Energy use and CO2-emissions for consumed products and services. IPP-indicators for private and public consumption based on environmental accounts

by:
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Preface

This report has been prepared on commission from EUROSTAT, which supports and co-ordinates the development of environmental statistics in the EU Member States. The European Commission through DG Environment has contributed financially to the project. Viveka Palm Anders Wadeskog and Annica Carlsson have carried out in the work and are responsible for the report.

In 1993, Statistics Sweden, the National Institute of Economic Research and the Swedish Environmental Protection Agency were instructed by the Government to prepare a study covering the physical links between the economy, the environment and natural resources, the monetary reflection of these relations, and the state of the environment. The aim of the work on environmental accounts at Statistics Sweden is to develop a system of physical accounts that are linked to the production and consumption activities described in the national accounts. In practice this means developing a system of environmental and natural resource statistics that can be linked to the industry, product and sector categories used in the national accounts, thus forming a satellite system of accounts around the national accounts.

According to the UN, a system of environmental accounts should in principle cover:

- **Flows of materials** through the economy, e.g. energy and chemicals, together with the **emissions** and **waste** to which these flows give rise. Within the EU, many countries have opted to use the NAMEA system[1] to describe these flows.

- **Economic variables** that are already included in the national accounts but are of obvious **environmental interest**, such as investments and expenditure in the area of environmental protection, environment-related taxes and subsidies, and environmental classification of activities and the employment associated with them.

- **Natural resources**. Environmental accounts should make it possible to describe stocks and changes in **stocks** of selected finite or renewable resources. They should deal both with questions related to the **monetary** valuation of this natural capital and **qualitative** aspects that do not have any market or other defined monetary value, e.g. the value of outdoor life and biodiversity.

Statistics Sweden, February 2006

[1] NAMEA stands for National Accounting Matrix including Environmental Accounts. In principle this is a Social Accounting Matrix (SAM) supplemented by environmental accounts data on, e.g., emissions to air and waste, linked to the Use and Supply Matrices that a SAM is constructed around. Just as a SAM is a way of presenting national accounts data, NAMEA is a way of presenting environmental accounts data.

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Included figures and tables:

Summary

Time series from 1993-2002 for Sweden of data relevant for making IPP-indicators is available at the web-site of the Environmental Accounts, Statistics Sweden, and also described and analysed in this report. The data is energy use and carbon dioxide emissions linked to the private and public consumption of Sweden and disaggregated on a product group level, both classifications of NACE and COICOP are used. All calculations of the suggested IPP-indicators are based on the Swedish environmental and national accounts, e.g. input-output (IO) matrices and emissions by industry.

The environmental pressure from private and public consumption is calculated as the environmental pressure in the Swedish production system including the imports, plus impacts from the user phase. Emissions caused in other countries due to Swedish consumption, are however calculated as they were domestic, i.e. imported products are handled as they were domestically produced. This since data on energy use and time series of air emission data in the framework of environmental accounts were not possible to collect for EU25, or EU15, within the frames of the project.

The results show that the total emission of carbon dioxide from Swedish private and public consumption is 44 million tonnes in 2002, of which the private consumption stands for 80%. For both public and private consumption a trend of decreasing emissions of fossil carbon dioxide emissions can be seen can be seen.

The data show how environmental pressure and resource use can be connected to the consumption of goods and services. The largest product group is direct emissions from fossil fuel use by households, other large shares are generation of electricity and heat, followed by housing and food. By comparing different policy initiatives with these product groups it is possible to see how important the IPP-initiatives can become in a total consumption perspective. The categories of transport, housing and food are of evident importance. The economic goals are to increase the GDP leading to increasing consumption. The key question for IPP policies is how to decouple the increasing economic consumption from the corresponding environmental pressure and energy use. Such decoupling can be accomplished in different ways: by switching to less carbon intensive fuels, by consuming services rather than goods, by efficiency measures etc..

The direct emissions from transport and heating houses are around 15 million tonnes. However. for private consumption the indirect emissions that are connected to the goods and services bought are of importance when compared with the direct emissions. Meat, milk, cheese and eggs are large groups among the food products. Also fish, bread and vegetables can be noted. Food in general is connected to emissions of around 5 million tones of carbon dioxide or 0,5 tonnes per capita.

