EAP Manual

Wilting, H.C.; Benders, R.M.J.; Kok, R.; Biesiot, W.; Moll, H.C.

E A P

Energy Analysis Program

Manual

Version 3.5

H.C. Wilting
R.M.J. Benders
R. Kok
W. Biesiot
H.C. Moll

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CONTENTS

1 INTRODUCTION

Households use energy directly for all kinds of applications, such as heating, lighting and driving. In addition, households use energy in an indirect way. This indirect use of energy concerns, for example, the energy used to manufacture consumption goods, to gather the raw materials for these goods, to transport these goods, or to provide services. Energy is used in each stage of the life cycle (from the gathering of the raw materials right up until the waste processing of the item) of an item of consumptive expenditure (a purchased good or a provided service) in a household.

The total energy use (both direct and indirect) can be calculated for each item of consumptive expenditure. This energy use covers the energy required for production and disposal of the purchased item, summed up over its whole life cycle and is expressed in primary energy. If the life-cycle energy use for each purchased product is known, the total energy requirements for a complete domestic consumption package can be calculated. Thus, via the energy requirements of domestic consumption patterns, the total energy use in an economy - on both production and consumption - can be investigated. This approach enables investigations on the combined effect, on total energy use, of improvements in energy efficiency in the production sectors on the one hand, and shifts in consumption patterns on the other. Such studies can furnish possible clues for reducing total energy use in an economy.

In the Netherlands, within the 'Energiegebruik en huishoudelijke consumptie' project[1], a method was developed to determine the total energy use of an item of consumptive expenditure. Since the method contains elements of process analysis as well as of input-output analysis, the method is referred to as 'hybrid'. In the method developed, the energy use in the various stages is calculated by means of a step-by-step scheme.

In order to streamline the use of the hybrid method by various researchers and to harmonise its application, it was translated into a computer program: the Energy Analysis Program EAP. The first version of EAP was developed in the context of the 'Energie intensiteit van levensstijlen' project[2]. This project was commissioned by the Ministry of Housing, Spatial Planning and the Environment, and was executed under the auspices of the NOVEM[3] (. Researchers from ECN[4], NW&S and IVEM calculated the total energy use of more than 350 items of consumptive expenditure. To enable the use of the same data by users, the program has a database with a large quantity of energy data.

In the framework of the 'Perspectief' project[5], commissioned by the Ministry of Housing, Spatial Planning and the Environment, and carried out under the auspices of CEA[6], the energy use of many variants on items of consumptive expenditure was calculated. For this project, several extensions to the first EAP version were made. Furthermore, acknowledging the research on lifestyle taking place in the context of the 'Global Air Pollution and Climate Changes' National Research Programme, the CO_2 emission as a consequence of using fossil energy carriers was also included in the EAP. This led to a second EAP version.

For the so-called 'Greenhouse' Project, which was a follow-on study to the lifestyle research and which was

1 This project (about energy use and domestic consumption) was commissioned by the Netherlands Ministry of Housing, Spatial Planning and the Environment (Energy Department), and was executed by NW&S (University of Utrecht) and IVEM (University of Groningen).

2 Energy intensity of life styles project sponsered by the Netherlands Ministry of Housing, Spatial Planning and the Environment [Schmidt and Postma, 1999]

3 NOVEM, Nederlandse onderneming voor energie en Milieu, Sittard (Netherlands Agency for Energy and the Environment)

4 ECN, Energie Centrum Nederland, Petten (Netherlands Energy Research Foundation)

5 Perspective project

6 CEA, Communicatie En Adviesbureau voor energie en milieu (Consultants on Energy and the Environment, Rotterdam)

also funded by the 'Global Air Pollution and Climate Changes' National Research Programme, EAP was further extended with the capacity to determine the emissions of two other important greenhouse gases, CH_4 and N_2O. Moreover, EAP was made compatible with the Windows operating system. In 2000 the data files of the EAP software were updated to the year 1996 [Kok, 2001].

The structure of this manual is as follows. Chapter 2 presents a description of the hybrid method. Chapter 3 contains instructions on how to operate the computer program. Chapter 4 demonstrates the analysis of items of consumptive expenditure by means of an example. Appendix A explains the installation procedure and provides an overview of the files on the EAP diskette. Appendix B describes the data that are included in the database. Appendix C gives a summary of the menu structure of EAP. Finally, Appendix D Explains how to create a new database with basic data.

2 THE METHOD

This chapter describes the method that is implemented in the EAP computer program to calculate the direct and indirect energy use of an item of consumptive expenditure. There are, in principle, two methods to calculate the total life-cycle use of an item of consumptive expenditure: process analysis and input-output analysis. Process analysis makes use of a description, in physical terms, of the processes involved in the production cycle of the consumptive expenditure under consideration [IFIAS, 1974; Boustead and Hancock, 1979]. The energy use in the processes is investigated in a detailed manner. Accordingly, process analysis is quite precise but also rather labour intensive. Input-output analysis uses so-called input-output tables in which the transactions between economic sectors are expressed in monetary terms. One of the result of energy input-output analysis is the cumulative energy intensity of a sector. This intensity depicts the amount of direct and indirect primary energy that a sector needs per financial unit worth of supplies [Wilting, 1996). Input-output analysis is less accurate than process analysis, but it provides the opportunity to calculate complete cycles.

The method that is described here makes use of a hybrid approach, for a comprehensive justification, consult see Van Engelenburg [Engelenburg *et al*., 1991, 1994]. The components of production cycles that are important in terms of energy use are measured by means of process analysis. The rest of the cycle is completely calculated by means of input-output analysis. A proposal to develop a hybrid approach was expressed before [Bullard *et al*., 1978).

2.1 Description of the method

The method can be used to determine the life-cycle energy use during the entire life cycle of an item of consumptive expenditure. The method has been streamlined into a step-by-step scheme. The eleven steps are:

First step: the cycle flow chart
First, the life cycle of the item of consumptive expenditure has to be established. In the flow chart, all activities that are expected to contribute reasonably to the total energy use are separately recorded. Figure 2.1 shows an example of a flow chart for the life cycle of a product.

In the manufacturing stages, when dealing with non-capital goods, a distinction is made between basic goods and residual goods. Basic goods are raw materials that are used in production whose nature and size are known. Residual goods are raw materials whose precise nature or size is unknown[7]. The residual goods also include products and services that are indirectly used in production, such as office requisites and maintenance of the premises.

Second step: the mass balance
In this step, an inventory is made of the basic goods used for production. As mentioned, basic goods concern raw materials and any other materials both for the product and for packing. Basic goods can be registered in a mass balance. Particularly when the composition of an item of consumptive expenditure can be analysed in terms of materials, it is possible to check whether the weight of the basic goods reasonably conforms to the total weight of the item of consumptive expenditure. For example, the weight of a refrigerator is determined by the combined weight of the materials present in it. Correspondingly, the mass balance can also be used to control the waste analysis. A check can be made to examine whether or not all basic goods are included in the waste processing.

Third step: the financial balance

7 The residual goods also include materials whose energy content is not known (see the fourth step for a definition of ‘energy content’).

Certain components of production cycles cannot be expressed in physical units. To determine the energy use of these components, the method makes use of financial units. A price is given to all components of the cycle, on the basis of the consumer price of the item of consumptive expenditure. Taking the margins of the relevant trade or service sectors into consideration, the selling price from the manufacturer can be fixed. This selling price is made up as follows:

- purchase price of the basic goods (see step 2)
- purchase price of energy
- depreciation
- nett added value
- purchase price of residual goods (residual costs)

In the next steps, the appropriate energy use is ascribed to the various components.

Fourth step: determining the energy use of basic goods and packaging materials
In the second step, the quantities of basic goods and materials that are used in the production of an item of consumptive expenditure are established. The energy that is necessary for the production of these basic goods is represented by the energy content of these basic goods (in MJ per kilo). The energy content of a material, also referred to as the GER value[8], is the total amount of energy required to generate one kilogram of that material, taken from the raw materials to the final production of the material. For each of the basic goods in the mass balance, the energy use is calculated by multiplying the quantity by the energy content. The total energy use of the basic goods is obtained by summing up over all the basic goods in the mass balance.

Fifth step: determining the energy use of the residual goods
The value of the residual goods is established in step 3. This value is multiplied by the energy intensity of the residual goods (MJ per guilder) in order to ascertain the energy use of the residual goods. The energy intensity of the residual goods is calculated from input-output analysis on the basis of the deliveries to the producing sector. In this calculation, a correction is made for those goods that are regarded as basic goods. [Wilting, 1996] describes the method for calculating the energy intensity of residual goods (see also appendix 2.a at the end of this chapter).

Sixth step: determining the energy use of capital goods
Energy is also necessary for the creation of the capital goods that are required to ensure production (buildings, machines, etc.). The energy use for the capital goods is determined via the energy intensity of the depreciation on the capital goods (MJ per financial unit). This energy intensity is determined by means of input-output analysis. The value of the depreciation is calculated at the financial balance (step 3).

Seventh step: determining the direct energy use during production
In the manufacturing sector, direct energy is applied to produce the item of consumptive expenditure. The amount can be established by means of process analysis. If this cannot be ascertained, use can be made of production statistics or of the direct energy intensity of the manufacturing sector (MJ per manufactured financial unit).

Eighth step: determining the energy use of transport and trade
The route from the manufacturer to the consumer normally takes place via a number of steps: transport and one or more intermediary organisations (trade, catering, repair firms, etc.). The energy use of these organisations must also be established. In the case of transport, the weight of the item of consumptive expenditure and the distance travelled by each means of transport are taken into consideration. By using energy intensities for each means of transport (MJ per tonne per km), the total energy use of the transport is calculated. Furthermore, the intermediary organisations (wholesale, retail trade, catering, etc.) use energy to deliver the item of consumptive expenditure to the consumer. In the financial balance (step 3), the margins for the various intermediary organisations are determined. By multiplying these margins by the respective energy

8 Gross Energy Requirement (IFIAS, 1974)

intensities (MJ per financial unit of margin), the total energy use for the intermediary organisations can be calculated.

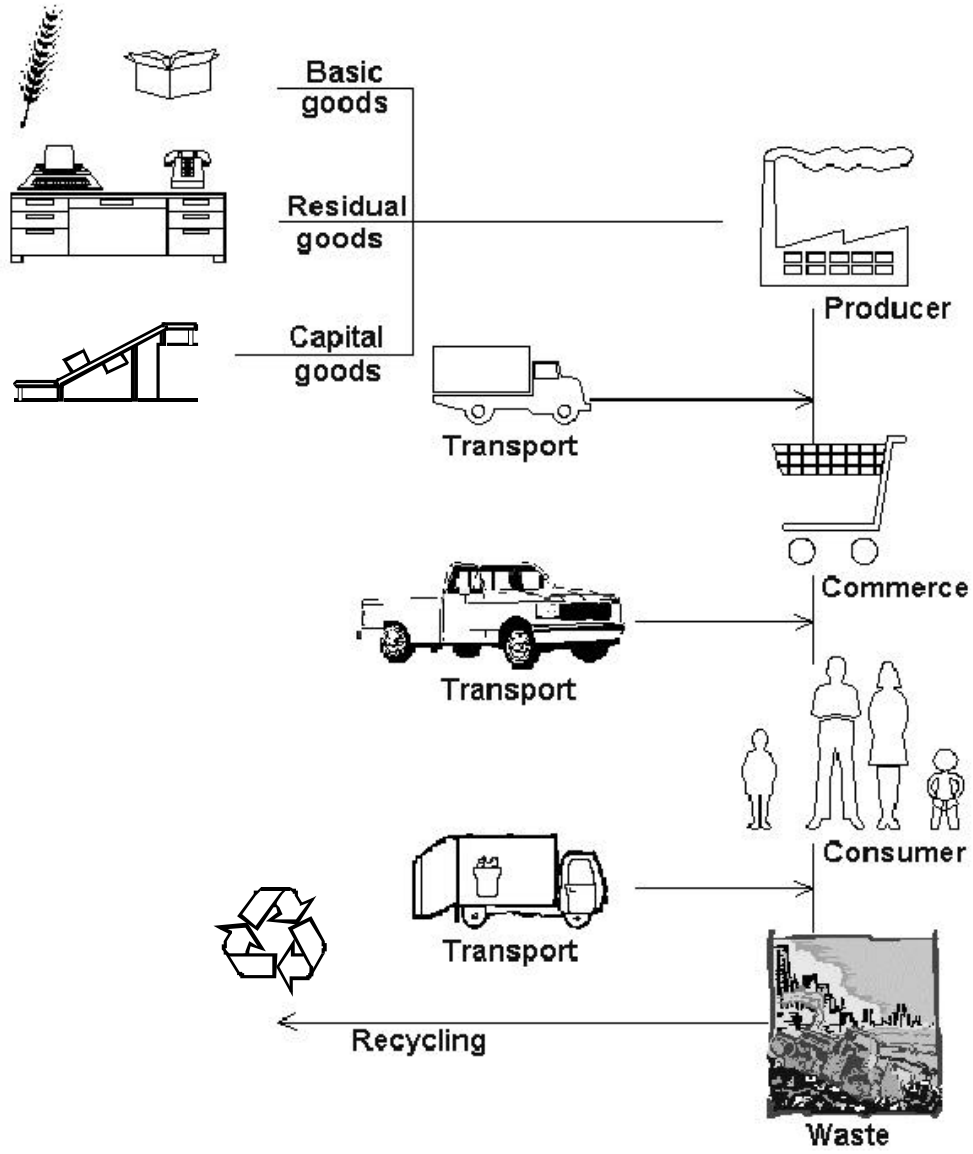

Figure 2.1: The product life cycle.

Ninth step: determining energy use during domestic usage
Some items of consumptive expenditure also use energy during their active working life in the household. A refrigerator uses electricity, a cooker uses gas, a car uses petrol and oil, etc. The total domestic energy use is determined via the use per unit and the economic life span of the item. The term 'unit' can refer to a unit of time (year, month, etc.) or also to a laundry session or a meal.

Tenth step: determining the energy use of waste processing
During and after the domestic use of the item of consumptive expenditure, garbage is created. The processing of this waste costs energy (collecting, dumping, etc.), but may also produce energy (burning, recycling). For the separate components of the item of consumptive expenditure, it is necessary to examine how the waste processing takes place. The quantities are multiplied by the energy use (positive or negative) per type of waste processing (MJ per kilograms).

Eleventh step: determining the total energy use
The total energy use during the entire life span of the item of consumptive expenditure can be determined by adding up all the figures for energy use obtained in the previous steps. To show this, the energy use in the various steps can be entered into the flow chart of the cycle (Figure 2.1).

2.2 Remarks concerning the method

We have discussed a method to calculate the life cycle energy use of an item of consumptive expenditure. The method can be applied to most items, without any difficulty. However, the method appears to be less applicable to some items of consumptive expenditure, particularly those in the services sector. In such cases, an *ad hoc* method would seem to be required to determine the energy use.

It should be noted that in composing the financial balance, sector data are applied to an item of consumptive expenditure. This may lead to errors, since values for an average product from a sector will not be valid for all products from that sector.

In the formulation of the mass balance (step 2), the weight of the basic goods does not have to be equal to the weight of the item of consumptive expenditure (including packing) in all cases. For a refrigerator, the total weight will correspond, within reasonable limits, to the weight of the materials used. However, to make a kilo of sugar, almost eight kilos of sugar beet are necessary. The same point applies to the processing of waste.

In the method, the manufacturer's price is determined by means of the consumer price and the margins of the Trade and Services sectors. Since probably not all transport costs are included in these margins, the manufacturer's price can be too highly estimated. Therefore, it is advisable to compare the manufacturer's price that has been established in this way with the price recorded in the production statistics of the CBS (Centraal Bureau voor de Statistiek, Statistics Netherlands) where possible. Taking into consideration the fact that a part of the margins may concern transport costs, a double counting may occur in the energy use of transport. We assume, however, that the transport costs share is very small, and that any double counting will therefore be negligible in comparison to the whole.

The method discussed was initially developed to calculate the total energy use of an item of consumptive expenditure. Of course, the emissions of greenhouse gases can also be calculated in about the same way.

Appendix 2.a Calculation of energy intensities of residual goods

In the calculation of the energy requirements of an item of consumptive expenditure, the hybrid method discriminates between basic goods and residual goods. Together, both types of goods constitute the inputs required in the production stage of that consumption item. Process analysis determines the energy requirements of the basic goods. The energy requirements of residual goods are determined by the contribution of the monetary value of the residual goods in the financial balance of the consumption item and by the energy intensity of the residual goods of the production sector. The contribution of the residual goods in the financial balance of the product is a remainder. This remainder is the price of the product decreased by both the purchase costs of the basic goods, inclusive energy, and the gross value added. The energy intensity of the residual goods is a result of input-output analysis. The method for calculating this energy intensity is described by Wilting [Wilting, 1996].

Starting point in input-output analysis is the so-called technological matrix, which reflects the direct inputs of economic sectors that are required for the production of one financial unit of sector output. Such a technological matrix can be easily derived from an input-output table of a country. The method for calculating the energy intensity of residual goods uses the Leontief inverse matrix $B = (I-A)^{-1}$ in which I is the unit matrix and A the technological matrix. The Leontief inverse matrix reflects both direct and indirect inputs of economic sectors. E.g., column j of the Leontief inverse matrix contains the cumulative production of each sector, so that sector j is able to produce one financial unit of final demand.

The residual goods concern all inputs exclusive basic goods. The energy intensity of the residual goods is the energy requirement of the residual goods divided by the value of these goods. In case there are no basic goods, the energy intensity of the residual goods is determined by dividing the indirect energy requirements of a sector by the total value of the direct deliveries to the sector:

$$e_j^r = \frac{(e_j - d_j)\, X_j}{? _i\, X_{ij}} = \frac{(? _i\, d_i\, B_{ij} - d_j)\, X_j}{? _i\, X_{ij}} \qquad (1)$$

with:

	e_j^r	=	energy intensity residual goods of sector j
	e_j	=	total energy intensity of sector j
	d_j	=	direct energy intensity of sector j
	X_j	=	total production of sector j
	X_{ij}	=	intermediate delivery from sector i to sector j
	B_{ij}	=	cumulative production of sector i per financial unit output from sector j

In case the hybrid method characterises some inputs as basic goods, the calculation of the energy intensity of residual goods is more complicated. Then, both the numerator and denominator in formula (1) have to be corrected for these basic goods. This correction is carried out by setting the deliveries of sectors which deliver basic goods to zero [Van Engelenburg, 1991]. Then, both the energy requirements of the deliveries to sector j and the value of these deliveries exclude basic goods.

