difficulty in determining the energy efficiency, which requires information of a technological nature and new statistical breakdowns. Whereas certain energy specialists have already looked into certain methodological aspects of the useful energy balance sheet, there are very few who have as yet attempted to draw one up.

In drawing up such a balance sheet one must bear in mind the efficiency of the devices in which the final energy transformation takes place; thus it is necessary to know:

(i) the main types of devices used by the final consumers of energy;

(ii) the quantities of energy used by each type of device;

(iii) the average efficiency of these devices.

The types of devices taken into consideration have to be relatively limited in order to avoid major difficulties in the statistical breakdown of the quantities supplied. It is advisable to distinguish only devices which have markedly different efficiencies. These efficiencies, which must be assumed to be constant for the entire existing stock and thus applicable to the overall quantities supplied, might conceal dispersions of a greater or lesser extent without however affecting the calculation of useful energy.

The drawing up of a useful energy balance sheet based on the efficiency of devices is a solution largely dictated by practical considerations. One might also consider determining useful energy as a function of technological processes, uses, sectors or branches of economic activity. However, these breakdowns present even greater theoretical and practical difficulties to which no satisfactory solutions have yet been found.

The decision to take into account only the efficiency of the devices is a deliberate one. Other losses do indeed occur after output from the devices; it might be possible to estimate some of them without too much difficulty — such as, for example, losses in the distribution circuits at the user's home. However, calculation would become extremely complicated if it were necessary to record losses occurring at a later stage (bad utilization of heating or of other energy-consuming devices). It is obvious that losses occurring at this final stage influence energy demand and consumption and that there may well be room for quite significant savings. These losses might be studied in complementary projects of a more technological nature the results of which, however, could hardly be included in an energy balance sheet in the strict sense of the term.

(c) *The 'primary fuel input equivalent of derived energy' balance sheet*

The aim of this balance sheet is to express, in terms of primary fuel input equivalence, the quantities necessary to satisfy final demand. Accordingly, all the items in the balance sheet are calculated in accordance with the volume of primary energy necessary for supply and are expressed in terms of a common unit, generally that of a fossil fuel, as though all requirements were met by one primary energy source, which is selected as a basis for reference.

In particular this means that:

(i) All the derived energy sources must be computed in accordance with their primary fuel input equivalent, i.e. the quantity of primary energy necessary to produce them.

(ii) The transformations do not record any 'gap', i.e. loss, because only the transformation inputs are taken into account, whereas the actual transformation outputs are never considered; the latter are aligned with inputs by means of a suitable conversion coefficient.

(iii) In the case of hydroelectric energy and electrical energy of geothermal and nuclear origin, it is necessary to make a substitution hypothesis[1] by computing the quantity of primary fuel which would have had to be burned in conventional thermal power stations to produce the same quantity of electrical energy.

In reality these principles are only applied partially and this for practical reasons. As transformation losses are not particularly significant except in conventional thermal power stations, the notion of primary input equivalence is applied only to electrical energy whereas the other energy sources are evaluated on a basis which is approximately in line with their actual energy content.

As follows from what has been said about the other balance sheets, even a limited application of the notion of primary input equivalence to electrical energy presents certain drawbacks, the most important of which are discussed below.

(i) The hypothesis requiring the substitution of hydroelectric energy and electrical energy of geothermal and nuclear origin by electrical energy of conventional thermal origin affects the calculations as follows:

(aa) the quantities actually necessary for supply are overestimated;

(bb) the degree of energy dependence is underestimated due to the artificial inflation of gross consumption found in the denominator of the formula used in the calculations.[2]

The balance sheet includes notional losses which would have arisen in the conventional thermal power stations which in our hypothesis replace production of hydroelectric and geothermal origin. As these power stations do not exist in reality they do not need energy supplies.

(ii) This balance sheet is hardly suited to analysing actual consumption and consumption forecasts because its structure is biased due to changes over time in the conversions into the primary fuel input equivalent. Moreover, comparisons between two countries with different consumption structures become unreliable. When the breakdown of consumption by energy source differs from one country to another the proportion of losses contained in consumption differs also. These losses vary greatly from one energy source to another (0% for natural gas, approximately 10% for petroleum products, approximately 65% for electricity). Thus the primary fuel input equivalent balance sheet is not suitable for preparing valid forecasts, because it presents a distorted picture of consumption.

(iii) As the coefficient used for converting derived sources into their primary fuel input equivalent differs from one country to another — because the transformation efficiencies are often not the same — the primary equivalent of a certain physical quantity of energy changes crossing a frontier, with the result that it is impossible to ensure consistency of the data where exchanges between countries are involved. To take an extreme example, Belgium supplies 830 GWh of electricity to the Grand Duchy of Luxembourg. In specific units of GWh exports and imports are equal, i.e. the foreign trade figures are consistent. The overall balance sheet in terms of primary fuel input equivalent would indicate (1) exports from Belgium 187 000 tep, (2) imports entering the Grand Duchy of Luxembourg 270 000 tep. The reason for the divergence is that the two countries have different conversion coefficients because of varying transformation efficiencies in their thermal power stations. It is impossible to achieve consistency in foreign trade. However, both figures are correct and accurately express the primary fuel input equivalent at supply level in each country.

(iv) The difference between conversion coefficients may have serious consequences when the consumption of different countries is compared. For the same consumption of electrical energy in specific units there may be differences ranging from 3 to 50% in terms of primary fuel input equivalent, depending on the country.

This balance sheet, which seems less suitable for real energy accounting than the energy supplied balance sheet, does have some value as an analysis balance sheet in so far as supply is analysed under certain very specific conditions, namely those which focus on the 'possibilities' (in principle theoretical) of substitution of energy sources; this involves drawing on the substitution theory which estimates the notional volume of supplies (and, accordingly, of total consumption) which would be required if some particular form of energy, in particular energy of geothermal and hydroelectric origin, did not exist. Of course, for certain analytical purposes, a notional volume of supply is quite adequate. It is therefore advisable to examine more cautiously the argument

[1] This substitution hypothesis assumes the replacement of hydroelectric energy and energy of geothermal and nuclear origin by electrical energy produced in conventional thermal power stations.

[2] $\frac{\text{Net imports}}{\text{Gross consumption}}$ = degree of energy dependence.

often used in favour of this type of balance sheet, namely that it is more suitable for analysing supplies. Indeed the 'energy supplied' balance sheet (which in this context is held to play an exclusive or at least predominant role in the analysis of consumption and, in particular, of energy savings), is the one which is most in line with the basic requirements of a supply analysis which purports to be based on real data, namely the evaluation of real needs at supply level.

In other words the energy supplied balance sheet indicates the actual level of supply (and, accordingly, overall consumption) and not supply as it might be if one form of energy or another were absent.

