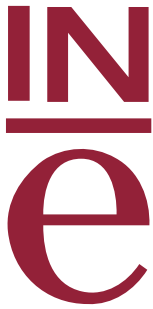


INSTITUTO NACIONAL DE ESTADISTICA



# Energy Accounts in Spain 2006. Pilot study<sup>1</sup>

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<sup>1</sup> A part of the work presented herein, carried out throughout the second half of the year 2010 and the first months of 2011, was performed under a subsidy contract with Eurostat (**NAMEA ENERGY ACCOUNTS. SPAIN GRANT AGREEMENT- 50304.2009.001-2009.253**), whose final report included a partial version of the contents of this document in English.

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# Introduction

The *European Strategy for Environmental Accounting (ESEA-2008)* had the objective of the regular production of a set of environmental accounts, as part of the new chapter of satellite accounts of the European System of Accounts (ESA). To this end, it was necessary to develop a legal basis for the environmental accounts, through the passing of a regulation, of the European Parliament and the Council, regarding environmental economic accounts, thus ensuring that the central statistics offices of the member countries carry out the work on said accounts, for the main purpose of providing standardised data in a given time and of a reasonable quality.

As a first priority, that is, in the short term, it was necessary to compile the environmental protection expenditure accounts, the atmospheric emission accounts, the material flow accounts and the environmental taxes. The second priority was to consider the energy accounts, together with the waste accounts and the environmental goods and services accounts.

In the summer of 2011, Regulation (EU) No. 691/2011, of the European Parliament and the Council, of 6 July 2011, was passed, regarding the European environmental accounts with modules corresponding to the first-priority accounts.

*ESEA-2008* considered developing the Energy Accounts, also known as NAMEA Energy, in the medium term (2011). To begin with, in order to carry out this task, in the year 2009, the Statistics Office of the European Union (Eurostat) sent all member countries a listing of questions whose objective was to identify concepts and prepare methodological norms regarding these accounts.

The questions posed, to be answered via e-mail, were the following:

**1.- For use on a political level, would be the most relevant information contained in the energy accounts?**

Very valuable information may be obtained from the accounts to assess energy intensity/efficiency, the emissions generated by companies while carrying out their activity, the flows of the different energy products in the economy, the energy dependence of the EU, both in production and in consumption, etc.

**2.- How might we define terms such as energy, energy flow, energy stock, energy products, sources of energy, etc.?**

The objective was to analyse the definitions relating to these terms considered in the energy statistics manuals compiled by different organisations (EIG, Eurostat, The United Nations, etc.).

**3.- What types of energy should the corresponding tables be prepared for, and with what priority?**

To begin with, and while this set of questions was being asked, Eurostat proposed to compile tables of energy flows in physical units, suggesting what types of flow to consider (primary energy consumption, net energy consumption, consumption that is relevant to emissions, non-energy consumption) and how to define them.

#### **4.- What classification of energy products should be used?**

Different possibilities were proposed, the list of 60 energy products considered in the international energy statistics (Eurostat, EIG), international statistical classifications of products (CPC, CPA), etc.

#### **5.- What classification of economic activities should be considered in the energy accounts?**

As the energy accounts must be compatible with the data from the National Accounts, the classification managed in the latter would have to be, if possible and as with the remaining environmental accounts, the same as in the ESA-95 Input-Output Accounts (Supply and Use Tables). Said classification corresponds to a two-digit breakdown of the CNAE, that is, to a division level, and with the same final consumption categories.

#### **6.- How do we define and bear in mind the limit between the environment and the economy?**

In fact, the energy flows can occur within the environment (natural energy flows, between the environment and the economy (flows of resources and residual flows) and within the economy (flows of products). Therefore, it is necessary to establish which of all of these flows should be considered, and establish accounting conventions for those cases that are borderline.

#### **7.- What units of measurement should be taken?**

The energy flows may be registered in physical units, according to the characteristics of the energy product (tonnes, cubic metres), as well as in a common energy unit (joules), expressing their energetic value. The transformation from physical units to energy units is made through the corresponding conversion factors related to each product.

#### **8.- Which would be the most important adjustments that would have to be made with regard to the principle of residence?**

In order to follow the principle of residence that is used in the National Accounts, important adjustments will have to be made in the data contained in the energy statistics and balances, since said data implies the principle of territoriality. These adjustments entail estimating and adding, in the energy accounts, the energy production/consumption carried out by the resident units outside of the territory, and estimating and subtracting the production/consumption carried out by the units not resident in the national territory.

Using the responses provided by the countries for this set of questions, a collection and synthesis document was drawn up with the following recommendations:

- Compile energy accounts that are integrated with the economic accounts, due to their political relevance and the added value that they imply.

- Compile flow accounts in physical units (Physical Supply and Use Tables) that are compatible with the monetary flow accounts.
- Coordination with the London Group (of economic accounts) and with the Oslo Group (of energy statistics).
- Reach a consensus on those decisions that, on concept, classification and convention levels, must be made.
- Develop compilation methods (tables).

The process that began this way has continued, up until the publication of the present document, with annual meetings of the Working Group ***NAMEA Energy Accounts***, which Spain is a part of, and in which the proposed recommendations have been developed, with the following objectives:

- 1.- To obtain the set of tables corresponding to the Energy Accounts
- 2.- To compile a manual of Energy Accounts

In order to ascertain the information available regarding energy, for the purpose of preparing the tables relating to the energy accounts, we have studied all of the statistical sources available that provide information, both on production and on consumption, of the different energy products. An almost comprehensive collection has been carried out, analysing the information contained above all in the statistics of the Ministry of Industry, Tourism and Trade (MITYC) and the National Statistics Institute (INE).

The statistics of the Ministry include information, in very detailed questionnaires, which is therefore very complete, on the production and resources of the main energy products, also including the distribution of those products to the different economic sectors.

The statistical operations of the INE provide the information relating to consumption, for a breakdown of the economic sectors (branches and categories of final consumption) that is stronger than that considered in the statistics of the Ministry.

# Pilot Energy Account for Spain 2006

As mentioned previously in the Introduction to the present document, for the first time, Energy Accounts are being compiled in Spain, taking the year 2006 as the reference year. This has been possible, fundamentally due to having a design of the first set of tables established, commented and passed in the first TF "NAMEA Energy Accounts" of Eurostat, held in May of 2010.