In case sector k is a basic goods sector and sector j the production sector, element B_{kj}, which contains the direct and indirect deliveries from sector k to j, has to be set to zero. All deliveries from the basic goods sector k, both directly and indirectly, needed for the production of sector j are ignored in this way. In order to take into account the financial deliveries concerning the basic goods, the denominator in formula (1) has to depict the deliveries to the production sector minus the deliveries of basic goods. This can be done by taking the ratio of all elements in column j of the Leontief inverse matrix and the elements exclusive the basic goods sectors. The formula for the calculation of the energy intensity of residual goods for sector j becomes:

$$e_j^r = \frac{X_j \left(\sum_i d_i B_{ij}^0 - d_j \right)}{\sum_i X_{ij}} \frac{\sum_i B_{ij} - 1}{\sum_i B_{ij}^0 - 1} \qquad (2)$$

with: $B_{ij}^0 = 0$ in case i is a basic goods sector; $i \neq j$
$B_{ij}^0 = 1$ in case i is a basic goods sector; $i = j$
$B_{ij}^0 = B_{ij}$ in case i is not a basic goods sector

For sector j, element B_{jj} also contains the delivery of one unit of final demand from sector j. For that reason, formula (1) contains a correction of -1 in the right terms.

3 THE COMPUTER PROGRAM

The previous chapter described a method to determine the life-cycle energy use and CO_2, CH_4, and N_2O emissions of an item of consumptive expenditure. To simplify and streamline the method, it has been implemented into a computer program: the Energy Analysis Program or, in short, EAP. The EAP user is guided through the method by means of screens in which data have to be entered. The presence of a data bank ensures that the same basic data are always used.

EAP consists of two components. On the one hand, there is a part to perform and manage energy and CO_2, CH_4 and N_2O analyses. Besides, there is a part to manage the files with basic data that are necessary for the analyses.

The installation of the program is outlined in Appendix A.
After clicking on the icon to open EAP, the main menu appears containing the options: *File, Data files, Analyses, Settings* and *Window*. Behind these options there is an extensive menu structure whose operation corresponds to that of other Windows programs. Appendix C gives an overview of the menu structure of EAP. This chapter discusses the options and the submenus, in the order of sequence that they appear on the screen.

3.1 File

This menu provides the opportunity to create new analyses, modify existing analyses or delete analyses.

New analysis
With this option, a name is assigned to a new analysis. This name consists of a unique code of eight characters at the most, which can be chosen by the user.
After the allocation of this code, this name appears in the EAP program bar at the top of the screen, so that it is clear which analysis EAP is currently working with. The data for this new analysis are subsequently entered via the *Analyses* option (see 3.3).

Modify analysis
This option is used to open existing analyses. Clicking on the option activates a screen displaying existing analyses. When a particular analysis has been chosen, its code appears in the EAP program bar at the top of the screen. The analysis is further processed via the *Analyses* option (see 3.3).

Delete analysis
This option enables a user to delete analyses.

Directories
This option concerns the management of analyses files. It is possible to create new directories, in which a new (sub)set of analyses can be stored, or delete them. It is also possible to copy or move one or more analyses from one subdirectory to another. The conversion from analyses from previous EAP versions can also be done here.

Exit
This option closes the EAP program.

3.2 Data files

This option enables the management of the data in the data bank. New data can be entered, and data that are already present in the data bank can be consulted, altered and even removed.
The data in the data bank cover both energy use and CO_2, CH_4 and N_2O emissions.
The data bank comprises seven basic data files, which are discussed below.

Basic goods
This file contains data on basic materials, raw materials, components, etc. that can be used in the production of an item of consumptive expenditure. A description must be given of each new basic good that is to be entered. Subsequently, the following data can be entered: the purchase price for the manufacturer, the life-cycle energy use and CO_2, CH_4 and N_2O emissions. For the calculation of the intensity of the residual goods, the number of the manufacturing sector from the input-output tables must also be entered (see Table A.1).
In the description, distinction in the same basic good can be made according to production method, country of origin, etc. Examples: aluminium (primary), aluminium (secondary), grain (France), grain (Canada).

Packing
This file has the same structure as the file with the basic goods. In this case, it covers packaging materials.

Manufacturers
This file contains data on manufacturing sectors. First of all, there is the description. Subsequently, the following items can be entered: a code (for the Dutch data files this code is according to the *StandaardBedrijfsIndeling*, SBI [Standard Commercial Classification - this is the SBI code as allocated by the CBS in 1993]), the energy price, the direct energy, CO_2, CH_4 and N_2O intensities (which depict the energy use per monetary unit of production), the percentages of net added value (NAV) and depreciation, the energy, CO_2, CH_4 and N_2O intensities of depreciation, and the input-output number of the sector (see Table A.1).

Transport
This file contains data concerning the life-cycle energy use and greenhouse gas emissions of means of transport. In addition to a field in which a description can be entered, there are fields for energy use and CO_2, CH_4 and N_2O emissions. The data are given per ton kilometres.

Trade, Services
This file contains data on the intermediary organisations. In addition to the description, this concerns the relation between the purchase price and the selling price for each sector (in percentages), and the energy, CO_2, CH_4 and N_2O intensities. The intensities are cumulative, in other words, they also contain the energy use and the greenhouse gas emissions in sectors that are located in previous production cycles. The intensities cover energy use and greenhouse gas emissions per financial unit of margin.

Direct consumption
This file contains data on the various forms of direct energy use during the use of an item of consumptive expenditure in the household.
For each form of domestic energy use, the price, the energy use and CO_2, CH_4 and N_2O emissions have to be entered.

Waste processing
This file contains data on energy use (or energy recovery) and (saved) CO_2, CH_4 and N_2O emissions of various methods of waste disposal. For each method of waste processing, the energy use is displayed in MJ per kilogram (a negative number means energy recovery) and the corresponding CO_2, CH_4, and N_2O emissions. Negative numbers signify saved emissions.

References
The references used to obtain the data are listed here.

3.3 Analyses

This component of the program enables energy and CO_2, CH_4 and N_2O analyses to be executed for any random item of consumptive expenditure. New analyses can be performed, and previous analyses can be opened and modified.
Furthermore, there are various possibilities to request the results of an analysis. In addition, a total overview can be generated in which energy use and CO_2, CH_4 and N_2O emissions per physical and financial unit can be shown for each analysis stored in EAP.
Clicking on the *Analyses* option shows the options *Perform analysis, Summary of analysis, Results of analysis, Overview of analyses, Results to table* and *Other analyses*. In order to make use of the first three options, it is necessary to open an analysis first (via *File, New analysis* or *File, Modify analysis*). The options are discussed below.

Perform analysis
The structure of the analysis corresponds to the life cycle of an item of consumptive expenditure. This life cycle includes, in broad terms, the following stages:
- winning of basic materials /raw materials
- production
- distribution
- consumption
- waste processing

Energy is used in all of these stages. The five stages can be dealt with via the options in the *Perform analysis* submenu, and these options sometimes present further options.
After selecting an option, two windows appear on the screen. The left-hand window is a window in which data can be entered; the right-hand window presents the results during an analysis.

General
The code of an analysis has already been entered in this window. The user can enter general data of the item of consumptive expenditure to be analysed here: the name/description, the specification of the physical unit (such as kg, litre or number), the number of physical units, the transport weight of the item of consumptive expenditure (thus, weight plus packing), the retail price inclusive value added tax (VAT), and the VAT percentage. A description of the analysis can be inserted in a comments field, referring, for example, to the performer of the analysis, date and version.

Production – Manufacturer
This input window contains one input field: the economic sector to which the item of consumptive expenditure belongs. The arrow button activates the database of economic sectors. The database can be ordered in two ways: alphabetically or in accordance with the SBI code.

Production – Basic goods
The basic goods (components, materials, ingredients, etc.) that are necessary for the production of the item of consumptive expenditure are entered with their quantities in this input window. It is only possible to enter basic goods that are stored in the data base. If a basic good is not listed in the database, it will not be taken into account during the calculation unless this basic good is entered in the database.

Production – Packing
Via this option, packaging materials can be entered in the same way as described above for the basic goods. In fact, the program regards the packaging materials as basic goods. This option concerns only packaging materials that are used in the sector referring to the manufacturing of the item of consumptive expenditure. Packing that is added to the item during trading should not be entered here. The energy use for these packaging materials is a part of the cumulative energy use of the trade.

Means of transport
This option presents the possibility to enter the various means of transport from the manufacturer to the consumer. The means of transport and the number of kilometres must be entered for each instance of transport. The program subsequently calculates, on the basis of the weight of transport specified in the general screen of the item, the energy use and the CO_2, CH_4 and N_2O emissions for transport.

Trade, Services
This window enables the user to specify intermediaries that are responsible for bringing the item of consumptive expenditure to the customer (trade, catering, etc.). The order of sequence of the intermediaries from the manufacturer to the consumer has to be specified. An organisation that is closer to the manufacturer (such as wholesale trade for example) should be assigned a lower number in the sequence than an organisation that is closer to the consumer (such as retail trade). This order of sequence is used to determine the margin between the purchase and selling price for the various organisations and the corresponding energy use and greenhouse gas emissions.

Direct consumption
In this input window, the data concerning the life span of the item are entered. The top input field allows a time unit of the user's choice to be specified (such as year, week, meal, wash), and the next screen contains the number of time units that the life span consists of.
Subsequently, the various forms of energy use employed during the use of the item in the household during one time unit have to be specified. When the various forms of energy use have been specified and saved, the life-cycle energy use or CO_2, CH_4 and N_2O emissions of the item of consumptive expenditure are displayed in the results window.

Waste processing
Manufacture, purchase and use of an item of consumptive expenditure produce waste. In addition to the packing waste, other forms of waste are generated during use, and finally a discarded item remains. Depending on the type of waste disposal (recycling, landfill, incineration) energy will be produced or consumed. This option enables the compilation of, a list of waste processing methods for various waste products. The amount in kilograms must be specified for each method.

Corrections
The program determines the values for residual goods and trade margins on the basis of the average data of economic sectors. The values for a particular item in a sector may deviate from the values for an average item. When the user is of the opinion that the actual values for residual goods and trade margin are not conform the values be calculated, the user can specify these values manually.

Overviews – Mass balance
This window gives a mass balance for the item of consumptive expenditure. The user can check whether or not the total weight of the specified basic and packaging materials corresponds to the transport weight of the item as specified in the general input window. However, this balance need not to be completely even. At the same time, the window also shows the weights of the parts of the item of consumptive expenditure that end up in the waste disposal.

Overviews – Financial balance
This option presents the financial balance for the item of consumptive expenditure as calculated by the program. This balance is necessary to calculate the share of the residual goods in the selling price of the item from the manufacturer. See the description of this method in Chapter 2 (step 3).

Overviews– Intensities
This window presents the energy, CO_2, CH_4 and N_2O intensities and the Global Warming Potential (GWP) of basic goods, packing, capital goods and residual goods respectively. The intensities of the basic goods and packing are calculated on the basis of the basic goods and packaging materials specified by the user. The

intensity of the capital goods depends on the manufacturing sector specified. The intensity of the residual goods is calculated by the model on the basis of the specified basic goods and packaging materials and the manufacturing sector.

Summary of analysis
This option presents, in table form, the most important findings of the currently active analysis. The results can be displayed both in energy terms and in greenhouse gas terms.

Results of analysis
This option presents the extensive results of the currently active analysis, distinguished according to life cycle (from basic goods to waste disposal stage). The results can be displayed in both chart and table form, both on the screen and on the printer, and the charts can be stored as WMF files (Windows Meta File) or as bitmap files (BMP). The results can be displayed both in energy terms and in greenhouse gas terms.

Overview of analyses
This option enables the mutual comparison of analyses previously made. The results can be presented either in chart or table form. In addition, the charts and tables can be printed, and the charts can be stored as WMF files (Windows Meta File) or as bitmap files (BMP). The results are displayed in energy terms, or in greenhouse gas terms.

Results to table
This option enables the summarising results of **all** analyses previously made to be written to a text file (ASCII). The user can make a selection of the fields that have to be written to the file. At the same time, a dBASE file (EAPP9.Dbf) is created in which these data are stored (the selection does not apply to this). It is also possible to add analyses that have been made without using EAP (see the option below).

Other analyses
Results of other analyses that were carried out without using EAP can be examined, added etc. here.

3.4 Settings

Reindex analyses
In case the index files for the analyses are damaged, it may be possible to restore them by means of this option.

Reindex data files
In case the data files being damaged, it may be possible to restore them by means of this option.

Language
This option enables the user to select the program language: Dutch or English. The data files are not effected by this choice.

Financial unit
This option enables the user to select the currency used in the program: Dutch guilders, US dollars or another currency defined by the user.

3.5 Window

This option enables the user to specify a preference for the display of windows on screen.

4 EXAMPLE OF AN ANALYSIS

To help clarify the method and the program, a complete analysis of an item of consumptive expenditure will be carried out, with the assistance of computer screen figures. A refrigerator has been chosen as the exemplary item. The entire life span of a wholemeal bread is covered when specifying the appropriate data in EAP. Although the order of entering the data does not matter, it is advisable to adhere to the life cycle of the bread to obtain an orderly overview.

In order to perform an EAP analysis, the *File* menu has to be opened, followed by the *New Analysis* option. This produces the screen shown in Figure 4.1

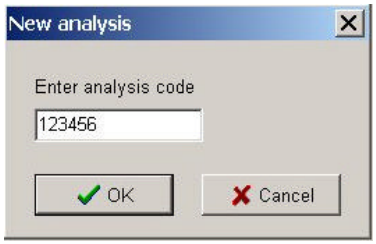

Figure 4.1: Start a new analysis.

The program asks for the specification of a code. This code must be unique, with a maximum of eight characters. Once the code has been entered, clicking on the *OK* button will close the window. The assigned code is now shown in the program bar at the top of the main window.
The data for the new analysis are specified via *Analyses, Perform analysis*.

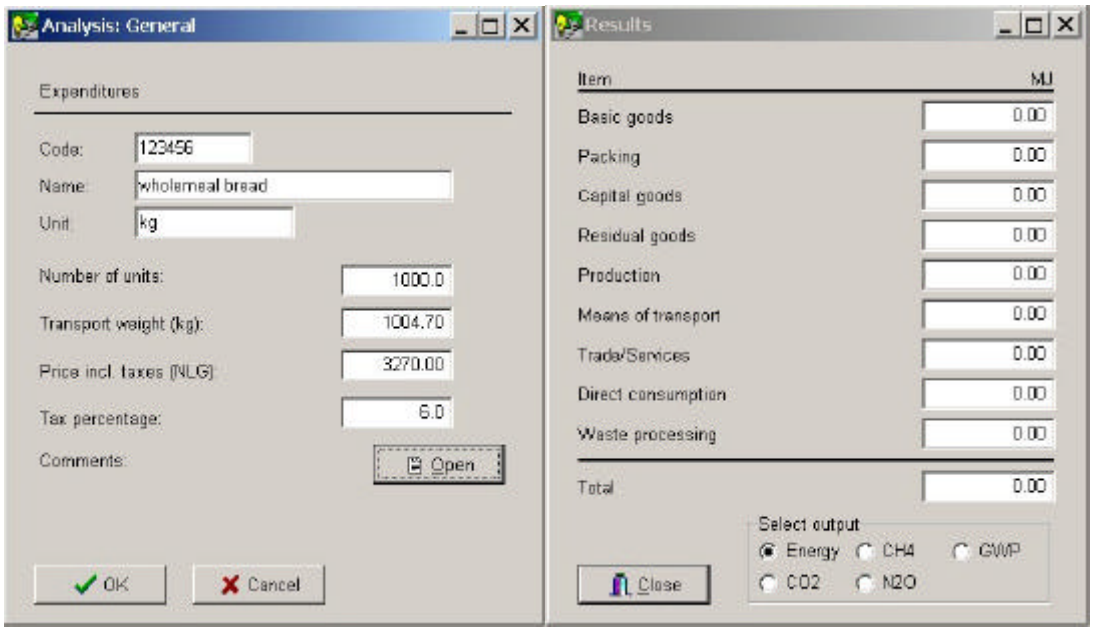

Figure 4.2: Input window for the general data (left) and the results window (right).

The first option is *General*. Activating this option produces the screen shown in Figure 4.2. The screen contains two windows: an input window on the left and a results window on the right. The input window has to be filled in; only the code has been specified up until now. The data that have to be entered are shown in the edit boxes.
The transport weight is of importance for the determination of the transport energy use and greenhouse gas emissions. The selling price from the manufacturing sector is established, based on the retail price, the VAT percentage and the margins in the trade.
There is also a *Comments* field (which can be opened via the *Open* button) in which notes and remarks can be recorded.
The input window can be quit by activating the *OK* button.