(d) *Mixed balance sheets*

Apart from these three types of balance sheets, one encounters in practice a combination of criteria which are based both on the notion of energy supplied and that of primary fuel input equivalent. This combination may relate either to products, where the conversion factors used are based on a different approach or to figures, where the aim is to make accurate calculations of the primary fuel input equivalents (in the 'available' section) and of the actual energy content (in the 'used' section).

Of the two abovementioned versions it should be recognized that the one which combines the two approaches at the aggregate level seems to be by far the better one.[1] In effect, while it attempts to comply with the requirement of expressing supply in terms of primary fuel input equivalent and consumption on the basis of the energy content, no inconsistency is introduced into the framework of the balance sheet, whereas in applying to certain products the notion of energy supplied and that of primary fuel input equivalent to others, a discriminatory element is introduced which involves the addition of elements which do not belong to the same category.

2. Aggregation of the sources

(a) *Principle of aggregation*

An overall energy balance sheet is based on specific balance sheets, expressed in specific units (kWh for electrical energy, metric tonnes for coal and oil, m^3 for gases, etc.). The problem then is how to aggregate heterogeneous units. The use of a common unit to express products from disparate sources, a problem frequently encountered in statistics, always presents considerable difficulties; the homogeneity obtained in this manner is to a certain extent purely formal, because each energy source has its specific character and cannot as a rule be substituted for another either directly or completely.

The crucial problem is how to aggregate products of such a disparate nature as electrical energy and fossil fuels. This problem is such a delicate one that certain energy economists confine themselves to drawing up an energy balance sheet which is 'incorrectly' called 'overall' and in which electrical energy is simply lumped together with solid, liquid and gaseous fuels.

[1] See for example 'Energiebilanzen der Bundesrepublik Deutschland'.

It would seem indispensable to aggregate the various energy products. This can only be done with the aid of appropriate conversion factors selected to suit the purpose of the balance sheet in question. To aggregate quantitative data of the different energy sources a common unit is used for:

(a) the actual energy content of each source in the case of the energy supplied and useful energy balance sheets;

(b) the primary fuel input equivalent of each source in the case of the primary fuel input equivalent balance sheet.

The kWh, the conventional unit of expression of electrical energy, would thus be converted on the basis of:

(a) the actual energy content (3 600 kjoules/kWh), corresponding to 86 grammes oil equivalent in line with the energy supplied balance sheet;

(b) the mean specific consumption of conventional thermal power stations, namely 210 to 320 grammes oil equivalent, depending on the country, in line with the primary fuel input equivalent balance sheet (8 800 to 13 400 kjoules/kWh).

In aggregating the sources one encounters the problem of the conventional units used in presenting the balance sheets.[2]

Although it is well known that all types of energy: heat, electrical energy, mechanical work, etc. can be measured and expressed in terms of the same unit, a variety of units are used. Together the imperial system and the metric system have no fewer than 10 different units to express energy content, which leads to difficulties in understanding and communication. For this reason the Commission of the European Communities, on the basis of the SI (International System of Units), has published two Directives[3] stipulating that the only units of energy shall be the joule[4] or the kWh and that *inter alia* the calorie and its derived units shall be abolished.

Up to now the units most commonly used in individual countries and in the international bodies which draw up energy balance sheets have been the calorie (or its multiples, in particular the Tera-C calorie), the tonne of coal equivalent (tce) and the tonne of oil equivalent (toe).

As regards the tonne of coal equivalent and the tonne of oil equivalent, for which there is no unequivocal definition, a number of points must be explained in order to remove the large number of misunderstandings and, in-

[2] One important point to remember in connection with the common unit is that the notion of calorific value with respect to the gross quantity of a fuel may be 'gross'(GCV) or 'net' (NCV) depending on whether or not it includes the latent heat of vaporization resulting from the hydrogen content and, in particular, the humidity content of the fuel. As it is not possible at present to recover this calorific loss it is advisable to eliminate it from the start by basing calculations on the net calorific value, as is the general practice.

[3] OJ L 243, 29.10.1971; OJ L 262, 27.9.1976.

[4] The joule is defined as equal to the work produced by a force of 1 newton whose point of application is displaced by 1 metre in the direction of the force, i.e. 1 watt second. This unit is suitable for measuring all forms of energy (heat, movement, radiation, etc.).

deed, errors which the use of these units can give rise to. In effect, the concepts tce and toe may be understood in two ways:

(a) tonnes coal equivalent or oil equivalent which can be called standardized units, equivalent to a theoretical tonne of coal or oil on the basis of a well-defined net calorific value of 29.3 million kjoules (7 million kcal) or 41.8 million kjoules (10 million kcal) respectively;

(b) tonnes coal equivalent or oil equivalent which are not standardized units, but which express a primary fuel input equivalent at supply level in terms of tonnes of coal or oil. This unit of primary fuel input equivalent at supply level substitutes for each quantity of derived energy the quantity which has to be or would have to be used on input into transformation in order to obtain that derived energy. This amounts to an energy definition of the unit of expression which varies in time and space. Disregarding the empirical procedures currently in use, the application of this criterion can lead to differences in the energy content of the tce or toe, depending on the extent of the losses recorded in the various transformation processes.

(b) *Conversion and conversion factors*

Conversion refers to the operation by which, with the aid of appropriate factors, the specific units of expression of the different energy sources are replaced by a common unit making it possible to aggregate to a global level.

Conversion, in particular with regard to derived energy, is influenced by the approach underlying the methodology of the balance sheets. Indeed it is the main criterion for calculating the 'transformation gap' which dictates the choice of the most appropriate factors: one cannot stress often enough the interdependence of balance sheet approach and the conversion coefficients.

In the case of the energy supplied and useful energy balance sheets, which are based on the actual energy content of the different energy sources, there is no difficulty in preparing a series of conversion coefficients. In general, specialists are able to measure the calorific value of all forms of energy.

In the case of the primary fuel input equivalent balance sheet the problem is more complex, as will be seen below. It mainly relates to the conversion of derived products.

(i) Coal and derived products

The conversion of different grades of coal into 'standard coal' expressed in tce (defined on the basis of 29.3 GJ or 7 Gcal/t) or in joules has given rise to much discussion. The different grades of coal present a wide variety of (gross) calorific values, ranging from 6.3 GJ/t for coal with a high level of inert matter (slurries and waste) to 33 GJ/t for certain anthracites. There is not much point in adding coal grades which differ so greatly, as is the practice in the specific balance sheets expressed in metric tonnes, when the aim is to integrate the grades in an overall energy balance sheet, even if this is expressed in terms of tonne coal equivalent. Thus it is clearly necessary to translate the specific data into a common unit.