The started point adopted has been the energy balances compiled by countries for Eurostat, the International Energy Agency and the United Nations.

the energy balances provided, for each one of the energy products considered, produced and/or consumed by a given country, the value, in physical units, of a series of variables (aggregates). Said variables are as follows:

- Primary production
- Imports
- Exports
- Variation in stock
- Bunkers
- Transformation input
- Transformation output
- Exchanges and transfers, returns
- Consumption by the energy sectors
- Distribution losses
- Consumption of non-energy use
- Consumption by industry
- Consumption by transport
- Consumption by households, services and the Public Administrations
- Statistical differences

The transformation input and transformation output are broken down into nine sections (items):

1. Thermal power stations for public use
2. Thermal power stations for self-producers
3. Nuclear power stations
4. Coal distillation (Patent fuel and briquetting plants)
5. Coke manufacturers
6. Blast furnaces
7. Gas plants
8. Refineries

## 9. Heating plants (District heating plants)

For industry, the consumption of energy products is broken down into ten large groups of sectors. In transport, consumption is specified in transport by rail, transport by road, air transport and domestic navigation. Consumption for international navigation corresponds to bunkers.

Consumption for the rest of the sectors is aggregated, and only household consumption is specified.

With slight differences, the information regarding the energy statistics of Eurostat, as determined in **Regulation (EC) No. 1099/2008 of the European Parliament and of the Council, of 22 October 2008, regarding the statistics on energy** and obtained using questionnaires on energy products, is the same as that located in the balances.

Mainly the compilation of energy accounts consists of the breakdown, for each energy product considered, of the large consumption groups of the balances according to a broader classification of economic activities, following the accounting regulations of the National Accounts, among them being the principle of residence, and bearing in mind the input/output framework. Lastly, and long-consolidated, the countries compile, in monetary terms, the origin/destination tables for an important classification of branches, one being the energy branches.

Regarding the principle of residence to follow in the accounts, its application will entail one of the main difficulties at the time of compiling said accounts regarding everything referring to transport. Both in land transport and in sea transport and air transport, the consumption to be assigned to the corresponding branches must refer to the consumption made by Spanish companies, both within the country and abroad.

On the other hand, it would not be necessary to consider the consumption by those supply branches made by foreign companies within the national territory (inside the country).

Another important difficulty, also related to transport, is derived from the fact that the fuel consumption made to carry out this activity must be assigned in the case of being carried out as a secondary activity, to the main branch of activity. This is different from that considered in the balances in what the consumption of fuel in transport is assigned to the activities corresponding thereto, irregardless of the branch carrying it out.

Subsequently, we will comment, within each product or group of products, on the difficulties encountered, and on which have served as additional sources of information, and the criteria considered to resolve the difficulties.

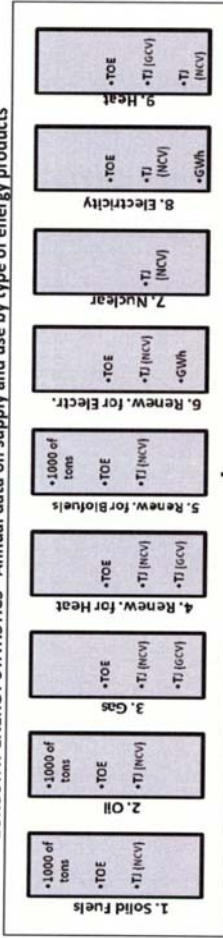
As mentioned previously, in the beginning phase, this has considered the information relating to the energy statistics and to the balances. The follow page offers the structure of said information in two tables that could be called "primary". Said primary tables would correspond to the:

- Gross Use of Energy Products
- Gross Supply of Energy Products



Stage 1

EUROSTAT ENERGY STATISTICS - Annual data on supply and use by type of energy products



Gross use of energy products (primary table) :  
46 use items - Source: Eurostat - Energy Statistics

	STC	EXP	BNK	TRF-4	ETR-1	ENG	DL	NEU	IND	TRP	HHS	SDF
62 energy Commodities (18 subtotals)	A	B	C	D	E	F	G	H	I	J	K	L

- STC : Stock changes
- EXP / IMP : Exports / Imports
- BNK : Bunkers
- TRF-4 / TRF-O (D / P) : Transformation -input / Transformation-Output
- ETR-1 : Ex-changes, transfers, returns
- ENG : Energy sectors consumption
- DL : Distribution losses
- NEU : Non-energy use
- IND : Industry
- TRP : Transport
- HHS : Private households and Services
- SDF : Statistical differences
- PPR : Primary production
- OTS : Other sources

Gross supply of energy products (primary table)  
12 supply items  
Source: Eurostat - Energy Statistics

	PPR	OTS	IMP	TRF-O
62 energy Commodities (18 subtotals)	M	N	O	P

The term "gross" refers to the fact that a dual computation is considered, since a secondary production of energy products is obtained by transformation of a primary energy production.

Using this primary tables, the Environmental Accounts Unit of Eurostat proposed the design of another two tables, also related to the gross consumption and the gross supply of energy products. These are as follows:

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## **T 11 Gross Use of Energy Products**

This table has 44 rows corresponding to the 44 energy products considered (**Annex I**) and as many columns as there are branches of activity considered in the A60+ classification proposed (**Annex II**), plus the final consumption categories (**Annex III**). Out of the final consumption categories from Annex III, the following have been considered:

- Households
- Public Administrations
- Exports
- Exchanges, transfers and returns
  - Transfers between products
  - Products transferred
  - Returns from the petrochemical industry
- Statistical differences

The table must be obtained as the sum of the following tables/matrices (which have the same structure and the same dimensions as the resulting table)

T1 Consumption in transformation / Final consumption  
(Transformation / Final use)

T3 Consumption by the energy sector / Final consumption  
(Energy sector consumption / Final use)

T5 Non-energy consumption / Final consumption  
(Non-energetic use / Final use)

T7 Consumption by industry and services / Final consumption  
(Industry and services / Final use)

