ENERGY BALANCE-SHEETS BASED ON THE INPUT-OUTPUT TABLES (1975)

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I - INTRODUCTION

This study is based on the 'energy input-output tables'. Briefly, it comprises a set of tables similar to those used in 'input-output' accounts but showing energy flows in terms of quantities. This involves combining the input-output matrices expressed in value terms with the quantitative energy balance-sheets compiled by the SOEC. The problem is a matter of entering the appropriate quantities of energy in the corresponding boxes of the input-output matrices in such a way as to ensure that the quantities/values ratios are correct. This compilation required firstly a number of changes to the input-output accounts to make them suitable for physical energy flows and, secondly, adaptation of the energy balance-sheets, especially as regards the layout. This very complex set of tables took several years' work, involving the solution of unprecedented problems. The main benefit derived from this work is that the quantitative energy balance-sheets are now linked to all the national accounts aggregates.

This exercise has several aims, namely:

- to construct an econometric model which is well suited to energy and can be used for simulation and forecasting purposes;
- to calculate the direct and indirect energy required for any economic activity (manufacture of a product or supply of a service);
- to provide a uniform, accurate and comprehensive picture of the relationships between economic variables requiring energy (structure of energy interrelationships);
- to improve information on energy flows and to supplement the energy balance-sheets, which are considered to be inadequate.

The latter is the particular concern of the present publication.

This will therefore be confined to setting out the quantitative energy balance-sheets, revised, improved and corrected in the light of the experience acquired with the input-output tables.

The improvements relate mainly to three aspects:

- to determine and show separately the consumption of households;
- to give a better breakdown of intermediate uses of energy in the various branches of industry and services;
- to give a breakdown by the main uses of energy, i.e. space heating, non-energy uses, transport, manufacturing, etc.

These aims have been achieved for some of the Community countries and the results are given below, notably for:

- the Federal Republic of Germany;
- France;
- Italy;
- the Netherlands;
- Denmark.

II - PRINCIPLES AND GENERAL CHARACTERISTICS

The preparation of the tables was governed by a number of fundamental principles, namely:

- harmonization of definitions, methods, calculations and presentation of results for the purposes of international comparison;
- conformity with the basic concepts used in the harmonized Community input-output tables, which means in particular defining the 'branches', and therefore the flows, on the basis of products and not of enterprises;
- alignment of the quantitative energy data on the main aggregates used in the energy balance-sheets compiled by the SOEC (production, imports, exports, bunkers, transformation, etc.);
- transitivity of results, obtained by using a specific, uniform unit of measurement facilitating aggregation and addition of energy flows.

The general characteristics of these tables may be outlined briefly as follows.

In view of the tremendous volume of work involved and the fact that the main aim is to describe a structure which changes slowly over the years, the energy input-output tables will be drawn up at five-yearly intervals concurrently with the detailed surveys, censuses and national accounts, i.e. 1975, 1980, 1985, etc. For years other than these it will obviously be possible to make all kinds of interpolations and extrapolations, with adjustment for a differing number of variables.

The results given in this study relate to the base year 1975 (updating to 1980 is in progress). It is the first time that data are being given on structural energy flows, based on the input-output tables. The structural analysis of these results is still relevant, despite the apparent remoteness of the base year.

The quantitative data are in line with the harmonized 'energy supplied' balance-sheets compiled by the SOEC since 1975 for all the Community countries. This type of balance-sheet records the actual energy content of each flow, without conversion into primary equivalence, this being the only method compatible with the input-output matrices. It was considered neither advisable nor feasible to go as far down the line as useful energy, i.e. to take account of the efficiency of consumers' appliances. The common unit of energy measurement chosen is the terajoule (NCV), which measures the net calorific value (NCV) of each energy source.

One terajoule is equal to one thousand million kilojoules, which in turn is equal to one kilowatt per second. At the end of this chapter, a table sets out the factors used for conversion between the terajoule and the specific units for the various energy sources (tonnes, kWh, etc.).

Some characteristics show differences from the input-output tables used in national accounts.

For the purposes of energy statistics certain changes have been made to the classification of branches used in the traditional national accounts input-output tables (NACE R-44) by splitting up certain branches in order to distinguish the large energy consumers (e.g. cement, glass, transport) and grouping others together in return. This has given a breakdown into 45 intermediate branches (+ households):

- 10 branches for energy;

- 25 branches for non-energy-generating products;
- 10 branches for services.

A classification at the end of this chapter gives the definitions of all the branches with reference to the NACE (General Industrial Classification of Economic Activities within the European Communities).

The ten energy branches were defined in some detail (these definitions are also given in an annex to this chapter).

In order to avoid having tables which are too bulky and difficult to handle, all refined petroleum products were grouped together in a single branch (although a secondary breakdown was made, which is available on request). In addition, coal was put together with coal briquettes and lignite with lignite briquettes, since in most cases small quantities were involved and also the briquetting process is not a true transformation of energy but a simple processing carried out without losses. These two aggregations mean that coal and lignite transformation inputs in briquetting works are no longer shown, so as to eliminate double counting[1] in both quantities and values.

Moreover, firewood and peat were not regarded as energy-generating products and are therefore still classified under the branches 'Agriculture' (code 010) and 'Other minerals and derived products' (code 157) respectively.

On the other hand, household refuse, sewage gas and industrial waste were counted as energy-generating products in so far as they were used as fuel in power-stations or district heating plants.

Depending on the circumstances, these recycled fuels are classified either under the branch 'Recovery and repair services' (code 550) or under the branch 'Non-market services' (code 860).

The definitions of energy-generating products in accordance with the energy balance-sheets differ somewhat from the R-44 classification used for the input-output tables; in particular, the concept of 'Gas distributed by pipes' is no longer used. In fact, this concept was not defined in terms of a product but was based on an activity, namely the resale of gas bought from another branch. This led to double counting. For example, natural gas was produced and imported by a branch and sold to the branch 'Gas distributed by pipes', which in turn resold it to the various users.

By totalling the matrix, natural gas was thus counted twice in two different branches. This was not a serious drawback for the value flows in the national accounts, since it did not affect value-added but merely led to a breakdown of intermediate flows. However, it became serious once quantitative flows were entered alongside value flows, since it was impossible to accept that the quantity of gas increased with each intermediate sales transaction. In fact, the quantity of energy remains constant whatever the number of subsequent sales between production and final use. By definition, energy is an immediately consumable product which can be used once only. The system of flows was therefore simplified and it was assumed that, except in obvious cases, where there is no transformation the energy-producing branch is also the distributing branch. A simplification of this kind has another advantage, namely that of reducing the number of inter-branch transfers. Unavoidable transfers are restricted to by-products and involve mainly coke-oven and blast-furnace gases. It should be noted that incidental production of blast-furnace gas is counted as a transformation in the branch 'Iron and steel products' (code 135), with transfer to manufactured gases.

In the same spirit of simplification and adaptation to the physical balance-sheets, all the circuits which served no purpose were eliminated. Thus, consumption for petrochemical synthesis was counted on the basis of net feedstock, replacing two flows of opposite

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[1] In the branch in question, both the coal supplied to the briquetting plant and the briquettes produced and delivered for consumption would have been counted.

directions (gross feedstock of petroleum products in the chemical industry, giving rise to a return of petroleum products to refineries).[1]

Another difference between energy balance-sheets and national accounts concerns the scope. The latter describe all the transactions carried out by national units (nationality principle), whereas the energy balance-sheets record all transactions taking place on the national territory (territoriality principle), regardless of the nationality of the agents concerned. This difference applies mainly in the case of ships' bunkers and aircraft fuel tanks.

In the national accounts and the traditional input-output tables, national units' bunkers and fuel tanks filled in another country are included in imports (resources) and domestic consumption (uses).

Similarly, refuelling of foreign ships and aircraft in the country is treated as exports. For the purposes of the energy balance-sheets and in the tables and results set out in the remainder of this document, the refuelling of national ships and aircraft in another country is ignored (extra-territorial transactions), whereas refuelling of foreign ships and aircraft in the country is included in consumption on the national territory along with refuelling of national units. Tables show these various refuelling operations for each country.

As a result of reciprocal adaptations, there are also differences in relation to the energy balance-sheets.

A branch 'Steam' was created to cover hot water and steam distributed and used as an energy source. This means introducing an additional energy transformer, namely the district heating plants. This branch's inputs are: the fuels burned to produce steam, and transfers of the recovered heat generated unavoidably in thermal power-stations. The creation of this branch results in a slight modification of the breakdown by sources of energy consumed, although it does not alter the overall equilibrium of the balance-sheet. However, it does introduce the concept of useful energy into a balance-sheet compiled on a free-to-consumer basis.

In principle, imports and exports should have been based on general trade, which records warehousing movements and gives a better description of operations carried out on the national territory (= scope of the energy balance-sheet). In practice, special trade was taken into account for some countries, since it corresponded more closely to payments and therefore to monetary flows. However, the quantitative difference between the two types of external trade proved to be minimal (1% or 2%) and therefore acceptable.

As it is treated in accordance with national accounts, road transport is broken down by the branch to which the vehicles belong. Thus, purchases of fuel for lorries belonging to cement works, for example, are included in the energy consumption of branch 151 'Cement, lime, plaster'. Accordingly, road transport is divided into three main groups:

- households (private vehicles);
- road (third-party account transport);
- other branches (own-account transport).

Since the 'transport function' is shown separately under 'Uses', it is always possible to obtain information on road transport activity and, therefore, to classify it into different groups as desired. This makes for great flexibility of use. The breakdown of road transport for each country is given in the tables.

The structure of the energy input-output tables differs from the usual layout of the energy balance-sheets, but all the different elements are included, so that it is easy to

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[1] The double flow led to an artificial increase (i.e. the volume returned) in resources of petroleum products, giving rise to double counting which could result in refinery production being greater than the volume of crude petroleum processed.

pass from one to the other. A diagram (page 15) shows the energy flows as presented in the input-output tables. There are four main parts:

A - the energy sub-matrix, which describes the flows within the 10 energy-producing branches;

B - the other intermediate uses (energy consumption in industry, agriculture and services);

A + B - this sum gives total intermediate uses;

C - final uses, i.e. households, stocks, exports;

A + B + C - this sum gives total uses;

D - resources (production + imports), which balance uses (D = A + B + C).

An intermediate addition (A + B + households) gives consumption on the national territory, which is a key item of information.

The energy sub-matrix (part A) contains the following data, shown separately under uses:

- transformation inputs;
- network losses;
- consumption of energy for the operation of plant;
- own-account road transport and space heating (where appropriate).

It must be borne in mind that addition of the primary and derived energy sources shown in the tables of 'Uses' leads to double counting. To avoid this, it is sufficient to deduct transformation inputs, which are shown separately under 'Uses'. This gives the concept of net energy consumption on the national territory (including bunkers and network losses).

Each flow of energy to the 45 consumer branches and households is broken down further by energy use:

- Space heating
- Transport
- Non-energy uses
- Transformation inputs
- Network losses
- International bunkers
- Other uses.

A number of points must be made clear:

- 'Space heating' is taken to mean the heating and air-conditioning of dwellings, offices, workshops, shops and other buildings. Heating of greenhouses is not included here but under 'Other uses'.
- 'Transport' is taken to mean the energy used for the propulsion of vehicles. Fuels for tractors and agricultural machinery are included under 'Other uses'.
- 'Non-energy uses' comprises consumption of energy-generating products for non-energy purposes, such as feedstock for chemical synthesis, lubricants, solvents, bitumens for road surfacing, etc.
- 'Other uses' are many and varied (manufacturing, lighting, etc.) but can be easily determined by cross-referencing branches and products. They are listed in the relevant tables.

A great wealth of information is obtained in this way. The triple combination 'energy sources x branches x uses', together with a further breakdown of petroleum products, gives a table of around 4 000 cells, which is not published but is available on request.

This publication is confined to a simplified presentation setting out the essential results:

- one table gives total uses by branch and energy source (parts A, B and C of the diagram);
- one table shows the resources which balance the uses (part D);
- a series of tables gives a breakdown of energy uses by product, with the branches being combined to form certain groups, as follows:
  (i) Energy = producers and transformers of energy (codes 031 to 075, 097 to 110);
  (ii) Agriculture = agriculture, forestry and fisheries (code 010);
  (iii) Industry = production of non-energy-generating products, including building and civil engineering works and repair and recovery services (codes 135 to 550);
  (iv) Transport = railways, third-party account road transport, inland waterways, shipping, commercial air transport, oil and gas pipelines (codes 611 to 633);
  (v) Other services = distributive trades, hotels, restaurants, market and non-market services (codes 095, 580, 720 and 860).

Finally, other supplementary tables give information on:

- road transport;
- ships' bunkers and aircraft fuel tanks.

These results are analysed for each country.

Comparison of balance-sheet layouts:

SOEC energy balance-sheet	Energy input-output tables
1. Primary production	a. Actual production
3. Imports	b. Transfers of by-products
4. Changes in stocks	c. Distributed production
5. Exports	d. Imports
6. Ships' bunkers	e. Resources
7. Available for gross domestic consumption	f. Intermediate uses (including: bunkers, transformation, network losses)
8. Transformation inputs	g. Consumption of households
9. Transformation outputs	h. Total uses on the national territory[2]
10. Exchanges and transfers	h'. Net uses on the national territory
11. Consumption of the energy sector	i. Changes in stocks (and statistical deviation)
12. Network losses	j. Exports
13. Available for final consumption	k. Total uses
14. Final consumption for non-energy purposes	
15. Final consumption for energy purposes[1]	
16. Statistical deviation	

The following equations apply:

a = 1 + 9

e = 1 + 9 + 3

h' = 6 + 11 + 12 + 14 + 15

k = 4 + 5 + 6 + 8 + 11 + 12 + 14 + 15 + 16

[1] Broken down into three sectors:
- heavy industry;
- transport;
- households, agriculture, craft trades, wholesale and retail distribution, etc.

[2] Broken down into 45 branches + households, with a further breakdown by energy uses.

CLASSIFICATION OF BRANCHES (= PRODUCTS)

Code	Heading	Definition in terms of NACE-CLIO groups
031	Coal and coal briquettes	111
033	Lignite (brown coal) and lignite briquettes	112
050	Coke	120
071	Crude oil	ex 130
073	Petroleum products	140
075	Natural gas	ex 130
097	Electric power	161
098	Manufactured gases[1]	162
099	Steam, hot water, compressed air	163
110	Nuclear fuels	151, 152
095	Water (collection, purification, distribution)	170
010	Agricultural, forestry and fishery products	011-030
135	Iron-ore and ECSC iron and steel products	211, 221
136	Non-ECSC iron and steel products	222, 223
137	Non-ferrous metal ores; non-ferrous metals except aluminium	212, ex 224
138	Aluminium	ex 224
151	Cement, lime, plaster	242
153	Glass	247
155	Earthenware and ceramic products	241, 248
157	Other minerals and derived products (non-metallic)	231-239, 243-246
170	Chemical products	252-260
190	Metal products	311-316
210	Agricultural and industrial machinery	321-328
240	Miscellaneous machines and electrical goods	330-347, 371-374
270	Motor vehicles and engines	351-353
290	Other transport equipment	361-365
360	Food products, beverages, tobacco products	411-429
410	Textiles and clothing	431-439, 453-456
430	Leathers, leather and skin goods, footwear	441-451
450	Timber and wooden furniture	461-467
471	Pulp, paper, board	471
473	Paper goods, products of printing	472-474
490	Rubber and plastic products	481-483
510	Other manufacturing products	491-495
530	Building and civil engineering works	505-509
550	Recovery and repair services[2]	620, 671, 672
580	Wholesale and retail trade, lodging and catering services	610-660
611	Railway transport services	710, 721, 725
613	Road transport services	722, 723
615	Services of transport by pipelines	724
617	Inland waterways services	730
631	Maritime and coastal transport services	741, 742
633	Air transport services	750
720	Other market services	761-984 (market)
860	Non-market services[2]	910-990 (non market)
Σ	Total intermediate uses	
015	Households	
Σ	Total consumption on the national territory	
-	Change in stocks	
-	Exports	
Σ	Grand total of uses	

[1] Does not correspond to the concept of 'gas distributed by pipes'.

[2] Possibly including refuse and waste used as fuels.

DEFINITIONS OF BRANCHES OF ENERGY-GENERATING PRODUCTS

These definitions are based on the energy sources used in Eurostat's harmonized energy balance-sheets and statistics.

Code

031 - Coal and patent fuel: hard coal, anthracites, slurries, low-grade coal, recovered products, coal briquettes, smokeless briquettes (including Rexite and Coalite in the United Kingdom).

033 - Lignite and brown coal briquettes: black lignite, brown coal, hard brown coal, brown coal breeze, dried brown coal, brown coal briquettes, brown coal char.

050 - Coke: hard coke, coke for electrodes, char or low-temperature coke, gasworks coke, coke breeze, brown coal coke.

071 - Crude oil: crude petroleum and bituminous mineral oils, semi-refined petroleum and condensates intended for distillation.

073 - Petroleum products: refinery gas, LPG (butane, propane), motor spirits, jet fuels, kerosene, naphthas, white spirit, industrial spirits, gas diesel oil, residual fuel oils, lubricants, bitumen, petroleum coke, other refined products.

075 - Natural gas: natural gas in the gaseous state, liquefied natural gas, mine gas.

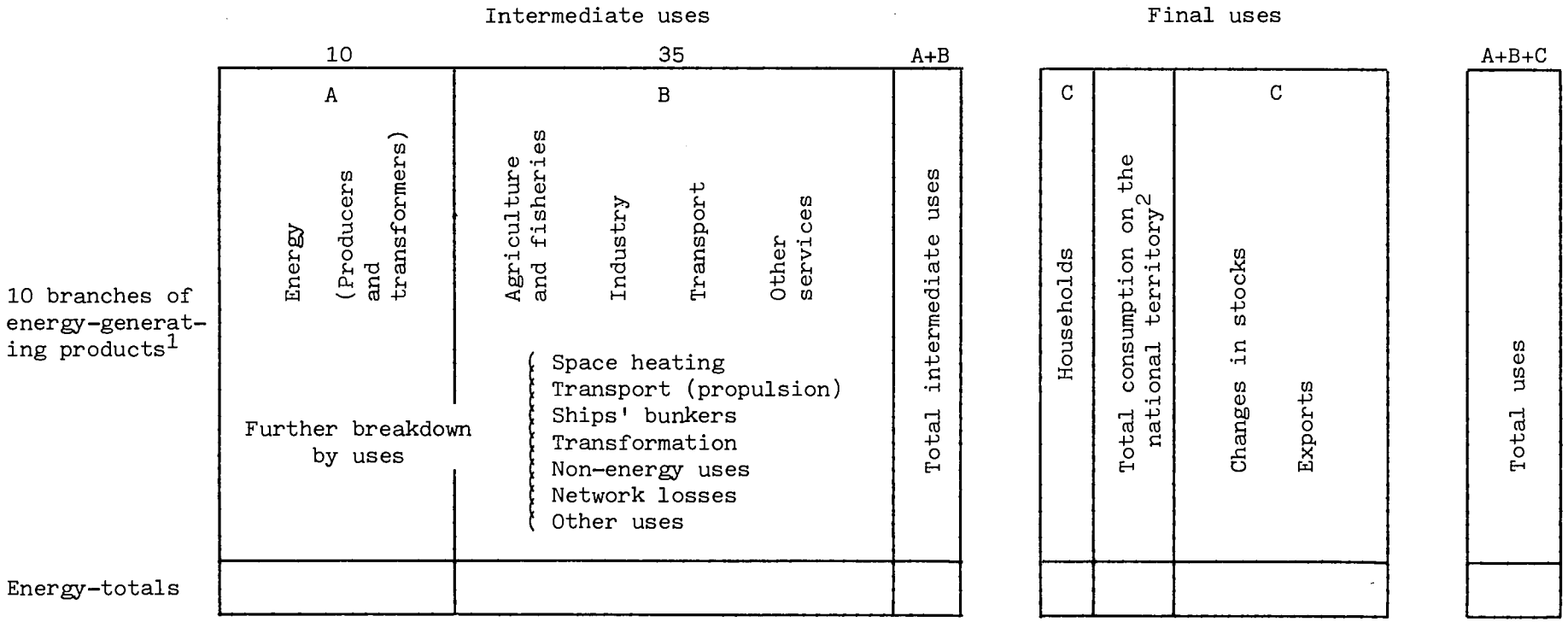
097 - Electric power: electrical energy.