In this conversion method energy calculation is based on the usable calorific content of the coal, which depends, particularly, on the proportion of inert matter. The proportion of types and grades of coal varies with the items of the balance sheet and thus it is necessary to use a different conversion factor for each line.

As regards fuels derived from coal, the method of conversion depends on the type of balance sheet used, namely:

(a) in the case of the energy supplied balance sheet, conversion must be based on actual energy content;

(b) in the case of the primary fuel input equivalent balance sheet, the conversion coefficient should be determined on the basis of the quantity necessary to produce a tonne of derived products (primary fuel input equivalent).

(ii) Lignite and derived products

The same approach is used in the case of lignite. Different sorts of lignite have different water contents. Conversion into a common calorific unit is facilitated by the fact that almost all lignite is used in thermal power stations and so the energy content can be determined quite accurately.

The conversion of derived products of lignite is carried out in accordance with the same criteria as those used for derived products of coal.

(iii) Crude oil and derived products

The conversion of crude oil is considerably less complex as the dispersion around a mean calorific value is not as great as in the case of coal. One simple but not very accurate approach is based on a single conversion coefficient of 41.86 GJ/t (10 Gcal/t) with a maximum margin of error of 2 to 3 %. A second approach, which is based on net refinery production and which takes losses and own consumption into account, provides an accurate picture of the energy content of crude oil treated in refineries and, accordingly, of the energy content of the crude oil available.

In the case of petroleum products conversion is carried out as follows:

(a) In the 'energy supplied balance sheet' it is based on the actual energy content of each type of petroleum product.

As the calorific value of each refined product is well known and as the characteristics of each of these products are very similar in all the Community Member States, with the exception of refinery gases, conversion coefficients can be determined without difficulty.

(b) In the primary fuel input equivalent balance sheet it is based on the quantities of crude oil required to produce them (= primary fuel input equivalent).

However, snags would arise if it were felt necessary to break down the petroleum products, as a weighted breakdown of losses and of own consumption by product would be almost impossible in practice. In reality the principle of primary fuel input equivalent can only be realized for the whole of petroleum products with all the associated drawbacks which that implies at the level of consumption, because of the predominant use of certain products in certain consumption sectors (e.g. motor fuel in the transport sector).

(iv) **Gas**

The calorific values per m^3 vary considerably with the type of gas; but they are well known. Furthermore, most gas statistics have already been converted into calories and, recently, into joules in line with the concept of gross calorific value. Given that, as a rule, energy balance sheets are drawn up on the basis of the net calorific value, this value is estimated, in the case of gas (with the exception of blast-furnace gas which does not contain humidity) by applying a reduction factor of 10 %.

As coke-oven and blast-furnace gases are considered as by-products they can, to simplify matters, be aligned with the transformation inputs; thus, independently of the type of balance sheet used, conversion is carried out on the basis of the actual energy content.

Conversion based on the primary fuel input equivalent approach is confined to works gas only, with all the difficulties such an operation entails for a product which is frequently the final stage of a consecutive series of transformations.

(v) **Electrical energy**

The conversion of electrical energy is one of the most controversial subjects because of the very significant transformation losses which arise during the production of electrical energy of thermal origin. As was mentioned in the paragraph relating to the primary fuel input equivalent balance sheet, the primary fuel input equivalent conversion method cannot in practice be applied to electrical energy because of the extent of these transformation losses.

The choice of conversion factors is decided mainly by the methodology of the energy balance sheet.

(a) In the context of an energy supplied balance sheet, the conversion of electrical energy is based on its actual energy content, namely 3 600 kjoules or 860 kcal/Kwh.

(b) In the case of the primary fuel input equivalent balance sheet, conversion is carried out on the basis of energy utilized on input into transformation. The conversion factor is drawn up on the basis of the mean quantity of fuel necessary to produce 1 kWh gross in a conventional thermal power station; it is equal to the mean specific consumption of all conventional thermal power stations. Accordingly this factor will vary with the country and year in question (as a rule 8 800 to 13 400 kjoules/kWh).

(vi) **Nuclear heat**

Nuclear energy in its primary energy form is generally computed only under the form of nuclear heat, because at present it is difficult to draw up balance sheets for nuclear fuels.[1]

The way this heat is assessed will depend on the type of balance sheet:

(a) in the case of the energy supplied balance sheet the figures will relate to the quantities of heat actually produced during fission in the reactor in the course of the reference year;

(b) in the case of the primary fuel input equivalent balance sheet, which is oriented towards traditional fuels, the substitution theory would require the primary fuel input equivalent of electrical energy of nuclear origin to be evaluated on the basis of the mean specific consumption of all conventional thermal power stations.[2]

[1] The difficulties involved in drawing up balance sheets for nuclear fuels are due to a lack of statistical information on the movements of these fuels and also to the impossibility, at present, of assigning to them a valid energy content.

[2] This assessment could also be made on the basis of:
(i) the entire number of power stations at present in operation;
(ii) the new thermal power stations which would need to be constructed in the absence of nuclear power stations;
(iii) the power stations which would cease operations permanently as soon as the nuclear power station was started up.
However, at the distribution stage no account is taken of the different sources of electrical energy, so the use of a different coefficient for nuclear energy introduces an inconsistency into the balance sheet. To remove this inconsistency it would be necessary to apply this coefficient to all forms of electricity.

Part II

Energy supplied balance sheets — explanatory notes

1. *Computation scheme*

The computation scheme containing data on energy flows indicates the inputs and outputs, i.e. the available quantities and uses of each energy source. The result is a double-entry table. The columns show the energy sources; the lines indicate the aggregates or items of the balance sheet which describe the different operations relating to energy.

The balance sheet indicates all operations carried out within a specific territory, irrespective of the nationality of the operators. Thus road transport consumption includes motor fuel acquired on the territory of the country in question to drive motor vehicles, whether national or foreign. This 'territoriality' principle thus differs from the notions used in national accounting.

2. *Energy sources (columns)*

As a general rule it can be said that the criterion for breakdown by energy source is based on the nature of the product, irrespective of its origin or use.

Some of these energy sources are primary (as found in their natural state) whereas others are derived (the result of a transformation). These two categories are shown separately in the balance sheet (aggregates). Certain products may be both primary and derived, e.g. natural gasoline (motor spirit) and liquefied petroleum gases (LPG) obtained during the production, purification and stabilization of natural gas, in the same way as motor spirit and LPG are obtained during the refining of crude oil. The columns show available and utilized energy sources which form part of the economic process, whether or not they are the object of commercial transactions. Thus, for example, the balance sheet takes into account own consumption by producers.

At present the energy sources not included in the balance sheet are: wood and wood paste,[1] peat[1] (with the exception of Ireland) and the 'new energies': solar energy, wind energy, biomass, and heat derived from thermal pumps.

These sources are excluded either because statistical data are not available or because of the negligible quantities of certain energies.