The public consumption has around seven million tons of carbon dioxide connected to it. The size shows the potential for green procurement. The profile of public spending and private spending is in some cases different, and there are some areas such as defense where the public consumption is of vast importance.

The underlying data comes from many different sources, and are based both on questionnaires to involved industries, but also on emission factors for CO2-content in fuels and model assumptions for smaller enterprises. The data quality is good in the respect that the data is generated every year and that the methods and coverage is as good as the economic standards in the national accounts demand. From this follows that an advantage of the method is that it is designed for

regular updating. Comparability between nations is also possible due to international classifications of industries, fuels, emission inventories and product groups. However, it is wise to treat the absolute figures with caution, and concentrate on comparisons between groups of products and between years.

The availability of international data is still not sufficient to really produce the kind of indicators we have presented here for the whole of EU or for a single member state with accurate calculations of the environmental pressures caused in other countries. In order to get good data also on the imported products and goods, more environmental accounts data is needed. The discussions on making a regulation for this type of statistics is a clear example of something that could rapidly increase the availability of country data in the EU. Basically three sources of data would need to be completed or developed further:

- Symmetric Input-Output tables for all member states, which is something that most have committed to, and eventually will be, delivering every 5 years.

- Environmental Accounts data for energy use, emissions and other data in the harmonized system, which most have agreed on. Data is available but not for all member states at 2-digit NACE level to link into the IO tables.

- Trade data for single country, bilateral and multilateral trade analysis of environmental pressures caused among trading partners. EU-wide analysis of trade with the rest of the world is probably easier to come by.

1. Introduction

1.1 Integrated product policy (IPP)

Integrated Product Policy is a European Union level initiative aimed at reducing the environmental burden of products and services throughout their life-cycles. The environmental relevance of the IPP approach is given by its general aim of reducing the environmental burdens of products and services throughout their life cycle by using a toolbox of policy instruments to green markets through both the demand side (consumption) and the supply side (product development) (Charter, 2001). The need to develop indicators for IPP has been identified both on a national (Swedish EPA, 2002) and a European (COM 2003) level. Such indicators are needed to measure the environmental improvements induced by the IPP approach (ibid).

How can progress of IPP be measured? As was noted in the Commission's latest report on IPP (Integrated product policy, building on environmental life-cycle thinking. Communication from the Commission to the Council and the European Parliament. COM (2003), there is a need for IPP-indicators. Many of the suggestions made are entirely based on an LCA-perspective, which does not allow an aggregation of products and therefore can not be linked to the total consumption of products. There are examples of studies with the objective of analyse product specific indicators for a basket of products as a measure of the IPP development in the whole economy (cf. the study by the Institute for Product Development (IPU), Commissions web site[2]).

As mentioned, indicators based on LCA are data intensive. Even if there are LCA-databases available, they are not updated on a regular basis and do not contain time-series. However, the environmental accounts do contain time-series and thus seem well adapted to be used in this context. Both national and regional studies have been made during the last years, showing the importance of trade as a component in the environmental pressure of consumption. The national studies cover Norway (Straumann, 2003; Hammer Strömman et al, 2004; Hertwich et al, 2002), Sweden, Denmark (Munksgaard et al. 2005 and StatBank Denmark for the time 1993-2000), Japan (Kondo et al, 1998), Holland (de Haan, 2002) and Australia (Lenzen, 1998). Regional comparisons of Japan, USA, Western Europe and the OECD have also been made (Muradian et al., 2002; Ahmad, 2003; Ahmad and Wyckoff, 2003; Hubacek and Giljum, 2003; Lenzen et al., 2004). Most of these studies have presented data in the forms of indicators such as the net trade balance, also called the environmental balance of trade. Recently, studies on IPP indicators alike the ones we present in this report has been conducted by Weidema et al.,(2005) and in the EIPRO– study (Tukker et al., 2005). The study of Weidema et al. (2005) were based on a combination of environmental statistics and the Danish national accounts, divided into 138 product groups. Consumption were divided between private consumption and public consumption and the results indicate that public consumption of products has much less impact on the environment than private consumption. The greatest potential for environmental improvements were identified in the product areas of food, housing, transport by ship and electricity (ibid.). In the EIPRO-study (Tukker et al., 2005) the objective of the study was to identify products (or product groups) that have the greatest environmental impact from a life-cycle perspective in the EU25. The EIPRO-study conclude that the Input-Output based analysis of products gives an overview which hardly can be created in any other way (ibid.).