098 - Manufactured gases: coke-oven gas, blast-furnace gas, gasworks gas (including propane-air and butane-air mixtures), synthetic gas.

099 - Steam, hot water, compressed air: steam and hot water supplied commercially by power-stations, steam and hot water supplied by district heating plants, geothermal heat. (In view of its insignificance, compressed air remains in this branch, as separating it could prove difficult).

110 - Nuclear fuels: energy computed on the basis of fission heat.

DIAGRAM OF THE ENERGY BALANCE-SHEET AND FLOWS



[1] Possibility of a supplementary branch for refuse and waste.

[2] Total energy consumption on the national territory comprises: A + B + households.

Table of conversion factors

Specific units - Terajoules NCV

Branch code	Products	TJ/1 000 t
031	Hard coal	29,3
031	Coal briquettes	31,4
033	Brown coal	6,5-8,1
033	Black lignite	14,5-21
033	Lignite briquettes	20
071	Crude oil	41-42
073	Refinery gas	50
073	LPG	46
073	Motor spirits, naphthas	44
073	Kerosene and jet fuels	43
073	Gas diesel oil	42,3
073	Lubricants	42,3
073	Residual fuel oils	40
073	Petroleum coke	31,4
073	Bitumen	37,7
073	Paraffins, waxes, other products	30
		NCV/GCV
075	Natural gas	0,916
098	Coke-oven gas	0,916
098	Gasworks gas	0,916
098	Blast-furnace gas	1
		TJ/GWh
097	Electricity	3,6

III - ANALYSIS BY COUNTRY

FR OF GERMANY

Introduction

As a result of the research and surveys carried out during the preparation of the energy input-output tables, a number of points of detail were clarified and amended in the energy balance-sheets. Attention must be drawn to the following points, in particular:

- The geographical coverage includes West Berlin.
- External trade was based on the concept of special trade so as to be more consistent with the value data and the national accounts. However, the difference compared with general trade remains minimal at around 1-3% for the various energy branches. The differences are due to warehousing movements and deliveries to the Allied armed forces stationed in the FR of Germany.
- The figures for the branch 'Steam' (099) were entered on the basis of the statistics available; in other words, the data are taken from the information supplied by the companies affiliated to the 'Arbeitsgemeinschaft Fernwärme' association. It is generally considered that the coverage is fairly extensive.
- These data cover in particular the activities of the STEAG company, presented in two flows: consumption of coal supplied by mines and supply of steam to the same mines for their own purposes.
- The sources of recovered energy, i.e. sewage gas and household refuse, are classified as production or transfers of non-market services (branch 860), since they are supplied by treatment plants and refuse disposal services operated by the local authorities.
- The branch 'Aluminium' (code 138) includes the following products: bauxite, alumina, aluminium of first smelting, semi-finished products made of aluminium and other light alloys, recovered aluminium.

Analysis

The grand total of uses, which tallies precisely with resources, amounts to 18 247 987 TJ; this figure represents the total primary and derived energy required at all levels during 1975 for the operation of the country's economy. It contains some double counting owing to energy transformations, which are sometimes carried out in series. To eliminate this, it is sufficient to deduct transformation inputs, i.e.: 18 247 987 - 8 550 248 = 9 697 739 TJ. This last figure represents total net energy demand. Exports and additions to stocks must also be deducted to give net consumption on the national territory, i.e. 8 261 202 TJ.

This figure represents a primary concept of the energy balance-sheets. It expresses all the energy consumed on the national territory, with no double counting, including the refuelling of foreign ships and aircraft (not included in exports) but excluding refuelling of German ships and aircraft in other countries.

The attached tables can be used for a whole range of analyses, the main points of which are summarized below.

- The scale of energy transformation, which processes a volume of transformation inputs amounting to 8 550 248 TJ - a higher figure than that for final energy consumption in the FR of Germany (including bunkers).

  Some energy sources are transformed several times prior to final consumption, owing to the fact that 85% of energy demand (excluding transformation) is for derived sources.

- All types of energy transformers exist in the FR of Germany (briquetting plants, coking plants, refineries, gasworks, thermal power-stations, district heating plants); this leads to fairly substantial transformation losses and own-account energy consumption. The difference between transformation inputs and outputs (losses) amounts to approximately 1 900 000 TJ, to which must be added 600 000 TJ of energy consumed to operate the transformation and production plants.

- Refined petroleum products constitute the main source of energy consumed, accounting for 60% of intermediate and final demand, excluding transformation. This requires extensive refining activities - not enough to meet demand, however - and consequently a high level of imports, resulting in an imbalance on external trade in energy, with imports amounting to 6 859 123 TJ[1] and exports to 975 976 TJ[2].

  Imports are seven times greater than exports. It should be noted, however, that the FR of Germany re-exports a considerable quantity of indirect energy incorporated in exported manufactured goods. The exact figure will be calculated later.

- A breakdown by group of consumer branches gives the following figures:

	TJ	%
Households	2 426 320	29,4
Energy[1]	683 441	8,3
Agriculture and fisheries	159 274	1,9
Industry[1]	3 502 589	42,4
Transport[2]	456 889	5,5
Other services	1 032 689	12,5
Total	8 261 202	100,0

[1] Excluding transformation inputs.

[2] Including bunkers of all flags within the country.

- The above breakdown shows the preponderance of industry, which accounts for a substantial a share of energy consumption as in Italy. However, in the FR of Germany all branches of industry are highly developed and the concentration on a few activities which consume vast quantities of energy is of nothing like the same proportions as in Italy and the Netherlands, for example.

- Other services (wholesale and retail distribution, private non-profit institutions and government, market and non-market services) also show substantial growth, accounting for 12,5% of total energy consumption (leading to heavy demand for heating and lighting purposes).

[1] Including 3 855 000 TJ of crude petroleum and 1 586 000 TJ of petroleum products.

[2] Not including foreign ships and aircraft refuelling in the FR of Germany.

- In view of what was said previously about energy transformation, it is not surprising to note the relatively high proportion (8,3%) of energy consumed by the energy-generating products branches to operate their installations.

- On the other hand, only a small proportion (5,5%) of energy consumption in Germany is accounted for by commercial transport. There are a number of reasons for this:

  (i) the importance of inland waterway services, which require only a small amount of energy per tkm;
  (ii) Rhine vessels refuel in Rotterdam;
  (iii) low growth of third-party account road transport[1];
  (iv) little refuelling of ships in German ports, because German ships refuel mainly in foreign countries[1] and the bulk of sea traffic serving the FR of Germany passes via Rotterdam.

  To sum up, the low level of consumption for transport in the FR of Germany is offset by the prolific consumption of this sector in the Netherlands.

- Even if own-account road transport and the consumption of vehicles belonging to households are added to commercial transport (to give the total for the 'transport' function), energy consumption is still one of the lowest in the Community (less than 18%), despite the high number of private cars.

- Another underdeveloped branch is 'Agriculture, forestry and fisheries', which accounts for 1,9% of energy consumption, despite the high degree of mechanization and the heating of greenhouses. This reflects the structure of German agriculture (small holdings geared to livestock farming).

- A breakdown by use gives the following results:

	TJ	%
Space heating	2 632 314	32,0
Transport	1 368 209	16,5
Ships' bunkers[1]	116 323	1,4
Non-energy uses	500 588	6,0
Network losses	70 186	0,8
Other uses	3 573 584	43,3
Total	8 261 202	100,0

[1] All flags within the country.

- Of these uses, space heating accounts for a considerable proportion of energy consumption as a result of:

  (i) the climate;
  (ii) the importance of the services sector (offices);
  (iii) the size of dwellings (66% have four or more rooms);
  (iv) the high degree of comfort.

- The second most important use of energy, after space heating, is manufacturing (classified under other uses) in industry (furnaces, boilers, motive power), amounting to approximately 2 380 000 TJ or 29% of total consumption. This confirms the part played by industry in the country's economy.

[1] See in particular the tables 'Road transport' and 'Bunkers' (K and L).

- The range of energy sources used in industry[1] (all uses except transport) is very wide:

Coal and coal briquettes	2,1%
Lignite and lignite briquettes	0,7%
Coke	16,4%
Petroleum products	42,5%
Natural gas	15,8%
Electricity	15,0%
Manufactured gases	6,0%
Steam	1,5%

  Unlike some countries (Italy, the Netherlands), the FR of Germany has a great variety of energy sources, which are widely used.

- Analysis of households' consumption confirms a number of remarks made previously. The two main uses, heating (61%) and transport (28%) (the latter being due to the high number of private cars), completely overshadow the other uses, which together make up only 11% (lighting, hot water, washing machines, etc.). Although petroleum products are by far the most important source of space heating, a wide range of other sources are also used.

- Finally, the energy structure of the FR of Germany differs radically from that of the Netherlands, although they are complementary and interlinked.

  This link is not a two-way one, but shows a predominant direction: the Netherlands imports, refines and transports for the FR of Germany. In this respect, there is a high degree of dependence between the two countries.

[1] Branches 135 to 550.

Table 1 A

Resources

Terajoules

	Coal and patent fuels 031	Lignite and lignite briquettes 033	Coke 050	Crude oil 071	Petroleum products 073	Natural gas 075	Electricity 097	Manufactured gases 098	Steam 099	Nuclear energy 110	Refuse, waste 860	Total
Effective production	(1) 2 824 456	962 724	1 257 313	259 118	(4) 3 943 937	586 999	1 196 542	92 214	44 969	-	40 833	11 209 105
Transfers	- 8 593		+ 33 500 - 262 907	(2) - 18 169		+ 8 593 + 18 169	- 115 022	- 33 500 (6) + 179 759 + 262 907 (7) + 5 863	+ 115 022		(7) - 5 863	+ 179 759
Distributed production	2 815 863	962 724	1 027 906	240 949	3 943 937	613 761	1 081 520	507 243	159 991	-	34 970	11 388 864
Imports	183 088	42 926	36 594	(3) 3 855 036	(5) 1 586 026	866 444	63 468	-	-	225 541	-	6 859 123
Resources	2 998 951	1 005 650	1 064 500	4 095 985	5 529 963	1 480 205	1 144 988	507 243	159 991	225 541	34 970	18 247 987

(1) Extracted 2 790 107; recovered 25 756; mine gas 8 593.
(2) Associated natural gas.
(3) Including semi-refined products (about 125 000 TJ).
(4) Of which primary production 360 and regenerated fuels 8 545.
(5) Moreover 175 409 TJ bunkers of German ships and aircraft abroad.
(6) Blast-furnace gas transferred from branch 135.
(7) Sewage gas transferred from branch 860.

Table 1 B

Uses matrix

Terajoules

(1)	031	033	050	071	073	075	097	098	099	110	095	010	135
031 Coal and patent fuels	11 421		1 306 556	5	672		796 490	47 993	14 500		4 467	256	10 586
033 Lignite and lignite briquettes		4 216					881 164						572
050 Coke	884		5 130				57	2 390	428		29	86	512 698
071 Crude oil					3 953 626								
073 Petroleum products	1 010	166	23 623	141	303 544	282	297 361	55 155	20 890	234	471	144 466	105 349
075 Natural gas	226	32			316	26 101	559 978	10 470	20 512		161	709	171 292
097 Electricity	22 108	10 249	3 877	251	15 861	1 226	118 463	86	299	175	4 392	13 690	72 154
098 Manufactured gases	100		102 292	768	293	1 441	140 198	2 375			33	67	116 477
099 Steam	12 456		8 206	15	30	72			7 005				2 843
110 Nuclear energy							225 541						
860 Refuse, wastes							34 970						
Total	48 205	14 663	1 449 684	1 180	4 274 342	29 122	3 054 222	118 469	63 634	409	9 553	159 274	992 971

Terajoules

	360	410	430	450	471	473	490	510	530	550	580	611	613
031 Coal and patent fuels	8 542	3 017	233	568	4 034	655	1 608	87	1 287	1 162	5 337	9 394	
033 Lignite and lignite briquettes	929	1 105	62	45	2 146	195	529			80		900	
050 Coke	4 107	1 710	315	884	114	942	542	114	3 278	713	6 242	1 625	
071 Crude oil													
073 Petroleum products	181 548	67 531	9 175	46 721	46 861	28 006	32 249	2 729	227 067	23 377	287 244	54 785	112 188
075 Natural gas	22 001	13 884	160	1 353	1 031	2 061	1 707	129	6 798	1 579	34 985	3 318	1 063
097 Electricity	27 673	16 103	706	10 407	21 931	7 836	15 174	468	16 614	5 814	33 513	26 910	2 372
098 Manufactured gases	1 400	100		366	2 300	699	900	67	1 167	299	5 865	433	133
099 Steam	13 335	3 399	88	1 758	938	616	1 759	59	6 682	2 374	13 395		
110 Nuclear energy													
860 Refuse, wastes													
Total	259 535	106 849	10 739	62 102	79 355	41 010	54 468	3 653	262 893	35 398	386 581	97 365	115 756

(1) See definition of the branches in Chapter II (page 13).

Table 1 B

Uses matrix

Terajoules

136	137	138	151	153	155	157	170	190	210	240	270	290	
192	1 891	1 324	3 303	559	1 113	1 724	25 079	1 974	1 265	1 417	1 841	263	031 Coal and patent fuels
	235		501	69	375	188	13 085	171	1 209	8	484	20	033 Lignite and lignite briquettes
	5 359	3 818	14 846	171	428	171		11 828	5 159	3 477	570	29	**050 Coke**
							2 980						071 Crude oil
21 384	10 573	6 925	124 287	37 383	36 130	19 450	403 509	70 202	58 862	76 740	38 070	7 244	073 Petroleum products
6 162	8 638	10 961	50 190	22 582	26 255	3 350	165 162	20 681	4 381	2 996	6 379	870	075 Natural gas
2 002	5 922	49 021	20 372	6 919	4 925	7 826	137 179	27 090	18 572	22 414	22 885	2 296	097 Electricity
4 935	1 629	2 071	67	2 901	1 600	2 333	38 732	18 202	2 034	1 333	3 633	500	098 Manufactured gases
88	6	53	1 143	176	235	703	12 515	1 553	1 143	1 289	469	117	099 Steam
													110 Nuclear energy
													860 Refuse, wastes
34 763	34 253	74 173	214 709	70 760	71 061	35 745	798 241	151 701	92 625	109 674	74 331	11 339	**Total**

Terajoules

615	617	631	633	720	860	Σ	015	Σ	Stocks	Export	Total		
	14	82		1 631	37 553	2 310 095	89 641	2 399 736	153 986	445 229	2 998 951		031 Coal and patent fuels
					459	909 747	84 294	994 041	1 975	9 634	1 005 650		033 Lignite and lignite briquettes
				3 623	12 087	603 854	50 616	654 470	183 198	226 832	1 064 500		**050 Coke**
						3 956 606		3 956 606	138 791	588	4 095 985		071 Crude oil
42	36 627	118 776	86 705	182 352	224 020	3 631 454	1 671 916	5 303 370	- 28 182	254 774	5 529 963		073 Petroleum products
	97	193	193	17 331	33 761	1 260 048	206 078	1 466 126	10 793	3 286	1 480 205		075 Natural gas
11	96	541	324	34 323	45 424	856 494	253 246	1 109 740		35 248	1 144 988		097 Electricity
	11	22	33	2 467	13 631	473 907	33 303	507 210		33	507 243		098 Manufactured gases
				15 493	12 400	122 413	37 226	159 639		352	159 991		099 Steam
						225 541		225 541			225 541		110 Nuclear energy
						34 970		34 970			34 970		860 Refuse, wastes
53	36 845	119 614	87 255	257 220	379 335	14 385 129	2 426 320	16 811 450	460 561	975 976	18 247 987		**Total**

Table 1 C

Internal consumption by branch

%

	Energy		Agri-culture	Industry		Trans-port (1)	Other ser-vices	House-holds	Total
	Total	of which: trans-formation		Total	of which: trans-formation				
Coal and patent fuels	90,7	90,2	0	3,1	-	0,4	2,0	3,7	100
Lignite and lignite briquettes	89,1	88,6	-	2,3	-	0,1	0	8,5	100
Coke	1,4	0,8	0	87,3	27,5	0,2	3,4	7,7	100
Crude oil	99,9	99,9	-	0,1	-	-	-	-	100
Petroleum products	13,2	7,1	2,7	31,7	-	7,7	13,1	31,5	100
Natural gas	42,1	40,1	0	37,6	-	0,3	5,9	14,1	100
Electricity	15,6	-	1,2	47,1	-	2,7	10,6	22,8	100
Manufactured gases	48,8	27,6	0	40,2	-	0,1	4,3	6,6	100
Steam	17,4	-	-	33,4	-	-	25,9	23,3	100
Nuclear energy	100,0	100,0	-	-	-	-	-	-	100
Refuse and waste	100,0	100,0	-	-	-	-	-	-	100
Total energy	53,9	49,8	0,9	21,9	1,1	2,7	6,1	14,4	100

(1) Professional transport, including bunkers.

Table 1 D

Internal consumption by use

%

	Trans-formation	Space heat-ing	Non ener-gy uses	Sea bunk-ers	Other trans-port (1)	Fish-ing	Net-work losses	Other uses	Total
Coal and patent fuels	90,2	5,4	-	-	0,3	-	-	4,1	100
Lignite and lignite briquettes	88,6	8,0	-	-	-	-	-	3,3	100
Coke	28,3	12,5	0	-	-	-	-	59,2	100
Crude oil	99,9	-	0,1	-	-	-	-	-	100
Petroleum products	7,1	35,0	8,7	2,2	25,2	0,2	-	21,6	100
Natural gas	40,1	18,8	2,5	-	-	-	0,7	37,9	100
Electricity	-	6,0	-	-	2,4	-	4,8	86,8 (2)	100
Manufactured gases	27,6	10,0	-	-	-	-	-	62,4	100
Steam	-	56,1	-	-	-	-	4,4	39,5	100
Nuclear energy	100,0	-	-	-	-	-	-	-	100
Refuse and waste	100,0	-	-	-	-	-	-	-	100
Total energy	50,9	15,7	3,0	0,7	8,1	0	0,4	21,2	100

(1) Traction and propulsion.
(2) Of which: lighting 12,6% and electrolysis 5,8%.

Table 1 E

Consumption by use in the 'Energy' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Network losses	Others	Total
Coal and patent fuels	629	-	-	2 165 183	-	11 825	2 177 637
Lignite and lignite briquettes	-	-	-	881 164	-	4 216	885 380
Coke	-	-	-	5 387	-	3 502	8 889
Crude oil	-	-	-	3 953 626	-	-	3 953 626
Petroleum products	21 562	5 297	1 971	375 986	-	297 591	702 406
Natural gas	2 538	-	7	588 434	10 000	16 656	617 635
Electricity	-	-	-	-	53 180	119 415	172 595
Manufactured gases	4	-	-	140 198	-	107 265	247 467
Steam	-	-	-	-	7 005	20 779	27 784
Nuclear energy	-	-	-	225 541	-	-	225 541
Refuse and waste	-	-	-	34 970	-	-	34 970
Total	24 733	5 297	1 978	8 370 489	70 186	581 249	9 053 930
%	0,3	0	0	92,5	0,8	6,4	100
% (1)	3,6	0,8	0,3	-	10,3	85,0	100

* Codes 031/075 and 097/110.
(1) Excluding transformations.