[1] However, to ensure consistency between inputs into power stations and outputs from conventional thermal power stations, the item 'other fuels' may include quantities of wood and peat.

The distinction between energy and non-energy is made with regard to uses and not with regard to products. Indeed, in practice there is no such thing as exclusively energy products or exclusively non-energy products, but rather uses which may be energy-oriented or not, e.g. natural gas may be used as a fuel or as a basic material in chemical synthesis and petroleum coke may be used either in charging coking ovens or as a component in electrodes.

The products included in the final energy matrix are as follows:

Coal and derived products

Hard coal: Coal with a net calorific value equal to or greater than 23 865 kjoules (or 5 700 kcal/kg), wet sample, free of ash. This also includes middlings, slurries and combustible shale. The 'black lignite' produced in Spain is also included with hard coal from 1.1.1987.

Patent fuel: Normally produced by hot milling under pressure with the addition of binding material (pitch).

Coke: Hard coke, gas-works coke, coal semi-coke, milled coke and lignite coke, produced by distillation of coal or lignite.

Lignite: Coal with a net calorific value not exceeding 23 865 kjoules (or 5 700 kcal/kg), wet sample, free of ash, such as black lignite, brown coal and hard lignite.

Peat: Fuel of vegetable origin suitable for combustion after drying.

Brown-coal briquettes: Produced by briquetting under high pressure. This includes dried brown-coal and brown-coal breeze.

Peat briquettes: Produced by milling under high pressure.

Tar, pitch and benzol: By-products obtained during the distillation of hard coal in coking plants.

Oil and derived products

Crude oil: Mineral petroleum oils or crude oils from bituminous minerals (including semi-refined petroleum and condensates when these are treated by distillation).

Refinery gas: Incondensible gas composed mainly of hydrogen, ethane, methane and olefine.[2]

[2] In the case of the United Kingdom refined ethane obtained by separation during the production of natural gas is entered here as a production of primary sources.

Liquefied petroleum gas: Propane and butane or a mixture of the two.

Motor spirit: Regular and four-star motor spirit, aviation spirit and natural gasoline and additives.

Paraffin oil and jet fuel: Paraffin oil (for heating and haulage), jet fuel in the form of spirits and oil.

Naphtas: Light, medium and heavy naphtas.

Gas/diesel oil: Gas oil and diesel oil for road transport and shipping, gas oil for heating, diesel oil with a viscosity of less than 115 seconds Redwood I at 37.7°C.

Residual diesel oil: Diesel oil with a viscosity greater than 115 seconds Redwood I at 37.7°C.

White spirit and industrial spirit: Narrow cut light oils.

Lubricants: Lubricating oils and greases (including spindle, white oils, insulating oils and cutting oils).

Bitumen: Petroleum bitumen (including bituminous mixtures and bitumen emulsions).

Petroleum coke: Solid petroleum residues.

Other petroleum products: Waxes, vaselines, paraffins, sulphur and other distillation residues.

Gas

Natural gas: Essentially methane but contains small proportions of other gases. It covers both non-associated natural gas and associated natural gas, methane recovered in coalmines and sewage gas.

Ethane, propane and butane and the other condensates are excluded in so far as they have been purified.

Coke-oven gas: Gas recovered as a by-product of coke ovens.

Blast-furnaces gas: Gas recovered as a by-product of blast furnaces.

Works gas: All types of gas obtained by distillation, cracking, reforming and hydrogenation. This gas differs from coking and blast-furnace gas in that it is not a by-product but a product manufactured intentionally in specialized plants.

Works gas is always a derived product, obtained from coal, refinery gas, oil, LPG, naphtas, gas oils, residual fuel oils or natural gas.

Other fuels

Household refuse, wood waste, gas and heat recovered by industry, used in conventional thermal power stations.

Heat

The heat may be primary, in the case of geothermal sources, or derived, in the case of recovered hot water or steam tapped in a thermal electrical station. Geothermal heat here covers the quantities used to heat buildings along with the geothermal heat in Italy used for the production of electrical energy. In the latter case the electricity thus produced is included in the balance sheets in electricity in the same way as energy of hydroelectric origin.

Nuclear energy is included in the form of heat released during the fission of uranium in reactors. This heat is considered as primary and figures as such under primary production. The heat computed in this way corresponds to the available energy obtained via fission during the year under consideration.

Electrical energy

Hydroelectric energy from natural sources, geothermal, conventional thermal and nuclear electrical energy (excluding pumped storage hydroelectric energy).

*
* *

3. *Aggregates (lines)*

The balance sheet indicates all the operations which the different energy sources have undergone.

The balance sheet is made up of three principal parts:

(I.) The available section: extraction from primary sources, plus the balance from foreign trade and variations of stocks. It indicates the actual supply and the overall consumption of the geographic entity under consideration.

(II.) The transformations section, which shows transformation inputs and outputs whenever the products are subjected to physical or chemical modification. This is the link between the 'available' and the 'uses' section.

(III.) The uses section, which shows final non-energy and energy consumption, the own consumption of the 'energy' sector and distribution losses.

In principle, the data are included in the table on the basis of functional or technical criteria and not institutional ones: it is the actual operation carried out on the energy sources which matters and not the nature of the operator. Thus, for example, all coking plants and electrical power stations must be treated as energy transformers (as this is their technical function), even if these installations belong to a coalmine, a steel plant or any other private or public undertaking whose main activity is not energy transformation.

In particular, the application of this principle to the two most important by-products, namely:

(i) petroleum products obtained in the petrochemical industry;

(ii) blast-furnace gas;

involves the following computations (see also lines 8.5 and 8.7):

(a) deduction of these respective quantities from overall consumption ('institutional') of the petrochemical sector and the iron and steel sector;

(b) imputation of these products and their inputs (conventionally assumed to be equal to their outputs) to the branches mainly involved in producing them, namely:

(i) refineries;

(ii) 'blast-furnace gas' branch. The introduction of this branch into the balance sheet is unavoidable because blast-furnace gas is not produced in any other branch as a main product.

Line 1 Primary products:

Extraction of energy from a natural source: coal, lignite, crude oil, natural gas, geothermic.

Hydroelectric energy is also considered as primary production. Nuclear energy, in the form of heat produced during fission, is treated as primary production.

The other fuels, which are taken into account only when they correspond to a transformation input into conventional thermal power stations, are conventionally included in primary production (an alternative would be to show them as recovered products, given that in most cases they correspond to real recoveries).

Primary production of coal is defined as net pithead production, i.e. after removal of the waste from the gross output (coal brought to the surface) by means of screening and washing. As a general rule, it includes the production of low-grade products (dust, middlings, slurries), but not recovered products.