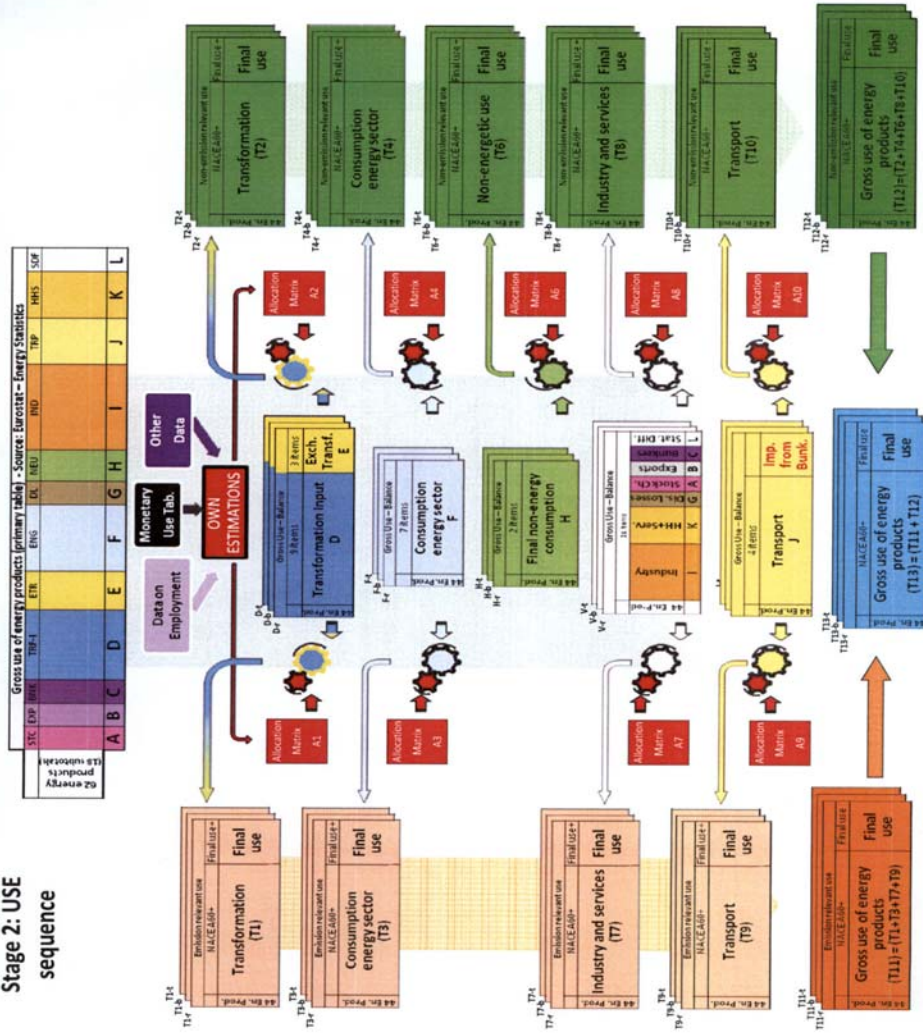
T9 Consumption by Transport / Final consumption  
(Transport / Final use)

These five tables must be obtained from the respective parts of the balances, using the estimates made using additional data sources (surveys conducted in the different sectors, employment data, monetary consumption tables, etc.).

The following page presents the structure of consumption table **T 11**, the tables that comprise it and the origin of each one of them within the balances.

Moreover, for each table integrating table **T11**, three versions are considered, one with the data referring to the principle of territoriality, another with the data referring to the principle of residence and a "bridge" table between the two principles. The right side considers the tables that contain the consumption data that is relevant in the generation of emissions.

Stage 2: USE sequence



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## T17 Gross Supply of Energy Products

This table has 44 rows corresponding to the 44 energy products, and as many columns as there are branches of activity in the A60+ classification, plus the following categories relating to other supplies:

- Imports
- Bunkers
- Variation in stocks
- Other sources

As with consumption table **T11**, the supply table, **T17** must be obtained as the sum of the following tables/matrices (which have the same structure and the same dimensions as the resulting table):

T14 Exit of transformation  
(Transformation)

T15 Primary production  
(Primary production)

These tables must be obtained from the respective items of the balances, assigning the productions, both primary and secondary (exits of transformation), to the respective productive branches of classification A60+.

In addition, the breakdown must be made relating to the production of electricity/heat of self-producers, assigned the electricity/heat part of the branch that produces them as a secondary activity.

The following page presents the structure of the table of energy product supplies, the tables that comprise it and the origin of them within the balances.

As with for the tables regarding consumption, for the supply tables, the three versions are also considered: territoriality, residence and the bridge between the former two.

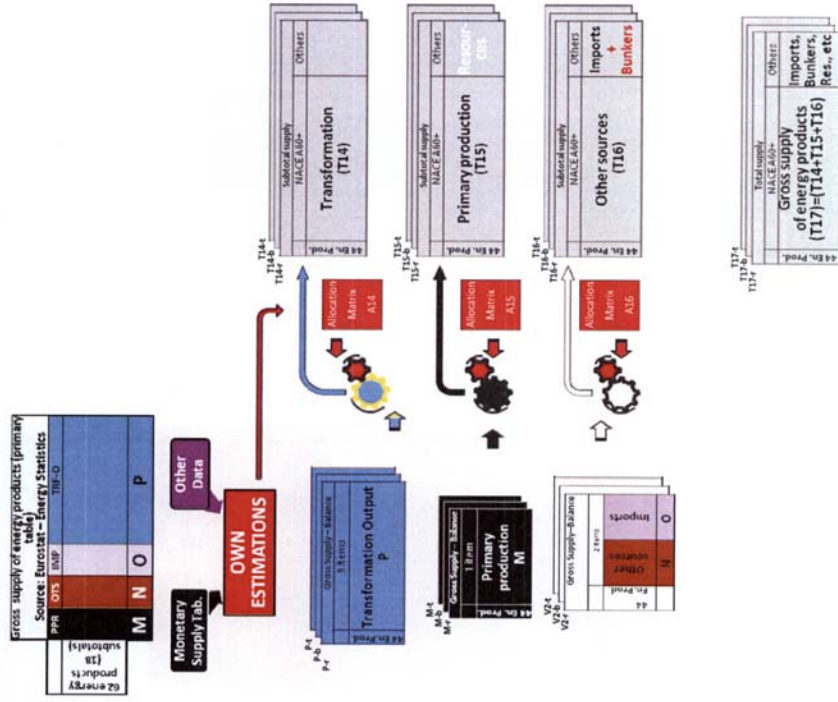
In a subsequent phase, we could obtain a vector relating to the net consumption of energy products, once the calculation of all of the amounts is made to the common energy unit is made, as well as the sum by column, of the vector resulting from table **T11** (Gross consumption of energy products), the vector resulting from table **T14** (Supply/exit of transformation).