Table 1 F

Consumption by use in the 'Agriculture' branch* (1)

Terajoules

	Space heating	Transport	Non-energy uses	Fishing	Others	Total
Coal and patent fuels	223	-	-	-	33	256
Lignite and lignite briquettes						-
Coke	77	-	-	-	9	86
Crude oil						-
Petroleum products	-	-	5 297	9 179	129 990 (2)	144 466
Natural gas	632	-	-	-	77	709
Electricity	1 437	-	-	-	12 253	13 690
Manufactured gases	47	-	-	-	20	67
Steam						-
Nuclear energy						-
Total	2 416	-	5 297	9 179	142 382	159 274
%	2	-	3	6	89	100

* Code 010.
(1) Dwellings are classed with households.
(2) Of which: 69 253 for tractors and agricultural machinery and 59 538 for heating greenhouses.

Table 1 G

Consumption by use in the 'Industry' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Others	Total
Coal and patent fuels	8 016	-	-	-	65 708	73 724
Lignite and lignite briquettes	5 340	-	-	-	17 668	23 008
Coke	16 926	-	314	179 759 (2)	374 275	571 273
Crude oil	-	-	2 980	-	-	2 980
Petroleum products	381 554	202 149	414 107	-	683 561	1 681 372
Natural gas	27 335	-	36 432	-	486 835	550 602
Electricity	81	-	-	-	522 222	522 303
Manufactured gases	11 912	-	-	-	191 834	203 745
Steam	11 108	-	-	-	42 233	53 341
Nuclear energy						-
Total	462 272	202 149	453 833	179 759	2 384 336	3 682 348
%	12,5	5,5	12,0	5,0	65,0	100
% (1)	13,2	5,8	13,0	-	68,0	100

* Codes 135/550.
(1) Excluding transformations.
(2) Transformation into blast-furnace gas.

Table 1 H

Consumption by use in the 'Transport' branches*

Terajoules

	Space heating	Transport (traction)	Non-energy uses	Sea bunkers (1)	Others	Total
Coal and patent fuels	2 914	6 576	-	-	-	9 490
Lignite and lignite briquettes	900	-	-	-	-	900
Coke	1 414	-	-	-	211	1 625
Crude oil						-
Petroleum products	35 081	243 050 (2)	11 097	116 323 (3)	3 572	409 124
Natural gas	3 317	-	-	-	1 547	4 864
Electricity	-	26 910	-	-	3 344	30 254
Manufactured gases	434	-	-	-	198	632
Steam						-
Nuclear energy						-
Total	44 060	276 536	11 097	116 323	8 872	456 889
%	10	60,5	2	25,5	2	100

* Codes 611/633.
(1) All flags within the country.
(2) Of which: 96 777 TJ for third party account.
(3) Including lubricants.

Table 1 I

Consumption by use in the 'Other Services' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	39 077	-	-	9 911	48 988
Lignite and lignite briquettes	360	-	-	99	459
Coke	19 051	-	-	2 930	21 981
Crude oil					-
Petroleum products	443 580	209 615 (1)	18 548	22 344	694 087
Natural gas	58 686	-	-	27 552	86 238
Electricity	11 893	-	-	105 759	117 652
Manufactured gases	14 973	-	-	7 023	21 996
Steam	41 288	-	-	-	41 288
Nuclear energy					-
Total	628 908	209 615	18 548	175 618	1 032 689
%	61	20	2	17	100

* Codes 095, 580, 720, 860.
(1) Including military consumption.

Table 1 J

Consumption by use in the 'Households' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	78 010	-	-	11 631	89 641
Lignite and lignite briquettes	73 369	-	-	10 925	84 294
Coke	44 041	-	-	6 575	50 616
Crude oil					-
Petroleum products	977 058	674 612	9 835	10 411	1 671 916
Natural gas	183 677	-	-	22 401	206 078
Electricity	53 182	-	-	200 064	253 246
Manufactured gases	23 362	-	-	9 941	33 303
Steam	37 226	-	-	-	37 226
Nuclear energy					-
Total	1 469 925	674 612	9 835	271 948	2 426 320
%	61	28	0	11	100

* Code 015.

Table 1 K

Bunkers

Terajoules

	Total in the country A + B	German flags within the country A	Foreign flags within the country B	German flags abroad C	Total German flags A + C
Sea					
Petrol	264	264	-	-	264
Gas diesel oil	23 588	9 671	13 917	31 005	40 676
Heavy fuel oil	88 960	23 560	65 400	117 400	140 960
Lubricants	3 511	2 792	719	42	2 834
Total	116 323	36 287	80 036	148 447	184 734 (1)
Air					
Petrol	836 (3)	748	88	-	748
Aviation fuel	84 409 (4)	46 182	38 227	26 961	73 143
Lubricants	191	191	-	1	192
Total	85 436	47 121	38 315	26 962	74 083 (2)
TOTAL	201 759	83 408	118 351	175 139	258 817

(1) 184 734 + 2 453 (heating) = 187 187 TJ.
(2) 74 083 + 1 100 (heating) + 169 (road) = 75 352 TJ.
(3) Not including military consumption (1 500 TJ).
(4) Not including military consumption (12 000 TJ).

Table 1 L

Road transport

Terajoules

	Petrol	Diesel oil	LPG	Total	%
Households	641 872	32 740	-	674 612	57,2
Third-party account	8 140	88 196	441	96 777	8,2
Own-account	197 428	209 136	576	407 140	34,5
of which: energy	2 671	2 627	-	5 297	(0,4)
industry	93 513	108 413	222	202 149	(17,2)
commerce and services	100 584	97 927	354	198 865	(16,9)
other transport (1)	660	169	-	829	(0,0)
Total	847 440	330 072	1 017	1 178 529	100,0
%	72	28	0	100	

(1) Lorries and buses belonging to the airlines and shipping companies, etc.

FRANCE

Introduction

On the whole, both the concepts used in the input-output tables and the constraints of the energy balance-sheets were observed.

It should be noted that the data collected for the branch 'Steam' (code 099) are not exhaustive, owing to the lack of a precise definition of collective heating systems. In actual fact, the results collected relate to the district heating companies which replied to a survey by the 'Agence pour les économies d'énergie'. As production in this branch was calculated in net terms, no network losses are shown.

In the French tables, lubricants for vehicles were classified exceptionally under 'transport' uses instead of under 'non-energy' uses.

The figures for the branches 'Non-ECSC iron and steel products' (code 136) and 'Aluminium' (code 138) are the result of very difficult estimates. In particular, branch 138 includes aluminium, magnesium, light alloys, semi-finished products made of aluminium and other light metals.[1]

Analysis

In 1975, resources totalled 12 866 000 TJ (see Table 2B), which balanced total uses (see Table 2A), apart from errors and omissions and cases where figures were rounded off. This overall figure contains an element of double counting, due to energy transformation. To obtain net consumption on the national territory, transformation inputs, exports and changes in stocks should be deducted, leaving a figure of 5 991 584 TJ. This figure, which represents an important concept of the energy balance-sheets, will be analysed in detail. It includes refuelling of foreign ships and aircraft on French territory (141 850 TJ) but not that of French ships and aircraft in other countries (129 129 TJ) (see Table 2K on bunkers).

All the tables set out at the end of this chapter can be used for a whole range of analyses, the main points of which are summarized below.

- The volume of energy transformed (6 496 971 TJ) is greater than net energy consumption on the national territory (5 991 584 TJ). This transformation activity is linked to domestic demand, since the balance of derived energy sources for export is minimal (approximately 90 000 TJ). This is due to the high level of demand for derived energy, i.e. in decreasing order of importance: petroleum products, coke and thermal electrical energy.

- In turn, this intense transformation activity involves, apart from transformation losses amounting to approximately 877 000 TJ, energy consumption for the operation of installations amounting to approximately 358 000 TJ, or 5,5% of transformation inputs.

- Refined petroleum products represent the main source of derived energy consumption,

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[1] Alumina is classified under 'Chemical products'.

totalling over 4 million TJ, or 67% of intermediate and final demand excluding transformation. Far behind comes coke (357 424 TJ), which in turn produces coke-oven and blast-furnace gases (210 843 TJ) as by-products. Finally, there is demand for thermal electrical energy (460 000 TJ), which is intended to supplement the inadequate production of hydro-electricity. This type of energy consumes 1 192 745 TJ of all types of fuels (transformation inputs). These three factors explain the scale of the energy-producing branches' transformation activity in France.

- Net energy consumption on the national territory is broken down by branch as follows:

	TJ	%
Households[1]	1 861 433	31,1
Energy[2]	441 294	7,4
Agriculture	156 732	2,6
Industry[2]	2 266 615	37,8
Transport[3]	626 110	10,4
Other services	639 400	10,7
Total	5 991 584	100,0

[1] Including fuel.

[2] Excluding transformation inputs.

[3] Excluding own-account services, but including refuelling of ships' bunkers on the national territory.

One-third of energy consumption goes to meet households' direct demands.

The other two-thirds are absorbed by the production of non-energy-generating products, which in turn serve three purposes: households (consumer goods), fixed capital formation (capital goods) and exports (external demand).

- Net energy consumption on the national territory is broken down by use as follows:

	TJ	%
Space heating	1 426 968	24
Transport	1 170 472	20
Ships' bunkers[1]	197 181	3
Non-energy uses	385 201	7
Network losses	63 457	1
Other uses	2 748 308	45
Total	5 991 584	100

[1] All flags within the country.

Approximately 25 % of total energy consumption is used for heating private houses, offices, shops and industrial premises.

A more detailed analysis of uses by branch can be made on the basis of Tables 2C to 2J. The following remarks are confined to one or two interesting aspects:

- Motor transport accounts for a substantial proportion (30%) of households' consumption, reflecting the very high number of private cars.
- The modest proportion of energy consumption for space heating in industry as a whole (6,7%) conceals vast differences from one branch to another, ranging from 0% in the iron and steel industry to 55% in the engineering industries.
- Although France is the leading agricultural country in the Community, with a high degree of mechanization, a preponderance of crops and a deep-sea fishing industry, this sector's share of energy consumption is a modest 2,6% of the total. The reason for this is the small scale of greenhouse heating.
- Energy consumption for road transport accounts for a substantial proportion (16%) of the total, the main consumers being private cars and third-party account transport services (see Table 2L). The transport system in France consequently has a high specific energy consumption.
- Industry is the main energy consumer, accounting for 37,8% of the total. Excluding transformation into blast-furnace gas, the energy consumed by industry is used for the following purposes:
  Manufacturing (75%);
  Chemical synthesis and other non-energy uses (17%);
  Space heating (7%);
  Own-account road transport (1%).
- The matrix of uses (Table 2B) shows clearly the complex and comprehensive structure of industry in France, comparable to the situation in the FR of Germany. Alongside a large number of light industries with a moderate specific energy consumption (textiles, food, mechanical engineering, etc.), there is a small number of heavy industries with a high energy consumption (iron and steel, aluminium, chemicals, cement, ceramics, glass). Note should also be made of the importance of the branch 'Building and civil engineering works', which accounts for more than 8% of industrial energy consumption. Overall, industrial consumption is relatively concentrated, with the five biggest energy-consuming branches accounting for 70% of the total.

Table 2 A

Resources

Terajoules

	Coal and patent fuels 031	Lignite and lignite briquettes 033	Coke 050	Crude oil 071	Petroleum products 073	Natural gas 075	Electricity 097	Manufactured gases 098	Steam 099	Nuclear energy 110	Recoveries (Refuse, waste) 550	Total
Effective production	(1) 610 734	39 077	407 005	45 285	4 537 311	258 262	673 426	32 922	92 388	114 438	35 000	6 845 848
Transfers	(2) - 4 674		(3) - 80 818			4 674	(5) - 4 560	(6) 210 843	4 560			130 025
Distributed production	606 060	39 077	326 187	45 285	4 537 311	262 936	668 866	243 765	96 948	114 438	35 000	6 975 873
Imports	490 230	3 533	79 002	4 448 082	(4) 323 028	400 231	31 612	4	-	114 438	-	5 890 160
Resources	1 096 029	42 610	405 189	4 493 367	4 860 339	663 167	700 477	243 769	96 948	228 876	35 000 (7)	12 866 032

(1) Patent fuels not included.
(2) Mine gas.
(3) Coke-oven gas.
(4) Moreover, 129 129 TJ French bunkers abroad.
(5) Recovered heat.
(6) Transfers received = 80 818 coke-oven gas and 130 025 blast furnace gas.
(7) Household rubbish.

Table 2 B

Uses matrix

Terajoules

(1)	031	033	050	071	073	075	097	098	099	110	095	010	135
031 Coal and patent fuels	1 485	234	434 665				278 025						55 091
033 Lignite and lignite briquettes		18					28 257						
050 Coke			9 177										307 950
071 Crude oil					4 581 087								
073 Petroleum products	218		3 266		257 593	1 334	492 738	23 708	54 996			140 507	90 924
075 Natural gas			4 674			26 043	108 993	16 558	8 436				31 542
097 Electricity	7 092	158	1 681		13 399	177	72 796	587	756	619	7 693	14 612	43 713
098 Manufactured gases			37 489				61 440	1 342					100 930
099 Steam							3 784					1 613	
110 Nuclear energy							22 876						
550 Recoveries (Refuse, waste)									35 000				
Total	8 795	410	490 952		4 852 079	27 554	1 274 909	42 225	110 762	619	7 693	156 732	630 150

Terajoules

	360	410	430	450	471	473	490	510	530	550	580	611	613
031 Coal and patent fuels	3 034	4 163	140	317	1 404	1 200	3 487			420	2 544	1 699	
033 Lignite and lignite briquettes	1 872	12								10	64	55	
050 Coke	2 956	22	6	225	1	2	1			21	127	371	
071 Crude oil													
073 Petroleum products	126 721	30 689	6 291	16 731	38 529	16 070	18 144	2 041	183 023	5 212	146 548	28 396	277 214
075 Natural gas	8 294	2 657		2 588	7 086	3 110	3 221	472		886	19 920		322
097 Electricity	19 487	12 247	1 034	4 546	15 509	4 395	6 008	2 092	5 551	2 340	39 474	21 236	
098 Manufactured gases										143	3 155		
099 Steam	3 068	2 688		538			269	269					
110 Nuclear energy													
550 Recoveries (Refuse, waste)													
Total	165 432	52 478	7 471	24 945	62 529	24 777	31 130	4 874	188 574	9 032	211 832	51 757	277 536

(1) See definition of the branches in Chapter II (page 13).

Table 2 B

Uses matrix

Terajoules

136	137	138	151	153	155	157	170	190	210	240	270	290	
374	1 895	1	5 156	4	670	3 197	10 968	631	90	160	3 091	95	031 Coal and patent fuels
		1 952					231						033 Lignite and lignite briquettes
304	6 439		4 258	3	94	441	4 319	8 434	1 551	49	1 390	20	050 Coke
													071 Crude oil
8 984	9 272	18 448	105 938	31 987	22 192	16 175	388 727	41 366	19 718	17 433	30 003	10 598	073 Petroleum products
5 548	4 080	2 247	24 456	17 228	17 772	10 863	95 510	11 227	3 010	3 401	9 019	1 369	075 Natural gas
3 629	16 349	24 158	11 402	4 439	3 717	4 230	64 753	11 344	5 587	10 112	22 342	5 303	097 Electricity
323	401		86	25	151	20	6 596	3 390					098 Manufactured gases
							3 871	269	3 828	3 828	1 534	1 150	099 Steam
													110 Nuclear energy
													550 Recoveries (Refuse, waste)
19 162	38 436	46 806	151 296	53 686	44 596	34 926	574 975	76 661	33 784	34 983	67 379	18 535	Total

Terajoules

615	617	631	633	720	860	Σ	015	Σ	Stocks	Export	Total		
				6 475	13 537	845 826	147 701	993 527	86 825	15 935	1 096 287		031 Coal and patent fuels
				166	368	33 005	4 011	37 016	5 304	276	42 596		033 Lignite and lignite briquettes
				371	741	349 273	8 151	357 424	26 988	20 777	405 189		050 Coke
						4 581 087	1 320 550	4 581 087	- 87 720	-	4 493 367		071 Crude oil
	8 373	(1) 197 181	(1) 82 501	71 422	(2) 205 405	3 246 616	184 155	4 567 166	- 182 777	475 881	4 860 270		073 Petroleum products
5 399				12 270	17 516	485 747	137 390	669 902	- 6 745	-	663 157		075 Natural gas
3 362				25 200	27 368	540 497	21 131	677 887	-	22 594	700 481		097 Electricity
				3 147	4 012	222 650	38 344	243 781	-	-	243 781		098 Manufactured gases
				13 804	18 072	58 585		96 929			96 929		099 Steam
						228 876		228 876			228 876		110 Nuclear energy
						35 000		35 000			35 000		550 Recoveries (Refuse, waste)
8 761	8 373	197 181	82 501	132 855	287 019	10 627 162	1 861 433	12 488 595	- 158 125	535 463	12 865 933		Total

(1) Including foreign bunkers.
(2) Including military consumption.

Table 2 C

Internal consumption by branch

%

	Energy		Agri-culture	Industry		Trans-port (1)	Other ser-vices	House-holds	Total
	Total	of which: trans-formation		Total	of which: Trans-formation				
Coal and patent fuels	73,0	72,9	-	9,6	-	0,2	2,3	14,9	100
Lignite and lignite briquettes	76,4	76,3	-	11,0	-	0,2	1,6	10,8	100
Coke	2,6	2,5	-	94,7	36,4	0,1	0,3	2,3	100
Crude oil	100,0	100,0	-	-	-	-	-	-	100
Petroleum products	18,3	12,4	3,1	27,5	-	13,0	9,2	28,9	100
Natural gas	24,7	20,1	-	39,3	-	0,9	7,5	27,6	100
Electricity	14,3	-	2,2	44,9	-	3,6	14,7	20,3	100
Manufactured gases	41,1	25,2	-	46,0	-	-	4,2	8,7	100
Steam	3,9	-	1,7	22,0	-	-	32,9	39,5	100
Nuclear energy	100,0	100,0	-	-	-	-	-	-	100
Refuse and waste	100,0	100,0	-	-	-	-	-	-	100
Total energy	54,5	51,0	1,3	19,2	1,0	5,0	5,1	14,9	100

(1) Professional transport, including bunkers.

Table 2 D

Internal consumption by use

%

	Trans-formation	Space heat-ing	Non ener-gy uses	Sea bunk-ers	Other trans-port (1)	Fish-ing	Net work losses	Other uses	Total
Coal and patent fuels	72,9	16,5	0,0	-	0,2	-	-	10,4	100
Lignite and lignite briquettes	76,3	11,6	-	-	0,2	-	-	11,9	100
Coke	38,9	2,7	1,1	-	0,1	-	-	57,2	100
Crude oil	100,0	-	-	-	-	-	-	-	100
Petroleum products	12,4	22,1	7,2	4,3	24,9	0,5	-	28,6	100
Natural gas	20,1	29,4	6,8	-	0,9	-	2,7	40,1	100
Electricity	-	2,9	-	-	3,6	-	6,6	86,9 (2)	100
Manufactured gases	25,2	3,3	1,9	-	-	-	0,4	69,2	100
Steam	-	86,3	-	-	-	-	-	13,7	100
Nuclear energy	100,0	-	-	-	-	-	-	-	100
Refuse and waste	100,0	-	-	-	-	-	-	-	100
Total energy	52,0	12,0	3,0	1,6	9,4	0,2	0,5	21,3	100

(1) Traction and propulsion.
(2) Of which: 15% lighting and 8,7% electrolysis.