[2] http://europa.eu.int/comm/environment/ipp/pdf/ta_indicators.pdf visited 21/02/2006.

1.2 IPP in Sweden

The interest in product policy in Sweden can be dated back to the 1960-ies when the first policy measures were taken to decrease product waste littering. Through an information campaign started by the Swedish Society for Nature Conservation called “Håll naturen ren” (Keep nature tidy, see www.hsr.se) the message was spread of the need for proper waste management from the consumer side. In 1971, the legislation was changed so that waste dumping in the sea became illegal and so that the municipalities received a greater responsibility for collecting and managing the waste. Some economic incentives such as refund on aluminium cans and on vehicles were set up. Gradually the environmental product field became more research intensive; the life cycle assessments on food packaging introduced the idea of measuring environmental performance per function, in order to be able to compare between different materials used for the same purpose.

Different policy measures are discussed to reduce the environmental impact of goods. Examples of the types of mechanisms include producer responsibility, environmental agreements, environmental taxes, eco-labelling, environmental product declarations, product directives, product and material standards and procurement regulations.

Similar measures to those suggested in this report have been constructed for the Swedish Producer Responsibility Committee, within a study focusing on environmental impacts of different product groups (Finnveden, G., Johansson, J., Moberg, Å., Palm, V. and Wadeskog, A. with contributions from Suh, S. and Huppes, G. (2001): Miljöpåverkan från olika varugrupper. In Swedish).

In that study the questions asked were:

- Which were the most important product groups from an environmental perspective?
- Had the existing producer responsibility in Sweden focused on the ”right” product groups? (Acknowledging that the definition of ”right” can be made in several ways).
- Which product groups could be of interest for an extension of the producer responsibility?

The approach and results have resulted in a large interest, not least from the international IPP discussions. Some results from that work will be published in a special issue on IPP in Journal of Industrial Ecology (Palm et al., 2005). However, the data and method are not yet easily available for the practitioners in the area. Therefore, there is a need for a report in English and also to publish such data on a web-site in order for different actors and practitioners to make use of it.

The Swedish EPA finances a research centre called FLIPP (Furthering Life cycle considerations through Integrated Product Policy). FLIPP is organised as a joint research program between the departments of Environmental Systems Analysis at Chalmers University of Technology (ESA) and the International Institute for Industrial Environmental Economics at Lund University (IIIEE). The research program of FLIPP has two focus areas, which also are aimed to be integrated in the structure of the program; 1) the relation between different actors within the product chain (the industry perspective) and 2) the possibilities of governments to control the environmental impact in the product chain (the policy perspective). Statistics Sweden participates in an ongoing project run by the Royal Institute of Technology, who also are a co-partner of FLIPP. The aim of that project is similar to this project to develop indicators for IPP for the Swedish and EU arena. A first step will be to make an inventory of and describe the needs of different stakeholders. Other issues will be to select sources of data, calculation methods, the level of aggregation of indicators (e.g. product, groups of products, or industry branches), and what environmental aspects should be indicated. An appropriate set of indicators for IPP will be suggested and calculated. The indicators will be based on a hybrid approach combining Life Cycle Assessment (LCA) and Environmentally extended Input Output Analysis (EIOA). Industry

data from the EIOA will be combined with user and end-of-life data from LCA databases. The final report of the project are to be finished in December 2006[3].

1.3 Environmental accounts

Environmental accounts describe the connections between the environment and the economy, e.g. in natural resource extraction or the emissions of air pollutants by a given sector of society or industry. It is a system that links the environmental pressure to the economic actors in society, and it can also be used to link the environmental pressure to the consumption of different product groups, with the help of input-output analysis. By including statistics on traded goods and services from different countries, as well as different national emission patterns, the environmental pressure of these product groups in a life-cycle perspective may also be covered.