In this first pilot exercise, the Energy Accounts of Spain for the year 2006 have been prepared compiling tables **T11 (USE)** and **T17 (SUPPLY)**.

Regarding the dimensions of the tables, they have respected the classifications proposed for energy products and categories proposed for final consumption . Regarding the classification of economic activities, this has considered classification A60+ for those activities related to the industrial sector and to the transport sector. Due to the insufficient information of the statistics regarding the

consumption of fuel in services and by the Public Administrations, for these sectors, we have not considered the breakdown proposed by branch of activity, but rather a more aggregated breakdown.

### Stage 3: SUPPLY sequence



# Energy products

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## Carbons

Of the listing of carbons contained in the list of the 44 energy products to be considered in the accounts (Annex I), in Spain, four are extracted: bituminous coal, anthracite, sub-bituminous coal and brown coal/lignite. In the energy balance, two products are considered: **hard coal**, which encompasses the first three carbons mentioned above, and **lignite**, the brown coal.

The tables relating to the accounts include the four carbons, and another row for the hard coal denomination.

The statistical sources used have been the *Mining Statistics and the Statistics on the Production and Distribution of Electricity* of the Ministry of Industry, Tourism and Trade (MITYC). These sources are those used for preparing the energy balances, and for completing the questionnaires of international organisations (Eurostat, EIG and the United Nations) regarding energy products.

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## BITUMINOUS COAL

All of the domestic production enters, almost in its entirety, as input in the public thermal power plants, and a less part in the self-producer power plants.

The magnitude of the imports is very important, as it is five times the production.

The destination of these resources, production and imports, is mainly their entry in transformation in the public service power plants for the production of electricity. A small part is consumed (used) by thermoelectric power plants in generating electricity, and a minute part is used in generating heat.

The consumption of this carbon by self-producers has been assigned to the main branch of activity using the information provided by the *Electricity Production Statistics*, since the questionnaires of the Statistics collect the consumption of fuel for generating electricity/heat, the sectors to which part of the electricity produced is sold, and the main activity of the generating company.

The industrial sector is the main self-producer, with 67%. Paper manufacturers, the chemical industry and the food sector are the greatest generators, in this same order. 23% is generated by the Public Administrations, and by the services relating to health and education (market and non-market), and 10% by the petroleum refineries within the energy sector.

In addition to the consumption in the generation of electricity, in the transformation sector, there is also a significant amount that is consumed in the coke refineries. The rest of the consumption occurs in the iron and steel industry, the cement industry, the sugar industry and the chemical industry.



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#### SUB-BITUMINOUS COAL

All domestic production enters as input into the public thermal power plants. There are no imports.

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#### ANTHRACITE

Practically all domestic production enters as input in the public thermal power plants. The imports are minimal. There is a small consumption by households.

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#### BROWN LIGNITE

All domestic production enters as input in public-use thermal power plants for the production of electricity. There are no imports.

There is only one extraction company for this carbon in Spain, in Galicia, and therefore, the Statistics does not give a production assessment.

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### **Coke, Coke-oven gas and Blast-furnace gas**

The information corresponding to these three energy products considered in the balances is from the *Statistics on the Manufacture of Coquable Paste, Coke-ovens and Blast-Furnace Gas*.

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#### HARD COKE

This denomination encompasses metallurgic coke, melting coke and coke powder. The Statistics for each one of these products provides the production, the variation in stock, the exports, the consumption as fuel with in the coke ovens (self-consumption) and the consumption by the rest of the industrial sectors (58%). Within the latter, 94% is consumed by the iron and steel industry. Blast furnaces consume part of this coke, metallurgic coke, as fuel, and part is consumed in transformation, producing blast-furnace gases. The meltings and ferroalloys consume a large percentage of the melting coke and coke powder. The melting of non-ferrous metals, food (sugar industries) and the chemical industry consume the rest.

The amount of imports is insignificant.

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#### COKE-OVEN GAS

Coke-oven gas includes battery gas and residual gas. This is a product of coke ovens and its production is consumed in transformation in the public-use electrical power plants, and to a greater extent, in the power plants of self-

producers. There is consumption within the coke ovens, in coke batteries, with the main destination being the integral iron and steel industry. There is also minimal, non-energy, use of this product in the chemical industry. The consumption by self-producers for the production of electricity has been assigned to the power plants of the chemical industry, and part to the electrical power plants of the refineries.

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#### BLAST-FURNACE GAS

This is a product of blast furnaces, using half of its production in transformation, in the electrical power plants for public use. The rest, for the most part, is consumed by the integral iron and steel industry, and part is consumed by coke batteries. There is also a small, non-energy use assigned to the iron and steel industry.

The data provided by the Statistics of the MITYC is in Nm<sup>3</sup>, and in the accounts, as with in the energy balances, it is in Terajoules. The conversion to Terajoules has been carried out using the lower heat power.

The two gases, coke-oven gas and blast-furnace gas, have a product code within division 40, and specifically in group 40.2 of CNAE-93 (gas production). However, the production of coke gas and blast-furnace gas have been assigned, respectively, to energy branches 23.1 and 27.1 (18 and 24, respectively, of classification A60+).

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#### GAS WORKS GAS

As with the previous two gases, gas works gas or manufactured gas has a code in group 40.2 of CNAE-93. And in this case, its production is assigned to branch 40.2 (37 in classification A60+). It is obtained through the manipulation of petroleum. Prior to the year 2005, it was also produced using natural gas.

Its production, and above all, its consumption, have increasingly lost importance over time, and are currently practically replaced by natural gas.

In the reference year under consideration, two-thirds of the production has been consumed by households. The remaining third has been consumed by market and non-market services, and by the Public Administrations.

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### Crude oil

The Mining Statistics provide the data on the petroleum extracted in Spain that corresponds to a minimum amount. All of the petroleum that is processed in the nine refineries existing in Spain is imported.

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## Raw materials for refineries

The amounts that enter for transformation in refineries correspond to imports, to products transferred, and in a small part, to returns of the petrochemical industry.

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## Finished refinery products

This has considered those finished petroleum refinery products that are included in the list of the 44 energy products in the accounts. In addition to the products considered in the energy balances, the following are also included:

- White spirit SBP
- Lubricants
- Bitumen
- Oil coke

This set of products from the accounts, with regard to the finished refinery products from the Eurostat questionnaire, contain the main products, according to the amount of the different variables considered in said questionnaire.