The production of crude oil includes the production of natural gasoline or other condensates obtained on production, purification and stabilization of natural gas only when these materials undergo transformation in the refineries.

The production of petroleum products covers liquefied petroleum gases (LPG), natural gasoline and other products obtained on production, purification and stabilization of natural gas which can be consumed without further refining.

The production of natural gas refers to purified natural gas, i.e. after removal of inert matter. The data always exclude blow-offs, flaring, production tests and amounts reinjected into the strata.

The producers' own consumption is included in the production data.

Line 2 Recovered products: recovered slurries, combustible waste-heap shale, recycled lubricants and certain products recovered in industry.

Line 3 Imports: Imports represent all entries into the national territory excluding transit quantities (notably via gas and oil pipelines); electrical energy is an exception and its transit is always recorded under foreign trade.

Data on imports are generally taken from importers' declarations; accordingly, they may differ from the data collected by the customs authorities and included in the foreign-trade statistics.

In the case of crude oil and petroleum products, imports represent the quantities delivered to the national territory and, in particular, those quantities:

(i) destined for treatment on behalf of foreign countries;

(ii) only imported on a temporary basis;

(iii) imported and deposited in uncleared bonded warehouses;

(iv) imported and placed in special warehouses on behalf of foreign countries;

(v) imported from regions and/or territories overseas under national sovereignty.

Community imports (EUR 12 and EUR 10) also include intra-Community trade.

Line 4 Variation of stocks: This refers to the difference between the existing quantities of energy stocked by the producers, importers, distributors of natural gas, transformers and large industrial consumers at the beginning and the end of the period under consideration. The sign + indicates reductions in stock and thus an increase in available energy, whereas the sign - indicates an increase in stocks and thus a decrease in energy available for consumption.

For natural gas, variations of stocks also represent the quantities of gas introduced into and removed from the transportation systems.

Line 5 Exports: In general the same rules apply as in the case of imports.

In the case of crude oil and petroleum products exports also represent all the quantities:

(i) re-exported after treatment or transformation;

(ii) supplied to national or foreign troops stationed abroad (in so far as secrecy permits this).

Line 6 Maritime bunkers: Supply of sea-going ships of all flags. Maritime bunkers can be considered either as exports, as is done in this matrix, or classified as consumption. The argument for the first solution is that refuelling activities are not normally related to the level of economic activity of the country itself.

Aviation bunkers are included in the final energy consumption of 'transportation' (line 15.2).

Line 7 *Gross inland consumption:* This is the key aggregate in the balance sheet. It represents for the reference period the quantity of energy necessary to satisfy inland consumption of the geographical entity under consideration.

The energy available for inland consumption is calculated from the top of the balance sheet down (primary production + imports + variations of stocks - exports - bunkers); it corresponds to the addition of consumption, distribution losses, transformation losses and statistical differences.

The negative figure shown for the aggregate in the case of certain products and countries is basically the result of exporting or placing into stock.

Line 8 *Transformation input:* The quantities in question represent all the inputs into a transformation plant destined to be converted into derived products. The concept of transformation applies only when the energy products are physically or chemically modified; accordingly, mixtures are not taken into account here but are entered in line 10.

Line 8.1 *Conventional thermal power stations:* quantities of fuel transformed in conventional public utility power stations for the production of electrical energy and commercialized steam, and thermal power stations of own producers (power stations in mines, refineries, the iron and steel sector, the chemical sector, other industrial branches and railways) exclusively for the production of electrical energy.

Line 8.2 *Nuclear power stations:* quantities of heat released due to the fission of nuclear fuel in the reactor core.

Line 8.3 *Patent fuel and briquetting plants:* quantities of hard coal, mainly anthracite and anthracitic/low volatile coal, pitch, lignite and peat for the production of patent fuel and briquettes.

Line 8.4 *Coke-oven plants:* quantities of coal, lignite and recycled breeze for transformation into coke and coke-oven gas.

Line 8.5 *Blast-furnace plants:* during the reduction of iron ore a certain quantity of gas is released as a by-product and is recovered. This recovery is thus considered as a transformation of coke into gas. The coke equivalent of gas produced in this manner is subtracted from the quantities of coke consumed in the iron and steel sector. Thus, it is assumed that there are no transformation losses and the quantities of gas used for blow-offs or flaring, which are in fact transformation losses, are included, for practical reasons, as consumption of the iron and steel sector.

Line 8.6 *Gas works:* quantities transformed (coal, naphtas, gas/diesel oil, liquefied petroleum gas and natural gas) in the production of works gas by distillation, cracking, reforming or hydrogenation, and gas coke.

Quantities of natural gas, coke-oven gas, blast-furnace gas for mixtures and coke-oven gas destined for distribution in the original state are not included here but are entered in line 10 'Exchanges and transfers'.

Line 8.7 *Refineries:* quantities of crude oil and intermediary products treated in the refineries (in principle by atmospheric distillation), including treatment on behalf of foreign countries. Also included here are the quantities of oil products re-treated in the refineries (recycling).

Line 9 *Transformation output:* The outputs are the result of the transformation process. They correspond to the production of derived products, namely: patent fuel, coke, brown-coal and peat briquettes, pitch, tar, benzol, refined petroleum products, derived gases, thermal electrical energy (conventional and nuclear) derived heat. Derived production always includes own consumption of transformation plants.

The difference between transformation input and transformation output constitutes transformation losses. To calculate these losses inputs and outputs must be entered on the lines which refer to a given transformer.

The data entered on these lines and on the line 'Transformation input' are taken from transformation balance sheets which are drawn up for each transformer with a view to ensuring consistency.

The total of 'transformation output' inevitably contains double and even triple counts whenever there are successive transformations (e.g. coke plus blast-furnace gas plus electrical energy produced from this gas). However, this does not influence the equilibrium of the overall balance sheet as the corresponding transformation input is computed in the same way.

Line 9.1 *Conventional thermal power stations:* gross production of electrical energy in conventional public utility power stations and own-producers' power stations.

Line 9.2 *Nuclear power stations:* gross production of electrical energy in conventional public utility power stations and own-producers' power stations.

Line 9.3 *Patent fuel and briquetting plants:* production of patent fuel, and brown-coal and peat briquettes.

Line 9.4 *Coke-oven plants:* derived production from the distillation of coal, namely: coke, coke-oven gas, pitch, benzol and tar.

Line 9.5 *Blast-furnace plants:* by-product gas resulting from the transformation of coke into gas in blast-furnace plants during the reduction of iron ores.

Line 9.6 *Gas works:* works gas and gas coke produced in plants whose main aim is the production and distribution of derived gas. This excludes mixtures and gas in the original state obtained from other gas producers.[1]

Line 9.7 *Refineries:* Gross production of refined petroleum products (including own-consumption of refineries).