Table 2 E

Consumption by use in the 'Energy' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Network losses	Others	Total
Coal and patent fuels	-	-	-	812 027	-	1 719	813 746
Lignite and lignite briquettes	-	-	-	28 257	-	18	28 275
Coke	-	-	-	8 750	-	428	9 178
Crude oil	-	-	-	4 581 087	-	-	4 581 087
Petroleum products	-	4 037	-	565 260	-	264 556	833 853
Natural gas	-	-	-	134 017	17 830	12 827	164 674
Electricity	-	-	-	-	44 611	52 653	97 264
Manufactured gases	-	-	-	61 440	1 016	37 815	100 271
Steam	-	-	-	-	-	3 784	3 784
Nuclear energy	-	-	-	228 876	-	-	228 876
Refuse and waste	-	-	-	35 000	-	-	35 000
Total	-	4 037	-	6 454 714	63 457	373 800	6 896 008
%	-	0	-	93,6	0,9	5,4	100
% (1)	-	0,9	-	-	14,4	84,7	100

* Codes 031/075, 095/110.
(1) Excluding transformations.

Table 2 F

Consumption by use in the 'Agriculture' branch* (1)

Terajoules

	Space heating	Transport	Non-energy uses	Fishing	Others (2)	Total
Coal and patent fuels						-
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	-	6 390	215	21 996	111 906	140 507
Natural gas						-
Electricity	-	-	-	-	14 612	14 612
Manufactured gases						-
Steam	-	-	-	-	1 613	1 613
Nuclear energy						-
Total	-	6 390	215	21 996	128 131	156 732
%	-	4	0	14	82	100

* Code 010.
(1) Dwellings are classed with households.
(2) Tractors, agricultural machinery, fixed engines, drying, etc.

Table 2 G

Consumption by use in the 'Industry' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Others (4)	Total
Coal and patent fuels	6 232	-	118 (2)	-	89 239	95 589
Lignite and lignite briquettes	35	-	-	-	4 043	4 078
Coke	703	-	4 016 (2)	130 025 (3)	203 741	338 485
Crude oil	-	-	-	-	-	-
Petroleum products	122 660	31 265	319 591	-	781 699	1 255 215
Natural gas	15 709	-	49 590	-	200 288	265 587
Electricity	1 669	-	-	-	302 620	304 289
Manufactured gases	74	-	4 577	-	107 414	112 065
Steam	13 428	-	-	-	7 904	21 332
Nuclear energy						-
Total	160 510	31 265	377 892	130 025	1 696 948	2 396 640
%	6,7	1,3	15,8	5,4	70,8	100
% (1)	7,0	1,4	16,7	-	74,9	100

* Codes 135/550.
(1) Excluding transformations.
(2) Electrodes and calcium carbide.
(3) By-product: blast-furnace gas.
(4) For manufacturing.

Table 2 H

Consumption by use in the 'Transport' branches*

Terajoules

	Space heating	Transport (Traction)	Non-energy uses	Sea (1) bunkers	Others	Total
Coal and patent fuels	-	1 699	-	-	-	1 699
Lignite and lignite briquettes	-	55	-	-	-	55
Coke	-	371	-	-	-	371
Crude oil	-	-	-	-	-	-
Petroleum products	-	396 485 (2)	-	197 181	-	593 666
Natural gas	-	5 721	-	-	-	5 721
Electricity	-	24 598	-	-	-	24 598
Manufactured gases						-
Steam						-
Nuclear energy						-
Total	-	428 929	-	197 181	-	626 110
%	-	68,5	-	31,5	-	100

* Codes 611/633.
(1) All flags within the country (except military).
(2) Of which: third-party account 277 214.

Table 2 I

Consumption by use in the 'Other Services' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	22 556	-	-	-	22 556
Lignite and lignite briquettes	598	-	-	-	598
Coke	1 239	-	-	-	1 239
Crude oil	-	-	-	-	-
Petroleum products	256 671	144 702 (1)	6 142	15 860	423 375
Natural gas	49 706	-	-	-	49 706
Electricity	-	-	-	99 735	99 735
Manufactured gases	7 159	-	-	3 155	10 314
Steam	31 876	-	-	-	31 876
Nuclear energy					-
Total	369 805	144 702	6 142	118 750	639 400
%	58	23	1	18	100

* Codes 580, 720, 860, 095.
(1) Including military consumption.

Table 2 J

Consumption by use in the 'Households' branch*

Terajoules

	Space heating	Transport (1)	Non-energy uses	Others (2)	Total
Coal and patent fuels	135 400	-	-	12 302	147 701
Lignite and lignite briquettes	3 668	-	-	343	4 011
Coke	7 729	-	-	423	8 152
Crude oil	-	-	-	-	-
Petroleum products	632 370	555 149	952	132 080	1 320 550
Natural gas	130 446	-	-	53 709	184 155
Electricity	17 860	-	-	119 531	137 390
Manufactured gases	836	-	-	20 295	21 131
Steam	38 344	-	-	-	38 344
Nuclear energy					-
Total	966 653	555 149	952	338 683	1 861 433
%	52	30	0	18	100

* Code 015.
(1) Fuel and lubricants for motor vehicles.
(2) Hot water, cooking, various household appliances, lighting.

Table 2 K

Bunkers

Terajoules

	Total in the country A + B	French flags within the country A	Foreign flags within the country B	French flags abroad C	Total French flags A + C
Sea					
Gas diesel oil	31 260	16 539	14 721	-	16 539
Heavy fuel oil	164 440	65 080	99 360	86 000	151 080
Lubricants	1 480	761	719	-	761
Total	197 181	82 381	114 800	86 000	168 381
Air					
Petrol (aircraft)	1 496	1 320	176	-	1 320
Aviation fuel	80 668	53 793	26 875	43 129	96 922
Lubricants	338	338	-	-	338
Total	82 502	55 451	27 051	43 129	98 580

Table 2 L

Road transport

Terajoules

	Petrol	Diesel oil	Natural gas	Lubricants	Total	%
Households	532 180	13 536	-	9 433	555 149	56,7
Third-party account	27 940	244 748	322	4 526	277 536	28,3
Own account	118 267	24 655	-	3 469	146 391	15,0
of which: agriculture	4 144	1 946	-	300	6 390	(0,7)
energy	2 684	1 142	-	208	4 034	(0,4)
industry	13 463	16 491	-	1 311	31 265	(3,2)
commerce and services	97 976	5 076	-	1 650	104 702	(10,7)
Total	678 387	282 939	322	17 428	979 079	100,0
%	69,3	28,9	0,0	1,8	100	

ITALY

Introduction

In Italy, the basic data used in the energy input-output tables were collected at a very detailed level. Energy uses were even cross-referenced with the further breakdown by petroleum product and were also broken down by origin, i.e. national production or imports. This resulted in a set of tables with a volume of around 10 000 cells, the relevant data being available on request.

To obtain these results, use was made of the ISTAT's censuses of companies and a number of special surveys were also conducted with a view to providing further information and improving the energy balance-sheets. In particular, gasworks' production and consumption were recorded in great detail, especially in the case of all municipal works.

A number of features peculiar to Italy are described below.

- External trade was based on the balance of payments, i.e. imports and exports including Italian embassies abroad and foreign embassies in Italy, as well as enclaves (Vatican City State). Only a few thousand TJ are involved. On the other hand, the figures for imports of petroleum products include the operations of independent importers (approximately 70 000 TJ).

- The branch 'Railway transport services' (code 611) includes ferry and road transport services operated by the State railways (FS).

- The branch 'Inland waterways services' (code 617) includes not only transport services on rivers, lakes and lagoons but also transport by private boat and certain sea-going ferries.

- No figures were given for the branch 'Steam' (code 099), as there were no statistical returns. Fuel inputs in collective heating systems are included in households' consumption.

- The branch 'Aluminium' (code 138) comprises the following products: alumina, primary aluminium, billets, plate, sheet, wire and other rolled products, recovered aluminium.

Analysis

In Italy, total intermediate and final energy consumption on the national territory amounted to 4 704 075 TJ in 1975, excluding double counting of transformations. To obtain total uses (see Table 3B), the above figure must be augmented by transformation inputs, changes in stocks and exports (giving a total of 10 693 985 TJ). This total also represents the supplies needed to meet all energy requirements, including transformation (see Table 3A on resources).

Net total consumption on the national territory is broken down by groups of branches as follows:

	TJ	%
Households	1 257 170	26,5
Energy[1]	364 063	8,0
Agriculture and fisheries	95 726	2,0
Industry[1]	2 021 489	43,0
Transport[2]	493 876	10,5
Other services	471 751	10,0
Total	4 704 075	100,0

[1] Excluding transformation inputs.

[2] Including bunkers of all flags within the country.

The above table shows:

- The substantial proportion of energy consumption accounted for by industry. Italy has become a highly-industrialized country, with heavy industries which consume vast amounts of energy (iron and steel, chemicals and building materials).
- The modest proportion accounted for by final consumption of households, for two reasons: the temperate climate and the low proportion of household appliances (washing machines etc.).
- An agricultural sector which consumes very little energy, considering its size and structure (crop farming more developed than livestock farming). This is due to the Mediterranean nature of agriculture in Italy (fruit trees, vineyards, etc.), which is very labour-intensive and unsuited to mechanization.
- The substantial consumption by the energy branches, owing to the preponderance of transformers, primarily coking plants, thermal power-stations and oil refineries (a considerable proportion of which carry out contract work for export).

This last remark is confirmed by the tremendous volume of energy transformation, amounting to over 5,4 million TJ (compared with consumption of 4,7 million TJ).

The breakdown by use confirms the above-mentioned conclusions and provides some further information:

- low consumption for space heating, on the whole;
- relatively high consumption for non-energy purposes, due primarily to the size of the chemical industry;
- substantial consumption by ships' bunkers. Italy is a maritime country with highly-developed coastal and international services. The bulk of its external trade is effected by sea.
- preponderance of 'Other uses', representing mainly the energy consumed by industry for manufacturing purposes.

	TJ	%
Space heating	1 020 994	22
Transport	785 971	17
Ships' bunkers[1]	240 146	5
Non-energy uses	428 861	9
Network losses	62 902	1
Other uses	2 165 205	46
Total	4 704 075	100

[1] All flags within the country.

To take the analysis further, comments may be made on the tables by branch (cross-referenced with uses and energy sources), which provide some interesting information.

The most immediately obvious feature of households' consumption is the substantial proportion accounted for by heating (60%), which appears to contradict the general conclusions. In fact, the proportion used for space heating seems high only because of the low consumption for 'Other uses' owing to the small number of household appliances in use. Households therefore use a considerable proportion of their energy consumption for heating, despite the temperate climate, since they consume little energy for lighting, hot water, electric appliances, etc.

In the agricultural sector, only a modest proportion of energy consumption is required for fishing, which is exclusively coastal, in contrast to the countries which have an Atlantic seaboard.

In industry, space heating accounts for a low proportion of energy consumption on average (4%, as against 6% in France and 14,5% in Denmark) as a result of the preponderance of heavy industries and the climate. However, the average conceals considerable differences, the proportion of energy consumption used for space heating ranging from 0% in the iron and steel industry to 23% in the branch 'Miscellaneous machines and electrical goods' (code 240) and even 50% in the branch 'Paper goods, products of printing' (code 473).

Moreover, in Italy there is a very great concentration of industrial consumption in a few branches, in the following order: chemicals, iron and steel, cement and ceramics (codes 170, 135, 151 and 155). These four branches alone consume 63% of the energy supplied to industry as a whole.

The transport sector (branches 611 to 633) shows a concentration on sea and rail traffic; third-party account road services are not very extensive and inland waterway services are negligible. It should be noted that the railways operate an extensive fleet of road vehicles. One of the attached tables (3L) gives a breakdown of energy consumption by road vehicles.

There is little of note as regards the other services (branches 095, 580, 720 and 860), apart from the fact that their consumption for heating purposes is fairly low, whereas their fuel consumption is very high (road vehicles for distributive trades, deliveries, etc.).

All these results, collected on the basis of the input-output table, show great consistency and clearly reflect the structure of the Italian economy.

Table 3 A

Resources

Terajoules

	Coal and patent fuels 031	Lignite and lignite briquettes 033	Coke 050	Crude oil 071	Petroleum products 073	Natural gas 075	Electricity 097	Manufactured gases 098	Steam (3) 099	Nuclear energy 110	Recoveries (Refuse, waste) (4) 550	Total
Effective production	-	14 250	291 910	45 433	4 053 490	504 445	524 812	25 700	-	-	11 306	5 471 346
Transfers			- 60 647					+ 60 647 (2) + 61 258				(2) + 61 258
Distributed production	-	14 250	231 263	45 433	4 053 490	504 445	524 812	147 605	-	-	11 306	5 532 604
Imports	361 799	1 223	4 631	3 995 095	(1) 429 308	300 916	20 545	-	-	47 863	-	5 161 380
Resources	361 799	15 473	235 894	4 040 528	4 482 798	805 361	545 357	147 605	-	47 863	11 306	10 693 984

(1) Moreover, 126 488 TJ Italian bunkers abroad.
(2) Blast-furnace gas, transferred to branch 135.
(3) Not recorded.
(4) Household rubbish and industrial waste.

Table 3 B

Uses matrix

Terajoules

(1)	031	033	050	071	073	075	097	098	099	110	095	010	135
031 Coal and patent fuels			322 910				20 715						1 846
033 Lignite and lignite briquettes							14 250						462
050 Coke			2 193										181 464
071 Crude oil					4 074 207								
073 Petroleum products		32	136	65	220 437	96	748 814	3 660			81	92 442	36 637
075 Natural gas			381		905	25 517	72 431	23 578			4	501	63 990
097 Electricity		202	850	4	7 027	306	72 310	590			7 772	2 783	46 836
098 Manufactured gases			31 525				29 720	1 950					54 886
099 Steam													
110 Nuclear energy							47 863						
550 Recoveries (Refuse, waste)							11 306						
Total		234	357 995	69	4 302 576	25 919	1 017 409	29 778	-	-	7 857	95 726	386 121

Terajoules

	360	410	430	450	471	473	490	510	530	550	580	611	613
031 Coal and patent fuels	140	18	7	21	31	1	171	-	-	-	454	2 264	-
033 Lignite and lignite briquettes													
050 Coke	1 589	23	6	4	1	42	26	-	-	148	2 280	9	-
071 Crude oil													
073 Petroleum products	76 794	46 478	6 650	18 772	36 043	3 823	24 080	1 333	90 338	4 879	157 974	33 629	138 749
075 Natural gas	29 826	13 718	716	1 311	14 803	948	4 384	1 213	477	1 316	7 594	6	2 635
097 Electricity	16 016	14 980	997	4 745	13 518	1 530	7 553	1 001	2 012	2 434	32 771	13 903	11
098 Manufactured gases	680	94	-	-	2	15	-	25	-	16	1 710	-	-
099 Steam													
110 Nuclear energy													
550 Recoveries (Refuse, waste)													
Total	125 045	75 311	8 376	24 853	64 398	6 359	36 214	3 572	92 827	8 793	202 783	49 811	141 395

(1) See definition of the branches in Chapter II (page 13).

Table 3 B

Uses matrix

Terajoules

136	137	138	151	153	155	157	170	190	210	240	270	290	
	645		2 373	3	152	9	674	304	100	28	11	43	031 Coal and patent fuels
					11	7	-	-	3				033 Lignite and lignite briquettes
	2 747	201	1 197	6	1 433	7	4 560	5 985	761	120	21	167	**050 Coke**
													071 Crude oil
10 382	8 136	1 820	109 935	29 108	66 269	5 696	425 651	22 434	42 882	17 984	20 887	5 250	073 Petroleum products
19 103	1 771	2 114	31 014	24 718	50 755	1 308	138 527	15 826	4 327	2 809	9 331	1 941	075 Natural gas
6 754	5 846	12 982	13 122	2 808	8 550	3 629	66 337	8 208	8 075	9 112	6 696	2 221	097 Electricity
	3		160	232	143	36	3 082	790	170	367	7	3	098 Manufactured gases
													099 Steam
													110 Nuclear energy
													550 Recoveries (Refuse, waste)
36 239	19 148	17 117	157 801	56 875	127 313	10 692	638 831	53 547	56 318	30 420	36 953	9 625	**Total**

Terajoules

615	617	631	633	720	860	Σ	015	Σ	Stocks	Export	Total		
-	-	117	-	357	1 740	355 134	4 776	359 909	+ 1 686	204	361 799		031 Coal and patent fuels
						14 732	759	15 490	- 18	-	15 472		033 Lignite and lignite briquettes
-	10	-	-	86	1 433	206 517	4 348	210 866	+ 2 310	22 718	235 894		**050 Coke**
						4 074 207	-	4 074 207	- 33 679	-	4 040 528		071 Crude oil
258	3 616	241 072	54 819	109 683	108 453	3 026 277	941 142	3 967 419	- 81 784	597 161	4 482 799		073 Petroleum products
-	-	-	-	2 923	6 584	579 305	188 611	767 915	- 37 446	-	805 361		075 Natural gas
2 282	7	230	259	17 676	11 430	436 374	96 293	532 667	-	12 690	545 356		097 Electricity
-	-	-	-	295	451	126 366	21 241	147 607	-	-	147 607		098 Manufactured gases
													099 Steam
						47 863		47 863			47 863		110 Nuclear energy
						11 306		11 306			11 306		550 Recoveries (Refuse, waste)
2 540	3 633	241 419	55 078	131 020	130 091	8 878 081	1 257 170	10 135 251	- 74 039	632 773	10 693 985		**Total**

Table 3 C

Internal consumption by branch

%

	Energy		Agri-culture	Industry		Trans-port (1)	Other ser-vices	House-holds	Total
	Total	of which: trans-formation		Total	of which: trans-formation				
Coal and patent fuels	95,5	95,4	-	1,8	-	0,7	0,7	1,3	100
Lignite and lignite briquettes	92,0	92,0	-	3,1	-	-	-	4,9	100
Coke	1,0	1,0	-	95,1	29,1	0,0	1,8	2,1	100
Crude oil	100,0	100,0	-	-	-	-	-	-	100
Petroleum products	24,6	18,9	2,3	28,0	-	11,9	9,5	23,7	100
Natural gas	16,0	12,5	0,1	56,8	-	0,3	2,2	24,6	100
Electricity	15,3	-	0,5	49,9	-	3,1	13,1	18,1	100
Manufactured gases	42,8	20,5	-	41,1	-	-	1,7	14,4	100
Steam	-	-	-	-	-	-	-	-	-
Nuclear energy	100,0	100,0	-	-	-	-	-	-	100
Refuse and waste	100,0	100,0	-	-	-	-	-	-	100
Total energy	56,6	53,0	0,9	20,6	0,6	4,9	4,6	12,4	100

(1) Professional transport, including bunkers.

Table 3 D

Internal consumption by use

%

	Trans-formation	Space heat-ing	Non energy uses	Sea bunk-ers	Other trans-port (1)	Fish-ing	Net-work losses	Other uses	Total
Coal and patent fuels	95,4	2,0	-	-	0,7	-	-	1,9	100
Lignite and lignite briquettes	92,0	4,8	-	-	-	-	-	3,2	100
Coke	30,1	3,8	0,2	-	-	-	-	65,9	100
Crude oil	100,0	-	-	-	-	-	-	-	100
Petroleum products	18,9	20,6	8,7	6,9	18,5	0,3	-	26,1	100
Natural gas	12,5	22,7	10,4	-	0,6	-	2,0	51,8	100
Electricity	-	0,8	-	-	2,4	-	8,8	88,0 (2)	100
Manufactured gases	20,5	5,7	2,1	-	-	-	0,6	71,1	100
Steam	-	-	-	-	-	-	-	-	-
Nuclear energy	100,0	-	-	-	-	-	-	-	100
Refuse and waste	100,0	-	-	-	-	-	-	-	100
Total energy	53,6	10,1	4,2	2,7	7,4	0,1	0,6	21,3	100

(1) Traction and propulsion.
(2) Of which: 10% lighting and 5,4% electrolysis.