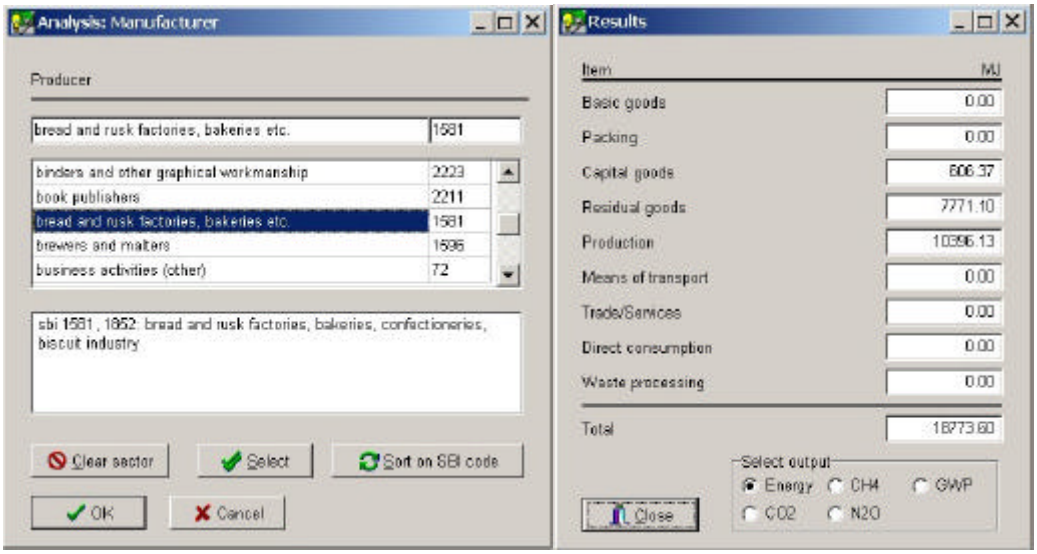

Figure 4.3: Input window for the manufacturing sector (left) and the results window (right).

After specifying the general data, the manufacturing data can be entered. Three submenus are available under *Perform analysis, Production*; they must all be filled in.
The first submenu is *Manufacturer*. When this submenu is activated, the input window for the manufacturing sector appears (see Figure 4.3). A list with sectors is displayed from which one can be chosen. This list can be sorted according to sector name or SBI code (Standard Commercial Classification). The required manufacturer is selected by pressing <Enter> or by clicking with the left mouse button on the relevant choice. For the refrigerator, the manufacturer is the **bread and rusk factories, bakeries etc.** (SBI code 1581). Subsequently activating *OK* quits this window. Energy use for capital goods, residual goods and production is calculated and displayed in the right-hand window. This principle applies to all input data referring to the item. When an input window is closed, the consequences for the energy use or the greenhouse gas emissions are calculated and displayed in the results window.

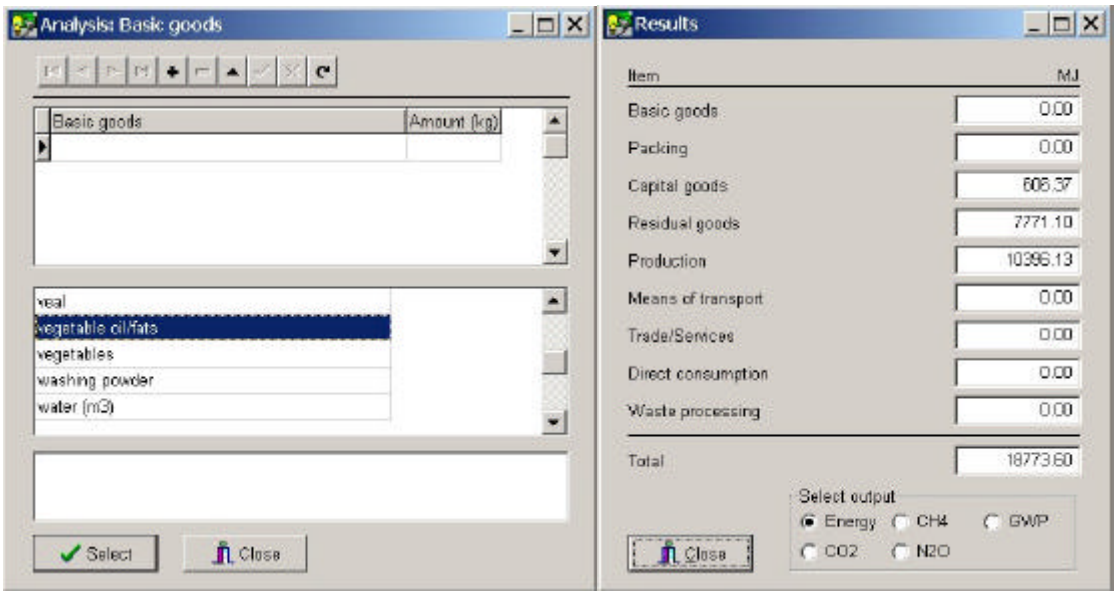

Figure 4.4: Input window for the basic goods (left) and the results window (right).

The second submenu is *Basic goods*. Clicking on this option activates a window that is empty when a new analysis is begun. Here basic goods are added via the + button in the toolbar. Subsequently a list of all available basic goods is shown. A basic good can be selected from this list by clicking with the mouse on the name and then double clicking on it again. The list can be reviewed using the scroll bar or the <PgUp>, <PgDn>, <Home> and <End> keys or by typing the first letter of the good to be selected.
Figure 4.4 shows that “vegetable oil/fats” has been selected. After a basic material has been selected, the quantity that is used in the manufacture of the item of consumptive expenditure has to be specified.

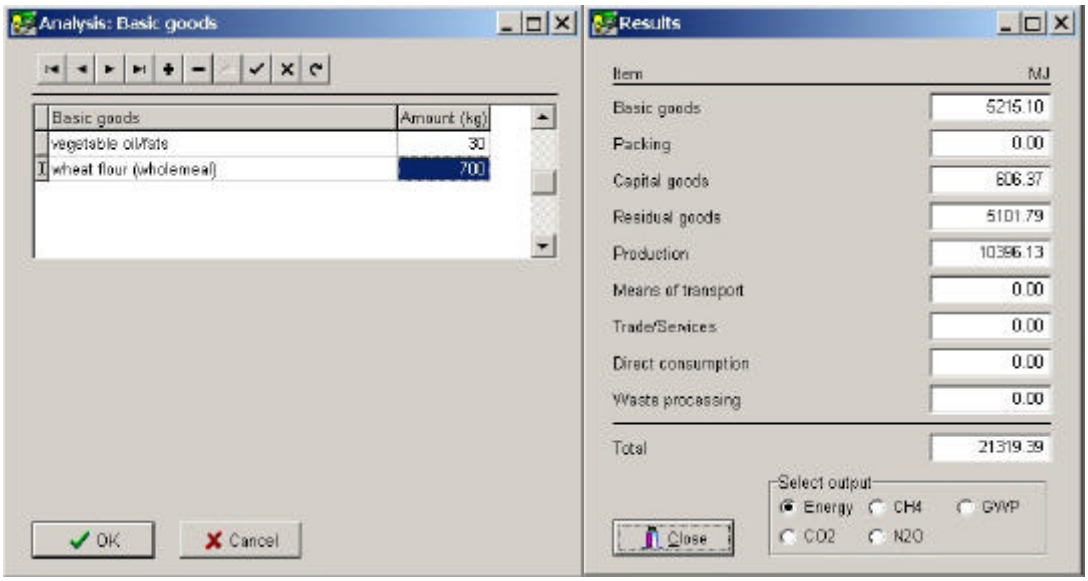

Figure 4.5: Input window for the basic goods (left) and the results window (right).

Similarly, the other basic materials that are used in the manufacture of a wholemeal bread have to be specified. The final result is displayed in Figure 4.5. All the specified basic materials and the corresponding amounts are displayed here.
Once all the basic materials have been specified, clicking on *OK* will close the window. Then the energy use as a result of specifying the basic goods is calculated and presented in the results window (right window).

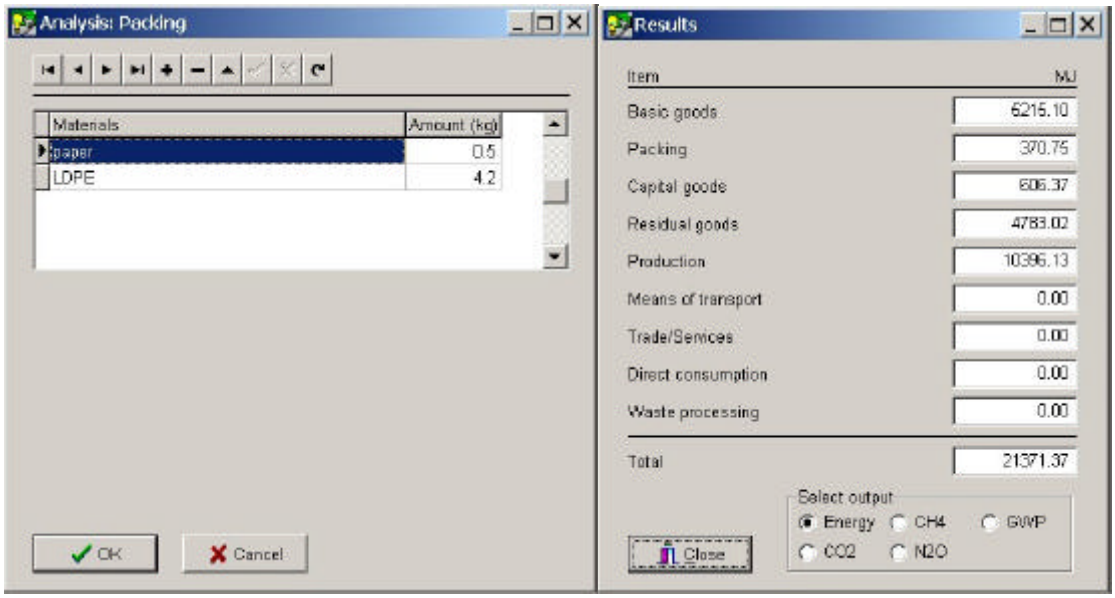

Figure 4.6: Input window for the packaging materials (left) and the results window (right).

The third submenu is *Packing*. The packaging materials that are used in the manufacturing sector are specified in the same way as the basic materials. The required amount of packaging material must also be specified. Figure 4.6 provides an overview of the packaging materials for the wholemeal bread. Clicking on the *OK* button closes this screen. The energy use and the greenhouse gas emissions that result from the use of packaging materials are calculated then (right window of Figure 4.6).

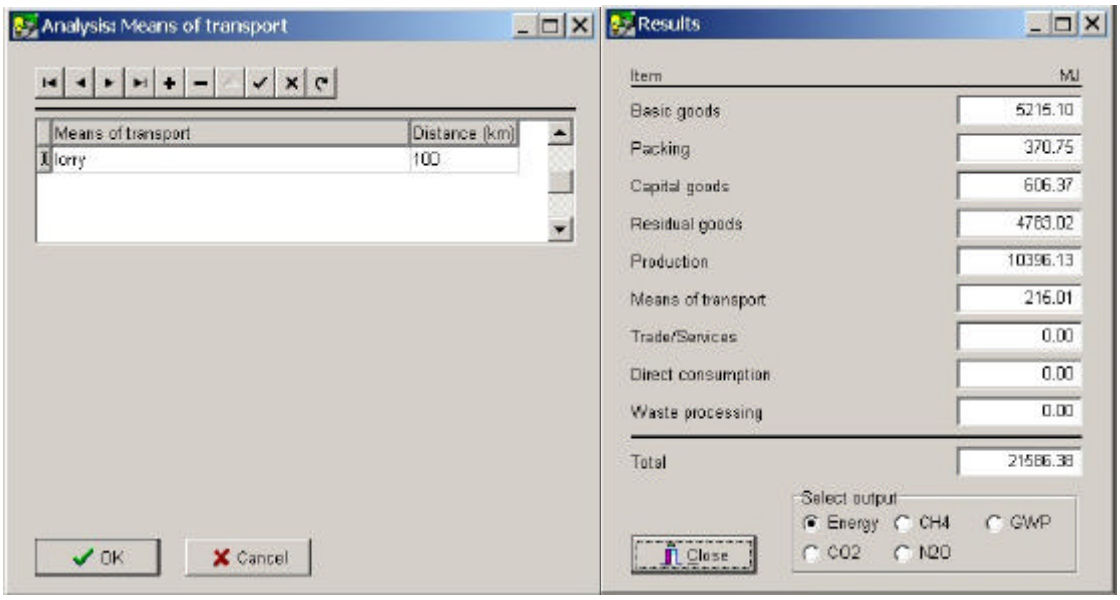

Figure 4.7: Input window for the means of transport (left) and the results window (right).

After the manufacturing data, the transport data are entered via *Analyses, Perform analysis, Means of transport*. The means of transport are added via the + button in the toolbar. Then a list with all the available means of transport is presented. The relevant means of transport can be selected by highlighting it and then pressing <Enter>. The list can be reviewed by using the scroll bar or by pressing the <PgUp>, <PgDn>, <Home> and <End> keys or by typing the first letter of the means of transport to be selected.

We assume a average distance of 100 km from the bread factories to the wholesale trade companies. To transport the bread a lorry is used (see Figure 4.7). Clicking on *OK* closes the input window, and the energy use and the greenhouse gas emissions of transport are calculated on the basis of the specified means of transport, transport distance and transport weight. The result is displayed in the right window of Figure 4.7.

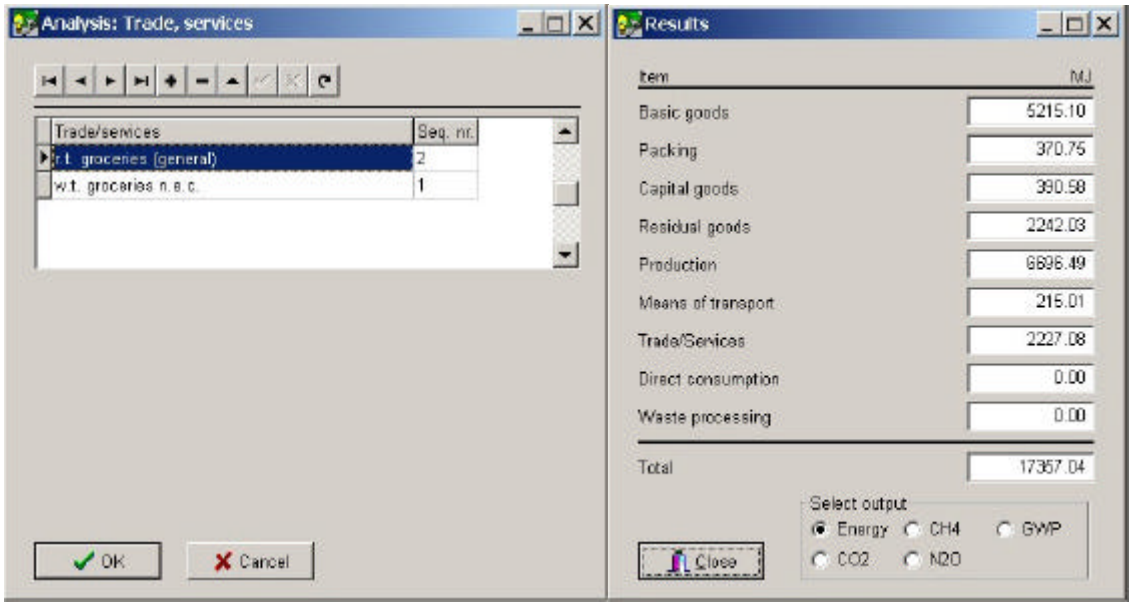

Figure 4.8: Input window for trade and services (left) and the results window (right).

Data concerning trade are specified via the *Trade, Services* option (*Analyses, Perform analysis*). Figure 4.8 displays the specified data for a wholemeal bread. Most of the bread in the Netherlands finds its way to the consumer via the "groceries n.e.c." and the "groceries (general)". The sectors have to be specified, along with the order of sequence corresponding to the life cycle (thus, first wholesale trade, then retail trade). This is specified by means of a sequence number (Seq. nr). The order of sequence is important for the calculation of the margins and the corresponding energy use. Clicking on *OK* closes the window. Since the trade margins are now calculated, the price from the manufacturer also alters. This means that the financial balance also changes, along with the energy use with reference to capital goods, residual goods and production (see right window of Figure 4.8).

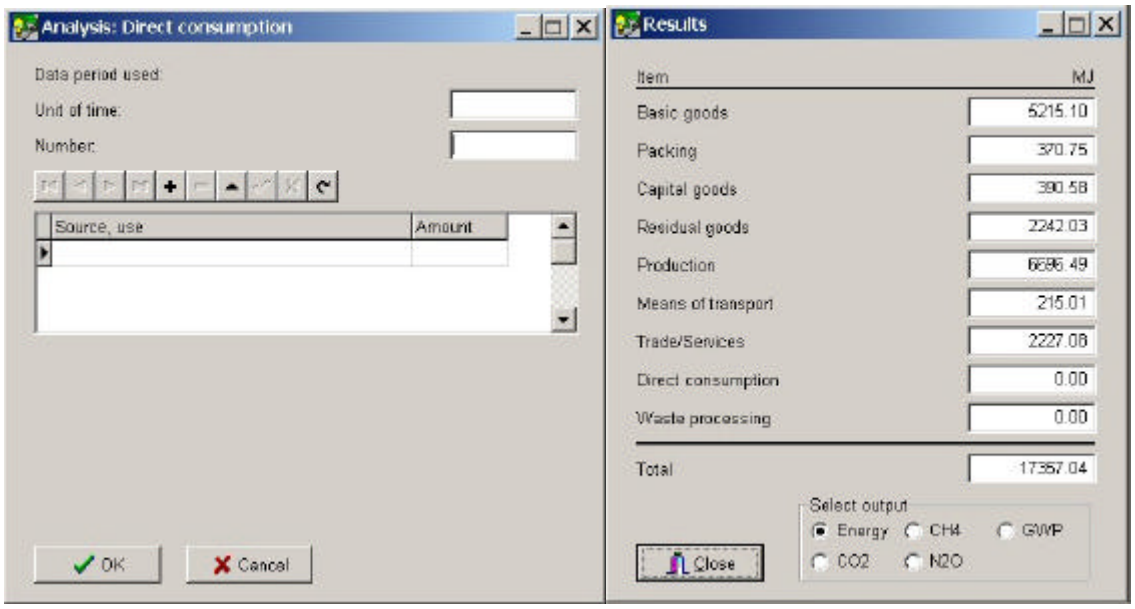

Figure 4.9: Input window for the direct consumption (left) and the results window (right).