Line 10 *Exchanges and transfers:* Mixtures of energy products, e.g. mixtures of petroleum products, LPG for enrichment added to natural gas, without transformation, and transfers for distribution without further processing.

Line 11 *Consumption of the energy sector:* The consumption of the energy sector covers the consumption of own-produced energy and of energy purchased by energy producers and transformers in operating their installations.

Line 11.1 *Electrical production and distribution:* Consumption of the auxiliary services of the power stations.

Line 11.2 *Production of hydroelectricity:* (Differences from pumping) To keep to the strict definition of transformation, pumping is not considered as a transformation activity by the electricity producer (as the nature of the product in the system of accounts is not changed). Pumping losses, the difference between the electrical energy absorbed in pumping and the electrical energy produced by pumping, are thus considered as own consumption by the producer, in the same way as the consumption of the auxiliary services of the power stations.

Line 11.3 *Coke-oven plants, gas works:* Consumption for the functioning of the coke-oven plants and gas works.

Line 11.4 *Extraction of oil and natural gas:* Consumption by the producers of crude oil and natural gas.

Line 11.5 *Oil and gas pipelines:* Quantities consumed in the compression and pumping stations of oil and gas pipelines.

Line 11.6 *Oil refining:* True consumption of the refineries, excluding losses of refining, as well as electrical energy consumption for the functioning of the installations.

Line 11.7 *Industry of nuclear fuels:* Quantities of electrical energy consumed for the enrichment and preparation of nuclear fuels.

This item also includes quantities consumed in compression stations and pumping stations for operating gas pipelines and oil pipelines.

Line 12 *Distribution losses:* Losses due to transport or distribution of electrical energy, natural gas and derived gases.

Line 13 *Final energy available for consumption:* Energy placed at the disposal of the final user. This is calculated by subtracting transformation losses (line 8 — line 9), distribution losses (line 12) and consumption of the energy sector (line 11) from the item 'energy available for gross inland consumption' (line 7).

Line 14 *Final non-energy consumption:* Consumption indicating:
in the line 'Chemical industry' — inputs for chemical synthesis (in particular petrochemicals);
in the line 'Other sectors' — non-energy uses in the other consumption sectors, mainly lubrication and road surfacing.

Line 15 *Final energy consumption:* The last energy flow computed in the balance sheet, namely energy supplied to the consumer's door for all energy uses.

Line 15.1 *Industry:* All industrial sectors with the exception of the energy sector.[1]

It should be recalled that the quantities transformed in the electrical power stations of industrial own-producers and the quantities of coke transformed into blast-furnace gas are not entered under overall industrial consumption but under the different transformation items in question. It should also be noted that this heading only includes quantities consumed for energy purposes.

It should be pointed out that there are certain defects in coverage and comparability both at the level of resources and at national level. In many cases the area covered is not the same: data on industries are gathered either on the basis of an annual energy consumption threshold or on the basis of a minimum number of employees which will frequently vary in time and space. Moreover, for certain sources — electrical energy and gas — the branches are often defined on the basis of tariff statistics.

Line *Iron and steel industry* (Nace[2] 221 + 222 + 223): in certain countries consumption for the extraction and treatment of iron ore is included under this heading.

[1] In the case of the United Kingdom gas-works production includes synthetic gas (SNG) when this gas is distributed via the natural gas network.

[1] Construction and civil engineering are, in principle, included under 'Industry'; however, most of the petroleum products consumed by this branch are included under 'transportation'.

[2] General classification of industrial activities in the European Communities.

Line *Non-ferrous metals* (NACE 224)

Line *Chemical industry* (NACE 25 + 26): this relates only to energy consumption, as non-energy consumption is included under heading 14.

Line *Non-metallic minerals* (NACE 24)

Line *Extractions* (fuels excluded) (NACE 21 + 23): Consumption for fuel extraction is taken under the 'Energy' section, on the lines extraction and preparation of solid fuels and extraction of oil and natural gas.

Line *Food, drink and tobacco* (NACE 41 + 42)

Line *Textiles, leather, clothing* (NACE 43 + 44 + 45)

Line *Paper and printing* (NACE 47)

Line *Metal manufacturing* (NACE 31 + 32 + 33 + 34 + 35 + 36)

Line *Other branches* (NACE 37 + 46 + 48 + 49 + 50)

Line 15.2 Transportation: all types of transportation, including transportation by households, public administration, etc. (see line 15.3) with the exception of maritime shipping which is included under the heading 'maritime bunkers'.

Line *Rail transportation:* consumption by railways and electrified urban transport systems (these data do not include inputs into electrical power stations managed by the railways).

Line *Road transportation:* quantities supplied to motor vehicles for the propulsion of such vehicles, whether utility cars or vehicles for own use or the use of others, including omnibuses which belong to railway companies.

Consumption by public works vehicles licensed to use the public road network are also included under road transport, in so far as they are subject to the normal taxation system, whereas motor fuel consumed by agricultural vehicles is included under agricultural consumption.

Line *Air transportation:* supplies for the requirements of national and international air traffic.

Line *Inland navigation:* consumption for inland navigation and yachting.

Line 15.3 Households, etc.: consumption by private households, small-scale industry, crafts, commerce, administrative bodies, services with the *exception of transportation,* agriculture and fisheries. Due to the lack of adequate statistical data this item is of very mixed quality.

Generally the data presented on this line constitutes a balance calculated on the basis of the quantities supplied to the market, from which consumption by industry and transportation has been deducted.

Line *Households:* Consumption by households, excluding the consumption of motor fuels for personal transport. It is drawn from very diverse authentic data from *ad hoc* surveys: Market studies, estimates from household expenditure, pricing systems, etc. Household consumption covers in total heating, water heating and all electrical usage.

Line *Agriculture:* consumption of petroleum products by agriculture, including engines used for agricultural transportation. These data are of fiscal origin because of the existence of certain forms of tax relief on products used for agricultural activities.

Line *Fisheries:* consumption by the fishing industry, excluding fishing on the high seas which is included under bunkers.

Line *Others:* Consumption by small industry, crafts, shops, public administration and services.

Line 16 Statistical difference: The difference between line 13 'Final energy available for consumption' on the one hand and lines 14 'Final non-energy consumption' and 15 'Final energy consumption' on the other.

The statistical difference may sometimes include variations of stocks which are not recorded in the statistics and are thus not included in line 4 and also military consumption when it is not included under final energy consumption.[1]

[1] In most cases however military consumption is distributed throughout the consumption branches according to use: diesel oil for the navy in maritime bunkers, fuel for the airforce under air transportation, fuels for land vehicles under road transportation, diesel oil for heating of buildings under the heading 'Households', etc.