Table 3 E

Consumption by use in the 'Energy' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Network losses	Others	Total
Coal and patent fuels	-	-	-	343 206	-	419	343 625
Lignite and lignite briquettes	-	-	-	14 250	-	-	14 250
Coke	-	-	-	2 193	-	-	2 193
Crude oil	-	-	-	4 074 207	-	-	4 074 207
Petroleum products	442	2 008	2 515	750 665	-	217 610	973 240
Natural gas	-	-	-	96 009	15 310	11 493	122 812
Electricity	-	-	-	-	46 696	34 593	81 289
Manufactured gases	-	-	-	30 218	896	32 081	63 195
Steam							-
Nuclear energy	-	-	-	47 863	-	-	47 863
Refuse and waste	-	-	-	11 306	-	-	11 306
Total	442	2 008	2 515	5 369 917	62 902	296 196	5 733 980
%	0	0	0	94	1,0	5,0	100
% (1)	0,1	0,5	0,7	-	17,3	81,4	100

* Codes 031/075, 097/110.
(1) Excluding transformations.

Table 3 F

Consumption by use in the 'Agriculture' branch* (1)

Terajoules

	Space heating	Transport (2)	Non-energy uses	Fishing	Others (3)	Total
Coal and patent fuels						-
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	-	2 388	1 870	10 896	77 288	92 442
Natural gas	-	-	-	-	501	501
Electricity	-	-	-	-	2 783	2 783
Manufactured gases	-	-	-	-	-	-
Steam						-
Nuclear energy						-
Total	-	2 388	1 870	10 896	80 572	95 726
%		2,5	2	11,5	84	100

* Code 010.
(1) Dwellings are classed with households.
(2) Own account road transport.
(3) Tractors and agricultural machinery, fixed engines, greenhouse heating, drying, lighting, etc.

Table 3 G

Consumption by use in the 'Industry' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Others	Total
Coal and patent fuels	-	-	-	-	6 577	6 577
Lignite and lignite briquettes	-	-	-	-	483	483
Coke	-	-	428	61 259 (2)	138 821	200 508
Crude oil						-
Petroleum products	66 308	55 787	322 183	-	667 982	1 112 261
Natural gas	20 153	554	79 822	-	335 718	436 246
Electricity	-	-	-	-	265 962	265 962
Manufactured gases	-	-	3 042	-	57 669	60 711
Steam						-
Nuclear energy						-
Total	86 461	56 341	405 475	61 259	1 473 212	2 082 748
%	4,0	3,0	19,0	3	71,0	100
% (1)	4,3	2,8	20,0	-	72,9	100

* Codes 135/550.
(1) Excluding transformations.
(2) Blast-furnaces.

Table 3 H

Consumption by use in the 'Transport' branches*

Terajoules

	Space heating	Transport (Traction)	Non-energy uses	Sea (1) bunkers	Others	Total
Coal and patent fuels	-	2 381	-	-	-	2 381
Lignite and lignite briquettes						-
Coke	19	-	-	-	-	19
Crude oil	-	-	-	-	-	-
Petroleum products	8 315	214 307 (2)	8 118 (3)	240 146 (4)	1 257	472 143
Natural gas	-	2 640	-	-	2	2 641
Electricity	-	13 126	-	-	3 567	16 692
Manufactured gases						-
Steam						-
Nuclear energy						-
Total	8 334	232 454	8 118	240 146 (5)	4 826	493 876
%	2	47	2	48	1	100

* Codes 611/633.
(1) All flags within the country, including military.
(2) Of which 134 683 TJ third-party account road transport.
(3) Of which 1 025 TJ for sea bunkers.
(4) Of which 1 631 TJ for ferries run by the State railway (FS).
(5) Moreover, 126 489 TJ Italian bunkers abroad.

Table 3 I

Consumption by use in the 'Other Services' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	2 551	-	-	-	2 551
Lignite and lignite briquettes					-
Coke	3 571	-	-	229	3 799
Crude oil					-
Petroleum products	155 967	191 465 (1)	5 276	23 484	376 191
Natural gas	9 656	1 573	-	5 876	17 105
Electricity	576	-	-	69 073	69 649
Manufactured gases	108	-	-	2 348	2 456
Steam					-
Nuclear energy					-
Total	172 429	193 038	5 276	101 010	471 751
%	36,5	41	1	21,5	100

* Codes 095, 580, 720, 860.
(1) Including military aircraft.

Table 3 J

Consumption by use in the 'Households' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	4 776	-	-	-	4 776
Lignite and lignite briquettes	739	-	-	19	758
Coke	4 348	-	-	-	4 348
Crude oil					-
Petroleum products	587 100 (1)	299 742	5 607 (2)	48 693	941 142
Natural gas	144 393	-	-	44 218	188 611
Electricity	3 600	-	-	92 693	96 293
Manufactured gases	8 372	-	-	12 870	21 242
Steam					-
Nuclear energy					-
Total	753 328	299 742	5 607	198 493	1 257 170
%	60	24	0	16	100

* Code 015.
(1) Including collective heating systems.
(2) Lubricants for motor vehicles.

Table 3 K

Bunkers

Terajoules

	Total within the country A + B	Italian flags within the country A	Foreign flags within the country B	Italian flags abroad C	Total Italian flags A + C
Sea					
Gas diesel oil	33 606	10 510 (1)	23 096	15 795	26 305
Heavy fuel oil	205 906	68 546	137 360	96 790	165 336
Lubricants	1 659	1 025	634	1 579	2 604
Total	241 171	80 081	161 090	114 164	194 245
Air					
Petrol (aircraft)	4 330	942	3 388	-	942
Aviation fuel	50 340	20 928 (2)	29 412	12 211	33 139
Lubricants	73	73	-	113	186
Total	54 743	21 943	32 800	12 324	34 267

(1) Of which 1 631, ships run by the State railways (FS).
(2) Not including military aircraft.

Table 3 L

Road transport

Terajoules

	Petrol	Diesel oil	LPG	Natural gas	Total	%
Households	(3) 279 959	5 499	14 283	-	299 742	43
Third-party account	19 137	111 625	3 921	2 634	137 317	20
Own account	170 713	78 776	8 015	2 133	259 637	37
of which: industry (1)	23 979	28 575	5 088	554	58 196	(8,4)
road services of FS	751	14 892	35	6	15 684	(2,2)
other transport (2)	1 796	-	-	-	1 796	(0,2)
commerce and services	142 803	34 305	2 893	1 573	181 574	(26,0)
agriculture	1 384	1 004	-	-	2 388	(0,3)
Total	469 809	195 900	26 220	4 766	696 695	100,0
%	67,5	28	4	0,5	100	

(1) Including energy branches.
(2) Road vehicles belonging to airlines, etc.
(3) Of which 145 TJ of aircraft petrol.

NETHERLANDS

Introduction

The construction of the basic input-output table was based very closely on the overall energy balance-sheet compiled in TJ by the SOEC, and there are thus no differences in approach or method of preparation. One or two special features of the Netherlands' table are described below for the record.

- Owing to the lack of statistical data, the following branches were combined:
  135 and 136: ECSC and non-ECSC iron and steel products;
  137 and 138: Aluminium and other non-ferrous metals.

- The branch 'Steam' (code 099) comprises only the heat sold by public-sector thermal power-stations.

- The branch 'Manufactured gases' comprises only coke-oven and blast-furnace gases (by-products of branches 050 and 135), since there are no longer any gasworks in the Netherlands.

- The branches 'Coal and coal briquettes' (031) and 'Lignite and lignite briquettes' (073) depend solely on imports.

- Consumption on the national territory includes the quantities taken by foreign units (non-Dutch sea-going vessels, inland waterway vessels, road vehicles and aircraft refuelling in the Netherlands). A distinction between national and foreign units is made in the table (4K) on ships' bunkers and aircraft fuel tanks. It was not possible to make this distinction for either road or inland waterway transport. The energy consumption of the branch 'Inland waterways services' (617) therefore includes substantial quantities of fuel taken by foreign vessels (especially Rhine barges).

Analysis

In 1975, total intermediate and final consumption on the national territory, excluding the double counting of transformation inputs, amounted to 2 556 951 TJ.

In order to calculate total uses as defined in the input-output table, transformation inputs, changes in stocks and exports should be added to the above figure, giving a grand total of uses of 8 537 039 TJ, which corresponds to the total of the last column in the matrix of uses (Table 4B). This total does not include refuelling of Dutch ships and aircraft outside the national territory, on which no information is available. It also represents the supplies needed to cover all energy requirements (including transformation and exports). Detailed figures are given in Table 4A on resources.

The analysis is concerned mainly with net consumption on the national territory (2 556 951 TJ). A great number of comments can be made on the basis of Tables 4B to 4J.

A general breakdown by consumer branches shows the following picture:

	TJ	%
Households	597 703	23
Energy[1]	167 955	7
Agriculture and fisheries	68 750	3
Industry[1]	900 009	35
Commercial transport[2]	562 770	22
Other services	259 764	10
Total	2 556 951	100

[1] Excluding transformation inputs.

[2] Including bunkers of all flags within the country.

On the other hand, the general breakdown by uses gives the following figures:

	TJ	%
Space heating	584 600	23
Transport	304 871	12
Ships' bunkers	432 573	17
Non-energy uses	277 643	11
Network losses	25 973	1
Other uses	931 291	36
Total	2 556 951	100

The analysis may be summarized in a few significant points, in particular:

- The scale of exports, which at almost 3 million TJ are greater than consumption on the national territory (2 557 000 TJ). If the refuelling of foreign ships and aircraft (394 000 TJ) is transferred to exports, the gap is even wider. The activity of the energy-producing branches in the Netherlands is therefore geared more to meeting demand from foreign units than to the domestic market.

- These exports are divided almost 50-50 between natural gas and refined petroleum products, the latter giving rise to demand for imports of crude petroleum and a considerable volume of contract refining for other countries.

- The above comments explain the substantial growth of transport in the Netherlands. The 'Transport' branches, i.e. commercial activities (third-party account road transport, inland waterway and Rhine transport, oil and gas pipelines, air transport and ships' bunkers) account for 22% of energy consumption, compared with around 10% in the other countries. Foreign units account for a substantial proportion of this consumption. The Netherlands is one of the hubs of Western Europe, and this involves substantial supplies of energy for transport activities, especially by sea (see also Table 4L on road transport.

- This preponderance of transport somewhat overshadows the other branches and uses of energy. Mention must be made, however, of the proportion of consumption accounted for by space heating as a result of the cool, wet climate. This is particularly apprecia-

ble in the case of households, where 64 % of total energy consumption is used for this purpose, much more than in the other countries.

- Another noticeable feature is the vast growth of non-energy uses, i.e. lubricants for transport, bitumen for road surfacing and, above all, feedstock for chemical synthesis.

- This last remark draws attention to the overdevelopment of the chemical industry, which on its own takes 51,5% of the energy consumed in industry. The other energy-consuming heavy industries are relatively underdeveloped (iron and steel, glass, cement, ceramics, etc.). On the other hand, there are many light industries in the Netherlands (food, electrical engineering). For more details, see Table 4B.

- The above remarks explain the specialized nature of the uses of petroleum products, with a breakdown which is completely different from that of the other countries:

Ships' bunkers	27,4 %
Other transport (fuel)	25,0 %
Non-energy uses	15,0 %
Transformation	3,4 %
Refineries' own consumption	7,4 %
Space heating	7,8 %
Furnaces and boilers (manufacturing)	14,0 %.

In the Netherlands, petroleum products are used solely for propulsion and non-energy purposes. On the other hand, natural gas is used mainly for manufacturing (28%), heating (34%) and transformation in power-stations (31%).

- A striking feature is the high energy consumption of the agricultural sector, comprising mainly natural gas (76%) used to heat greenhouses. This very intensive agriculture accounts for 3% of total energy consumption on the national territory (compared with 2% in France, which, however, has the largest agricultural sector in the Community).

- The energy branches are concentrated on two transformation activities, namely petroleum refining and electricity generation from natural gas. Although refining consumes a lot of energy (partly for export), overall these branches do not account for too great a proportion of the country's total energy consumption (only 7%, including network losses). The reason for this is natural gas, which requires little energy for extraction and distribution.

- To sum up, the Netherlands has a 'dual-energy' economy based on indigenous natural gas and imported petroleum, electricity being produced from gas and solid fuels playing a secondary part, centred on coke for the iron and steel industry. Energy is used for a number of specialized purposes and the main consumer is transport.

Table 4 A

Resources

Terajoules

	Coal and patent fuels 031	Lignite and lignite briquettes 033	Coke 050	Crude oil 071	Petroleum products 073	Natural gas 075	Electricity 097	Manufactured gases 098	Steam 099	Nuclear energy 110	Recoveries (Refuse, waste) (3) 550	Total
Effective production	-	-	96 810	65 363	2 343 747	2 926 254	199 593	-	-	-	10 946	5 642 713
Transfers			- 20 430				- 4 261	+ 20 430 (2) + 21 491	+ 4 261			(2) + 21 491
Distributed production	-	-	76 380	65 363	2 343 747	2 926 254	195 332	41 921	4 261	-	10 946	5 664 204
Imports	118 956	280	11 885	2 294 764	(1) 402 815	-	8 046	-	-	36 089	-	2 872 835
Resources	118 956	280	88 265	2 360 127	2 746 562	2 926 254	203 378	41 921	4 261	36 089	10 946	8 537 039

(1) Not including Dutch sea and air bunkers abroad.
(2) Blast-furnace gas transferred from the branch 'iron and steel industry' (135).
(3) Household rubbish and industrial waste.

Table 4 B

Uses matrix

Terajoules

(1)	031	033	050	071	073	075	097	098	099	110	095	010	
031 Coal and patent fuels			99 568				4 693						
033 Lignite and lignite briquettes													
050 Coke													
071 Crude oil					2 369 934								
073 Petroleum products			1 758		103 540		45 894				400	15 643	
075 Natural gas					1 028	31 154	420 182				-	51 915	
097 Electricity			274		3 665	814	18 056				1 270	1 192	
098 Manufactured gases			9 424				15 831						
099 Steam													
110 Nuclear energy							36 089						
550 Recoveries (Refuse, waste)							10 946						
Total			111 024		2 478 167	31 968	551 691				1 670	68 750	

Terajoules

	360	410	430	450	471	473	490	510	530	550	580	611	613
031 Coal and patent fuels	4	1			50		6				1 252	117	
033 Lignite and lignite briquettes											100		
050 Coke	470				5		5				155		
071 Crude oil													
073 Petroleum products	20 704	3 177	600	2 725	3 985	751	1 330	920	72 795	2 250	28 514	1 961	43 823
075 Natural gas	50 710	7 524	200	1 600	17 000	3 000	2 621	200	9 570	5 180	29 725	2 790	-
097 Electricity	8 280	1 796	144	1 015	3 960	1 570	1 303	720	3 420	1 440	10 321	3 240	-
098 Manufactured gases													
099 Steam	465										500		
110 Nuclear energy													
550 Recoveries (Refuse, waste)													
Total	80 633	12 498	944	5 340	25 000	5 321	5 265	1 840	85 785	8 870	70 567	8 108	43 823

(1) See definition of the branches in Chapter II (page 13).

Table 4 B

Uses matrix

Terajoules

135/136	137/138		151	153	155	157	170	190	210	240	270	290	
75	56		425		282		942	40			20	20	031 Coal and patent fuels
													033 Lignite and lignite briquettes
59 720	883		235		155		4 002	5					050 Coke
													071 Crude oil
16 980	259		963	2 410	735	2 387	237 711	3 104	2 555	6 737	659	2 295	073 Petroleum products
19 535	3 639		9 240	4 900	15 700	5 300	190 534	6 024	2 342	5 187	1 506	1 673	075 Natural gas
6 862	17 212		1 098	1 080	720	641	28 062	2 160	1 440	2 808	396	1 224	097 Electricity
14 296			511				1 859						098 Manufactured gases
				200	200								099 Steam
													110 Nuclear energy
													550 Recoveries (Refuse, waste)
117 468	22 049		12 472	8 590	17 792	8 328	463 110	11 333	6 337	14 732	2 581	5 212	Total

Terajoules

615	617	631	633	720	860	Σ	015	Σ	Stocks	Export	Total		
				200	100	107 851	3 573	111 424	3 223 1 584	2 725	118 956		031 Coal and patent fuels
				100	80	280	-	280	-	-	280		033 Lignite and lignite briquettes
						65 635	-	65 635	4 817	17 813	88 265		050 Coke
						2 369 934		2 369 934	- 9 807	-	2 360 127		071 Crude oil
	40 595	432 573	36 697	28 931	34 230	1 200 591	201 540	1 402 131	- 37 891	1 382 322	2 746 562		073 Petroleum products
		190	190	63 040	36 900	1 000 299	346 017	1 346 316	- 8 211	1 588 149	2 926 254		075 Natural gas
360	-	34	200	11 492	11 354	149 623	44 777	194 400	-	8 978	203 378		097 Electricity
						41 921	-	41 921	-	-	41 921		098 Manufactured gases
				600	500	2 465	1 796	4 261	-	-	4 261		099 Steam
						36 089	-	36 089	-	-	36 089		110 Nuclear energy
						10 946	-	10 946	-	-	10 946		550 Recoveries (Refuse, waste)
360	40 595	432 797	37 087	104 363	83 164	4 985 634	597 703	5 583 337	- 46 285	2 999 987	8 537 039		Total

Table 4 C

Internal consumption by branch

%

	Energy		Agri-culture	Industry		Trans-port (1)	Other ser-vices	House-holds	Total
	Total	of which: trans-forma-tion		Total	of which: trans-forma-tion				
Coal and patent fuels	93,6	93,6	-	1,7	-	0,1	1,4	3,2	100
Lignite and lignite briquettes	-	-	-	-	-	-	100,0	-	100
Coke	-	-	-	99,8	32,7	-	0,2	-	100
Crude oil	100,0	100,0	-	-	-	-	-	-	100
Petroleum products	10,8	3,4	1,1	27,5	-	39,6	6,6	14,4	100
Natural gas	33,6	31,2	3,9	27,0	-	0,2	9,6	25,7	100
Electricity	11,7	-	0,6	45,0	-	2,0	17,7	23,0	100
Manufactured gases	60,2	37,8	-	39,8	-	-	-	-	100
Steam	-	-	-	20,3	-	-	37,6	42,1	100
Nuclear energy	100,0	100,0	-	-	-	-	-	-	100
Refuse and waste	100,0	100,0	-	-	-	-	-	-	100
Total energy	56,8	53,8	1,2	16,5	0,4	10,1	4,7	10,7	100

(1) Professional transport, including bunkers.