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## REFINERY GAS

The only data to consider for this product are the production in the refinery and its use as fuel therein (self-consumption). Its use is therefore consumption by an energy branch, that of the refinery, and it has been considered in the accounts, though this should not compute the consumption of those products made within the same unit in which they are produced.

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## LPG

The information on the liquid petroleum gases (LPG), mainly butane and propane, used in the energy balances and in the questionnaires, is provided by the *Statistics on Petroleum Refineries*, in all that relating to the production, variation in stocks, imports, consumption inside the refineries (self-consumption) and transfers. The *Statistics on the Gas Industries (on Production and Distribution)* obtained from the companies that store and distribute gas, both by weight and packaged, provide the supply to the domestic market with energy purposes for a distribution of sectors that is equal to that considered in natural gas and electricity. Said Statistics provide a greater breakdown by sector, branch of activity, than that considered in the energy balances of the consumption of LPG, above all with regard to the industrial sectors. They also provide a breakdown of the grouping considered in the balance, specifying the

consumption of the Public Administrations, accommodation and trade and services (market and non-market).

Three-quarters of the production distributed, that produced and the part imported are consumed by households. The rest is diversified in the branches of the industrial and services sectors, with the consumption in the chemical industry being of particular note. Within transport, there is small consumption assigned to road transport.

There is also a small consumption in the transformation in gas plants.

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#### KEROSENE, JET FUELS

All of the production of the refineries, together with the imports, is consumed by the branch of air transport. The transfers of products are important, being half of the production of the refineries, and with a negative sign.

The consumption consigned in the energy balances in air transport corresponds to the supply, in Spain, of airplanes from Spanish and foreign companies. In order to comply with the principle of residence to follow in the energy accounts (as with in the rest of the economic accounts), we must deduct, from said consumption, that relating to foreign airplanes, and that amount must be accounted for as an export. On the other hand, in the consumption to be consigned in the branch of air transport, we must add the supply, in foreign airports, of the airplanes from Spanish companies (in the USE table), and that same amount must be consigned, for the accounting balance, in the SUPPLY table, within the imports.

The consumption of kerosene in physical amounts, by Spanish companies, has been estimated using the data in the value provided by the *Annual Services Survey (ASS)*. Said survey distinguishes between that consumption made in Spain and that which is made in other countries (of the E.U. and in third-party countries). The physical amounts have been obtained by dividing that consumption by the price of the kerosene.

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#### NAPHTHA

There is a small production, of an amount similar to the transfers between products (with a positive sign), with twice the exports that are likewise doubled by the imports. The consumption of NAPHTHA almost in its entirety is used in the petrochemical industry as a raw material, that is, it is a non-energy consumption for a non-energy branch.

A minimal part of the consumption enters in transformation, as energy consumption, in the gas plants (branch 40.2).

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## MOTOR SPIRIT

This denomination encompasses motor gasoline (petrol) of different octane and with or without lead. According to the data contained in the energy balance, a significant part of the production is exported, 35% in fact, and the rest is used as fuel in road transport. Part of that consumption is carried out by those branches of activity for which transport is a secondary activity, whether from the industrial sector or from services. Unlike the energy balances, in which all of the consumption is made in transport as a main activity or secondary activity assigned to the transport sector; in the energy accounts, the consumption of fuels in transport is assigned to the branch of main activity that is carried out as a secondary activity.

The amounts assigned to the energy and industrial sectors, and their breakdown into the different branches of activity, have been estimated using the data on the consumption as a value provided by the *Energy Consumption Survey (ECS)* of the INE, and using the prices of gasoline during the reference year. Unlike the *Industrial Company Survey*, which includes a joint valuation of the consumption of fuels, the ECS collects, as a value, the consumption by the industrial sectors, whether energy or non-energy, of the most important refinery products that are used as fuel.

Regarding the rest of the sectors, this provides the consumption by the transport carried out by companies as a main activity, and is practically entirely consumed by road transport. Consumption is assigned, without breaking it down into the corresponding branches, for the Public Administrations and services. As may be observed in the Appendix, which contains the listing of the data sources, the *Services Survey* does not provide, even as a value, the consumption of fuels of the different sections researched, with the exception of those activities relating to transport for that item of data is collected in special modules, though without discriminating by type of fuel.

The *Road Freight Transport Survey* of the Ministry of Development does not collect any information on the consumption of fuels, though it does gather the CNAE code of the main activity of the companies in the event that they carry out the transport activity as a secondary activity.

Using the data from the *Household Budget Survey*, we have estimated the household consumption of gasoline, as we have estimated that of the diesel automotive fuels. The HBS collects, as an amount and as a value, family expenditure on fuels and lubricants.

On the other hand, and with regard to the principle of residence, the consumption data for road transport, and which has been broken down and assigned to the different economic sectors, corresponds to the amount of gasoline distributed in the national territory (country), and therefore consumed by resident and non-resident units. Facing the lack of additional sources of information, above all with regard to the consumption made in Spain by non-resident units, the corresponding estimates have not been made for the adaptation of the data to this principle.

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## RESIDUAL FUEL OIL

This denomination includes the BIA fuel oil, refinery fuel oil, other fuel for marine use and other fuel oils.

In the Eurostat questionnaire on petroleum products (which is also sent to the EIG and to UNECE), the data relating to the variables considered is also provided for another classification of fuel oils: those with a high sulphur content and those with a low sulphur content (according to whether said content is less than or greater than 1%).

A very significant amount of the production, together with the imports, is earmarked for the bunkers. The bunkers (bunkers from international boats), according to the definition in Regulation 1099/2008, regarding the statistics on energy, are those amounts of fuel supplied to ships under any flag dedicated to international navigation. In the energy accounts, to calculate the consumption to be assigned to sea transport applying the principle of residence, it is necessary to subtract, from the amount corresponding to the bunkers, the part corresponding to the supply made in Spain by those ships under foreign flags or of foreign nationalities. Likewise, that supply, that same amount, must be assigned, so as to attain accounting balance, to the exports. In turn, we must consider, within the consumption of this product within the branch of sea transport, the supply in foreign ports made by Spanish ships, at the same time that the amount corresponding to said supply is consigned in the imports. The corresponding estimates have been made jointly with those carried out for sea gas oil, as the *Annual Services Survey (ASS)* provides, as a value, the total consumption of fuel in sea transport for ships from Spanish companies, distinguishing between purchases according to whether they have been made in Spain or in other countries. We have managed the consumption of these two fuels used (fuel oil and diesel fuel) in the calculation of the emissions and prices thereof in 2006.