Since 1993, Statistics Sweden produces environmental accounts focusing on the connections between the environment and the economy (SEEA, 1993; UN, 2000; SEEA 2003). The environmental accounts connect economic data from the national accounts system, that describe the production and consumption activities (e.g. value added and employment in different industries), with environmental data such as emissions, waste and use of material that stem from these activities (See for example Keuning and de Haan, 1996; Keuning et al., 1999; Hellsten et al., 1999; Statistics Sweden, 2003; and Isacsson et al., 2000). The environmental accounts also include other data, e.g. environmental taxes, subsidies and environmental protection expenditures as well as some social data (See e.g. Palm 2001, Sjölin et al. 2000, MIR2003:3, MIR2003:4, MIR2004:1).

Input-output accounts (IOA) are a part of the national accounts and are used for bringing consistency in the system, to align the production with the consumption activities for a certain year, as well as for different types of analyses. The IOA was invented by Wassily Leontief in the end of the 1930-ies, partly based on the ideas that were proposed by Quesnay in his “Tableau Economique” in the midst of the 18th century (Leontief, 1986). The IOA were used in models for economic planning since the 1940ies and onwards, and are still at the core of many economic models used.

The accounts are created by describing several matrices where all different industries and sectors in the economy are depicted according to their production input, i.e. the goods they purchase, called the demand or use matrix, and by the goods or services they produce, called the goods or supply matrix, in monetary terms. By combining this information, a linear activity model between production and consumption is obtained, expressed as final demand including private consumption, investments and export, in a country (See e.g. UN, 1996).

For example, Sweden is a small open economy with extensive trade with the world around. A large part of what is consumed in Sweden – equal to 34 per cent of GNP – is produced elsewhere in the world. Similarly, a large part of what is produced is consumed in other parts of the world (40 per cent of GNP). The ordinary environmental statistics are concerned with the activities and state of the administrative and geographic boundary of Sweden, which is a mixture of the production and the consumption within the country. The indicators of IPP that we suggest in this report illustrate the environmental pressure of the nations consumption, including imported goods and excluding exported goods.

[3] More information on the project is available on www.infra.kth.se/fms

2. Objectives

The expected output of this project is a description of a method that would make it possible to produce IPP-indicators from the environmental accounts. The output will also be a presentation of data on environmental pressure per product group consumed in Sweden that could be used for indicators for IPP for the years 1993-2002. The indicators produced can be disaggregated showing the impact of particular product groups or services. In this project, we would focus on energy consumption and fossil carbon dioxide emissions. The data are internationally available, the carbon dioxide emissions will be in focus because of the Kyoto protocol and what may follow, and the energy consumption is a complement which shows the demand for energy also in those countries where the energy mix is not so carbon dioxide intense, such as France, Sweden and Norway.

3. Method

The calculations are based on data from the Swedish SEEA. The national accounts provide monetary data on the economic activities presented either by industry or by products and services, through supply and use tables. The supply and use tables can be transformed into input-output (IO) matrices. The IO-matrices provide linkages between different production sectors in the economy. For each industry, the matrices show how much is purchased from other industries in terms of input goods and how much is supplied to other industries and to final demand in monetary terms. In the SEEA, this information is complemented by calculating the use of resources and corresponding emissions by industry. By using the input-output structure it is then possible to redistribute this information so that resources and emissions are shown by products and services consumed in final demand. In this report, the results for private and public consumption are presented.

The IO-structure is partly updated each year. However, a detailed investigation of all transactions is not possible, so parts of the structure rely on older data. The documentation of techniques and data provision of the economic IO for Sweden is described in Statistical messages. Since 1999, the Swedish National Accounts has been adapted to the European System of National and Regional accounts (ESA 95), as stipulated in the EU council regulation of 1996.

Industries are defined according to the international standard NACE rev.1.1 classification (Found at the Eurostat homepage in the classification database RAMON, Eurostat, 1996) and is harmonised with the UN classification ISIC (guide to the classifications can be found at the classification registry at UN website http://unstats.un.org/unsd). The data was aggregated into 51 industries. The categories of final demand can either be expressed as NACE-products, following the same categories as the industry classification (approximately 60 in the Swedish case), or they can be further refined using the COICOP (classification of individual consumption by purpose) nomenclature, also found at the Eurostat and UN-websites. In this report both classifications will be used.