The next stage in the life cycle of some of the consumer good is the user phase. Data referring to this phase can be entered via the *Direct consumption* option under the *Perform analysis* submenu. In the case of the wholemeal bread there is no matter of direct energy.
In case of an other consumer good e.g. a refrigerator, in this option the life span of the item must be specified. If we assume a life time of 12.5 years for a refrigerator, just behind "Unit of time" **year** should be entered and just behind "Number" **12.5** should be entered. For the source of energy, electricity should be selected and the amount of electricity consumption per year should be entered.
But, because our example analyses concerns a bread, leave this input screen empty and close the window.

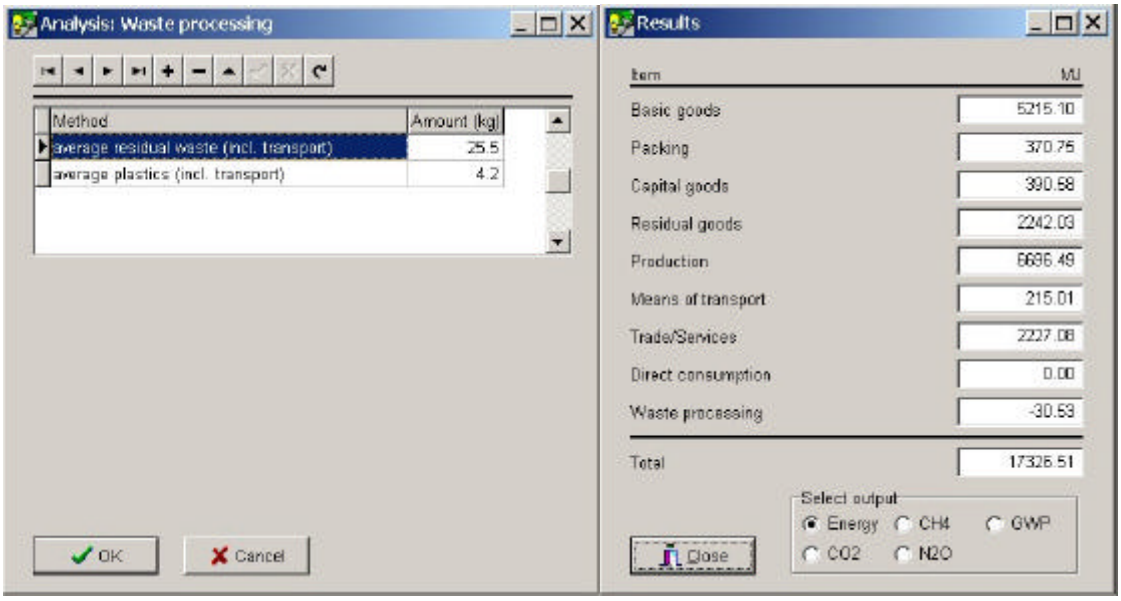

Figure 4.10: Input window for the waste processing (left) and the results window (right).

The last stage in the life cycle of the wholemeal bread is the waste disposal phase. Data referring to waste processing are entered via *Analyses, Perform analysis, Waste processing*. Figure 4.10 shows two types of waste processing. The quantities have to be filled in by the user. The total weight does not corresponds to the transport weight of the wholemeal bread. The largest part has been eaten. Only a little bread and the packaging materials are supposed to become waste. The leftovers of the bread and the paper (packaging material) The input screen for the waste disposal stage is closed by clicking on *OK*, and the energy use for the waste disposal is then calculated. The total energy use for the entire life span of the wholemeal bread has now been calculated (Figure 4.10). By clicking on an option in the *Select output* radio group, total CO_2, CH_4 and N_2O emissions or GWP results are shown.

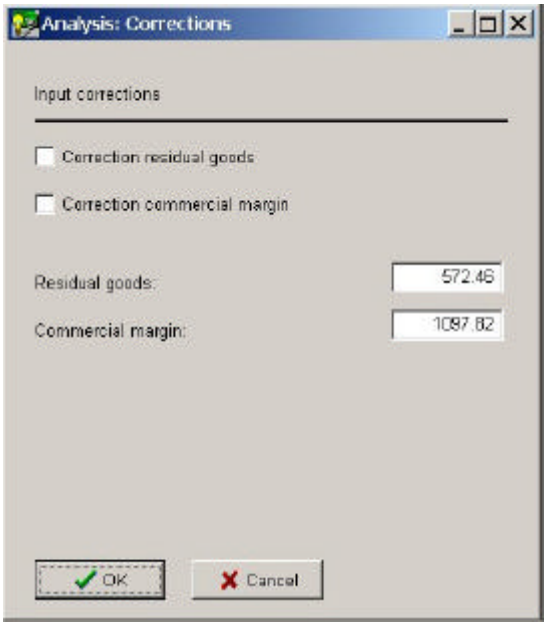

Figure 4.11: Input window price corrections.

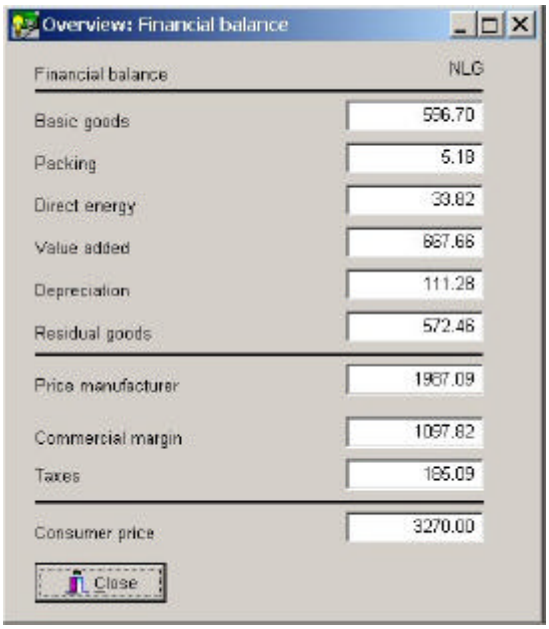

Figure 4.12: Overview window, financial balance.

The *Corrections* option is activated via *Analyses, Perform analysis, Corrections*. Should, for some reason the calculated value of the residual goods turn out to be too high or too low, the value can be manually adjusted here. The same applies to the calculated margin for trade (see Figure 4.11).

The final option under *Analyses, Perform analysis* is *Overviews*. There are three overviews.

The *Financial balance* provides insight into the structure of the price of the item of consumptive expenditure, VAT, trade margins and the cost structure of the manufacturing sector (see Figure 4.12). The value of the residual goods is a complementary sum in the financial balance of the manufacturing sector. This value can be corrected under the *Perform analysis, Corrections* option (see Figure 4.11).

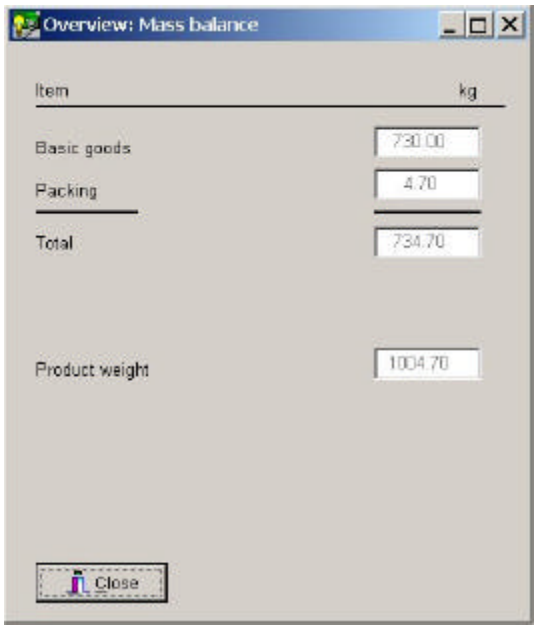

Figure 4.13: Overview window, mass balance.

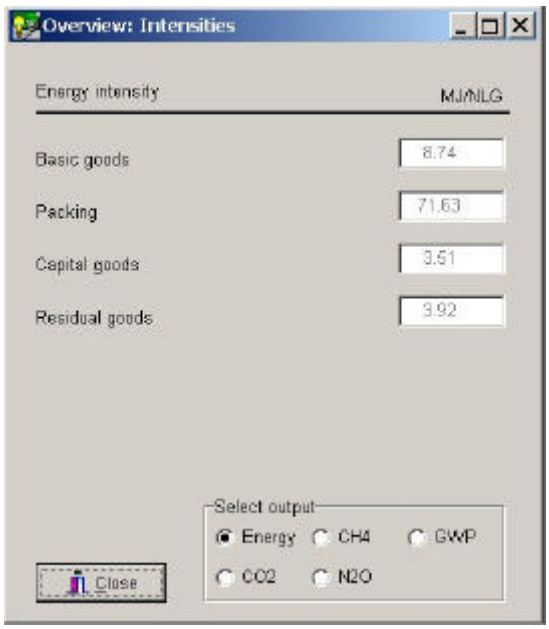

Figure 4.14: Overview of energy intensities.

The *Mass balance* option provides insight into whether or not the weight of the basic and packaging materials corresponds reasonably with the transport weight of the item of consumptive expenditure. This can be very convenient particularly in cases where the composition of products is analysed. However, the weight of the basic materials need not always correspond to that of the item of consumptive expenditure (for example, in meat products the garbage is not included in the product). In the case of the wholemeal bread, the mass balance corresponds not completely. (Figure 4.13). Reason for this is that with the production of the bread also water is used. Water was not added in the basic goods. This window is closed by means of the *Close* button.

Finally, the last option under *Overviews* is *Intensities*. This option provides insight into the energy and greenhouse gas intensities of the basic materials, packaging materials, the capital goods and the residual goods (see Figure 4.14).
The whole analysis has now been executed. The *Modify analysis* option enables the user to open this analysis at a later date, examine it and modify it if necessary. With this option, a list is displayed of all the analyses that have been carried out and saved using EAP (with a code and a name for each analysis). At this moment in time, the list will only contain the wholemeal bread. An existing analysis can be removed by means of the *Delete analysis* option. Before actually using this option, it is advisable to examine the other five options in the *Analyses* menu.

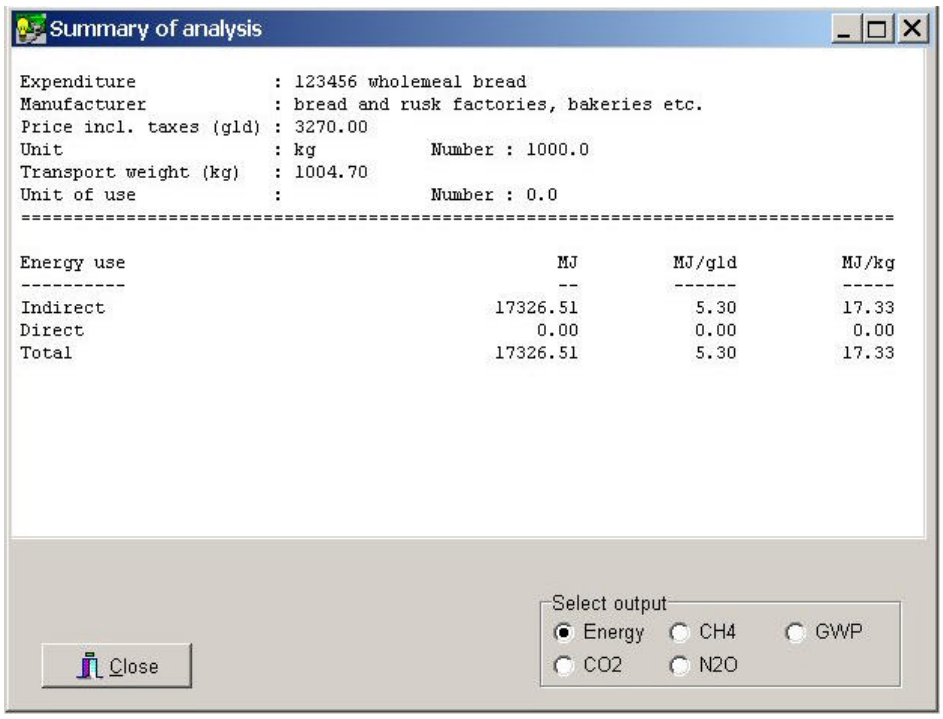

Figure 4.15: Report window, summary of the active analysis.

The last five options under *Analyses* are used to make overviews of the results of the analyses. The *Summary of analysis* option displays the most important results of the analysis (Figure 4.15). In this window, a choice can be made between the results for energy or those for greenhouse gas emissions.

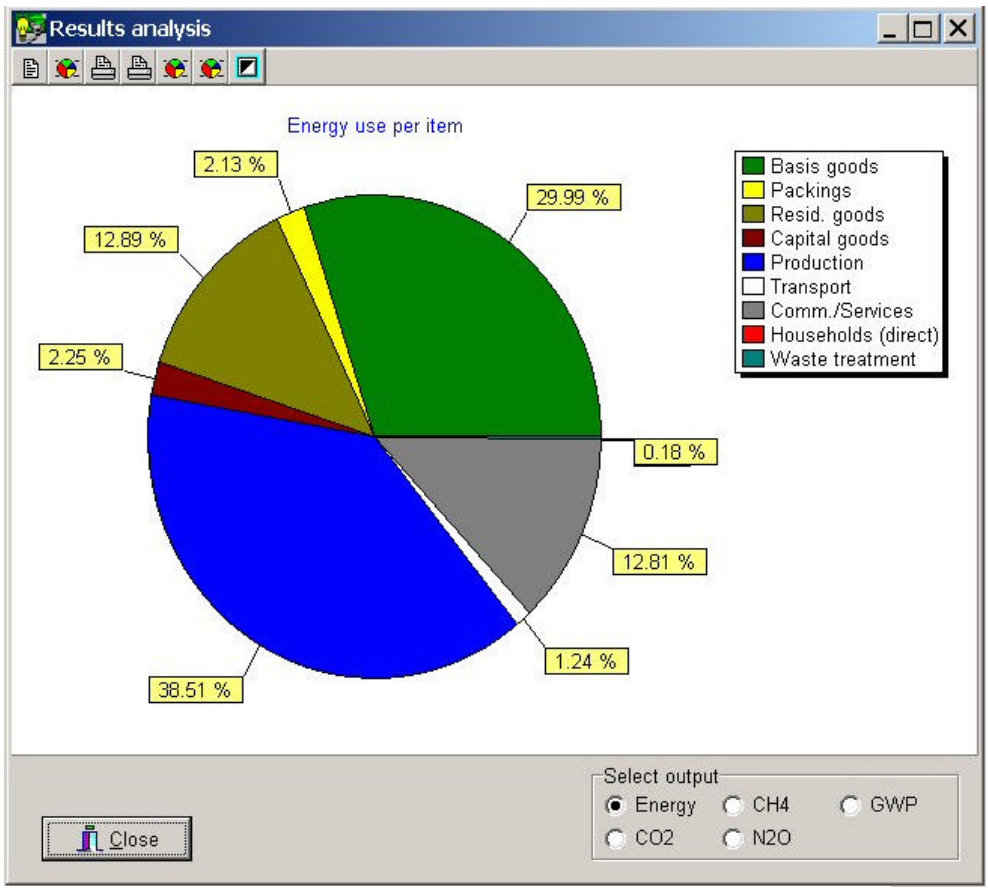

Figure 4.16: Report window, graphical presentation of the active analysis.

The *Results of analysis* option provides a more detailed outcome of an analysis in a table as well as a graphical form. This table or pie chart contains data on the item of consumptive expenditure and the corresponding energy use and greenhouse gas emissions (Figure 4.16). An example of a table report is shown in Figure 4.18. It is possible to print the results of both table and chart. The chart can also be stored as a Windows Meta File (WMF) or as a bitmap (BMP).

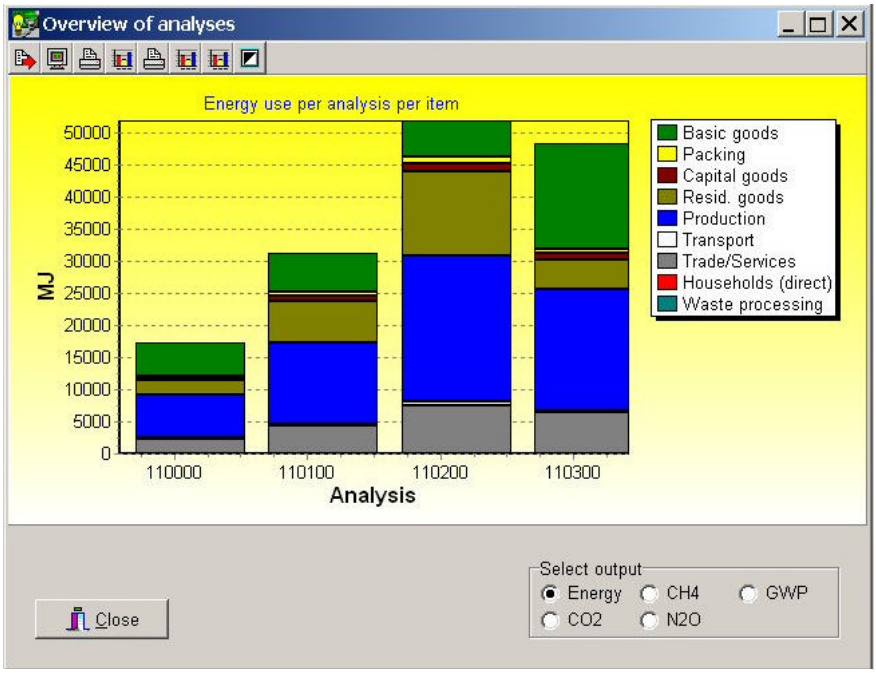

Figure 4.17: Report window, graphical presentation of four selected analyses (all breads).