ES Clasificación de las publicaciones de Eurostat

TEMA

1 Estadísticas generales (azul oscuro)
2 Economía y finanzas (violeta)
3 Población y condiciones sociales (amarillo)
4 Energía e industria (azul claro)
5 Agricultura, silvicultura y pesca (verde)
6 Comercio exterior (rojo)
7 Servicios y transportes (naranja)
9 Diversos (marrón)

SERIE

A Anuarios
B Coyuntura
C Cuentas, encuestas y estadísticas
D Estudios y análisis
E Métodos
F Estadísticas rápidas

GR Ταξινόμηση των δημοσιεύσεων του Eurostat

ΘΕΜΑ

1 Γενικές στατιστικές (βαθύ μπλε)
2 Οικονομία και δημοσιονομικά (βιολετί)
3 Πληθυσμός και κοινωνικές συνθήκες (κίτρινο)
4 Ενέργεια και βιομηχανία (μπλε)
5 Γεωργία, δάση και αλιεία (πράσινο)
6 Εξωτερικό εμπόριο (κόκκινο)
7 Υπηρεσίες και μεταφορές (πορτοκαλί)
9 Διάφορα (καφέ)

ΣΕΙΡΑ

A Επετηρίδες
B Συγκυρία
C Λογαριασμοί, έρευνες και στατιστικές
D Μελέτες και αναλύσεις
E Μέθοδοι
F Ταχείες στατιστικές

IT Classificazione delle pubblicazioni dell'Eurostat

TEMA

1 Statistiche generali (blu)
2 Economia e finanze (viola)
3 Popolazione e condizioni sociali (giallo)
4 Energia e industria (azzurro)
5 Agricoltura, foreste e pesca (verde)
6 Commercio estero (rosso)
7 Servizi e trasporti (arancione)
9 Diversi (marrone)

SERIE

A Annuari
B Tendenze congiunturali
C Conti, indagini e statistiche
D Studi e analisi
E Metodi
F Note rapide

DA Klassifikation af Eurostats publikationer

EMNE

1 Almene statistikker (mørkeblå)
2 Økonomi og finanser (violet)
3 Befolkning og sociale forhold (gul)
4 Energi og industri (blå)
5 Landbrug, skovbrug og fiskeri (grøn)
6 Udenrigshandel (rød)
7 Tjenesteydelser og transport (orange)
9 Diverse statistikker (brun)

SERIE

A Årbøger
B Konjunkturoversigter
C Regnskaber, tællinger og statistikker
D Undersøgelser og analyser
E Metoder
F Ekspresoversigter

EN Classification of Eurostat publications

THEME

1 General statistics (midnight blue)
2 Economy and finance (violet)
3 Population and social conditions (yellow)
4 Energy and industry (blue)
5 Agriculture, forestry and fisheries (green)
6 Foreign trade (red)
7 Services and transport (orange)
9 Miscellaneous (brown)

SERIES

A Yearbooks
B Short-term trends
C Accounts, surveys and statistics
D Studies and analyses
E Methods
F Rapid reports

NL Classificatio van de publikaties van Eurostat

ONDERWERP

1 Algemene statistiek (donkerblauw)
2 Economie en financiën (paars)
3 Bevolking en sociale voorwaarden (geel)
4 Energie en industrie (blauw)
5 Landbouw, bosbouw en visserij (groen)
6 Buitenlandse handel (rood)
7 Diensten en vervoer (oranje)
9 Diverse statistieken (bruin)

SERIE

A Jaarboeken
B Conjunctuur
C Rekeningen, enquêtes en statistieken
D Studies en analyses
E Methoden
F Spoedberichten

DE Gliederung der Veröffentlichungen des Eurostat

THEMENKREIS

1 Allgemeine Statistik (Dunkelblau)
2 Wirtschaft und Finanzen (Violett)
3 Bevölkerung und soziale Bedingungen (Gelb)
4 Energie und Industrie (Blau)
5 Land- und Forstwirtschaft, Fischerei (Grün)
6 Außenhandel (Rot)
7 Dienstleistungen und Verkehr (Orange)
9 Verschiedenes (Braun)

REIHE

A Jahrbücher
B Konjunktur
C Konten, Erhebungen und Statistiken
D Studien und Analysen
E Methoden
F Schnellberichte

FR Classification des publications de l'Eurostat

THÈME

1 Statistiques générales (bleu nuit)
2 Économie et finances (violet)
3 Population et conditions sociales (jaune)
4 Énergie et industrie (bleu)
5 Agriculture, sylviculture et pêche (vert)
6 Commerce extérieur (rouge)
7 Services et transports (orange)
9 Divers (brun)

SÉRIE

A Annuaires
B Conjoncture
C Comptes, enquêtes et statistiques
D Études et analyses
E Méthodes
F Statistiques rapides

PT Classificação das publicações do Eurostat

TEMA

1 Estatísticas gerais (azul escuro)
2 Economia e finanças (violeta)
3 População e condições sociais (amarelo)
4 Energia e indústria (azul)
5 Agricultura, silvicultura e pesca (verde)
6 Comércio externo (vermelho)
7 Serviços e transportes (laranja)
9 Diversos (castanho)

SÉRIE

A Anuários
B Conjuntura
C Contas, inquéritos e estatísticas
D Estudos e análises
E Métodos
F Estatísticas rápidas

Número de títulos por tema y serie □ Antal publikationer pr. emne og serie □ Anzahl der Veröffentlichungen pro Themenkreis und Reihe □ Αριθμός δημοσιεύσεων κατά θέμα και σειρά □ Number of publications per theme and series □ Nombre de publications par thème et série □ Numero di pubblicazioni per tema e serie □ Aantal publikaties naar onderwerp en serie □ Número de títulos por tema e série

	1	2	3	4	5	6	7	9
A	6	1	–	3	1	1	1	–
B	1	5	2	5	3	2	1	–
C	1	6	7	6	6	2	3	1
D	–	2	–	4	1	4	–	–
E	–	4	2	2	2	2	–	–
F	1	–	1	2	1	1	–	–

European Communities — Commission

Principles and methods of the energy balance sheets

Luxembourg: Office for Official Publications of the European Communities

1988 — 16 pp. — 21 x 29.7 cm

Theme 4: Energy and industry (blue covers)
Series E: Methods

ES, DE, EN, FR, IT

ISBN 92-825-7962-X

Catalogue number: CA-49-87-785-EN-C

Price (excluding VAT) in Luxembourg:
ECU 6.90

This publication describes the principles and methods by which the SOEC draws up the overall energy balance sheets. It will enable users of the energy balance sheets to judge the validity of certain choices and to get a better understanding of the content of the balance sheets. It consists of two parts: the first part explains the different types of overall energy balance sheets whereas the second part provides a description of the SOEC's matrix of the 'energy supplied' balance sheet, defining each aggregate and each product.