Table 4 D

Internal consumption by use

%

	Trans-forma-tion	Space heat-ing	Non ener-gy uses	Sea bunk-ers	Other trans-port (1)	Fish-ing	Net-work losses	Other uses	Total
Coal and patent fuels	93,6	4,6	-	-	-	-	-	1,8	100
Lignite and lignite briquettes	-	100,0	-	-	-	-	-	-	100
Coke	32,7	-	0,5	-	-	-	-	66,8	100
Crude oil	100,0	-	-	-	-	-	-	-	100
Petroleum products	3,4	7,8	15,0	30,9	21,5	0,2	-	21,2	100
Natural gas	31,2	34,4	5,0	-	-	-	1,3	28,1	100
Electricity	-	1,9	-	-	1,9	-	4,5	91,7 (2)	100
Manufactured gases	37,8	-	-	-	-	-	-	62,2	100
Steam	-	79,7	-	-	-	-	-	20,3	100
Nuclear energy	100,0	-	-	-	-	-	-	-	100
Refuse and waste	100,0	-	-	-	-	-	-	-	100
Total energy	54,2	10,5	5,0	7,7	5,4	0,1	0,5	16,6	100

(1) Traction and propulsion.
(2) Of which: 15% lighting and 8% electrolysis.

Table 4 E

Consumption by use in the 'Energy' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Transformation inputs	Network losses	Others	Total
Coal and patent fuels	-	-	-	104 261	-	-	104 261
Lignite and lignite briquettes							-
Coke							-
Crude oil	-	-	-	2 369 934	-	-	2 369 934
Petroleum products	-	-	-	47 652	-	103 540	151 192
Natural gas	-	-	-	420 182	17 258	14 924	452 364
Electricity	-	-	-	-	8 715	14 094	22 809
Manufactured gases	-	-	-	15 831	-	9 424	25 255
Steam							-
Nuclear energy	-	-	-	36 089	-	-	36 089
Refuse and waste	-	-	-	10 946	-	-	10 946
Total	-	-	-	3 004 895	25 973	141 982	3 172 850
%	-	-	-	94,5	1	4,5	100
% (1)	-	-	-	-	15,5	84,5	100

* Codes 031/075 et 097/110.
(1) Excluding transformations.

Table 4 F

Consumption by use in the 'Agriculture' branch* (1)

Terajoules

	Space heating	Transport (2)	Non-energy uses	Fishing	Others (3)	Total
Coal and patent fuels						-
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	-	1 100	200	3 384	10 959	15 643
Natural gas	-	-	-	-	51 915	51 915
Electricity	-	-	-	-	1 192	1 192
Manufactured gases						-
Steam						-
Nuclear energy						-
Total	-	1 100	200	3 384	64 066	68 750
%	-	2	0	5	93	100

* Code 010.
(1) Dwellings are classed with households.
(2) Own account road transport.
(3) Tractors and agricultural machinery, fixed engines, greenhouse heating, drying, etc.

Table 4 G

Consumption by use in the 'Industry' branches*

Terajoules

	Space heading	Transport	Non-energy uses	Transformation inputs	Others	Total
Coal and patent fuels	-	-	-	-	1 921	1 921
Lignite and lignite briquettes						-
Coke	-	-	342	21 491 (2)	43 647	65 480
Crude oil						-
Petroleum products	4 495	19 326	203 589	-	158 622	386 032
Natural gas	18 560	-	67 102	-	277 523	363 185
Electricity	-	-	-	-	87 351	87 351
Manufactured gases	-	-	-	-	16 666	16 666
Steam					865	865
Nuclear energy						-
Total	23 055	19 326	271 033	21 491	586 595	921 500
%	2,5	2,0	29,5	2,0	64,0	100
% (1)	2,6	2,1	30,1	-	65,2	100

* Codes 135/660.
(1) Excluding transformations.
(2) Blast-furnace.

Table 4 H

Consumption by use in the 'Transport' branches*

Terajoules

	Space heating	Transport (Traction)	Non-energy uses	Sea (1) bunkers	Others	Total
Coal and patent fuels	-	-	-	-	117	117
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	-	120 666 (2)	2 410	432 573	-	555 649
Natural gas	3 170	-	-	-	-	3 170
Electricity	-	3 600	-	-	234	3 834
Manufactured gases						-
Steam						-
Nuclear energy						-
Total	3 170	124 266	2 410	432 573	351	562 770
%	0,5	22	0,5	77	0	100

* Codes 611/633.
(1) All flags within the country.
(2) Of which: 41 823 TJ third-party account.

Table 4 I

Consumption by use in the 'Other Services' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	1 552	-	-	-	1 552
Lignite and lignite briquettes	280	-	-	-	280
Coke	-	-	-	155	155
Crude oil					-
Petroleum products	54 004	24 379	1 000	12 692	92 075
Natural gas	119 000	-	-	10 665	129 665
Electricity	-	-	-	34 437	34 437
Manufactured gases					-
Steam	1 600	-	-	-	1 600
Nuclear energy					-
Total	176 436	24 379	1 000	57 949	259 764
%	68	9,5	0	22,5	100

* Codes 095, 580, 720, 860.

Table 4 J

Consumption by use in the 'Households' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels	3 573	-	-	-	3 573
Lignite and lignite briquettes					-
Coke					-
Crude oil					-
Petroleum products	50 783	135 800	3 000 (1)	11 957	201 540
Natural gas	322 000	-	-	24 017	346 017
Electricity	3 787	-	-	40 990	44 777
Manufactured gases					-
Steam	1 796	-	-	-	1 796
Nuclear energy					-
Total	381 939	135 800	3 000	76 964	597 703
%	64	22,5	0,5	13	100

* Code 015.
(1) Lubricants for motor vehicles.

Table 4 K

Bunkers

Terajoules

	Total within the country A + B	Dutch flags within the country A	Foreign flags within the country B	Dutch flags abroad C	Total Dutch flags A + C
Sea					
Gas oil	64 042	28 822	35 220		
Heavy fuel oil	366 120	19 360	346 760		
Lubricants	2 411	444	1 967	(1)	
Total	432 573	48 626	383 947		
Air					
Petrol (aircraft)	352	352	-		
Aviation fuel	36 335	25 856	10 479	(1)	
Lubricants	10	10	-		
Total	36 697	26 218	10 479		

(1) Unknown.

Table 4 L

Road transport

Terajoules

	Petrol	Diesel oil	LPG	Total	%
Households	127 600	-	8 200	135 800	61
Third-party account	-	41 823	-	41 823	19
Own account	25 124	19 681	-	44 805	20
of which: industry	1 860	17 466	-	19 326	(8,7)
commerce and services	22 164	2 215	-	24 379	(11,0)
agriculture	1 100	-	-	1 100	(0,5)
Total	152 724	61 504	8 200	222 428	100,0
%	69	27,5	3,5	100	

DENMARK

Introduction

To construct the energy input-output tables for Denmark, use was made of a great number of statistical surveys and studies, in particular the industrial census, which provided a great wealth of information on the uses of energy. This information enabled many cross-checks to be carried out, so that the construction of the tables may be regarded as sound. These tables give a comprehensive and detailed picture of energy flows, tallying with both the national accounts and the energy balance-sheets.

As regards the presentation of the tables, the following points should be noted.

- The geographical coverage does not include the overseas territories (the Faroe Islands and Greenland).

- The data for the branch 'Steam' are fairly extensive. This branch is more representative in Denmark than in the other countries.

- There are no data for many energy-producing branches, since they do not exist in Denmark, e.g. coal, lignite, coke, natural gas, nuclear fuels (coal and coke are used, however, but they are imported). The tables therefore relate to only eight energy-producing branches.

- Branches 135 and 136 (ECSC and non-ECSC iron and steel products) and branches 137 and 138 (Aluminium and other non-ferrous metals) were combined, owing to their low level of activity in Denmark.

- There are no data for branch 270 (Motor vehicles and engines) because of the total absence of construction and assembly plants in the country.

- Similarly, there are no inland waterways or oil and gas pipelines in Denmark (no data for branches 615 and 617).

- In the air transport sector (branch 633), it was impossible to distinguish national aircraft's consumption from that of foreign aircraft, owing to the international status of the SAS company.

- Contrary to general practice, petroleum bitumens are regarded as being consumed by the chemical industry, which emulsifies and blends them before sending them to the branch 'Building and civil engineering works'.

Analysis

The grand total of resources and uses amounts to 1 391 489 TJ (Tables 5A and 5B). It represents the total activity of the energy-producing branches in Denmark. To obtain net consumption on the national territory (without double counting), transformation inputs, changes in stocks and exports should be deducted, giving a total of 655 220 TJ. This is the figure which will be analysed in detail below.

In contrast to the situation in the other Community countries studied in this document,

the volume of energy transformed (593 791 TJ) is lower than net consumption on the national territory (655 220 TJ). The breakdown of energy transformation is as follows:

Refining of crude petroleum	57%
Thermal power-stations	32%
District heating plants	10%
Gasworks	1%.

Another notable feature is that almost all energy is imported to offset the insignificance of primary production on the national territory. Imports amount to 902 655 TJ, with refined petroleum products accounting for half (see Table 5A). Primary energy production totals only 9 560 TJ, comprising crude petroleum from the North Sea (6 974 TJ), recovery of refuse and waste (2 500 TJ) and hydro-electricity (86 TJ).

Extraction is therefore negligible and transformation in the country covers only less than half of derived energy requirements, the remainder being covered directly by imports of derived energy. The above remarks explain the low level of activity of the energy-producing branches in Denmark.

Of total imports, almost half comprise primary energy, 37% crude petroleum and 12% coal, two-thirds of which is for use in power-stations.

This situation inevitably leads to a substantial imbalance in external trade, energy imports being nine times greater than exports.

Energy demand on the national territory is broken down by consumer branch as follows:

	TJ	%
Households	259 756	39,5
Energy[1]	45 661	7,0
Agriculture	45 293	7,0
Industry	158 880	24,0
Transport[2]	75 435	11,5
Other services	70 195	11,0
Total	655 220	100,0

[1] Excluding transformation inputs.

[2] Including bunkers.

Three features are immediately striking:

- the predominance of households, which constitute the country's main source of energy demand;
- the relatively important part played by agriculture (which accounts for 2-3% of demand in the other countries);
- the relatively low demand from industry.

Half of energy consumption is accounted for by households and services (offices), whose main demand is for space heating. It may be inferred from this that energy consumption in Denmark is particularly sensitive to climatic fluctuations. This conclusion is confirmed by the breakdown of consumption by use.

	TJ	%
Space heating	204 038	31
Transport	133 218	20
Ships' bunkers[1]	26 351	4
Non-energy uses	17 758	3
Network losses	17 049	3
Other uses	256 805	39
Total	655 220	100

[1] All flags within the country, excluding armed forces.

Almost one-third of energy consumption is dependent on the climate and 25% is accounted for by transport, especially inland services. Consumption for non-energy purposes is very moderate, mainly because there is no petrochemical industry. The main uses in this respect are connected with road transport (lubricants and bitumens for road surfacing).

It is interesting to have a look at the transport sector's consumption:

	TJ	%
Road (all vehicles)	96 734	62
Sea (all flags)	26 439[1]	17
Air (all flags)	26 885	17
Railway (rail propulsion)	5 583	4
Total[2]	155 641	100

[1] Including 3 000 TJ for ferries operated by the railways.

[2] Excluding consumption of the navy and air force.

Road transport accounts for by far the biggest proportion. A breakdown is given in Table 5L, which shows the importance of households' private vehicles and own-account transport services (in connection mainly with commercial deliveries, the food industries and building construction).

Consumption by ships' bunkers appears on the low side, considering Denmark's shipping activities. Few foreign ships refuel in Danish ports and Danish ships themselves refuel in other countries on account of the price (see Table 5K). On the other hand, refuelling of aircraft accounts for a fair proportion of consumption, since Copenhagen airport is one of the hubs of northern Europe.

Despite its secondary role, industry accounts for almost a quarter of energy consumption. Its structure differs greatly from that in the other Community countries (see Table 5B on uses). The biggest energy-consuming industry is food (with 23% of the total for industry as a whole). This is obviously due to the development of agriculture, which was mentioned above. There are few heavy energy-consuming industries, apart from cement and plaster works (13% of total industrial consumption). Industry is therefore typified by light industries which have a low specific energy consumption. This explains the breakdown of industrial consumption by use:

Space heating	14,5%
Own-account road transport	7,5%
Non-energy uses	10 %
Manufacturing	68 %
	100 %

A striking feature is the substantial proportion of consumption accounted for by space heating, due to the climate and the preponderance of light industries. The main non-energy use is for bitumen (10 000 TJ), which is processed in the branch 'Chemicals'.

To sum up, the energy flows in Denmark are directed mainly towards satisfying internal final demand (households), which does not give rise to very great intermediate demand (light industries and little energy transformation). The flows draw on three sources of derived energy, namely refined petroleum products, steam and electricity. In turn, these derived forms of energy come from only two primary sources (crude petroleum and coal), which are imported from third countries.

Table 5 A

Resources

Terajoules

	Coal and patent fuels 031	Coke 050	Crude oil 071	Petroleum products 073	Electricity 097	Manufactured gases 098	Steam 099	Recoveries (Refuse, waste) 550	Total
Effective production	-	-	6 974	336 151	90 794	7 600	44 815	2 500	488 834
Transfers		(1) + 2 413			(2) - 22 027	- 2 413	+ 22 027		0
Distributed production	-	2 413	6 974	336 151	68 767	5 187	66 842	2 500	488 834
Imports	109 307	3 251	332 560	(3) 451 835	5 702	-	-	-	902 655
Resources	109 307	5 664	339 534	787 986	74 469	5 187	66 842	2 500	1 391 489

(1) Gas coke.
(2) Heat recovered in thermal power stations.
(3) Not including bunkers abroad.

Table 5 B

Uses matrix.

Terajoules

(1)	031	033	050	071	073	075	097	098	099	110	095	010	135
031 Coal and patent fuels							66 926	3 496	-				
033 Lignite and lignite briquettes													
050 Coke								194					910
071 Crude oil					339 725								
073 Petroleum products					22 160	-	119 757	4 989	56 500	-	34	40 950	3 853
075 Natural gas													
097 Electricity					734		11 881	44	382	-	493	4 257	614
098 Manufactured gases								139					4
099 Steam					6				10 026		16	86	1
110 Nuclear energy													
550 Recoveries (Refuse, waste)									2 500				
Total	-	-	-	-	362 625	-	198 564	8 862	69 408	-	543	45 293	5 382

Terajoules

	360	410	430	450	471	473	490	510	530	550	580	611	613
031 Coal and patent fuels	1 146	28	-	2	2 125	-							
033 Lignite and lignite briquettes													
050 Coke	251	6	11	2									
071 Crude oil													
073 Petroleum products	30 179	3 532	316	3 291	1 682	1 988	1 740	233	11 499	799	16 199	8 864	15 529
075 Natural gas													
097 Electricity	3 644	762	70	1 202	553	657	743	155	720	320	4 820	414	31
098 Manufactured gases	46	6	-	1	-	15	-	10	638	-	112		
099 Steam	1 064	165	23	109	1	385	37	40	352	350	3 916	56	34
110 Nuclear energy													
550 Recoveries (Refuse, waste)													
Total	36 330	4 499	420	4 607	4 361	3 045	2 520	438	13 209	1 469	25 047	9 334	15 594

(1) See definition of the branches in Chapter II (page 13).

Table 5 B

Uses matrix

Terajoules

136	137	138	151	153	155	157	170	190	210	240	270	290	
	.		13 543	2	81	1 083	79	21	3	8	-	1	031 Coal and patent fuels
													033 Lignite and lignite briquettes
	135		9		19	790	20	303	49	1	-	60	050 **Coke**
													071 Crude oil
	474		5 999	3 369	4 696	7 986	22 820	3 725	3 858	1 398	-	2 278	073 Petroleum products
													075 Natural gas
	139		718	297	350	829	2 272	1 099	900	630	-	781	097 Electricity
	35			45	259	12	8	172	4	43	-	32	098 Manufactured gases
	38			19	29	122	314	184	193	210	-	56	099 Steam
													110 Nuclear energy
													550 Recoveries (Refuse, waste)
	821		20 269	3 732	5 434	10 822	25 513	5 504	5 007	2 290	-	3 208	**Total**

Terajoules

615	617	631	633	720	860	Σ	015	Σ	Stocks	Export	Total		
						88 544	2 073	90 617	18 666	24	109 307		031 Coal and patent fuels
													033 Lignite and lignite briquettes
						2 760	714	3 474	158	2 032	5 664		050 **Coke**
						339 725	-	339 725	- 191	0	339 534		071 Crude oil
-	-	23 439	26 955	9 696	16 765	477 552	191 111	668 663	25 087	94 236	787 986		073 Petroleum products
													075 Natural gas
-	-	16	37	3 324	5 518	49 406	22 604	72 010	-	2 459	74 469		097 Electricity
				-	186	1 767	3 420	5 187	-	-	5 187		098 Manufactured gases
		18	41	4 054	5 062	27 007	39 834	66 841	-	-	66 842		099 Steam
													110 Nuclear energy
						2 500	-	2 500			2 500		550 Recoveries (Refuse, waste)
-	-	23 473	27 033	17 074	27 531	989 262	259 756	1 249 018	43 720	98 751	1 391 489		**Total**

Table 5 C

Internal consumption by branch

%

	Energy		Agri-culture	Industry		Trans-port (1)	Other ser-vices	House-holds	Total
	Total	of which: trans-formation		Total	of which: trans-formation				
Coal and patent fuels	77,7	77,7	-	20,0	-	-	-	2,3	100
Lignite and lignite briquettes	-	-	-	-	-	-	-	-	100
Coke	5,6	-	-	73,9	-	-	-	20,5	100
Crude oil	100,0	100,0	-	-	-	-	-	-	100
Petroleum products	30,4	27,1	6,1	17,3	-	11,2	6,4	28,6	100
Natural gas	-	-	-	-	-	-	-	-	100
Electricity	18,1	-	5,9	24,2	-	0,7	19,7	31,4	100
Manufactured gases	2,7	-	-	25,6	-	-	5,8	65,9	100
Steam	15,0	-	0,2	5,5	-	0,2	19,5	95,6	100
Nuclear energy	-	-	-	-	-	-	-	-	100
Refuse and waste	100,0	100,0	-	-	-	-	-	-	100
Total energy	51,2	47,5	3,6	12,7	-	6,1	5,6	20,8	100

(1) Professional transport, including bunkers.

Table 5 D

Internal consumption by use

%

	Trans-formation	Space heat-ing	Non ener-gy uses	Sea bunk-ers	Other trans-port (1)	Fish-ing	Net-work losses	Other uses	Total
Coal and patent fuels	77,7	3,0	-	-	-	-	-	19,3	100
Lignite and lignite briquettes	-	-	-	-	-	-	-	-	100
Coke	-	18,3	-	-	-	-	-	81,7	100
Crude oil	100,0	-	-	-	-	-	-	-	100
Petroleum products	27,1	22,1	2,7	3,9	19,9	1,4	-	22,9	100
Natural gas	-	-	-	-	-	-	-	-	100
Electricity	-	4,0	-	-	-	-	9,7	86,3 (2)	100
Manufactured gases	-	45,9	0,2	-	-	-	-	53,9	100
Steam	-	70,9	-	-	-	-	15,0	14,1	100
Nuclear energy	-	-	-	-	-	-	-	-	100
Refuse and waste	100,0	-	-	-	-	-	-	-	100
Total energy	47,5	16,4	1,4	2,1	10,7	0,7	1,4	19,8	100

(1) Traction and propulsion.
(2) Of which: 15,4% lighting and 1,2% electrolysis.

Table 5 E

Consumption by use in the 'Energy' branch*

Terajoules

	Space heating	Trans-port	Non-energy uses	Trans-formation inputs	Network losses	Others	Total
Coal and patent fuels	-	-	-	70 422	-	-	70 422
Lignite and lignite briquettes							-
Coke	-	-	-	-	-	194	194
Crude oil	-	-	-	339 725	-	-	339 725
Petroleum products	5	81	18	181 151	-	22 152	203 406
Natural gas							-
Electricity	-	-	-	-	7 023	6 018	13 041
Manufactured gases	-	-	-	-	-	139	139
Steam	6	-	-	-	10 026	-	10 032
Nuclear energy							-
Refuse and waste	-	-	-	2 500	-	-	2 500
Total	11	81	18	593 798	17 049	28 503	639 459
%	0	0	0	93	2,5	4,5	100
% (1)	0	0,2	0	-	37,3	62,4	100

* Codes 031/075, 097/110.
(1) Excluding transformations.