In the case of domestic navigation, we have assumed that the data contained in the balance, and also in the questionnaire, practically corresponds to the consumption made by Spanish ships.

Regarding the remaining destinations, and as per transformation, there is a consumption of fuel oil in the generation of electricity by the power plants for public use, and a smaller part in the co-generation of electricity and heat by self-producers, and which has been assigned to the branch of their main activity for each one of these two products, though fundamentally electricity, using the information provided by the electricity statistics.

With regard to the consumption of fuel oil as a fuel, in the energy branches, there is consumption in refineries (self-consumption), a small part in households and in services, both in Private and in Public Administrations, and a quarter in the industrial sector. The breakdown of this last consumption in the branches considered in the accounts has been carried out using the consumption structure obtained by using the data from the ECS of the INE.

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## GAS/DIESEL OIL

From the listing of products obtained in the petroleum refineries, under the gas/diesel oil denomination, we find the following:

- Bio diesel
- Mixed bio diesel
- Diesel for marine use
- Diesel A
- Diesel A10 PPM
- Diesel B
- Diesel C
- Diesel for marine use
- Other diesel

The Eurostat questionnaire of energy products provides the information on the variables considered for the following breakdown:

- Transport diesel
- Bio diesel
- Heating and other gas oil

All of the resources relating to **transport diesel**, the production, the transfers between productions (which are double the former) and the imports, are used as fuel in road transport, and they are assigned to this sector in the energy balance. In the energy accounts, it is necessary to estimate and break down into its corresponding branches, the part consumed of that fuel that the industrial sector (energy and non-energy) and services earmark for transport and that they carry out as a secondary activity. We must also estimate the part intended for the Public Administrations and for households.

As for the industrial sector, transport diesel fuel has been treated the same way as transport gasoline (petrol). Using the prices and the consumption, as a value, of this product by the industrial sectors, provided by the ECS of the INE, we have obtained the breakdown of the corresponding branches. A joint estimation is provided for services (market and non-market).

Continuing with the products from this section, bio diesel barely has any numerical significance in the year that we are considering.

The third group of products, that relating to heating fuels (gas oil C), to gas oils for maritime use and other gas oils, has a significant production in refineries, with imports also being important (half of the amount produced). The consumption of these gas oils is very diverse, depending on the type of product considered. One part enters into transformation for the production of electricity in the power plants for public use, and also in generation plants of self-producers.

Consumption by the industrial sector has been broken down for the classification of branches considered, applying the structure obtained from the data of the ECS of the INE for this product to the consumption of the groups of the sectors contained in the Eurostat questionnaire.

The consumption of gas oils in the third group assigned to households and to agriculture is that consigned in the questionnaire. Also obtained from this source is the consumption in both market and non-market services.

Regarding the gas oil for maritime use, its consumption within the transport sector occurs, to a small extent, in that transport relating to domestic navigation, with the rest taking place in bunkers in international waters. Following the principle of residence, the amount to be assigned to the branch relating to maritime (sea) transport must be obtained by subtracting, from the bunker data, the part corresponding to the supply of ships sailing under foreign flags, and adding the supply of Spanish ships abroad. The part relating to the supply of foreign ships must be consigned in the exports, and the part of the supply of Spanish ships abroad must be considered within the imports. The sources of data used to make the corresponding estimates are those listed in the fuel oil section.

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#### WHITE SPIRIT

There is a small production that, together with imports of a similar amount, is consumed by part of the industrial sector for non-energy use.

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#### LUBRICANTS

Production is in small amounts, as are imports. Its consumption, which is non-energy consumption, is carried out in transport, for the most part in road transport (a minimal part is consumed in maritime transport), and in the industrial sector in its main activities, and also in those related to transport. There is also household consumption.

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#### BITUMEN

All of the production, together with the imports, minus a minimal part that is exported, is consumed in construction. It is a non-energy consumption by this branch (branch 45).

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#### PETROLEUM COKE

Practically all of the production, and the imports that are four times the former, are consumed as fuel by the industrial sector. There is a part of non-energy



consumption by this sector. Another small part enters into transformation for the production of electricity in power plants for public use.

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## Other petroleum products

This denomination encompasses those finished petroleum refinery products not specified in the listing of the 44 products considered in the energy accounts. Among them, we find asphalt products, solvents and paraffin.

The production of this set of products is divided between an energy consumption by the refineries (which use it as fuel) and a non-energy consumption on being used as a raw material by the petrochemical industry.

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## Natural gas

As with crude oil, almost the entirety of the natural gas consumed is imported. 44% enters into transformation for the production of electricity, 6% is consumed by the energy sector, and the remaining 48% is consumed by the rest of the sectors, mainly the industrial sector. 2% has non-energy use in the chemical industry.

The amounts of natural gas used in the thermal power plants for the production of electricity, both in the power plants for public use and in those for use by self-producers, are provided by *the Statistics on the Production and Distribution of Natural Gas* of the MITYC. This information is also available in the *Statistics on the Production of Electricity* of the MITYC. Within the production of electricity by power plants of self-producers, 70% thereof is generated using natural gas.

The consumption of natural gas by self-producer has been assigned to the main branch of activity using the information provided by the *Statistics on the Production of Electricity*, since the questionnaires for these statistics collect the consumption of fuels for the generation of electricity/heat, the sectors to which part of that electricity is sold and the main activity of the generating company.

*The Natural Gas Statistics* provide the consumption, in physical amounts, of the sectors which the distributing companies supply, with a sufficient breakdown level with regard to the non-energy industrial sectors. Total consumption is given for the latter. In order to make the breakdown of the consumption of the energy branches considered in the accounts, as well as for some breakdowns in industrial sectors, we have considered the consumption structure obtained using the data, as a value, from the *Annual Industrial Companies Survey (AICS)*. This survey provides the gas consumption, in monetary terms, to three digits of the CNAE.

For the remaining sectors, the gas statistics specify the consumption in construction, in rail transport, in road transport and for other transport companies, in accommodation, in trade and in services (joint consumption), in the Administration and public services and in households. Using additional

information, above all that contained, as a value, within the input/output framework in the "Production and distribution of gas" branch, we have estimated the consumption of natural gas by the main consuming branches related to services, whether market or non-market.