The *Overview of analyses* option is used to review (in table form, see Figure 4.18) or compare (in chart form) a number of existing analyses (see Figure 4.17). As an example a comparison is made between four types of bread:
110000: wholemeal bread;
110100: white bread
110200: rusks and other sorts of bread
110300: currant bread
Both can be printed and here too it is possible to store charts as a WMF file or bitmap (BMP).
The *Results to table* option creates an overview of the general data and the total energy use and/or greenhouse gas emissions for all EAP analyses and also all analyses not made using EAP (accessible via the *Other analyses* option). This overview is stored under a user defined name. At this moment, the overview will only contain data concerning the wholemeal bread.
Finally, there is the *Other analyses* option. This option displays a database for storing outcomes of analyses which were carried out without using EAP. This database can be viewed and modified (change, add, and remove).

```
Expenditure             : 123456,  wholemeal bread
Manufacturer sector     : bread and rusk factories, bakeries etc.
Price incl. taxes (gld) : 3270.00
Unit                    : kg           Number : 1000.0
Transport weight (kg)   : 1004.70
Unit of use             :              Number :   0.0
================================================================================

Basic goods                                    kg          MJ/kg            MJ
-----------                                    --          -----            --
vegetable oil/fats                          30.00          20.77        623.10
wheat flour (wholemeal)                    700.00           6.56       4592.00

Packing                                        k g         MJ/kg            MJ
-------                                        --          -----            --
paper                                        0.50          40.85         20.43
LDPE                                         4.20          83.41        350.32

Other inputs                                  gld         MJ/gld            MJ
------------                                  ---         ------            --
residual goods                             572.46           3.92       2242.03
capital goods                              111.28           3.51        390.58

Production                                    gld         MJ/gld            MJ
----------                                    ---         ------            --
production                                1987.09           3.37       6696.49

Means of transport                             km       MJ/tonkm            MJ
------------------                             --       --------            --
lorry                                      100.00           2.14        215.01

Trade/Services                                gld         MJ/gld            MJ
--------------                                ---         ------            --
r.t. groceries (general)                   687.93           2.29       1575.37
w.t. groceries n.e.c.                      409.88           1.59        651.71

Households (direct)                            kg        MJ/amnt            MJ
-------------------                            --        -------            --

Waste processing                               kg          MJ/kg            MJ
----------------                               --          -----            --
average residual waste (incl. transport)    25.50           0.44         11.22
average plastics (incl. transport)           4.20          -9.94        -41.75

================================================== ==============================

Energy use                                     MJ          MJ/gld          MJ/kg
----------                                     --          ------          -----
Indirect                                17326.51            5.30          17.33
Direct                                      0.00            0.00           0.00
Total                                   17326.51            5.30          17.33
```

Figure 4.18: Table report of an analysis.

LITERATURE

Boustead, I., Hancock, G.F. (1979), *Handbook of industrial energy analysis*, Ellis Horwood Publishers, Chichester.

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Van Engelenburg, B.C.W., Van, Rossum, T.F.M., Blok, K., Vringer, K. (1994), *Calculating the energy requirements of household purchases: a practical step by step method*, Energy Policy, Vol. 22, pp. 648-656.

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Kok, R., R.M.J. Benders H.C. Moll (2001) Energie-intensiteiten van de Nederlandse consumptieve bestedingen anno 1996, IVEM research report No. 105, University of Groningen.

Schmidt, T. and A.D. Postma (1999), *Minder energiegebruik door een andere leefstijl? : Project Perspectief, december 1995-juni 1998 : eindrapportage*, Projectteam Perspectief, VROM, Den Haag

Wilting, H.C. (1996), *An energy perspective on economic activities, PhD Thesis*, Groningen.

APPENDIX A: INSTALLATION AND DESCRIPTION OF THE EAP FILES

Installation

EAP 3.5 runs under Windows95 and higher. Insert the EAP CD in the CDRom drive, the installation will automatically start. If this is not the case select Run from the Start menu, and type D:\setup (where D is de drive letter of your CDRom). EAP will be installed in the required directory.
The manual is on the CD in Pdf format.

EAP files

The EAP diskette contains one configuration file and one program file. These files are:

EAP.INI	The EAP configuration file in which the settings for the monitor etc. are stored.
EAP.EXE	The actual EAP program. To be able to work with EAP, this program must be started from your computer's operating system.

EAP makes use of the dBASE structure (version IV and higher) to store data,. Therefore, these data can also be accessed by means of the dBASE database program. The following files contain the basic data:

EAPB1.DBF	The basic file for basic goods.
EAPB2.DBF	The basic files for packaging materials.
EAPB3.DBF	The basic file for manufacturers.
EAPB4.DBF	The basic file for means of transport.
EAPB5.DBF	The basic file for trade/services.
EAPB6.DBF	The basic file for domestic energy use.
EAPB7.DBF	The basic file for waste processing.

The storage of analyses that have been performed with EAP takes place in seven files. These files are not present on the original EAP diskette; they are created when the first analysis is carried out. These files are:

EAPP1.DBF	File for general data on items of consumptive expenditure.
EAPP2.DBF	File for the basic goods of items of consumptive expenditure.
EAPP3.DBF	File for the packing of items of consumptive expenditure.
EAPP4.DBF	File for the means of transport of items of consumptive expenditure.
EAPP5.DBF	File for the trade/services of items of consumptive expenditure.
EAPP6.DBF	File for the energy use of items of consumptive expenditure.
EAPP7.DBF	File for the waste processing of items of consumptive expenditure.

The following two files are created when the corresponding options are chosen:

EAPP8.DBF	File with data of items of consumptive expenditures that have not been analysed using EAP. This file is used by the option *Other analyses* from the *Analyses* menu.
EAPP9.DBF	File with an total overview of all analyses (both EAP and other analyses). This file is created when the *Results to table* option is chosen from the *Analyses* menu.
EAPRef.DBF	File with references to the data sources

In order to calculate the intensities of the residual goods, five data files are used. These are:

CUMTOT.DAT	File with the Leontief inverse of the intermediary matrix from the input-output table.
DIRCI.DAT	File with the direct CO_2 intensities of 64 input-output sectors.
DIRMI.DAT	File with the direct CH_4 intensities of 64 input-output sectors in.
DIRNI.DAT	File with the direct N_2O intensities of 64 input-output sectors in.
DIREI.DAT	File with the direct energy intensities of 64 input-output sectors.

These five data files contain data based on Dutch input-output sectors for the year 1996. If one is interested in making analyses for an other year or an other country, these data files must be adjusted. For more information see Appendix D.

Table A.1 Input-output sectors corresponding with row numbers in DAT-files.

IO sec	Name	IO sec	Name
1	agriculture	35	manufacture of domestic appliances
2	horticulture	36	manufacture of office machinery and computers
3	cattle breeding	37	manufacture of electrical machinery n.e.c.
4	other agriculture and forestry	38	manufacture of motor vehicles, trains, trams and aircraft
5	fishery	39	manufacture of ships and boats
6	crude petroleum and natural gas production	40	manufacture of other transport equipment
7	other mining and quarrying	41	manufacture of furniture
8	slaughtering and meat-processing industry	42	other manufacturing
9	processing of fish	43	electricity and gas supply
10	processing of fruit and vegetables	44	water supply
11	manufacture of dairy products	45	construction
12	manufacture of animal feed	46	auto, motorcycle trade and petrol stations
13	manufacture of other foods	47	wholesale trade
14	beverage industry	48	retail trade and repair
15	tobacco-processing industry	49	hotel and catering
16	textiles industry	50	land transport
17	clothing industry	51	air and water transport
18	leather, footwear and other leather ware	52	supporting transport activities
19	manufacture of wood and wood products	53	communication
20	paper and cardboard industry	54	banking
21	paper ware and corrugated cardboard industry	55	insurance and pension funding
22	printing, publishing and related industry	56	activities auxiliary to financial intermediation
23	reproduction of recorded media	57	real estate activities
24	petroleum industry	58	renting of movables
25	manufacture of other basic chemicals and man-made fibers	59	business activities (other)
26	manufacture of inorganic chemicals	60	government: civilian and military activities
27	manufacture of petrochemicals	61	subsidized education
28	fertilizer industry	62	human health and veterinary activities
29	chemical final products industry	63	social work activities
30	rubber and plastic-processing industry	64	sewage and refuse disposal services
31	manufacture of building materials	65	recreational, cultural and sporting activities
32	basic metal industry	66	other service activities
33	manufacture of metal products	67	non-competitive imports
34	manufacture of other machinery and equipment	68	depreciation

APPENDIX B: BASIC DATA

This appendix contains the data that are included in the EAP basic data files. The figures refer, as much as possible, to the year 1996 to the situation in the Netherlands. The financial unit is in NLG, which corresponds (from 1 January 1999) with 0.45378 Euro.

B.1. Basic goods and packaging materials

The basic files *Basic goods* and *Packaging materials* contain data on basic materials and products. These data cover the price, the life-cycle energy use and greenhouse gas emissions per physical unit. The prices shown were mostly taken from CBS production statistics [CBS, 1997b, 1998a, 1998b, 1998c, 1999c and Silvis en van Bruchem, 1999] and, where necessary, from manufacturers' price index figures indexed for 1996. The sources concerning the life-cycle energy use of the basic commodities were indicated in the tables as much as possible. The greenhouse gas emissions for each basic commodity were calculated by working out the relationship of the cumulative energy intensity to the cumulative greenhouse gas intensity of the sector that produces the basic commodity. Besides this also not fuel related emissions are taken into account [VROM, 2000].

The life-cycle energy use of basic goods in which fossil fuel is used as feedstock (synthetic materials, paper, wood, fertilisers) includes the caloric value of this fossil fuel [Heijningen, 1992]. For paper and wood, the values are given exclusive the caloric value of the raw material. So the EAP database contains data including the caloric value of the raw material in case the energy carrier is generally used as fuel (oil, natural gas, etc.). In case the energy carrier is not generally used as fuel (e.g. wood), the life-cycle energy use is exclusive the feedstock energy.

Table B.1.1 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the cattle breeding sector (io sector 3) [30].

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
veal	19,29	95,58	15,609	508,534	27,900	Kok, 2000
milk (unprocessed)	0,78	6,20	1,013	32,988	1,810	Kramer, 1996
milk (unprocessed organic)	0,95	4,65	0,759	24,741	1,357	Kramer, 1997
horse meat	9,23	31,28	5,109	166,446	9,132	Kok, 2000
sheep/goat meat	9,23	31,28	5,109	166,446	9,132	Kok, 2000
beef	9,26	49,18	8,032	261,673	14,356	Kok, 2000
beef (pet food)	4,63	24,59	4,016	130,836	7,178	Kok, 2000
pork	6,46	31,28	5,109	166,446	9,132	Kok, 2000
pork (pet/animal food)	3,23	15,64	2,554	83,223	4,566	Kok, 2000

Table B.1.2 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the agricultural sector (io sector 1).

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
consumer potatoes	0,10	1,10	0,106	0,367	0,475	Proce, 1986
cons potatoes (organic)	0,13	1,16	0,111	0,386	0,499	Kramer, 1995
factory potatoes	0,12	0,93	0,089	0,309	0,399	Proce, 1986
barley	0,30	4,24	0,407	1,417	1,830	Kok, 2000
coffee beans	7,69	10,22	0,980	3,413	4,409	Kok, 2000
nuts (fresh)	2,34	15,67	1,503	5,232	6,759	Kok, 2000
rice	0,74	6,57	0,630	144,810	2,832	Kok, 2000
soya mash	0,48	5,07	0,486	1,693	2,187	Kok, 2000
soya beans	0,65	7,74	0,742	2,585	3,339	Kok, 2000
sugar beet	0,10	0,53	0,051	0,176	0,227	Proce, 1986
tobacco	11,33	45,50	4,364	15,194	19,629	De Paauw, 1993
wheat	0,28	4,20	0,403	1,402	1,811	Proce, 1986
tea (rough) (excl. transport)	0,98	3,10	0,297	1,035	1,337	Kok, 2000
sunflower seeds	0,85	8,71	0,835	2,908	3,757	Kok, 2000
sunflower mash	0,30	2,51	0,241	0,838	1,083	Kok, 2000

Table B.1.3 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the horticultural sector (io sector 2).

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
apples	0,40	1,81	0,124	0,234	0,030	Kok, 2000
growing mushrooms	2,31	7,39	0,504	0,955	0,121	Kok, 2000
fruit	0,70	5,71	0,390	0,737	0,093	Kok, 2000
fruit (excl. transport)	0,70	2,68	0,183	0,346	0,044	Kok, 2000
glasshouse growing fruit	5,30	26,19	1,787	3,381	0,428	Kok, 2000
open air growing fruit	1,42	0,68	0,046	0,087	0,011	Kok, 2000
vegetables	0,92	16,46	1,123	2,126	0,269	Kok, 2000
glasshouse growing vegetables	1,75	26,19	1,787	3,381	0,428	Kok, 2000
open air growing vegetables	1,03	0,68	0,046	0,087	0,011	Kok, 2000
wine grapes	1,61	4,91	0,335	0,634	0,080	Kok, 2000
cabbage	0,40	1,53	0,104	0,198	0,025	Kok, 2000

Table B.1.4 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the agricultural (other) and forestry sector (io sector 3).

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
eggs (farm)	1,80	19,23	3,140	102,314	5,613	Welten, 1994
chick meat	3,05	22,33	3,647	118,831	6,519	Kok, 2000
chick (animal/pet food)	1,53	11,17	1,824	59,415	3,260	Kok, 2000

Table B.1.5 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the fishing sector (io sector 5).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
herring	0,63	11,59	0,903	1,637	0,184	Kok, 2000
fish	3,26	57,52	4,482	8,125	0,912	Kok, 2000
fish (pet/animal food)	1,94	28,76	2,241	4,063	0,456	Kok, 2000

Table B.1.6 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the other mining and quarrying sector (io sector 7).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
gravel	0,02	0,10	0,010	0,030	0,001	Heijningen, 1992
gravel (broken)	0,02	0,19	0,019	0,057	0,002	Heijningen, 1992
lime	0,12	0,02	0,002	0,006	0,000	Vringer, 1993
chalk	0,16	0,10	0,010	0,030	0,001	Brand, 1993
chalk sandstone	0,09	0,77	0,077	0,230	0,009	Heijningen, 1992
natural stone (broken)	0,02	0,37	0,037	0,111	0,004	Heijningen, 1992
potting compost (kg)	0,31	0,74	0,074	0,221	0,008	Heijningen, 1992
potting compost (m3)	111,60	270,00	27,136	80,729	3,064	Heijningen, 1992
sand	0,01	0,10	0,010	0,030	0,001	Heijningen, 1992

Table B.1.7 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the dairy products industry (io sector 11).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
buttermilk	1,03	4,92	0,636	14,990	0,817	Kok, 2000
skimmed milk	0,27	3,22	0,416	9,811	0,535	Kramer, 1995
skimmed milk (org.)	0,33	2,42	0,313	7,373	0,402	Kramer, 1995
butter	6,85	66,45	8,586	202,461	11,040	Kok, 2000
whey	0,01	0,50	0,065	1,523	0,083	Kok, 2000

Table B.1.8 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the vegetable and fruit processing industry (io sector 10).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
currants	5,96	42,47	4,593	16,442	2,273	Kok, 2000

Table B.1.9 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the feed processing industry (io sector 12).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
mixed feed for breeding pigs	0,42	5,43	0,531	4,634	0,784	Kok, 2000
mixed feed for laying-hens	0,47	6,36	0,622	5,427	0,918	Kok, 2000
mixed feed for fatting-chick	0,56	6,10	0,596	5,205	0,880	Kok, 2000
mixed feed for porkers	0,45	5,91	0,578	5,043	0,853	Kok, 2000
mixed feed for poultry	0,52	11,00	1,075	9,387	1,587	Kramer, 1995
mixed feed for cattle	0,37	6,77	0,662	5,777	0,977	Kok, 2000
mixed feed for pigs	0,53	7,00	0,684	5,974	1,010	Kramer, 1995

Table B.1.10 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the manufacture of other foods industry (io sector 13).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
flour	0,75	7,88	0,769	3,584	0,565	Kok, 2000
wheat flour (wholemeal)	0,78	6,56	0,640	2,983	0,470	Kok, 2000
wheat flour (average)	0,78	7,22	0,705	3,283	0,517	Kok, 2000
pasta	1.98	13.00	1.269	5.912	0.932	Kok, 2000
potato starch	2.02	14.22	1.388	6.467	1.019	Kok, 2000
beet pulp (dried)	0,24	12,50	1,220	5,685	0,896	Brand, 1993
molasses	1,54	4,56	0,445	2,072	0,327	Kramer, 1995
molasses (as by-product)	0,22	1,24	0,121	0,564	0,089	Kramer, 1995
sugar	1,53	9,35	0,913	4,252	0,670	Kok, 2000
cocoa beans	2,14	3,42	0,334	1,555	0,245	Kramer, 1995
cocoa butter	8,54	13,31	1,299	6,053	0,954	Kok, 2000
cocoa mass	3,19	7,99	0,780	3,634	0,573	Kok, 2000
cocoa powder	2,32	3,62	0,353	1,646	0,259	Kok, 2000
animal fats	0,66	4,42	0,431	2,010	0,317	Brand, 1993
vegetable oil/fats	1,69	20,77	2,028	9,445	1,488	Kok, 2000
sunflower oil	2,13	21,48	2,097	9,768	1,539	Kok, 2000

Table B.1.11 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the beverages industry (io sector 16)].