Table 5 F

Consumption by use in the 'Agriculture' branch* (1)

Terajoules

	Space heating	Transport	Non-energy uses	Fishing	Others (2)	Total
Coal and patent fuels						-
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	774	-	518	9 221	30 436 (3)	40 950
Natural gas						-
Electricity	-	-	-	-	4 257	4 257
Manufactured gases						-
Steam	27	-	-	-	59	86
Nuclear energy						-
Total	801	-	518	9 221	34 752	45 293
%	2	-	1	20	77	100

* Code 010.
(1) Dwellings are classified with households.
(2) Agricultural work, traction, drying, greenhouse heating, fixed engines, etc.
(3) Tractors and agricultural machinery consume 25 033 TJ.

Table 5.G

Consumption by use in the 'Industry' branches*

Terajoules

	Space heading	Transport	Non-energy uses	Transformation inputs	Others	Total
Coal and patent fuels	1 036	-	-	-	17 086	18 122
Lignite and lignite briquettes						-
Coke	66	-	-	-	2 500	2 566
Crude oil						-
Petroleum products	18 101	12 130	15 425	-	70 059	115 715
Natural gas						-
Electricity	-	-	-	-	17 455	17 455
Manufactured gases	416	-	8	-	906	1 330
Steam	3 638	-	-	-	54	3 692
Nuclear energy						-
Total	23 257	12 130	15 433	-	108 060	158 880
%	14,5	7,5	10	-	68	100

* Codes 135/550.

Table 5 H

Consumption by use in the 'Transport' branches*

Terajoules

	Space heading	Transport (Traction)	Non-energy uses	Sea (1) bunkers	Others	Total
Coal and patent fuels						-
Lignite and lignite briquettes						-
Coke						-
Crude oil						-
Petroleum products	227	47 653 (2)	518	26 351	39	74 788
Natural gas						-
Electricity	-	-	-	-	498	498
Manufactured gases						-
Steam	149	-	-	-	-	149
Nuclear energy						-
Total	376	47 653	518	26 351	537	75 435
%	0	63	1	35	1	100

* Codes 611/633.
(1) All flags within the country (except military consumption).
(2) Of which: 15 195 TJ third-party account road transport

Table 5 I

Consumption by use in the 'Other Services' branches*

Terajoules

	Space heating	Transport	Non-energy uses	Others	Total
Coal and patent fuels					-
Lignite and lignite briquettes					-
Coke					-
Crude oil					-
Petroleum products	20 113	19 863 (1)	335	2 381	42 694
Natural gas					-
Electricity	-	-	-	14 155	14 155
Manufactured gases	186	-	-	112	298
Steam	11 709	-	-	1 339	13 048
Nuclear energy					-
Total	32 008	19 863	335	17 987	70 195
%	46	28	0	26	100

* Codes 095, 580, 720, 860.
(1) Including military consumption.

Table 5 J

Consumption by use in the 'Households' branch*

Terajoules

	Space heating	Transport	Non-energy uses	Others (1)	Total
Coal and patent fuels	1 658	-	-	415	2 073
Lignite and lignite briquettes					-
Coke	571	-	-	143	714
Crude oil					-
Petroleum products	108 829	53 491	936	27 854	191 111
Natural gas					-
Electricity	2 880	-	-	19 724	22 604
Manufactured gases	1 779	-	-	1 641	3 420
Steam	31 868	-	-	7 966	39 834
Nuclear energy					-
Total	147 585	53 491	936	57 743	259 756
%	57	21	0	22	100

* Code 015.
(1) Hot water, cooking, lighting, various household appliances.

Table 5 K

Bunkers (1)

Terajoules

	Total within the country A + B	Danish flags within the country A	Foreign flags within the country B	Danish flags abroad C	Total Danish flags A + C
Sea					
Petrol and LPG	43	43	-	-	43
Gas diesel oil	9 149	3 010	6 139	27 397	30 407
Heavy fuel oil	17 160	3 501	13 659	100 042	103 543
Lubricants	88	88	-	-	88
Total	26 439	6 641 (2)	19 798	127 439	134 080
Air					
Petrol (aircraft)	504	504			
Aviation fuel	26 371	26 371	(3)	(4)	
Lubricants	10	10			
Total	26 885	26 885			

(1) Not including military sea and air bunkers.
(2) Of which 3 000 TJ ferries run by the railways (classed under branch 611).
(3) Included under A (SAS).
(4) Unknown (SAS).

Table 5 L

Road transport

Terajoules

	Petrol	Diesel oil	LPG	Total	%
Households	52 722	420	349	53 491	55,3
Third-party account	2 518	12 066	611	15 195	15,7
Own account	11 531	15 786	731	28 048	29,0
of which: agriculture	-	-	-	-	(-)
energy	44	33	4	81	(0,1)
industry	3 847	8 129	154	12 130	(12,5)
commerce and services	7 640	7 624	573	15 837	(16,4)
Total	66 771	28 272	1 691	96 734	100,0
%	69	29	2	100	

IV - CONCLUSIONS AND COMMUNITY COMPARISONS

The analysis by country in Chapter III has already shown indirectly the structural differences from one country to another. In the present chapter, another aspect of the various structures will be examined (with international comparisons) in conjunction with the main macroeconomic data.

First of all, the overall energy flows are set out in Table 6, which shows the breakdown of energy demand.

- Households' direct demand accounts for about a quarter of the total volume of 'called up' energy. This demand is used to meet the energy requirements of heating, private car travel, cooking, lighting and various household appliances.

- Except in the Netherlands, energy exports do not represent a major element of demand, amounting to around 10%.

- These two flows constitute direct final energy demand.

- The remainder, i.e. approximately two-thirds of total energy, is taken up by intermediate demand,[1] i.e. for the production of non-energy goods and services, which in turn are used to satisfy household and export demand. This flow represents approximately the indirect energy content of goods and services.

- If exports are deducted, the resultant figure represents energy consumption (final and intermediate) on the national territory (approximately 90%).

All these flows were calculated on the basis of net consumption, i.e. excluding energy transformation inputs. To determine the supply of primary energy required, transformation losses (approximately 20%) must be added.

This gives an overall view of the whole energy system, with its direct and indirect flows which are always dependent on final demand (households and exports).

This structure differs somewhat from the traditional layout of energy balance-sheets. However, this is necessary in order to be better able to break down and analyse the energy demand mechanism, relate energy to other goods and services, incorporate energy into the macroeconomic data and finally to produce simulation, extrapolation, forecasting, etc. models.

To take the overall analysis further, net energy consumption on the national territory can be compared with the main economic data: population, GDP, etc. The results are set out in Table 7 below.

Consumption per inhabitant gives an overall idea of energy-related activity, either for direct consumption or for the production of goods and services, a proportion of which is exported. This first figure brings out the basic differences between countries, the causes of which will be outlined throughout the analysis below.

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[1] This demand includes consumption by foreign units (fuel tanks of ships, aircraft, boats and road vehicles).

The ratio between intermediate energy consumption and the number of persons employed shows the energy-intensity of labour, while the ratio per unit of GDP expresses the energy-intensity of the process of production of goods and services.

The high figures for the Netherlands are due mainly to transport activity in connection with international traffic. Deducting the consumption of foreign bunkers in this country, consumption per unit of GDP is similar to that for Italy.

Consumption per km^2 gives an idea of the pollution caused by the use of energy. The very high figure for the Netherlands is reduced somewhat if refuelling is deducted (52 TJ/km^2).

Taking the analysis a step further, Table 8 gives the breakdown of net energy consumption on the national territory by groups of branches. What is immediately striking is the share of industry (and energy demand for manufacturing) in Italy and the FR of Germany, while third-party account transport services are highly developed in the Netherlands, which explains the high levels of specific consumption per person employed and units of value-added (Table 7). Approximately 7-8% of all energy is consumed by energy producers and transformers for the operation of their installations (excluding transformation losses). The lower figure recorded for the Netherlands is due to natural gas, the production and transport of which require little energy.

Without any other comments, Table 8 shows clearly the structural differences from one country to another and the relative importance of the branches which have an influence on energy demand.

Another aspect is shown in Table 9, which gives a breakdown of energy consumption by use (all branches together). This breakdown brings out the effects of climate, a random exogenous variable which gives rise to energy consumption of up to one-third of total demand in the cold countries.

The relatively modest proportion of consumption accounted for by space heating in the Netherlands is due to two factors: the scale of non-energy uses and refuelling, which completely overshadow all the other uses, and the use of natural gas in heavy-duty heating appliances.

The large proportion of 'Other uses' in Italy confirms the high level of industrial concentration in that country.

In France and Denmark, the high proportion (20%) of consumption accounted for by the 'transport' function (private and public) is due to the prolific growth of road transport, which has a high energy consumption in relation to the services provided.

Finally, Table 10 gives a breakdown of consumption by energy source. As this table relates to consumption <u>after</u> transformation, energy sources not used without further processing are not shown (e.g. crude petroleum). This also explains the modest proportion of solid fuels, which are intended primarily for transformation and are then consumed in another form (coke, electricity, manufactured gases and steam). This table confirms the dominance of petroleum products (which represent more than half of energy supplies in all the countries).

Manufactured gases are for the most part by-products connected with coke, which explains the correlation observed between these two energy sources. This table links up with the energy supply side, which is analysed better in the tables of resources and the energy balance-sheets.

This overall picture needs to be looked at in greater depth in order to throw more light on the causes of the structural differences observed. This is the purpose of the following analysis by groups of branches.

Table 6

Energy demand[1]

%

	FR of Germany	France	Italy	Nether-lands	Denmark
1 Households	26,3	28,5	23,5	10,7	34,5
2 Exports	10,6	8,2	11,9	54,0	13,1
1 + 2 Final demand	36,9	36,7	35,4	64,7	47,6
3 Intermediate demand[1]	63,1	63,3	64,6	35,3	52,5
1 + 2 + 3 Total	100	100	100	100	100
1 + 3 Consumption within the country[1]	89,4	91,8	88,1	46,0	87,0

[1] Not including transformations.

Table 7

Net energy consumption within the country

Year 1975	FR of Germany	France	Italy	Nether-lands	Denmark
(a) Total net energy consumption[1] TJ	8 261 202	5 991 584	4 704 075	2 556 951	655 220
(b) Intermediate energy consumption[1] TJ	5 834 882	4 130 151	3 446 905	1 959 248	395 464
(c) Population 1 000	61 829	52 705	55 830	13 666	5 060
(d) Persons employed 1 000	25 266	21 213	19 978	4 656	2 323
(e) Area 1 000 km^2	248,6	544,0	301,3	41,2	43,1
(f) GDP[2] 10^9 ECU	339,0	273,0	154,9	66,8	30,6
a/c Total consumption per 1 000 inhabitants TJ	133,6	113,7	84,3	187,1	129,5
a/d Total consumption per 1 000 employed persons TJ	327	282	235	549	282
b/d Intermediate consumption per 1 000 employed persons TJ	231	195	173	421	170
a/e Consumption per km^2 TJ	33,2	11,0	15,6	62,1	15,2
a/f Total consumption per 000 million/GDP TJ	24 369	21 947	30 368	38 277	21 412
b/f Intermediate consumption per 000 million/GDP TJ	17 212	15 129	22 252	29 330	12 924

[1] Not including entries into transformation.

[2] At market prices.

Table 8

Breakdown of net energy consumption by branch

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Energy[1]	8,3	7,4	8,0	6,5	7,0
Agriculture	1,9	2,6	2,0	3,0	7,0
Industry[1]	42,4	37,8	43,0	35,5	24,0
Third-party account transport	5,5	10,4	10,5	22,0	11,5
Other services	12,5	10,7	10,0	10,0	11,0
Total intermediate consumption	70,6	68,9	73,5	77,0	60,5
Households[2]	29,4	31,1	26,5	23,0	39,5
Total internal uses	100,0	100,0	100,0	100,0	100,0

[1] Not including inputs for transformation, but including network losses.

[2] Includes motor fuels.

Table 9

Breakdown of net energy consumption by use[1]

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Space heating	32,0	25,0	22,0	22,5	31,0
Sea bunkers	1,4	3,0	5,0	17,0	4,0
Other transport (traction)	16,5	19,5	17,0	12,0	20,0
Non-energy uses	6,0	7,0	9,0	13,0	3,0
Network losses	0,8	1,0	1,0	1,0	3,0
Other uses	43,3	44,5	46,0	34,5	39,0
Total	100,0	100,0	100,0	100,0	100,0

%

Space heating	32,0	25,0	22,0	22,5	31,0
of which: industry	5,6	2,7	1,8	0,9	3,6
other services	7,6	6,2	3,7	6,8	4,9
households	17,8	16,1	16,0	14,8	22,5
Other transport	16,5	19,5	17,0	12,0	20,0
of which: industry	2,4	0,5	1,2	0,8	1,8
other services	2,5	2,4	4,1	1,0	3,0
third-party account transport	3,3	7,2	4,9	4,8	7,2
households	8,2	9,3	6,4	5,3	8,0
Other uses	43,3	44,5	46,0	34,5	39,0
of which: industry	28,9	28,3	31,3	22,9	16,5
other services	2,1	2,0	2,2	2,3	2,8
households	3,3	5,7	4,2	3,0	8,8

[1] Not including transformation inputs.

Table 10

Breakdown of net consumption by energy source

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Coal and briquettes	2,8	4,5	0,4	0,3	3,1
Lignite and briquettes (brown coal)	1,4	0,2	0,0	0,0	-
Coke	5,7	3,6	3,1	1,7	0,5
Petroleum products	59,7	66,8	68,4	53,0	74,4
Natural gas	10,6	8,9	14,3	36,2	-
Electricity	13,4	11,3	11,3	7,6	11,0
Manufactured gas	4,4	3,0	2,5	1,0	0,8
Steam	1,9	1,6	-	0,2	10,2
Total	100,0	100,0	100,0	100,0	100,0

ENERGY

These branches comprise energy producers and transformers. Their consumption of energy to operate their installations depends primarily on transformation (coking plants, oil refineries, thermal power-stations, etc.), since the extraction or production of primary energy sources require less energy than their transformation. It takes 10-15 TJ to extract and prepare 1 000 TJ of coal, lignite or natural gas, whereas it takes an average of 50 TJ to convert 1 000 TJ of energy into another form. Specific energy consumption for the extraction and transformation of energy is around 5%, except in the Netherlands on account of natural gas.

These branches have a high energy consumption and a small workforce (between 1 000 and 2 000 TJ per 1 000 persons employed, compared with 200-300 TJ in industry). Similarly, the ratio between own consumption of energy and volume of gross value-added is slightly higher than for industry. The results are fairly uniform, except for the Netherlands on account of natural gas production (small workforce and substantial volume of value-added).

The energy is used almost exclusively for technical purposes (space heating, non-energy uses and own-account transport services being nil or negligible). A breakdown by energy source (Table 12) shows the preponderance of petroleum products (refining), electricity (power-stations' ancillary services) and manufactured gases (produced in coking plants). In general, own consumption accounts for a very substantial proportion, preference being given to consuming energy available on the spot (use of low-grade by-products) rather than buying energy from other producers.

To the figures given in Tables 11 and 12 it might be necessary to add network distribution losses (for electricity and gas), which are obviously a consequence of the activity of these branches.

Table 11

Energy consumption in the energy branches

		FR of Germany	France	Italy	Nether-lands	Denmark
(a) Energy consumption[1]	TJ	613 255	377 837	301 161	141 982	28 612
(b) Production of primary energy	TJ	4 690 289	1 287 414	720 353	2 991 617	7 060
(c) Energy transformation	TJ	8 370 489	6 366 951	5 369 917	3 004 895	593 798
(d) Employed persons	1 000	432	304	186	59	16,4
(e) Gross value-added[2]	mio ECU	18 617	10 598	7 391	5 219	651
a/d Consumption per 1 000 employed people	TJ/ 1 000	1 420	1 243	1 619	2 406	1 745
a/e Consumption per value-added	TJ/ mio ECU	32,9	35,7	40,7	27,2	44,0
a/b+c Specific consumption	%	4,7	4,9	4,9	2,4	4,8

[1] Not including network losses and transformation inputs.

[2] At market prices.

Table 12

Breakdown of consumption in the energy branches by source of energy[1]

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Coal	2,0	0,5	0,1	-	-
Lignite	0,7	0,0	-	-	-
Coke	0,6	0,1	-	-	0,7
Petroleum products	53,2	71,1	73,9	72,9	77,8
Natural gas	3,1	3,4	3,8	10,5	-
Electricity	19,5	13,9	11,5	9,9	21,0
Manufactured gas	17,5	10,0	10,7	6,6	0,5
Steam	3,3	1,0	-	-	-
Total	100,0	100,0	100,0	100,0	100,0

[1] Not including network losses and transformation inputs.

AGRICULTURE

The ratio of energy consumption to gross value-added or person employed shows the intensive nature of farming in Denmark and above all the Netherlands. However, these overall results have to be adjusted by eliminating fisheries and examining the uses of energy. Energy consumption in agriculture (excluding fisheries) per annual labour unit takes account of seasonal and part-time work. This shows the ratio between labour and energy: vast labour force and low degree of mechanization in Italy owing to the scale of permanent crops (vines, fruit trees, etc.), and vice-versa in Denmark and the Netherlands. The uses of energy (Table 14) give rise to further comments. There is a relationship between energy consumption for traction purposes and the area of arable land, ranging from 6 to 11 TJ per 1 000 ha depending on the country. On the other hand, livestock farming and permanent crops consume virtually no energy. Greenhouse heating is not very widespread in France and Denmark but highly developed in the FR of Germany (3 500 ha of land covered and heated) and especially the Netherlands (7 700 ha). Intensive crops under heated shelters consume approximately 6 to 7 TJ per hectare.

Other uses include: fixed engines, lighting, automatic milking machines and drying of harvests, especially hay - the latter being widely practised in the FR of Germany.

In the case of fisheries, it is interesting to compare energy consumption (diesel fuel) for catching fish. The following figures are obtained per 1 000 t of catch:

Denmark	5,2 TJ
Netherlands	9,7 TJ
FR of Germany	20,8 TJ
Italy	25,6 TJ
France	27,2 TJ

Apart from the size of the vessels, the main factor is the distance to the fishing areas.

A breakdown by energy source confirms agriculture's virtually total dependence on petroleum products (approximately 90%), except in the Netherlands where natural gas is used (75%) to heat greenhouses.

Table 13

Energy consumption in agriculture, horticulture and fishing

%

		FR of Germany	France	Italy	Netherlands	Denmark
(a) Total energy consumption	TJ	159 274	156 732	95 726	68 750	45 293
(b) Energy consumption (excluding fishing)	TJ	150 095	134 736	84 830	65 366	36 072
(c) Gross value-added of the branch	mio ECU	9 705	13 768	11 913	3 136	1 735
(d) Gross value-added of agriculture (excluding fishing)[1]	mio ECU	7 877	12 843	11 552	3 040	1 440
(e) Employed persons	1 000	1 812	2 127	3 047	299	228
(f) Units-work-year	1 000	1 234	1 950	2 827	254	177
(g) Agricultural area utilized	1 000 ha	12 399	29 463	16 486	2 086	2 966

Table 13 (continued)

%

		FR of Germany	France	Italy	Nether-lands	Denmark
a/c Energy consumption per value-added	TJ/ mio ECU	16,4	11,4	8,0	21,9	26,1
a/e Per employed person	TJ/ 1 000	87,9	73,7	31,4	229,9	198,7
b/f Per UWY	TJ/1 000	121,6	63,3	27,8	257,3	203,8
b/g Per agricultural area utilized	TJ/ 1 000 ha	12,11	4,57	5,15	31,34	12,16
b/d Per agricultural value-adeed	TJ/ mio ECU	19,1	10,5	7,3	21,5	25,0

[1] At market prices.