Venta y suscripciones · Salg og abonnement · Verkauf und Abonnement · Πωλήσεις και συνδρομές
Sales and subscriptions · Vente et abonnements · Vendita e abbonamenti
Verkoop en abonnementen · Venda e assinaturas

BELGIQUE / BELGIE

Moniteur belge / Belgisch Staatsblad
Rue de Louvain 40-42 / Leuvensestraat 40-42
1000 Bruxelles / 1000 Brussel
Tél 512 00 26
CCP / Postrekening 000-2005502-27

Sous-dépôts / Agentschappen

Librairie européenne / Europese Boekhandel
Rue de la Loi 244 / Wetstraat 244
1040 Bruxelles / 1040 Brussel

CREDOC
Rue de la Montagne 34 / Bergstraat 34
Bte 11 / Bus 11
1000 Bruxelles / 1000 Brussel

DANMARK

Schultz EF-publikationer
Møntergade 19
1116 København K
Tlf: (01) 14 11 95
Telecopier (01) 32 75 11

BR DEUTSCHLAND

Bundesanzeiger Verlag
Breite Straße
Postfach 10 80 06
5000 Koln 1
Tel. (02 21) 20 29-0
Fernschreiber ANZEIGER BONN 8 882 595
Telecopierer 20 29 278

GREECE

G.C. Eleftheroudakis SA
International Bookstore
4 Nikis Street
105 63 Athens
Tel 322 22 55
Telex 219410 ELEF

Sub-agent for Northern Greece

Molho's Bookstore
The Business Bookshop
10 Tsimiski Street
Thessaloniki
Tel 275 271
Telex 412885 LIMO

ESPAÑA

Boletín Oficial del Estado
Trafalgar 27
28010 Madrid
Tel (91) 446 60 00

Mundi-Prensa Libros, S.A.
Castelló 37
28001 Madrid
Tel. (91) 431 33 99 (Libros)
431 32 22 (Suscripciones)
435 36 37 (Dirección)
Télex 49370-MPLI-E

FRANCE

Journal officiel
Service des publications des Communautés européennes
26, rue Desaix
75727 Paris Cedex 15
Tél (1) 45 78 61 39

IRELAND

Government Publications Sales Office
Sun Alliance House
Molesworth Street
Dublin 2
Tel 71 03 09

or by post

Government Stationery Office
EEC Section
6th floor
Bishop Street
Dublin 8
Tel 78 16 66

ITALIA

Licosa Spa
Via Lamarmora, 45
Casella postale 552
50 121 Firenze
Tel 57 97 51
Telex 570466 LICOSA I
CCP 343 509

Subagenti

Libreria scientifica Lucio de Biasio -AEIOU
Via Meravigli, 16
20 123 Milano
Tel 80 76 79

Herder Editrice e Libreria
Piazza Montecitorio, 117-120
00 186 Roma
Tel 67 94 628/67 95 304

Libreria giuridica
Via 12 Ottobre, 172/R
16 121 Genova
Tel 59 56 93

GRAND-DUCHÉ DE LUXEMBOURG
et autres pays / and other countries

Office des publications officielles des Communautés européennes
2, rue Mercier
L-2985 Luxembourg
Tél 49 92 81
Télex PUBOF LU 1324 b
CCP 19190-81
CC bancaire BIL 8-109/6003/200
Sogenal 61-490226-96-26

Abonnements / Subscriptions

Messageries Paul Kraus
11, rue Christophe Plantin
L-2339 Luxembourg
Tél 49 98 881
Télex 2515
CCP 49242-63

NEDERLAND

Staatsdrukkerij- en uitgeverijbedrijf
Christoffel Plantijnstraat
Postbus 20014
2500 EA 's-Gravenhage
Tel (070) 78 98 80 (bestellingen)

PORTUGAL

Imprensa Nacional
Casa da Moeda, E. P.
Rua D Francisco Manuel de Melo, 5
1092 Lisboa Codex
Tel 69 34 14
Telex 15328 INCM

Distribuidora Livros Bertrand Lda.
Grupo Bertrand, SARL
Rua das Terras dos Vales, 4-A
Apart 37
2700 Amadora CODEX
Tel 493 90 50 - 494 87 88
Telex 15798 BERDIS

UNITED KINGDOM

HMSO Books (PC 16)
HMSO Publications Centre
51 Nine Elms Lane
London SW8 5DR
Tel (01) 211 77 02

Sub-agent

Alan Armstrong & Associates Ltd
Arkwright Road
Reading, Berks RG2 OSQ
Tel (0734) 75 17 69
Telex 849937 AAALTD G

TURKIYE

Dünya süper veb ofset A.Ş.
Narlıbahçe Sokak No 15
Cağaloğlu
Istanbul
Tel 512 01 90
Telex 23822 dsvo-tr

UNITED STATES OF AMERICA

European Community Information Service
2100 M Street, NW
Suite 707
Washington, DC 20037
Tel (202) 862 9500

CANADA

Renouf Publishing Co., Ltd
61 Sparks Street
Ottawa
Ontario K1P 5R1
Tel Toll Free 1 (800) 267 4164
Ottawa Region (613) 238 8985-6
Telex 053-4936

JAPAN

Kinokuniya Company Ltd
17-7 Shinjuku 3-Chome
Shiniuku-ku
Tokyo 160-91
Tel (03) 354 0131

Journal Department
PO Box 55 Chitose
Tokyo 156
Tel (03) 439 0124

Price (excluding VAT) in Luxembourg

ECU 6.90

OFICINA DE PUBLICACIONES OFICIALES DE LAS COMUNIDADES EUROPEAS
KONTORET FOR DE EUROPÆISKE FÆLLESSKABERS OFFICIELLE PUBLIKATIONER
AMT FÜR AMTLICHE VERÖFFENTLICHUNGEN DER EUROPÄISCHEN GEMEINSCHAFTEN
ΥΠΗΡΕΣΙΑ ΕΠΙΣΗΜΩΝ ΕΚΔΟΣΕΩΝ ΤΩΝ ΕΥΡΩΠΑΪΚΩΝ ΚΟΙΝΟΤΗΤΩΝ
OFFICE FOR OFFICIAL PUBLICATIONS OF THE EUROPEAN COMMUNITIES
OFFICE DES PUBLICATIONS OFFICIELLES DES COMMUNAUTÉS EUROPÉENNES
UFFICIO DELLE PUBBLICAZIONI UFFICIALI DELLE COMUNITÀ EUROPEE
BUREAU VOOR OFFICIËLE PUBLIKATIES DER EUROPESE GEMEENSCHAPPEN
SERVIÇO DAS PUBLICAÇÕES OFICIAIS DAS COMUNIDADES EUROPEIAS

L-2985 Luxembourg

ISBN 92-825-7962-X

9 789282 579626