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
alcohol	1,50	21,34	3,936	9,840	0,821	Kok, 2000

Table B.1.12 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emission of basic goods produced in the cattle breeding (io sector 3),Textile industry (io sector 16) and Leather industry (io sector 18).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
cotton	6,83	49,90	4,100	12,200	0,753	Idemat 2000
leather	50,53	40,80	3,977	39,389	2,051	Idemat 2000
wool	4,00	20,00	3,266	106,411	5,838	Potting 2001

Table B.1.13 Price (excl. VAT), life-cycle energy use, including and excluding feedstock) energy and CO_2, CH_4 and N_2O emission of basic goods produced in the wood industry (io sector 19).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
hardwood (sawn)	0,82	6,20	0,765	2,786	0,110	Heijningen, 1992
hardwood (round)	0,82	0,40	0,049	0,180	0,007	Heijningen, 1992
softwood (sawn)	1,96	3,10	0,382	1,393	0,055	Heijningen, 1992
chipboard	0,98	11,80	1,456	5,302	0,209	Heijningen, 1992
plywood	3,50	16,00	1,974	7,189	0,283	Heijningen, 1992

Table B.1.14 Price (excl. VAT), life-cycle energy use, including and excluding feedstock energy and CO_2, CH_4 and N_2O emissions of basic goods produced in the paper and board industry (io sector 20, 21).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
paper (graphic)	1,83	28,52	2,142	5,889	0,148	Kok, 2000
paper (newspaper)	0,17	21,31	1,600	4,401	0,110	SAEFL, 1998
paper (sanitary)	0,16	13,30	0,999	2,747	0,069	Heijningen, 1992
paper pulp	0,41	32,84	2,466	6,782	0,170	Kok, 2000
cardboard (corrugated)	2,13	17,86	1,486	4,610	0,145	Kok, 2000
cardboard	1,85	27,54	2,291	7,108	0,223	SAEFL, 1998

Table B.1.15 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the petroleum industry (io sector 24).

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
petrol (gasoline)	1,17	49,28	3,512	6,775	1,431	Kok, 2000
bitumen	0,89	42,00	2,993	5,774	1,220	Vringer, 1993

Table B.1.16 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the chemical industry (io sector 25, 26, 27, 28, 29).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
ABS (granules)	5,75	86,71	6,493	14,917	1,784	Idemat 2000
polyacrylic fibre	10,56	135,70	10,161	23,344	2,792	Boustead, 1997
HDPE (granules)4	1,08	75,74	5,671	13,030	1,558	Idemat 2000
LDPE (granules)	1,13	83,41	6,245	14,349	1,716	Idemat 2000
LDPE (regranules)	0,76	20,85	1,561	3,587	0,429	Kok 2000
nylon (PA 66)	38,00	130,70	9,786	22,484	2,689	Idemat 2000
nylon fiber	48,33	185,58	13,896	31,925	3,818	Boustead, 1997
PET (granules)	4,24	73,02	5,467	12,562	1,502	Idemat 2000
polycarbonate (granules)	8,96	105,00	7,862	18,063	2,160	Idemat 2000
polyester	14,20	97,80	7,323	16,825	2,012	Idemat 2000
polypropene (granules)	1,64	82,00	6,140	14,106	1,687	Idemat 2000
aramid fibre	58,13	191,00	14,301	32,858	3,929	Idemat 2000
polystyrene (granules)	3,31	96,05	7,192	16,523	1,976	Idemat 2000
PMMA	7,70	99,27	7,433	17,077	2,042	Idemat 2000
PUR (flexible foam)	4,13	93,90	7,031	16,154	1,932	Idemat 2000
PUR (hard foam)	4,13	103,00	7,712	17,719	2,119	Idemat 2000
PVC (soft, granules)	1,75	61,79	4,627	10,630	1,271	Idemat 2000
PVC (hard, granules)	1,75	54,94	4,114	9,451	1,130	Idemat 2000
SBR rubber (grains)	3,46	85,47	6,400	14,703	1,758	Idemat 2000
chlorine (Cl2)	0,15	18,40	1,809	3,128	0,193	Heijningen, 1992
benzene	0,55	67,72	4,826	9,310	1,967	APME, 2000
butadiene	0,65	81,70	5,823	11,231	2,373	APME, 2000
ethene	0,73	68,22	4,862	9,378	1,981	APME, 2000
glycerol	1,55	0,79	0,056	0,109	0,023	De Paauw, 1993
lipid	1,86	32,60	2,323	4,482	0,947	De Paauw, 1993
propene	0,54	67,44	4,806	9,271	1,959	APME, 2000
styrene	1,12	83,98	5,985	11,545	2,439	APME, 2000
fertiliser: ammonium nitrate	0,24	12,30	1,089	1,271	1,958	Heijningen, 1992
fertiliser: phosphoric acid	0,24	15,50	1,372	1,601	2,467	Heijningen, 1992
fertiliser: K20	0,41	2,60	0,230	0,269	0,414	Brand, 1993
fertiliser: potassium chloride	0,24	1,22	0,108	0,126	0,194	Heijningen, 1992
fertiliser: KAS	0,25	10,70	0,947	1,105	1,703	Heijningen, 1992
fertiliser: N	0,37	38,90	3,444	4,019	6,191	Brand, 1993
fertiliser: NPK	0,44	16,50	1,461	1,705	2,626	Heijningen, 1992

Table B.1.16 (contd.)

	Price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
fertiliser: P2O5	0,52	4,30	0,381	0,444	0,684	Brand, 1993
fertiliser: nitrous acid	0,24	7,60	0,673	0,785	1,210	Heijningen, 1992
fertiliser: urea	0,24	22,70	2,009	2,345	3,613	Heijningen, 1992
ammonia	0,27	74,56	6,600	7,703	11,866	APME, 2000
surface active material	2,24	51,40	4,582	14,995	1,175	De Paauw, 1993
washing powder	2,12	28,75	2,563	8,387	0,657	Potting et al., 1995
sweeteners	277,50	160,00	14,263	46,677	3,658	Kramer, 1995
paint (alkyd resin)	8,81	65,10	5,803	18,992	1,489	FOEFL, 1994
paint (acrylic)	2,74	38,70	3,450	11,290	0,885	FOEFL, 1994

Table B.1.17 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the manufacture of building materials (io sector 31).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
cement (average used NL)	0,16	3,54	2,608	4,673	0,340	Heijningen, 1992
cement (Hoogoven)	0,16	2,68	1,974	3,537	0,257	Heijningen, 1992
cement (Portland)	0,16	4,50	3,315	5,940	0,432	Heijningen, 1992
cement (fly ash)	0,16	3,82	2,814	5,042	0,367	Heijningen, 1992
glass	0,93	10,57	7,786	13,952	1,015	SAEFL, 1998
glass (flat)	3,61	21,00	15,468	27,718	2,016	Fraanje, 1990
glass wool	0,28	20,00	14,732	26,398	1,920	Fraanje, 1990
bricks	0,23	3,10	2,283	4,092	0,298	Heijningen, 1992
plaster (blocks)	0,29	0,77	0,567	1,016	0,074	Boustead, 1979
Portland cement clinker	0,20	3,90	2,874	5,150	0,375	Heijningen, 1992
concrete	0.06	0.93	0.685	1.228	0.089	Idemat 2000

Table B.1.18 Price (excl. VAT), life-cycle energy use and CO_2, CH_4 and N_2O emissions of basic goods produced in the basic metal industry (io sector 32).

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
aluminium	4,79	168,01	18,608	43,508	0,470	Idemat 2000
chromium	21,16	174,88	19,369	45,287	0,489	Idemat 2000
gold (per gram)	20,93	5,60	0,620	1,450	0,016	De Paauw, 1993
copper (cathodic)	3,11	97,59	10,808	25,272	0,273	Idemat 2000
bronze	9,34	106,67	11,814	27,623	0,298	Idemat 2000
brass	3,22	87,69	9,712	22,708	0,245	Idemat 2000
lead	1,44	28,90	3,201	7,484	0,081	Idemat 2000
manganese	0,23	216,34	23,960	56,024	0,605	Idemat 2000
nickel (electrolytic)	8,83	360,50	39,927	93,355	1,008	Idemat 2000
steel	1,22	29,96	3,318	7,758	0,084	Idemat 2000
tin	14,12	211,05	23,374	54,654	0,590	Idemat 2000
titanium	16,56	641,00	70,993	165,994	1,792	Idemat 2000
silver	282,65	80,00	8,860	20,717	0,224	De Paauw, 1993
zinc	1,66	52,10	5,770	13,492	0,146	Idemat 2000
zirconium	68,08	1200,00	132,904	310,753	3,354	Kemna, 1981
cast iron	1,90	12,70	1,407	3,289	0,036	Idemat 2000
stainless steel	8,62	43,70	4,840	11,317	0,122	Idemat 2000
stainless steel (Ni compound)	7,64	69,60	7,708	18,024	0,195	Idemat 2000

Table B.1.19 Price (VAT), life-cycle energy use and CO_2, CH_4 and N_2O emission of basic goods in water distribution companies (io sector 44).

	price NLG/m^3	energy MJ/m^3	CO_2 kg/m^3	CH_4 g/ m^3	N_2O g/ m^3	References
water (m3)	1,95	5,74	0,633	1,742	0,060	Kok 2000

2. Packaging materials

The packaging materials are a subset of the basic goods as described in the previous paragraph. They are listed here because they are a separate item and database in the EAP software.

Table B.2.1Price (VAT), life-cycle energy use and CO_2, CH_4 and N_2O emission of packaging materials.

	price NLG/kg	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg	References
softwood (sawn)	1.96	3.10	0.382	1.393	0.055	Heijningen, 1992
paper	0.86	40.85	3.068	8.436	0.212	Kok, 2000
cardboard (corrugated)	2.13	17.86	1.486	4.610	0.145	Kok, 2000
cardboard (dry food)	1.85	12.55	1.044	3.239	0.102	SAEFL, 1998
cardboard (others)	1.85	43.89	3.651	11.326	0.355	SAEFL, 1998
cardboard (beverages)	1.85	36.37	3.026	9.386	0.294	SAEFL, 1998
HDPE	1.08	75.74	5.671	13.030	1.558	Idemat 2000
LDPE	1.13	83.41	6.245	14.349	1.716	Idemat 2000
polypropene (granules)	1.64	82.00	6.140	14.106	1.687	Idemat 2000
PVC (soft, granules)	1.75	61.79	4.627	10.630	1.271	Idemat 2000
PET bottle grade	5.62	79.53	5.955	13.682	1.636	Idemat 2000
PET bottle grade (re-used, deposit)	0.28	23.86	1.786	4.104	0.491	Kok, 2000
PET (granules)	4.24	73.02	5.467	12.562	1.502	Idemat 2000
polystyrene (granules)	3.31	96.05	7.192	16.523	1.976	Idemat 2000
polycarbonate (granules)	8.96	105.00	7.862	18.063	2.160	Idemat 2000
glass (once used; packaging)	0.93	10.57	7.786	13.952	1.015	SAEFL, 1998
glass (re-used, deposit)	0.04	2.64	1.946	3.488	0.254	Kok, 2000
aluminium	2.88	168.01	18.608	43.508	0.470	Idemat 2000
tinplate	4.08	35.77	3.962	9.263	0.100	SAEFL, 1998

3. Manufacturers

The *Producers* file in EAP contains the data of the manufacturing sectors. Table B.3.1 contains the data for the sectors included in EAP, according to their SBI code [CBS, 1992]. For each sector, the input-output sector, the energy price, the direct energy and greenhouse gas intensities, the percentages of net added value (NAV) and depreciation are given. EAP also contains the energy and greenhouse gas intensities of the depreciation in each sector. In the present databank, the same value for these intensities is applied to all sectors (respectively. 4.1 MJ/NLG, 0.32 kg CO_2/NLG, 0.69 g CH_4/NLG and 0.03 g N_2O/NLG). These values are not displayed in the table.

The input-output division is based on the classification in the *Nationale Rekeningen* (National Accounts) [CBS 1999b], see also table A.1. The energy price refers to the price of one GJ of primary energy (excl. VAT). The energy prices were calculated by means of energy statistics [Brouwer and van Bruchem, CBS, 1997a, 1998a, 1998c] and production statistics [CBS, 1999c]. The energy use per energy carrier is expressed in primary energy by means of the ERE values in Table B.5.2. The percentages of NAV and depreciation are derived from production statistics [CBS 1999c].

Table B.3.1 Energy price direct energy and CO_2, CH_4 and N_2O intensity, and percentages of net added value and depreciation of economic sectors, according to SBI code and input-output sector.

SBI	IO	sector	price	energy	CO_2	CH_4	N_2O	NAV	dep.
			NLG/GJ	MJ/NLG	kg/NLG	g/NLG	g/NLG	%	%
0111	1	agriculture	19.93	1.86	0.129	0.233	1.886	35.9	11.2
011a	2	horticulture	13.41	2.20	0.135	0.229	0.303	35.9	11.2
011b	2	glasshouse horticulture	8.83	15.37	0.874	1.236	0.005	35.9	11.2
012	3	cattle breeding	21.11	1.32	0.085	21.176	0.915	35.9	11.2
013	4	other agriculture and forestry	13.41	1.75	0.107	0.181	0.005	35.9	11.2
05	5	fishery	10.38	15.85	1.123	1.759	0.244	40.9	18.6
11	6	crude petroleum and natural gas prod.	2.70	1.43	0.095	4.361	0.000	72.3	11.0
14	7	other mining and quarrying	2.70	1.62	0.109	0.203	0.013	72.3	11.0
1511	8	slaughter industry (excl. poultry)	13.86	0.52	0.034	0.072	0.001	7.7	0.9
1512	8	poultry slaughter industry	13.86	0.52	0.034	0.072	0.001	14.0	1.9
15131	8	snack industry (incl. salads etc.)	13.86	0.52	0.034	0.072	0.001	27.6	3.5
15132	8	meat processing industry	13.86	0.52	0.034	0.072	0.001	16.4	2.4
152	9	fish processing industry	15.35	0.67	0.044	0.100	0.001	17.4	3.2
1531	10	potato products factories	9.30	3.63	0.220	0.402	0.002	21.0	5.2
1532	10	vegetable and fruit processing Ind.	11.01	1.46	0.089	0.162	0.001	20.5	3.5
154	13	margarine, fat industry etc.	9.26	1.65	0.093	0.130	0.000	11.5	1.8
155	11	dairy industry	9.90	1.24	0.076	0.134	0.001	10.4	2.5
1561	13	flour industry (excl. starch)	12.45	1.51	0.100	0.236	0.001	15.2	2.8
1562	13	starch and sugar industry	13.59	3.11	0.286	0.326	0.001	24.3	6.0
157	12	fodder industry	13.01	1.19	0.077	0.160	0.003	10.6	2.5
1581	13	bread and rusk factories, bakeries etc.	5.05	3.37	0.198	0.314	0.003	33.6	5.6
15841	13	cocoabean processing industry	11.07	1.02	0.064	0.128	0.001	15.6	2.4
15842	13	chocolate and sweets industry	11.07	1.02	0.064	0.128	0.001	28.9	4.1
1585	13	pasta, coffee, spices industry etc.	22.63	1.03	0.063	0.119	0.001	28.1	3.2
15891	13	bakerie raw materials industry	22.63	1.03	0.063	0.119	0.001	3.8	2.4
15892	13	other foodstuffs industry	22.63	1.03	0.063	0.119	0.001	26.5	3.1
1591	14	alcohol factories and distilleries etc.	9.26	1.81	0.106	0.171	0.001	47.0	3.4
1596	14	brewers and malters	10.28	0.96	0.057	0.094	0.000	44.4	6.1
1598	14	soft drinks industry	12.03	0.70	0.043	0.083	0.000	31.6	7.1
16	15	tobacco processing industry	13.69	0.22	0.016	0.033	0.000	58.8	1.9

Table B.3.1 (contd.)

SBI	IO	sector	price NLG/GJ	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG	NAV %	dep. %
171	16	spinning and weaving mills	11.64	5.46	0.336	0.648	0.003	29.9	5.0
173	16	textile refinement industry	11.64	5.46	0.336	0.648	0.003	41.0	6.0
174	16	textile wares (ex. clothes)	12.54	0.94	0.058	0.111	0.001	33.2	3.2
175	16	other textile industry	11.79	1.07	0.066	0.129	0.001	25.1	2.8
177	16	ind. of knitted and crocheted articles	13.93	0.45	0.028	0.056	0.001	29.2	4.2
181	17	leather and other clothing ind.	13.93	0.45	0.028	0.056	0.001	28.7	2.4
1822	17	outer wear industry	13.93	0.45	0.028	0.056	0.001	24.3	2.1
1823	17	underwear and night clothing industy	13.93	0.45	0.028	0.056	0.001	17.1	1.6
191	18	tanneries	14.99	0.79	0.050	0.102	0.001	21.7	1.6
192	18	leatherware industry (excl. shoes)	14.99	0.79	0.050	0.102	0.001	31.3	2.4
193	18	shoe industry	14.99	0.79	0.050	0.102	0.001	38.0	3.4
201	19	sawmills, plate material ind. etc.	18.04	0.75	0.049	0.111	0.001	31.3	3.5
20301	19	wooden doors, windows and frames ind.	17.88	0.57	0.038	0.086	0.001	34.0	2.7
20302	19	carpenter industry (excl. doors, windows)	17.88	0.57	0.038	0.086	0.001	27.7	2.4
204	19	wood packaging industry	14.27	1.11	0.070	0.144	0.001	24.5	4.2
211	20	pulp, paper and board industry	9.95	8.05	0.479	0.817	0.004	26.0	7.9
21121	20	graphical paper and board industry	9.95	8.05	0.479	0.817	0.004	24.6	8.4
21211	21	paper and board packaging mat. ind.	11.46	1.48	0.096	0.198	0.001	29.5	5.9
21212	21	corrugated paper and cardb. ind.	11.46	1.48	0.096	0.198	0.001	30.6	4.6
2122	21	domestic paperware ind.; wallpaper	11.46	1.48	0.096	0.198	0.001	24.6	7.6
2123	21	ind. of paper office articles	11.46	1.48	0.096	0.198	0.001	33.5	5.2
2125	21	other paper and board ind.	11.46	1.48	0.096	0.198	0.001	30.2	4.9
2211	22	book publishers	15.99	0.20	0.013	0.029	0.001	37.7	1.2
2212	22	daily newspaper publishers	15.99	0.20	0.013	0.029	0.001	43.5	4.8
2213	22	magazine publishers	15.99	0.20	0.013	0.029	0.001	44.1	1.9
2214	22	other publishers	15.99	0.20	0.013	0.029	0.001	31.1	3.3
2221	22	printing-works	14.55	0.71	0.046	0.101	0.001	34.7	6.0
2223	22	binders and other graphical workmanship	14.55	0.71	0.046	0.101	0.001	38.9	6.1
2224	22	graphical reproduction companies	14.55	0.71	0.046	0.101	0.001	50.9	9.7
223	23	reproduction companies of recorded media	12.50	0.51	0.034	0.081	0.001	23.4	7.0
23201	24	petroleum refineries	10.55	1.18	0.099	0.106	0.000	5.3	4.3
23	24	other petroleum and coal process. ind.	33.56	7.50	0.515	0.919	0.077	35.8	13.5
241	25	basic chemistry	6.42	25.78	2.057	2.901	1.151	22.6	6.4
2413	26	inorganic chemistry	6.42	26.57	2.603	4.030	0.156	22.6	6.4
2414	27	petrochemical products industry	6.42	22.04	1.465	2.349	0.629	22.6	6.4
2415	28	fertiliser industry	6.42	45.01	3.899	3.559	7.795	22.6	6.4
242	29	agricultural chemicals industry	11.03	1.29	0.087	0.166	0.008	24.8	4.7
243	29	paint, varnish, mastic industry etc.	14.78	0.49	0.034	0.066	0.001	31.2	3.4
245	29	soap, detergents and cosmetics ind.	13.65	0.65	0.042	0.083	0.002	28.6	3.5
244	29	other chemical industry	8.96	1.37	0.094	0.142	0.001	23.5	5.6
251	30	rubber processing industry	12.05	1.92	0.121	0.254	0.001	36.0	6.2
252	30	synthetic material processing industry	12.43	1.74	0.114	0.258	0.002	30.3	5.7
261	31	glass and glass treatment industry	8.15	7.77	0.647	0.887	0.027	37.9	6.9
2612	31	flat-glass processing industry	8.15	7.77	0.647	0.887	0.027	28.4	4.7
262	31	ceramic products industry	9.15	5.91	0.372	0.591	0.002	43.0	7.0
264	31	ind. for ceramic building materials	8.86	11.42	0.879	1.117	0.004	46.0	9.0
265	31	cement, chalk and plaster industry etc.	7.60	5.56	1.357	0.688	0.036	36.1	9.1
266	31	concrete, cement and plaster ware Ind.	12.40	1.32	0.081	0.147	0.002	34.1	5.6
26611	31	concrete building materials industry	12.40	1.32	0.081	0.147	0.002	35.9	5.3
26612	31	chalk sandstone industry	12.40	1.32	0.081	0.147	0.002	46.1	9.3
2663	31	ready-to-pour concrete industry	12.40	1.32	0.081	0.147	0.002	23.8	4.2

Table B.3.1 (contd.)