Table 14

Breakdown of consumption in agriculture, horticulture and fishery by use of energy

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Space heating	2	-	-	-	2
Road transport[1]	-	4	2,5	2	-
Non-energy uses	3	0	2,0	0	1
Fishing	6	14	11,5	5	20
Agricultural traction[2]	43	63	63,0	13	55
Greenhouse heating	16	6	-	72	9
Other uses	30	13	21,0	8	13
Total	100	100	100,0	100	100

[1] Own-account lorries.

[2] Tractors and agricultural vehicles (harvesters, rotuators, ploughs, grass cutters etc).

INDUSTRY

Energy consumption in industry (including building and civil engineering works) reveals structural differences from one country to another, as can be seen from the figures for total energy consumption per person employed and per unit of value-added. However, these figures must be considered in the light of the various uses of energy in industry (see Table 16). To determine specific consumption for technical purposes (i.e. directly related to manufacturing) consumption for space heating and own-account transport should be deducted. This shows quite clearly the high level of energy consumption per unit of value-added in the Netherlands and Italy, where there is a high concentration of heavy

industry. In the Netherlands, the figure is made even higher by feedstock for chemical synthesis for non-energy purposes. If this is deducted, average consumption works out at about 30,74 TJ per million ECU of value-added, slightly lower than the figure for Italy.

The breakdown by use gives rise to further comments. The proportion of consumption accounted for by space heating is due not only to climate but also to the growth of light industries (textiles, mechanical engineering, food, etc.). Denmark is a typical example of this.

In France, the low proportion of consumption accounted for by own-account transport services is offset by the growth of third-party account transport services, while the opposite is true in Denmark and the FR of Germany. Finally, the high level of non-energy uses in the Netherlands (for chemical synthesis) is particularly noticeable.

A breakdown by energy source (Table 17) casts things in another light. The dominance of petroleum products is confirmed in all the countries. The use of natural gas is obviously dependent on the proximity of the gasfields, while electricity consumption depends on two contrasting factors, namely the scale of electrometallurgy, a highly-concentrated activity, and the development of light industries. Consumption of manufactured gases comprises mainly coke-oven and blast-furnace gases and is therefore linked to the iron and steel industry (FR of Germany, France and Italy).

Another table (No 18) shows the structure of industry by branch (horizontal coefficients). It explains and confirms a number of remarks made previously about the concentration of industry. In the Netherlands, four branches account for 81% of industrial energy consumption. The predominance of certain branches is also apparent:

- chemicals in the Netherlands and Italy;
- food in Denmark;
- building materials in Italy;
- building and civil engineering works in the Netherlands, Denmark and France;
- iron and steel in the FR of Germany and France.

Many other analyses can be made on the basis of this table and each country's matrix of uses.

Table 15

Energy consumption in industry[1]

		FR of Germany	France	Italy	Netherlands	Denmark
(a) Total energy consumption	TJ	3 502 589	2 266 615	2 021 489	900 009	158 880
(b) Of which: for manufacturing[2]	TJ	2 838 169	2 074 840	1 878 687	857 628	123 493
(c) Persons employed	1 000	10 641	7 556	7 375	1 514	681
(d) Gross value-added[3]	mio ECU	137 188	92 235	58 331	19 085	8 748

Table 15 (continued)

	FR of Germany	France	Italy	Nether-lands	Denmark
a/c Energy consumption per persons employed TJ/1 000	329,16	300,00	274,10	594,50	233,30
b/c Energy consumption for manufacturing per persons employed TJ/1 000	266,72	274,60	254,74	566,46	181,34
a/d Consumption per unit of value-added TJ/mio ECU	25,53	24,57	34,66	47,16	18,16
b/d Energy consumption for manufacturing per unit of value-added TJ/mio ECU	20,69	22,50	32,21	44,94	14,12

[1] Excluding transformation and energy-producing branches, but including civil engineering works, building and repair and recovery services.

[2] Including non-energy uses.

[3] At market prices.

Table 16

Breakdown of the consumption[1] of industry by use of energy

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Space heating	13,2	7,1	4,1	2,6	14,5
Road transport[2]	5,8	1,4	3,1	2,0	7,5
Non-energy uses	13,0	16,7	19,6	30,1	10,0
Other uses[3]	68,0	74,8	73,2	65,3	68,0
Total	100,0	100,0	100,0	100,0	100,0

[1] Not including transformation inputs.

[2] Own-account transport.

[3] Ovens, boilers and motive power.

Table 17

Breakdown of the consumption of industry by energy source

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Coal and briquettes	2,1	4,2	0,3	0,2	11,4
Lignite and briquettes	0,6	0,2	0,0	-	-
Coke[1]	11,2	9,2	6,9	4,9	1,6
Petroleum products	48,0	55,4	55,0	42,9	72,8
Natural gas	15,8	11,7	21,5	40,3	-
Electricity	14,9	13,4	13,2	9,7	11,0
Manufactured gas	5,8	5,0	3,0	1,8	0,8
Steam	1,5	0,9	-	0,1	2,3
Total	100,0	100,0	100,0	100,0	100,0

[1] Not including transformation inputs.

Table 18

Breakdown of consumption[1] of energy by industrial branch

Code	Branch	FR of Germany	France	Italy	Nether-lands	Denmark
135	Iron-ore and ECSC iron and steel products	23,2	22,0	16,1	10,7	3,4
136	Non-ECSC iron and steel products	1,0	0,8	1,8		
137	Non-ferrous metal ores; non-ferrous metals except aluminium	1,0	1,7	0,9	2,4	0,5
138	Aluminium	2,1	2,0	0,8		
151	Cement, lime, plaster	6,1	6,7	7,8	1,4	12,8
153	Glass	2,0	2,4	2,8	1,0	2,3
155	Earthenware and ceramic products	2,0	2,0	6,3	2,0	3,4
157	Other minerals and derived products (non-metallic)	1,0	1,5	0,5	0,9	6,8
170	Chemical products	22,8	25,4	31,6	51,5	16,0
190	Metal products	4,3	3,4	2,6	1,3	3,5
210	Agricultural and industrial machinery	2,6	1,5	2,8	0,7	3,2
240	Miscellaneous machines and and electrical goods	3,1	1,5	1,5	1,6	1,4
270	Motor vehicles and engines	2,1	3,0	1,8	0,3	-
290	Other transport equipment	0,3	0,8	0,5	0,6	2,0
360	Food products, beverages, tobacco products	7,4	7,3	6,2	9,0	22,9
410	Textiles and clothing	3,0	2,3	3,7	1,4	2,8
430	Leathers, leather and skin goods, footwear	0,3	0,3	0,4	0,1	0,3
450	Timber and wooden furniture	1,8	1,1	0,3	0,6	2,9
471	Pulp, paper, board	2,3	2,8	3,2	2,8	2,7
473	Paper goods, products of printing	1,2	1,1	0,3	0,6	1,9
490	Rubber and plastic products	1,6	1,4	1,8	0,6	1,6
510	Other manufacturing products	0,1	0,2	0,2	0,2	0,3
530	Building and civil engineering works	7,5	8,3	4,6	9,5	8,3
550	Recovery and repair services	1,0	0,4	0,4	1,0	0,9
	Total industry	100,0	100,0	100,0	100,0	100,0

[1] All uses, except transformations.

TRANSPORT

It is difficult to analyse these branches owing to the dichotomy between the concepts of territoriality and nationality (see Chapter II). Particularly in the case of sea and air transport, refuelling on the national territory is not directly related to the activity of national operators (e.g. value-added). It is therefore preferable to consider only inland transport (rail, road, rivers). Even so, considerable differences are apparent from country to country in energy consumption per person employed or per unit of value-added (Table 19). Account must be taken of the diversity of modes of transport, as can be seen from Table 20. Thus, the high level of energy consumption per person employed in France is due to the predominance of third-party account transport services, while the low level in Italy is due to the very high number of persons employed, especially by the railways. In the Netherlands, energy consumption is overstated, since the consumption of the branch 'Inland waterways services' includes refuelling of foreign vessels on the Rhine (estimated at about 20 000 TJ).

In relation to value-added, energy consumption is moderated as a result of the considerable proportion accounted for by inland waterways and rail transport services in the FR of Germany and rail transport services in Denmark, these being modes of transport which have a modest specific consumption. In contrast, in Italy and above all in France the figures are influenced by the high specific consumption of road transport. In France, third-party account road transport services account for 80% of the energy consumption of inland transport services (72% in Italy).

The above figures refer to commercial transport. It is also interesting to consider private and commercial road transport together. In this context, Table 21 gives the breakdown of the energy consumption of all road vehicles by ownership. Two comments may be made.

Third-party account transport services and industrial own-account transport services are complementary and mutually exclusive: if one sector is developed, the other is underdeveloped (extreme cases: the FR of Germany and France). Adding the two together gives a virtually constant figure (25-30% of the total energy consumption of road transport). These two categories of transport are linked to a country's industrial activity to such an extent that there is a correlation between energy consumption for road transport and the gross value-added of industry.

In all the countries, distributive trades and services account for a substantial proportion of the consumption of the own-account road transport sector, owing mainly to the use of delivery vehicles.

Table 19

Energy consumption by land and inland waterway transport services[1]

		FR of Germany	France	Italy	Nether-lands	Denmark
(a)	Energy consumption TJ	250 019	346 427	197 379	92 886	24 928
(b)	Persons employed 1 000	(800)	628	703	207	67
(c)	Gross value-added[2] mio ECU	8 465	5 182	3 886	1 643	982
a/b	Consumption per person employed TJ/1 000	312	552	281	449	372
a/c	Consumption per unit of value-added TJ/mio ECU	29,54	66,85	50,79	56,53	25,38

[1] Railways, third-party account road transport, pipelines, inland waterways.
[2] At market prices.

Table 20

Breakdown of consumption by method of transport

Terajoules

	FR of Germany	France	Italy	Nether-lands	Denmark
Railways	97 365	51 757	49 811	8 108	9 334
Road (third-party account)	115 756	277 536	141 395	43 823	15 594
Pipelines (oil and gas)	53	8 761	2 540	360	-
Inland waterways	36 845	8 373	3 633 [a]	40 595	-
Total internal transport	250 019	346 427	197 379	92 886	24 928

[a] Includes sea ferries.

Table 21

Sub-breakdown of energy consumption of road vehicles

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Households	57,2	57,0	43,0	61,1	55,3
Third-party account	8,2	28,0	19,7	18,8	15,7
Own-account	34,5	15,0	37,3	20,1	29,0
i.e.: Energy branch	0,4	0,4	0,3	0,0	0,1
Agriculture	-	0,7	0,3	0,5	-
Industry	17,2	3,2	8,1	8,7	12,5
Commerce and Services	16,9	10,7	26,1	11,0	16,4
Other transport [a]	0,0	0,0	2,5 [b]	0,0	0,0
Total	100,0	100,0	100,0	100,0	100,0

[a] Vehicles belonging to airlines etc.

[b] Road vehicles of FS (State railways).

OTHER SERVICES

'Other services' comprise the group of service branches excluding commercial transport, i.e. distributive trades, hotels and restaurants, water distribution services, market services (banking, insurance, posts and telecommunications, transport ancillary services, laundries, leisure services, private health and education services, etc.), and non-market services (government, public hospitals and schooling, armed forces, sanitation services, compulsory social security, fire services, street lighting, etc.).

Energy consumption per person employed in this category differs from one country to another according to the structure of the branches in question. Consumption thus appears

on the low side in Denmark and France as a result of the scale of non-market services (government employs a large number of people, who consume little energy). In Italy, the low level of consumption per person employed is due mainly to the high ratio of personnel to level of activity (as in the case of transport).

Energy consumption per unit of value-added leads to similar conclusions. It is on the low side in Denmark and France because of the scale of non-market services, which consume little energy, whereas the level is higher as a result of the predominance of distributive trades and hotels in Italy and other market services in the Netherlands. All these structural factors can be clearly seen and understood by taking a closer look at the matrix of uses.

A breakdown by use shows that these branches consume energy for three main purposes, namely space heating, lighting and road transport, the latter being directly linked to distributive trades since it involves delivery services. In Italy, the distributive trades branch is highly developed, resulting in a high level of consumption for transport, whereas the opposite is true in the Netherlands (see also each country's road transport tables and Table 21 in the section on transport).

Other uses include: hot water for sanitary purposes, hot water and steam for technical purposes (e.g. laundries), institutional kitchens, fixed appliances, lighting.

Lighting plays a very important part, whether for offices, shops or public roads (the latter in connection with road traffic, for which it represents an indirect form of energy consumption).

Street lighting accounts for an appreciable proportion, generally over 20%, of the electricity consumption of non-market services (branch 860). A breakdown of consumption by energy source shows the comparatively high proportion accounted for by electricity and steam (many office buildings are heated by district heating systems). In this respect, the structure of other services' consumption differs from that of households' consumption.

Table 22

Energy consumption in the 'Other services' branch

		FR of Germany	France	Italy	Nether-lands	Denmark
(a) Energy consumption	TJ	1 032 689	639 400	471 751	259 764	70 195
(b) Employed persons	1 000	11 372	10 528	8 601	2 542	1 304
(c) Gross value added[1]	mio ECU	168 107	184 898	76 098	33 735	17 608
a/b Consumption per 1 000 persons	TJ/ 1 000	90,81	60,73	54,85	102,19	53,83
a/c Consumption per unit of value-added	TJ/ mio ECU	6,14	4,74	6,20	7,70	3,99

[1] At market prices.

Table 23

Breakdown of consumption in the 'Other services' branch by use

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Space heating	61,0	58,0	36,5	68,0	46,0
Transport[1]	20,0	23,0	41,0	9,5	28,0
Non-energy uses	2,0	1,0	1,0	0,0	0,0
Other uses	17,0	18,0	21,5	22,5	26,0
(of which electricity)	(10,2)	(15,6)	(14,6)	(13,3)	(20,2)
Total	100,0	100,0	100,0	100,0	100,0

[1] Includes military consumption.

Table 24

Breakdown of consumption in the 'Other services' branch by energy source

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Solid fuels	7,0	3,8	1,3	0,8	-
Petroleum products	67,2	66,2	79,7	35,4	60,8
Natural gas	8,4	7,8	3,6	49,9	-
Electricity	11,4	15,6	14,8	13,3	20,2
Manufactured gas	2,0	1,6	0,5	-	0,4
Steam	4,0	5,0	-	0,6	18,6
Total	100,0	100,0	100,0	100,0	100,0

HOUSEHOLDS

Households' energy consumption per inhabitant (Table 25) gives an idea of the general level of comfort enjoyed by the population and of the degree of mechanization (size of dwellings, air-conditioning, number of appliances, car travel).

Consumption for heating per dwelling gives an initial idea of the energy requirements determined by climate and the degree of comfort (inside temperature). The calculation per number of rooms in the dwelling and per inhabitant largely obviates the influence of dwelling size and gives a result directly related to the severity of the climate. A comparison with degree-days would provide an even closer and more interesting correlation.

The second most important item after heating is the consumption of motor fuel. The high degree of motorization in France and the FR of Germany is immediately apparent, resulting in a considerable proportion of energy consumption being used for private transport (Table 26). Another aspect is brought out by average consumption per private vehicle,

which shows the use made of vehicles. As a general rule, the greater the number of inhabitants per vehicle, the more the vehicles are used and the greater their consumption. In Italy, the low unit consumption is due to two special features, namely small vehicles of low capacity and very short journeys. In this country, the distance between home and work is short and cars are used less than in other countries. It is in the small, densely-populated countries that the inhabitants use their private cars the most and travel furthest to go to work.

Households' consumption is concentrated on three types of energy, namely petroleum products, natural gas and electricity in that order (petroleum products, steam and electricity in Denmark). Of note is the proportion of consumption accounted for by natural gas in the Netherlands as a result of favourable tariffs.

Households' energy consumption is highest in Denmark and the Netherlands, as can also be clearly seen from the ratio of energy consumption to total household expenditure (TJ per thousand million ECU).

Table 25

Energy consumption of households

		FR of Germany	France	Italy	Nether-lands	Denmark
(a) Energy consumption	TJ	2 426 320	1 861 433	1 257 170	597 703	259 756
(b) of which heating	TJ	1 469 925	966 653	753 328	381 939	147 585
(c) of which motor fuels	TJ	674 612	555 149	299 742	135 800	53 491
(d) Population	1 000	61 829	52 705	55 830	13 666	5 060
(e) Dwellings	1 000	21 030	20 320	18 040	4 360	1 900
(f) Number of rooms	1 000	85 000	71 000	65 700	18 000	6 700
(g) Private cars	1 000	17 898	15 300	15 060	3 495	1 295
(h) Household expenditure	10^9 ECU	205,5	168,3	100,6	38,2	17,05
a/d Consumption per 1 000 inhabitants	TJ	39,24	35,32	22,52	43,74	51,34
b/e Consumption for heating per dwelling	TJ	0,0699	0,0476	0,0417	0,0876	0,0777
b/f Consumption for heating per 1 000 rooms	TJ	17,29	13,61	11,47	21,22	22,03
b/d Consumption for heating per 1 000 inhabitants	TJ	23,77	18,34	13,49	27,95	29,17
c/g Consumption of motor fuels per 1 000 cars	TJ	37,69	36,28	19,90	38,85	41,31
a/h Energy per 10^9 ECU	TJ	11 807	11 060	12 497	15 647	15 235

Table 26

Breakdown of household consumption by energy uses

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Space heating	61	52	60	64	57
Road transport	28	30	24	23	21
Other uses	11	18	16	13	22
Total	100	100	100	100	100

Table 27

Breakdown of household consumption by source of energy

%

	FR of Germany	France	Italy	Nether-lands	Denmark
Coal and briquettes	3,7	7,9	0,4	0,6	0,8
Lignite and briquettes	3,5	0,2	0,0	-	-
Coke	2,1	0,4	0,3	-	0,0
Petroleum products	68,9	70,9	74,9	33,7	73,6
(of which motor fuels)	(27,8)	(29,8)	(23,8)	(22,7)	(20,6)
Natural gas	8,5	10,0	15,0	57,9	-
Electricity	10,4	7,4	7,7	7,5	8,7
Manufactured gas	1,4	1,1	1,7	-	1,3
Steam	1,5	2,1	-	0,3	15,3
Total	100,0	100,0	100,0	100,0	100,0

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Energy balance-sheets based on the input-output tables (1975)

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One of the objects of drawing up input-output tables especially for energy was to improve the quantitative energy balance-sheets. This aspect is treated in the present publication, which exposes and analyses the structural results of the basic year 1975.

The results are presented three ways:

— by product:	10 energy sources
— by branch:	45 user branches, plus households
— by energy use:	space heating transport non-energy uses transformation etc.

Five countries took part in this first study: FR of Germany, France, Italy, Netherlands, Denmark.

All the results in quantities are linked to values in the national accounts, which introduces a new dimension to the energy balance-sheets and enables comparison and extrapolation.

Although the base year 1975 may not seem very recent, it supplies new and previously unpublished results, from which much valuable information can be drawn. This is because it shows a structural aspect which changes slowly in the course of time.

Moreover, these results constitute the basis of an updating for 1980, which is being carried out at the moment.

This is therefore the first of a series of publications centred on the energy input-output tables.

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