For the specific case of transport, we have considered the data regarding consumption, as a value, obtained in the *Annual Services Survey* of the INE, using the information gathered in the modules relating to land transport (rail, metropolitan, city and inter-city passenger transport and road freight transport), domestic sea transport, air transport and postal transport. Said consumption is related, in part, to fuels, and in part, to the joint consumption of electricity and gas used as a means of propulsion.

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## **Electricity (Electrical energy)**

In the year 2006, 57% of the production of electrical energy came from thermal power plants, 23% from nuclear power plants, 11% from hydroelectric origin, and 9% aeolic origin. Electrical energy of solar origin was scarcely significant. 88% was produced in installations whose main activity was the production of electrical energy, and 12% was obtained by self-producers.

In the energy balance, in the column relating to electricity, and within the transformation exits, we have the production of the thermal power plants and the nuclear power plants, which are assigned in the accounts of the branch of electrical energy. The production, also in thermal power plants, of the self-producers is assigned to the branch of main activity producing it, as the consumption of fuels for the production of said electricity is also assigned to said branches.

The Statistics of the MITYC regarding self-producers provide the main activity of those self-producers and the economic activity of the companies to which they supply the part of electrical energy that they sell.

Regarding production, the statistics differentiate gross and net production, ascertaining self-consumption by the difference. According to the rules to be following in compiling the economic accounts, for this self-consumption, we should not compute, in the energy accounts, that which is carried out within the same unit that produces it.

The electricity of a hydraulic origin and aeolic electrical energy each have their own columns in the energy balance, and which include the (primary) production and the transfers of products for the same amount as the production, and with a negative sign. In the electricity column, these transfers appear with a positive sign, thus dividing this production by consumption sector, together with the production of other origins.

The production of electricity of a hydraulic origin appears in SUPPLY, and within the matrix relating to primary production, in the cell corresponding to the Hydro Power product and to branch 40.1. The production of electricity of an aeolic

origin appears in SUPPLY, in the matrix relating to primary production, in the cell corresponding to the Wind Energy product and to branch 40.1. The amount of said production appears in USE, and within the final consumption categories, in the cell of the transfers with Hydro Power and Wind Energy products, respectively.

USE distributes the entire production of electricity, including that of hydraulic and aeolic origin, in the different sectors in their respective tables/matrices. The amount of the sum of these two production items is assigned within the final consumption categories of electricity to the cell relating to the transfers between products.

Regarding the distribution by branch, the *Statistics on the Electrical Energy Industry* of the MITYC provides the supplies, both of the power plants for public service and of the self-producers, to all of the economic sectors, with the sufficient breakdown, above all with regard to the industrial branches, whether energy or non-energy. For services, this collects the data from the set of "*trade and services*", specifying only the consumption in accommodation. It also provides the data relating to the whole of the "Administration and public services" and to households.

In order to estimate the consumption of electrical energy by those branches for which the statistics supply aggregated data that includes other branches, we have used the *Industrial Companies Survey* of the INE, which includes, as a value, consumption of electrical energy for a breakdown of activity to three digits of the CNAE.

In transport, the Statistics of the MITYC specifies that consumption made by the rail system, and provides a global consumption for the other types of transport. A breakdown of that consumption for land transport has been made, without distinguishing between road transport and pipeline transport, transport by boat (sea and inland) and air transport.

For trade and services, this consider the global data provided by the Statistics of the Ministry, breaking it down into the corresponding branches, using the information contained, as a value, in the destination table of the input/output framework in the "Production and distribution of electricity" branch.

The consumption computed in household also comes from the Statistics of the MITYC.

With regard to HEAT, no production of heat derived from co-generation is registered in the energy balances or in the product questionnaires.

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## Solar heat

Two-thirds of solar heat is produced and consumed by households, with practically the remaining third produced and consumed by services and the Public Administrations. A minimal part is consumed by industry and by agriculture.

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## **Geothermal heat**

During the reference year of the accounts, there was barely a small production/consumption of this energy, and it was carried out by the agricultural sector.

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## **Wood and wood waste (Biomass)**

The production there of has been assigned to "other sources" in the SUPPLY table. The consumption is distributed between the entry into transformation for the production of electricity, mainly by self-producers, among household and by industry. The distribution in the different industrial branches of classification A60+ has been carried out using the data from the *Energy Consumption Survey* of the INE, which gathers the value of the consumption of this energy material.

## Annex I. Listing of energy products

P44	Código		PRODUCTOS	Energía primaria = p Productos secundarios = s	(i) flujo natural/materia prima (ii) Productos	Código CPA
1	2111	Hard coal	TRES CARBONES	p	(ii)	10.1
2	2112	Bituminous coal	HULLA	s	(ii)	10.2/3
3	2115	Patent fuels	AGLOMERADOS	p	(ii)	10.1
4	2116	Anthracite	ANTRACITA	p	(ii)	23.1
5	2117	Coking coal		p	(ii)	10.x
6	2118	Sub-bitum. Coal	HULLA SUBBITUMINOSA	p	(ii)	10.x
7	2121	Hard coke	COQUE	s	(ii)	23.1
8	2211	Black lignite		p	(ii)	10.2
9	2212	Brown coal (lignite)	LIGNITO PARDO	s	(ii)	10.2
10	2220	Brown coal coke		s	(ii)	23.1
11	2230	Brown coal briquettes		p	(ii)	10.2/3
12	2310	Peat		p	(ii)	10.3
13	3110	Crude oil	CRUDO DE PETRÓLEO	s	(ii)	11
14	3190	Feedstocks	MATERIAS PRIMAS REFIN.	s	(ii)	24
15	3210	Refinery gas	GAS DE REFINERÍA	s	(ii)	23.2
16	3220	LPG	GLP	s	(ii)	23.2
17	3230	Motor spirit	GASOLINAS	s	(ii)	23.2
18	3240	Kerosenes-Jet fuels	QUEROSENOS	s	(ii)	23.2
19	3250	Naphta	NAFTA	s	(ii)	23.2
20	3260	Gas/Diesel oil	GASÓLEOS	s	(ii)	23.2
21	3270	Residual fuel oil	FUELOLEOS	s	(ii)	23.2
22	3281	White and industrial spirit	WHITE SPIRIT	s	(ii)	23.2
23	3282	Lubricants	LUBRICANTES	s	(ii)	23.2
24	3283	Bitumen	BETÚN	s	(ii)	23.2
25	3285	Petroleum coke	COQUE DE PETRÓLEO	s	(ii)	23.2
26	3290	Other petroleum products	OTROS PRODC. PETROL.	s	(ii)	23.2
27	4100	Natural gas	GAS NATURAL	p	(ii)	11.1
28	4210	Coke-oven gas	GAS DE COQUERÍA	s	(ii)	40.2
29	4220	Blast furnace gas	GAS DE ALTO HORNO	s	(ii)	40.2
30	4230	Gasworks gas	GAS MANUFACT.	s	(ii)	40.2
31	5100	Nuclear energy	ENERGÍA NUCLEAR	p o s ???	?	23.3
32	5200	Derived heat		s	(ii)	40.3
33	5510	Hydro power	ENERGÍA HIDRÁULICA	p	(i)	n.a.
34	5520	Wind energy	ENERGÍA EÓLICA	p	(i)	n.a.
35	5532	Solar heat	CALOR SOLAR	p	(i)	n.a.
36	5534	Photovoltaic power		p	(i)	n.a.
37	5541	Wood and wood waste	MADERA Y RESIDUOS	p	(ii)	02
38	5542	Biogas	BIOGÁS	s	(ii)	40.2
39	5543	MSW		p ???	(ii)	90.1
40	5546	Biogasoline	BIOGASOLINA	s	(ii)	24
41	5547	Biodiesel	BIODIÉSEL	s	(ii)	24
42	5550	Geothermal energy	ENERGÍA GEOTERMAL	p	(i)	n.a.
43	6000	Electrical energy	ENERGÍA ELÉCTRICA	s	(ii)	40.1
44	7100	Industrial waste	RESIDUOS INDUSTRIALES	p ???	(ii)	90.1