SBI	IO	sector	price NLG/GJ	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG	NAV %	dep. %
267	31	natural stone processing industry	7.60	5.56	1.357	0.688	0.036	37.4	4.7
271	32	metal industry (excl. foundries)	4.70	21.25	2.300	4.992	0.036	29.4	6.4
2751	32	iron and steel foundries	4.70	21.25	2.300	4.992	0.036	30.1	6.2
2753	32	non-ferrous metal foundries	4.70	21.25	2.300	4.992	0.036	30.1	6.2
2811	33	construction workshops, steam boiler ind.	8.72	0.73	0.045	0.091	0.001	28.5	2.5
2812	33	metal windows, doors and frames industry	8.72	0.73	0.045	0.091	0.001	31.9	2.0
2821	33	tank and reservoir construction	14.88	0.40	0.025	0.053	0.000	34.9	2.1
2822	33	central heating boiler and radiator industry	14.88	0.40	0.025	0.053	0.000	22.2	3.3
284	33	forging and profile rolling ind. etc.	15.09	0.62	0.040	0.086	0.001	30.7	4.5
2851	33	surfacing companies	15.02	1.44	0.090	0.185	0.001	40.6	4.8
2852	33	other metal treatment industry	15.02	1.44	0.090	0.185	0.001	47.6	5.3
2861	33	scissors, knives and cutlery ind. etc.	15.87	0.66	0.042	0.094	0.001	42.6	4.3
2862	33	tools industry	15.87	0.66	0.042	0.094	0.001	47.5	5.1
2871	33	metal packaging industry	13.60	1.09	0.069	0.143	0.001	29.7	3.9
2873	33	wire products industry	13.60	1.09	0.069	0.143	0.001	22.2	4.9
2874	33	nuts, bolts, screws and chain ind.	13.60	1.09	0.069	0.143	0.001	33.5	5.0
2875	33	other metal products industry n.e.c.	13.60	1.09	0.069	0.143	0.001	36.3	4.8
2911	34	motor and turbine ind. (excl. vehicles)	14.78	0.47	0.030	0.063	0.000	22.8	2.0
2912	34	pump and compressor industry	14.78	0.47	0.030	0.063	0.000	32.1	3.3
2913	34	appendage industry	14.78	0.47	0.030	0.063	0.000	34.0	4.5
2914	34	gears and ballbearings ind. etc.	14.78	0.47	0.030	0.063	0.000	35.8	3.1
2921	34	ind. of industrial furnaces and burners	16.75	0.32	0.020	0.041	0.000	21.3	1.5
2922	34	crane, lifting and other transport ind.	16.75	0.32	0.020	0.041	0.000	29.0	2.6
2923	34	machine ind. of cooling technology	16.75	0.32	0.020	0.041	0.000	32.1	2.4
2924	34	ind. of other machines for general use	16.75	0.32	0.020	0.041	0.000	34.2	3.1
293	34	agric. machines and instruments ind.	13.31	0.54	0.034	0.071	0.001	31.8	2.5
294	34	machine tools industry	13.80	0.69	0.043	0.089	0.000	37.0	2.7
2951	34	machine ind. for steel production etc.	15.25	0.40	0.025	0.053	0.000	35.5	3.1
2953	34	ind. of machines for foodstuffs	15.25	0.40	0.025	0.053	0.000	35.0	2.8
2954	34	ind. of machines for textile and clothes	15.25	0.40	0.025	0.053	0.000	38.4	5.1
2955	34	industry for other machines n.e.c.	15.25	0.40	0.025	0.053	0.000	34.9	2.4
297	35	domestic equipment industry	16.27	0.46	0.029	0.057	0.000	26.5	3.0
30	36	office equipment and computer industry	12.85	0.39	0.026	0.059	0.000	22.9	3.3
311	37	electromotors, generator ind. etc.	15.85	0.40	0.025	0.052	0.000	29.0	2.8
312	37	switch and distributing construction Ind.	13.37	0.43	0.028	0.062	0.000	36.5	5.1
313	37	isolated wire and cable industry	12.52	0.96	0.063	0.145	0.001	32.6	3.6
314	37	ind. of batteries, lamps, audio equipment etc.	12.19	1.18	0.080	0.152	0.009	30.5	5.3
33101	37	dental technical companies	12.19	1.18	0.080	0.152	0.009	61.6	2.4
334	37	optical, photo and film equipment ind etc.	12.19	1.18	0.080	0.152	0.009	40.0	4.6
341	38	car, tracks and airplane industry etc.	12.97	0.49	0.034	0.067	0.001	17.2	6.0
34201	38	chassis industry	16.44	0.46	0.029	0.059	0.000	25.5	1.9
34202	38	trailers and semi-trailers industry	16.44	0.46	0.029	0.059	0.000	27.2	2.1
343	38	car parts ind.	13.52	0.53	0.034	0.073	0.000	27.7	3.7
3511	39	constr. of ships and drilling rigs	14.58	0.59	0.038	0.080	0.001	20.9	1.6
3512	39	constr. of sports and pleasure cruises	14.58	0.59	0.038	0.080	0.001	28.8	1.5
3541	40	bicycle and motor bike ind.	7.05	1.31	0.088	0.150	0.011	27.5	2.2
3543	40	other transport industry	7.05	1.31	0.088	0.150	0.011	31.5	2.8
3611	41	furniture industry	15.24	0.64	0.041	0.087	0.001	26.0	2.5
36121	41	interior construction industry	15.24	0.64	0.041	0.087	0.001	37.0	2.6
36122	41	factory furniture industry	15.24	0.64	0.041	0.087	0.001	38.5	3.8

Table B.3.1 (contd.)

SBI	IO	sector	price	energy	CO_2	CH_4	N_2O	NAV	dep.	
			NLG/GJ	MJ/NLG	kg/NLG	g/NLG	g/NLG	%	%	
3613	41	kitchen and bathroom furniture industry			15.24	0.64	0.041	0.087	0.001	28.5	2.6
3614	41	other furniture industry			15.24	0.64	0.041	0.087	0.001	31.1	4.8
3615	41	matress industry			15.24	0.64	0.041	0.087	0.001	27.1	2.5
362	42	jewelry industry etc. (excl. imitation)			14.43	1.18	0.077	0.171	0.002	36.4	3.7
363	42	other industry			14.43	1.18	0.077	0.171	0.002	36.0	5.4
37	42	preparation to recycling			14.43	1.18	0.077	0.171	0.002	19.4	8.1
40	43	electricity and gas supply			2.70	0.88	0.078	0.109	0.000	27.4	11.3
41	44	water supply			12.94	1.76	0.136	0.292	0.003	27.4	11.3
45	45	construction			16.29	0.15	0.010	0.017	0.001	32.4	2.0
50	46	trade/repair of motor vehicles/cycles			14.51	0.73	0.046	0.090	0.001	48.4	4.2
51	47	wholesale trade			17.97	0.48	0.029	0.055	0.001	55.7	5.6
52	48	retail trade and repair			8.52	1.29	0.082	0.172	0.001	55.2	7.3
55	49	hotels and restaurants			15.64	1.61	0.101	0.196	0.003	42.1	6.3
60	50	land transport			24.68	4.54	0.318	0.544	0.059	44.4	8.6
61	51	air and water transport			7.02	11.15	0.789	1.241	0.170	25.4	9.6
63	52	supporting transport activities			16.36	0.94	0.061	0.125	0.003	39.4	6.2
64	53	communication			16.60	0.34	0.023	0.042	0.003	40.4	24.9
65	54	banking			20.53	0.21	0.014	0.032	0.000	61.8	6.0
66	55	insurance and pension funding			20.44	0.12	0.008	0.017	0.000	48.8	6.0
67	56	activities auxiliary to financial intermediation			19.62	0.13	0.008	0.018	0.000	68.3	6.0
70	57	real estate activities			18.76	0.03	0.002	0.004	0.000	45.0	32.5
71	58	renting of movables			19.34	0.07	0.005	0.010	0.000	31.3	31.6
72	59	business activities (other)			15.01	0.27	0.017	0.037	0.000	59.5	2.7
75	60	government: civilian and military activities			13.43	0.38	0.024	0.046	0.001	52.6	21.7
80	61	subsidized education			15.78	0.76	0.046	0.081	0.001	75.9	5.9
851,2	62	human health and veterinary activities			13.91	0.63	0.037	0.068	0.001	65.7	7.8
853	63	social work activities			13.33	1.03	0.061	0.104	0.000	65.7	7.8
90	64	sewage and refuse disposal services			10.55	0.92	0.062	53.836	0.005	41.2	2.7
92	65	recreational, cultural and sporting activities			13.71	0.62	0.038	0.074	0.001	36.5	2.6
93	66	other service activities			14.09	0.54	0.033	0.057	0.001	61.5	2.7
1532	10	drying fruit			11.01	3.61	0.220	0.402	0.003	20.5	3.5
1532	10	drying vegetables			11.01	2.31	0.182	0.333	0.003	20.5	3.5
1532	10	canning vegetables			11.01	0.75	0.059	0.108	0.001	20.5	3.5
1532	10	canning fruit in juice			11.01	0.59	0.047	0.085	0.001	20.5	3.5
1532	10	canning fruit, compote/sauce			11.01	2.58	0.204	0.373	0.003	20.5	3.5
1532	10	freezing vegetables			11.01	5.77	0.456	0.833	0.007	20.5	3.5
15132	8	freezing meat			15.35	1.81	0.116	0.249	0.002	16.4	2.4
152	9	freezing fish			13.86	1.50	0.079	3.381	0.001	17.4	3.2

4. Means of transport

In this section, we present energy use and greenhouse gas emissions as a result of using means of transport. Table B.4.1 displays the energy use and the corresponding greenhouse gas emissions for Freight transport. The greenhouse gas emissions were calculated with an average emission factors for petroleum products. The data for freight transport were included in EAP in the *Means of Transport* file.

Table B.4.1 Direct, indirect and total energy use (MJ/tonne km) and CO_2, CH_4 and N_2O emission (kg CO_2/tonne km, g CH_4/tonne km and g N_2O/tonne km) for Freight transport

	direct MJ/tonne km	indirect MJ/tonne km	total MJ/tonne km	CO_2 kg/tonne km	CH_4 g/tonne km	N_2O g/tonne km
Airplane	8.96 (3)	0.8 (5)	9.76	0.767	1.202	0.167
Lorry	1.68 (2)	0.46 (5)	2.14	0.168	0.264	0.037
Lorry (cooling transport)	1.81 (3)	0.46 (5)	2.27	0.179	0.280	0.039
Ship (inland waters)	0.60 (1)	0.26 (5)	0.86	0.067	0.106	0.015
Ship (short sea)	0.28 (3)	0.03 (4)	0.31	0.024	0.038	0.005
Ship 55,000 t			0.13 (6)	0.009	0.016	0.002
Ship 250,000 t (bulk)	0.07 (4)	0.01 (4]	0.08	0.006	0.010	0.001
Train	0.61 (1)	0.34 (5)	0.95	0.129	0.374	0.109
Van	10.7 (1)	5.80 (5)	16.50	1.297	2.033	0.282

(1) [Brink and van Wee, 1997], table 4.3

(2) the energy use for cooling transport is 8% higher than normal transport [Rudolphij et al., 1993]

(3) [Brink, 1998]

(4) [Boustead, 1979]

(5) [Bos, 1998]

(6) [Frischknecht et al., 1995]

5. Trade and services

The *Trade/services* file contains data concerning margins, energy use and greenhouse gas emissions in the Trade and Services sector. In EAP, to work out the margin, the purchase price is taken as a percentage of the net turnover (excl. VAT) [CBS, 1997b and 1999a]. The cumulative energy and greenhouse gas intensities are based on the direct and indirect intensities. For the direct intensities, data on the direct energy use [CBS, 1997a, 1998c and 1999a] and the greenhouse gas emissions factors of each energy carrier were used. The indirect intensities are based on the indirect energy intensities of input-output sectors 46, 47, 48, and 49.These indirect energy intensities were calculated by using input-output analysis. Tables B.5.1 to B.5.4 present the data for the retail trade, wholesale trade, catering trade and auto/motorcycle trade and petrol stations. The energy intensities are given in energy use per unit of margin. The same holds for the greenhouse gas emissions.

Table B.5.1 Relation of purchase price to net turnover (%), cumulative energy and CO_2, CH_4 and N_2O intensities per NLG margin for the Retail trade.

	%	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG
groceries (general)	77.7	2.29	0.142	0.265	0.003
potatoes, vegetables and fruit	65.4	2.29	0.142	0.265	0.003
meat and meat products	60.6	2.29	0.142	0.265	0.003
game and game birds	65.1	2.29	0.142	0.265	0.003
fish	56.5	2.29	0.142	0.265	0.003
chocolate and sweets	58.5	2.29	0.142	0.265	0.003
liquor	80.8	2.29	0.142	0.265	0.003
tobacco products	83.7	2.29	0.142	0.265	0.003
cheese	66.5	2.29	0.142	0.265	0.003
reform articles	68.6	2.29	0.142	0.265	0.003
durable and other consumption art.	63.3	2.29	0.142	0.265	0.003
chemist's shop articles	67.5	2.29	0.142	0.265	0.003
clothing materials, wool etc.	56.5	2.29	0.142	0.265	0.003
outer garments	59.5	2.29	0.142	0.265	0.003
other clothing	60.2	2.29	0.142	0.265	0.003
footwear, leather and travel art.	59.1	2.29	0.142	0.265	0.003
furniture, lighting etc.	61.3	2.29	0.142	0.265	0.003
glassware, pottery, porcelain	60.3	2.29	0.142	0.265	0.003
other domestic articles	66.3	2.29	0.142	0.265	0.003
white goods, audio/visual etc.	74.6	2.29	0.142	0.265	0.003
music instruments	67.0	2.29	0.142	0.265	0.003
sewing and knitting machines	58.5	2.29	0.142	0.265	0.003
do-it-yourself articles	65.5	2.29	0.142	0.265	0.003
books, magazines and office art.	70.6	2.29	0.142	0.265	0.003
photographic articles	59.7	2.29	0.142	0.265	0.003
optical articles	38.0	2.29	0.142	0.265	0.003
jeweller's articles and clocks	53.4	2.29	0.142	0.265	0.003
bicycles	68.5	2.29	0.142	0.265	0.003
sports and camping articles	63.3	2.29	0.142	0.265	0.003
flowers and plants	56.6	2.29	0.142	0.265	0.003
nurserygarden	60.7	2.29	0.142	0.265	0.003
animals/pets and accessories	67.1	2.29	0.142	0.265	0.003
computers	83.1	2.29	0.142	0.265	0.003
toys	66.3	2.29	0.142	0.265	0.003
all companies (average)	68.4	2.29	0.142	0.265	0.003

Table B.5.2 Relation between purchase price and net turnover (%), cumulative energy and CO_2, CH_4 and N_2O intensities per NLG margin for the Wholesale trade.

	%	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG
all companies (average)	80.9	1.59	0.098	0.184	0.002
agricultural prod., living animals	86.6	1.59	0.098	0.184	0.002
vegetables and fruit	85.7	1.59	0.098	0.184	0.002
consumer potatoes	79.5	1.59	0.098	0.184	0.002
poultry and game (birds)	89.4	1.59	0.098	0.184	0.002
meat and meat products	88.9	1.59	0.098	0.184	0.002
dairy products, oil and fats	93.6	1.59	0.098	0.184	0.002
eggs	89.5	1.59	0.098	0.184	0.002
beverages	84.9	1.59	0.098	0.184	0.002
tobacco products	93.0	1.59	0.098	0.184	0.002
sugar, chocolate and sweets	82.6	1.59	0.098	0.184	0.002
coffee, tee, cocoa, spices	63.8	1.59	0.098	0.184	0.002
snacks	82.0	1.59	0.098	0.184	0.002
fish	81.6	1.59	0.098	0.184	0.002
groceries n.e.c.	82.9	1.59	0.098	0.184	0.002
raw materials food industry	85.4	1.59	0.098	0.184	0.002
groceries (general)	88.8	1.59	0.098	0.184	0.002
textiles and leather wares	77.2	1.59	0.098	0.184	0.002
electrical domestic app. etc.	79.3	1.59	0.098	0.184	0.002
glassware, pottery, porcelain etc.	65.6	1.59	0.098	0.184	0.002
perfumes and cosmetics	64.6	1.59	0.098	0.184	0.002
pharmaceutical articles	75.3	1.59	0.098	0.184	0.002
other domestic articles	74.5	1.59	0.098	0.184	0.002
fuels	89.3	1.59	0.098	0.184	0.002
ores and metals	83.3	1.59	0.098	0.184	0.002
wood and building materials	77.8	1.59	0.098	0.184	0.002
iron and metalware etc.	74.3	1.59	0.098	0.184	0.002
chemicals	82.1	1.59	0.098	0.184	0.002
other intermediate goods	81.9	1.59	0.098	0.184	0.002
refuse and waste products	82.5	1.59	0.098	0.184	0.002
machines and other w.t.	75.8	1.59	0.098	0.184	0.002

Table B.5.3 Relation between purchase price and net turnover (%), cumulative energy and CO_2, CH_4 and N_2O intensities per NLG margin for the Hotel and Catering industry

	%	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG
hotels	17.5	3.45	0.213	0.399	0.004
holiday centres	14.4	3.45	0.213	0.399	0.004
restaurants	33.9	3.45	0.213	0.399	0.004
bars	33.2	3.45	0.213	0.399	0.004
canteens and catering	38.9	3.45	0.213	0.399	0.004

Table B.5.4 Relation between purchase price and net turnover (%), cumulative energy and CO_2, CH_4 and N_2O intensities per NLG margin for car and motorcycle trade and petrol stations.

	%	energy MJ/NLG	CO_2 kg/NLG	CH_4 g/NLG	N_2O g/NLG
importers of private cars	71.9	2.40	0.148	0.278	0.003
trade - private cars	84.3	2.40	0.148	0.278	0.003
trade- car servicestation	43.0	2.40	0.148	0.278	0.003
r.t. car parts	62.9	2.40	0.148	0.278	0.003
w.t. car parts	78.0	2.40	0.148	0.278	0.003
r.t. motorcycle companies	81.4	2.40	0.148	0.278	0.003
petrol (gasoline) station	89.1	2.40	0.148	0.278	0.003

6. Energy use

The *Energy use* file contains data on various forms of energy consumption while using a consumer commodity in the household. Table B.6.1 provides an overview of the data stored in EAP. EAP contains the price per unit (including VAT; recommended price in 1996), the primary energy use and the lifecycle greenhouse gas emissions per unit, for every type of energy use. Primary energy use was calculated from secondary energy carriers [CBS, 1997a] by means of ERE values (Table B.6.2). The ERE value of an energy carrier is the total amount of primary energy that is necessary to supply one unit of energy. Table B.6.2 also contains the greenhouse gas emission factors that are used for the calculation of the lifecycle greenhouse gas emissions of the various energy carriers. For the conversion from units of weight to units of volume and vice versa, the figures in Table B.6.3 were applied.

Table B.6.1 Price incl. VAT [CBS, 1997 and 1999a], energy content and CO_2, CH_4 and N_2O emission for various types of domestic energy use [CBS, 1997a and 1998c].

	unit	price NLG/unit	energy MJ/unit	CO_2 kg/unit	CH_4 g/unit	N_2O g/unit
diesel	litre	1.10	39.81	2.819	4.418	0.613
domestic fuel oil	litre	0.69	39.81	2.819	4.418	0.613
electricity	kWh	0.21	9.90	0.755	1.730	0.012
LPG	litre	0.55	26.09	1.847	2.895	0.402
mixed lubrication	litre	1.50	39.81	2.819	4.418	0.613
natural gas	m^3	0.49	31.97	1.788	2.350	0.003
paraffin	litre	0.81	37.79	2.676	4.194	0.582
petrol -euro95	litre	1.72	35.16	2.490	3.903	0.542
petrol -super	litre	1.80	35.16	2.490	3.903	0.542
water [29]	m^3	1.91	6.07	0.450	0.963	0.050

Table B.6.2 ERE values and CO_2, CH_4 and N_2O emission factors for various secondary energy carriers [CBS, 1997a, Wilting et al., 1994 and Kramer, 1997].

energy carrier	ERE val. MJ/MJ	CO_2 g/MJ	CH_4 g/MJ	N_2O g/MJ
coal as fuel	1.10	103.4	0.354	0.003
coal products (cokes)	1.25	132.9	0.354	0.003
electricity	2.55	174.4	0.445	0.003
natural gas	1.01	56.5	0.074	0.000
petroleum products	1.11	78.6	0.123	0.017

Table B.6.3 Density of liquid fuels [PBNA, 1987 and Binas, 1986].

	kg/litre
diesel and domestic fuel oil	0.84
heavy fuel oil	0.97
light fuel oil	0.88
liquid gas	0.58
paraffin	0.79
petrol	0.72

7. Waste processing

The *Waste processing* file in EAP contains data on energy use and related greenhouse gas emissions concerning processing and recycling waste. We used the data presented in Table B.7.1 and Table B.7.2. Table B.7.1 displays the energy use [AOO, 1995, Sas, 1995, Nijdam 2000] and greenhouse gas emissions of various methods of waste processing.
On the basis of the different methods of processing and the percentages for the Netherlands in 1990, we calculated an average for the total processing of domestic waste in the Netherlands. In 1996, 40% of the rubbish (including bulk refuse) was incinerated and 60% was dumped (landfill) of the remaining waste fraction (after composting or recycling) [VROM, 1999].

Table B.7.1 Energy use and CO_2, CH_4 and N_2O emission of various methods of processing domestic waste and an average processing (see text).

	energy MJ/kg	CO_2 kg/kg	CH_4 g/kg	N_2O g/kg
collecting and transport	0.11 (1)	0.008	0.012	0.002
landfill	0.08 (2)	0.006	0.009	0.001
incineration plastics (with heat exploitat.)	-16.80 (2)	-1.151	-2.935	-0.019
incineration residual waste (no heat expl.)	0.51 (3)	0.035	0.089	0.001
composting	0.15 (4)	0.010	0.026	0.000
average residual waste (incl. transport)	0.44 (5)	0.031	0.069	0.002
average plastics (incl. transport)	-9.94 (6)	-0.681	-1.746	-0.010

(1) [AOO, 1995]
(2) based on 40% to landfill and 60% incineration {VROM, 1999}
(3) [Sas, 1994]
(4) [DHV, 1985]
(5) based on efficiency of 16.5% [AOO, 1995], all energy gains is assumed to come from plastics
(6) based on the difference between net and gross efficiency of 5% of the waste incinerator [AOO, 1995]

Using waste for the production of materials can save energy. The difference between primary production (natural raw materials) and secondary production (refuse as raw material) is the energy that is saved. Table B.7.2 displays the energy use of the primary and secondary production for a number of materials, along with the energy saved and the greenhouse gas emissions. Taking into account the fact that synthetic materials were scarcely collected separately in 1996, no figures for the recycling of synthetic materials were included.
The energy figures for the basic goods paper and glass were based on combined primary and secondary production. Therefore no figures for the recycling of these materials are given.

Table B.7.2 Energy use of primary and secondary production, energy saving and CO_2, CH_4 and N_2O saving and the percentage of recycled materials.

material	primary MJ/kg	secondary MJ/kg	recycling MJ/kg	recycling kg CO_2/kg	recycling g CH_4/kg	recycling g N_2O/kg
aluminium	168.01 (1)	10 (1)	-158.01	-17.500	-40.918	-0.442
steel	29.96 (1)	7 (3)	-22.96	-2.543	-5.946	-0.064
tinplate	35.77 (2)	18 (2)	-17.77	-13.089	-23.455	-1.706
copper	97.59 (1)	12 (3)	-85.59	-9.479	-22.164	-0.239
lead	28.90 (1)	10 (3)	-18.90	-2.093	-4.894	-0.053
rubber	85.47 (1)	10 (3)	-12.70	-1.124	-1.312	-2.021
zinc	52.10 (1)	27 (3)	-25.10	-2.780	-6.500	-0.070

(1) [Idemat, 2000]

(2) [SAEFL, 1998]

(3) [Bootsma, 1988]

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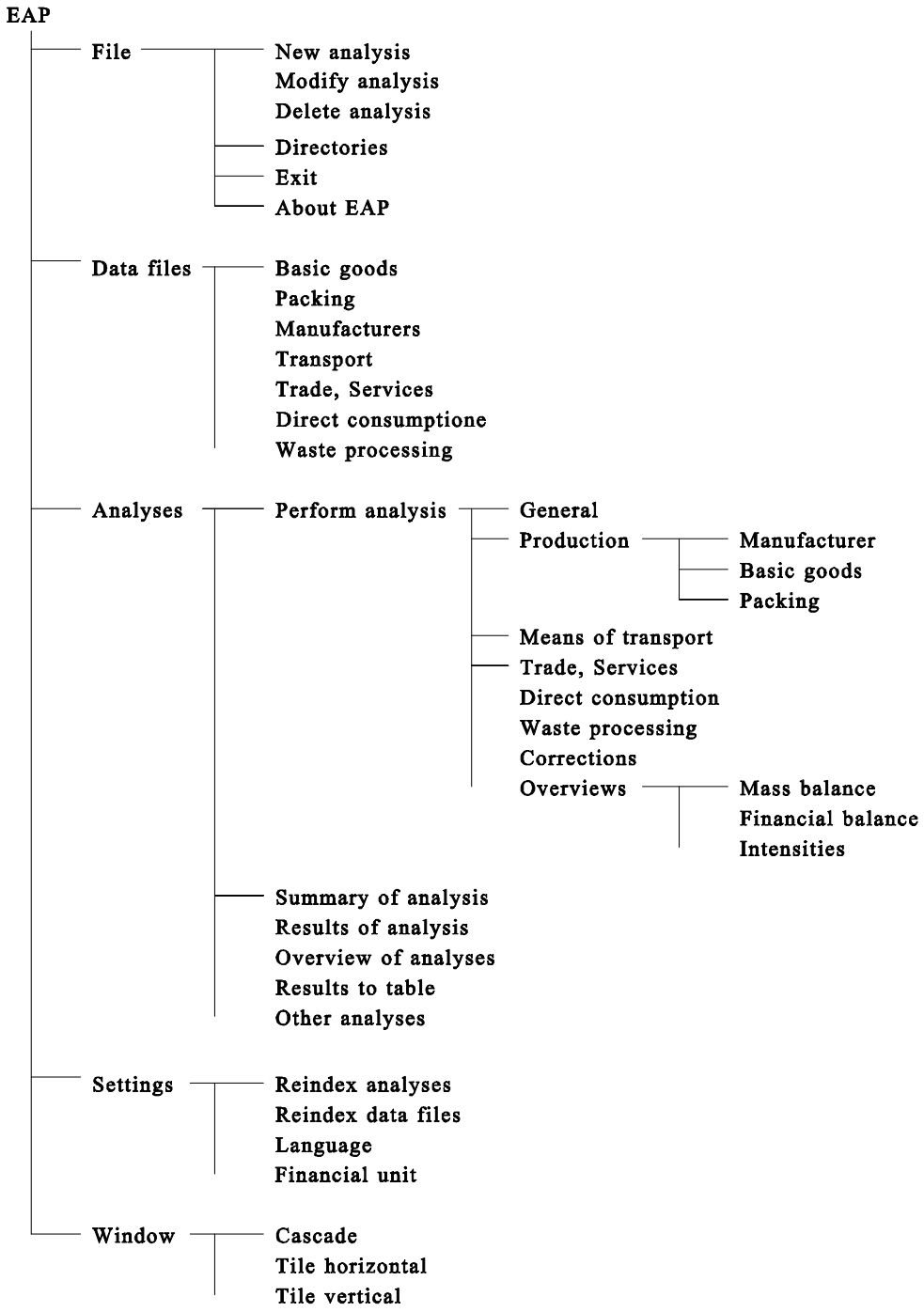
APPENDIX C: MENU STRUCTURE

Figure C.1 shows the menu structure of EAP. After starting the program, the main menu shows up with the options: *File*, *Data files*, *Analyses*, *Settings* and *Window.*

Figure C.1 Menu structure of EAP



APPENDIX D: CREATING A NEW DATABASE

The EAP program consists of a database with data concerning the Netherlands and the year 1990. In order to analyse items of consumptive expenditures for another country or year, the database has to be adapted. Such an adaptation is carried out in a number of steps.

The data files direi.dat, dirci.dat, dirmi.dat, and dirni.dat comprise the direct energy, CO_2, CH_4, and N_2O intensities of the input-output sectors, respectively. The direct intensities depict the amount of energy used directly or greenhouse gases emitted directly per financial unit of production. In case of another year, country or classification of the input-output table used, these files have to be changed. Such a change can be carried out by a program for text editing under Windows, e.g. Notepad.
The number of lines per file corresponds with the number of input-output sectors, so each data file should have the same number of lines. Each line in the files corresponds with one economic sector. The present files corresponds with the sectoral classification in table A.1. The file direi.dat comprises for all sectors the direct energy intensity which is the ratio of energy use and total production. The three other files comprise the ratios of greenhouse gas emissions and total production. Total production of sectors can be obtained from input-output tables.

The file cumtot.dat contains the Leontief inverse matrix of the input-output table used. The Leontief inverse matrix is $(I - A)^{-1}$ in which I is the unit matrix and A the technological matrix of the economy under consideration. The technological matrix is derived from an input-output table by dividing per sector all column elements by total production of that sector. In this way, each column gives the normalised production structure for a sector. For more details on the Leontief inverse matrix, we refer to textbooks on input-output analysis.

Furthermore, the data files in the EAP program have to be changed. These changes can be performed via the *Data files* option in the program. The data in the seven data files can be edited or deleted. Furthermore, new data can be added.

Structure of EAPB1.Dbf: Basic goods

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
BNAAM	Char	25		Name of the basic good
BPRGEW	Num	7	2	Price (Financial unit/kg)
BENGEW	Num	7	2	Energy content (MJ/kg)
BCO2GEW	Num	7	3	CO_2 emission (kg/kg)
BCH4GEW	Num	7	3	CH_4 emission (g/kg)
BN2OGEW	Num	7	3	N_2O emission (g/kg)
BIOSEC	Num	2	0	Input Output sector code

Structure of EAPB2.Dbf: Packaging materials

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
VNAAM	Char	25		Name of the packaging material
VPRGEW	Num	7	2	Price (Financial unit/kg)
VENGEW	Num	7	2	Energy content (MJ/kg)
VCO2GEW	Num	7	3	CO_2 emission (kg/kg)
VCH4GEW	Num	7	3	CH_4 emission (g/kg)
VN2OGEW	Num	7	3	N_2O emission (g/kg)
VIOSEC	Num	2	0	Input Output sector code

Structure of EAPB3.Dbf: Manufacturers

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
ENAAM	Char	25		Name of the manufacturer
ECODE	Char	4		SBI code
EENPR	Num	5	2	Energy price (financial unit/kg)
EDEI	Num	5	1	Direct energy intensity (MJ/financial unit)
EDCO2I	Num	5	2	Direct CO_2 emission intensity (kg/financial unit)
EDCH4I	Num	5	2	Direct CH_4 emission intensity (g/financial unit)
EDN2OI	Num	5	2	Direct N_2O emission intensity (g/financial unit)
ETW	Num	5	1	Nett added value (%)
EAFS	Num	5	1	Depreciation (%)
EAFSEI	Num	5	1	Energy intensity of depreciation (MJ/financial unit)
EAFSCO2I	Num	5	2	CO_2 intensity of depreciation (kg/financial unit)
EAFSCH4I	Num	5	2	CH_4 intensity of depreciation (g/financial unit)
EAFSN2OI	Num	5	2	N_2O intensity of depreciation (g/financial unit)
EIO	Num	2	0	Input Output sector code

Structure of EAPB4.Dbf: Means of transport

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
TNAAM	Char	25		Name of the transport mode
TENGAF	Num	6	2	Energy content (MJ/tonne km)
TCO2GA	Num	6	3	CO_2 emission (kg/tonne km)
TCH4GA	Num	6	3	CH_4 emission (g/tonne km)
TN2OGA	Num	6	3	N_2O emission (g/tonne km)

Structure of EAPB5.Dbf: Trade and Services

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
DNAAM	Char	25		Name of the trade and service sector
DIKVK	Num	5	1	Relation of purchase price to net turnover (%)
DCEI	Num	5	1	Cumulative energy (MJ/financial unit margin)
DCCO2I	Num	5	2	CO_2 emission (kg/financial unit margin)
DCCH4I	Num	5	2	CH_4 emission (g/financial unit margin)
DCN2OI	Num	5	2	N_2O emission (g/financial unit margin)

Structure of EAPB6.Dbf: Direct consumption

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
HNAAM	Char	25		Name of the direct consumption
HPREH	Num	7	2	Price inclusive VAT (financial unit/unit)
HENEH	Num	7	2	Energy content (MJ/unit)
HCO2EH	Num	7	3	CO_2 emission (kg/unit)
HCH4EH	Num	7	3	CH_4 emission (g/unit)
HN2OEH	Num	7	3	N_2O emission (g/unit)

Structure of EAPB7.Dbf: Waste processing

FIELDNAME	TYPE	SIZE	DEC	DESCRIPTION
ANAAM	Char	25		Name of the waste processing method
AENGEW	Num	7	2	Energy use (MJ/kg)
ACO2GEW	Num	7	3	CO_2 emission (kg/kg)
ACH4GEW	Num	7	3	CH_4 emission (g/kg)
AN2OGEW	Num	7	3	N_2O emission (g/kg)