## Annex II. Classification of economic activities (CNAE rev. 1.1: A60+)

A60+	A60	CNAE	Rev. 1	Industrias
1	1	1		Agricultura, ganadería y caza
2	2	2		Silvicultura y explotación forestal
3	3	5		Pesca y acuicultura
	4	10		Extracción de antracita, hulla, lignito y turba
4			10.1	Extracción y aglomeración de antracita y hulla
5			10.2/3	Extracción y aglomeración de lignito y turba
6	5	11		Extracción de crudos de petróleo, gas natural, uranio y torio
7	6	12		Extracción de crudos de petróleo, gas natural, uranio y torio
8	7	13		Extracción de minerales metálicos
9	8	14		Extracción de minerales no metálicos
10	9	15		Industria de productos alimenticios y bebidas
11	10	16		Industria del tabaco
12	11	17		Industria textil
13	12	18		Industria de la confección y de la peletería
14	13	19		Industria de la confección y de la peletería
15	14	20		Industria de la madera y el corcho
16	15	21		Industria del papel
17	16	22		Edición, artes gráficas y reproducción de soportes grabados
	17	23		Coquerías, refino de petróleo y tratamiento de combustibles nucleares
18			23.1	Coquerías
19			23.2	Refino de petróleo
20			23.3	Tratamiento de combustibles nucleares
21	18	24		Industria química
22	19	25		Industria de la transformación del caucho y materias plásticas
23	20	26		Fabricación de otros productos minerales no metálicos
	21	27		Metalurgia
24			27.1-3	Fabricación de productos básicos de hierro y acero
25			27.4-5	Producción y primera transformación de metales preciosos y metales no ferreos
26	22	28		Fabricación de productos metálicos
27	23	29		Maquinaria y equipo mecánico
28	24	30		Máquinas de oficina y equipos informáticos
29	25	31		Fabricación de maquinaria y material eléctrico
30	26	32		Fabricación de material electrónico
31	27	33		Instrumentos médico-quirúrgicos y de precisión
32	28	34		Fabricación de vehículos de motor y remolques
33	29	35		Fabricación de otro material de transporte
34	30	36		Muebles y otras industrias manufactureras
35	31	37		Reciclaje
	32	40		Producción y distribución de energía eléctrica y gas
36			40.1	Producción y distribución de electricidad
37			40.2	Producción y distribución de gas
38			40.3	Producción y distribución de vapor y agua caliente
39	33	41		Captación, depuración y distribución de agua
40	34	45		Construcción
41	35	50		Venta y reparación de vehículos de motor; comercio al por menor de combustible para automoción
42	36	51		Comercio al por mayor e intermediarios
43	37	52		Comercio al por menor; reparación de efectos personales
44	38	55		Hostelería
	39	60		Transporte terrestre; transporte por tubería
45			60.1	Transporte por ferrocarril
46			60.2	Otros tipos de transporte terrestre
47			60.3	Transporte por tubería
	40	61		Transporte marítimo, de cabotaje y por vías de navegación interiores
48			61.1	Transporte marítimo
49			61.2	Transporte por vías de navegación interiores
50	41	62		Transporte aéreo y espacial
51	42	63		Actividades anexas a los transportes; actividades de agencias de viajes
52	43	64		Correos y telecomunicaciones
53	44	65		Intermediación financiera
54	45	66		Seguros y planes de pensiones
55	46	67		Actividades auxiliares de la intermediación financiera
56	47	70		Actividades inmobiliarias
57	48	71		Alquiler de maquinaria y enseres domésticos
58	49	72		Actividades informáticas
59	50	73		Investigación y desarrollo
60	51	74		Otras actividades empresariales
61	52	75		Administración pública
62	53	80		Educación
63	54	85		Actividades sanitarias y veterinarias; servicios sociales
64	55	90		Actividades de saneamiento público
65	56	91		Actividades asociativas
66	57	92		Actividades recreativas, culturales y deportivas
67	58	93		Actividades diversas de servicios personales
68	59	95		Hogares que emplean personal doméstico
69	60	99		Servicios proporcionados por organismos extraterritoriales

### Annex III. Classification of Final Consumption Categories

Eurostat Proposal	Final consumption categories
1	Final consumption expenditure
2	Household expenditure
3	Expenditure of non-profit institutions serving households (NPISH)
4	Expenditure of the Public Administrations
5	Gross capital formation
6	Gross formation of fixed capital
7	Changes in value
8	Changes in stock
9	FOB Exports
10	FOB exports within the EU
11	FOB exports to member countries of the Euro zone
12	FOB exports to member countries outside of the Euro zone
13	FOB exports outside of the EU
14	Losses in distribution, aimed at the environment
15	Exchanges, transfers and returns
16	Transfers between products
17	Products transferred
18	Returns to the petrochemical industry
19	Statistical differences
20	The environment