3.1 Input-Output Analysis

Going from an industry-based accounting system to the product-based approach in IPP requires using Input-Output Analysis (IOA). The IOA redistributes the environmental pressure in the production phase to the goods and services of final demand. Capital goods (i.e. Gross Capital Formation) was not allocated as intermediary inputs into industries. Public Consumption in Final Demand includes all intermediary inputs/use that is used in production in the public sector. However in this report, results are not presented for the whole final demand, but for the private and public consumption. The exports are not included. In the future, part of the investments could be part of the Swedish consumption indicators. In this project however, investments are not included.

In the future, investments would ideally be handled specifically in the analysis and the indicators. Gross investments are classified as final demand but a part of this, e.g. replacements, could be attributed to the production of goods and services in the current year. This would mean a reallocation of indirect emissions from gross investments to the other components of final demand. In this project however, it has not been possible to do this reallocation.

The environmental pressure data included in the report are emissions of CO2 from fossil fuels, district heating and electricity. The environmental pressure from private and public consumption

is calculated as the total environmental pressure in the Swedish production system including the imports, *plus impacts from the user phase*, namely the fuel consumption and corresponding air emissions from private cars, electricity use, fuel use and corresponding air emissions in private housing.

As most Statistical Agencies in Europe, Statistics Sweden is committed to delivering symmetric domestic IO-tables to Eurostat every 5 year. The first year being 1995. The time series of calculations at the Environmental Accounts is therefore based on symmetric IO-tables for the whole series from 1993, developed at the Environmental Accounts.

The IO-tables used are based on the 134 by 134 Use and Supply Tables. The matrices used are: Use and Make Tables for domestic use and production. The 134 products by 134 industries domestic use tables were converted to product by product tables using the Make matrix and the so called industry assumption. This means that an industry that produces several different products is assumed to do this with the same production recipe. The same applies to all matrices in the industry dimension.

The Final Demand side of the analysis is covered using to different classifications systems. When looking at the different components, Final Demand is classified according to NACE. When looking strictly at Private Consumption Final Demand is classified by purpose (COICOP). The National Accounts contains cross-classification of private consumption between NACE and COICOP.

Import Tables for inputs into domestic production as well as domestic final demand
Tables from the Environmental Accounts, covering Emissions to Air and Energy use by fuel and industry, were used in all calculations.

3.2 Calculations of emissions

The basic single country calculations of emission from final demand is:
$E = e(I - A)^{-1} y$
with
e vector of domestic emission coefficients as emissions per domestic gross output *x*
$A = T\hat{x}^{-1}$ with *T* = Use matrix so *A* is the matrix of input coefficients
I = Identity matrix
y = vector of Final Demand (or matrix of components of Final Demand)

If this algorithm is used with the actual Final Demand you end up with the emissions calculated for the Environmental Accounts. For IPP purposes it is more interesting to look at the different components of Final Demand, and especially Private and Public Consumption as well a Export. Differences in structure and volume will produce different environmental burdens.

The basic algorithm has to be expanded in order to account for the emissions hidden in trade between countries. A significant part of the input into Swedish production is produced in other countries, thereby causing emissions that are not calculated in the Swedish environmental accounts. Hence, the initial idea was to use the IO-tables and environmental accounts data from other EU Member states as well, to calculate the emissions caused in other countries due to Swedish consumption. This would have given a more correct estimation of the emissions and is here after referred to as Model 1(Ideal), see Figure 1**.** Together with data on export of products and services from Sweden the environmental accounts would then be possible to balance.

Figures can then also be presented at an industrial level, for example in environmental economic profiles, which show for instance the contribution of different industries to total Swedish import and export. The method of trade-adjust environmental accounts has been presented and discussed in a former project “Environmental Impact of Swedish Trade” (MIR2002:2). As described elsewhere Model 1(ideal) was due to lack of data not possible to accomplish this time.

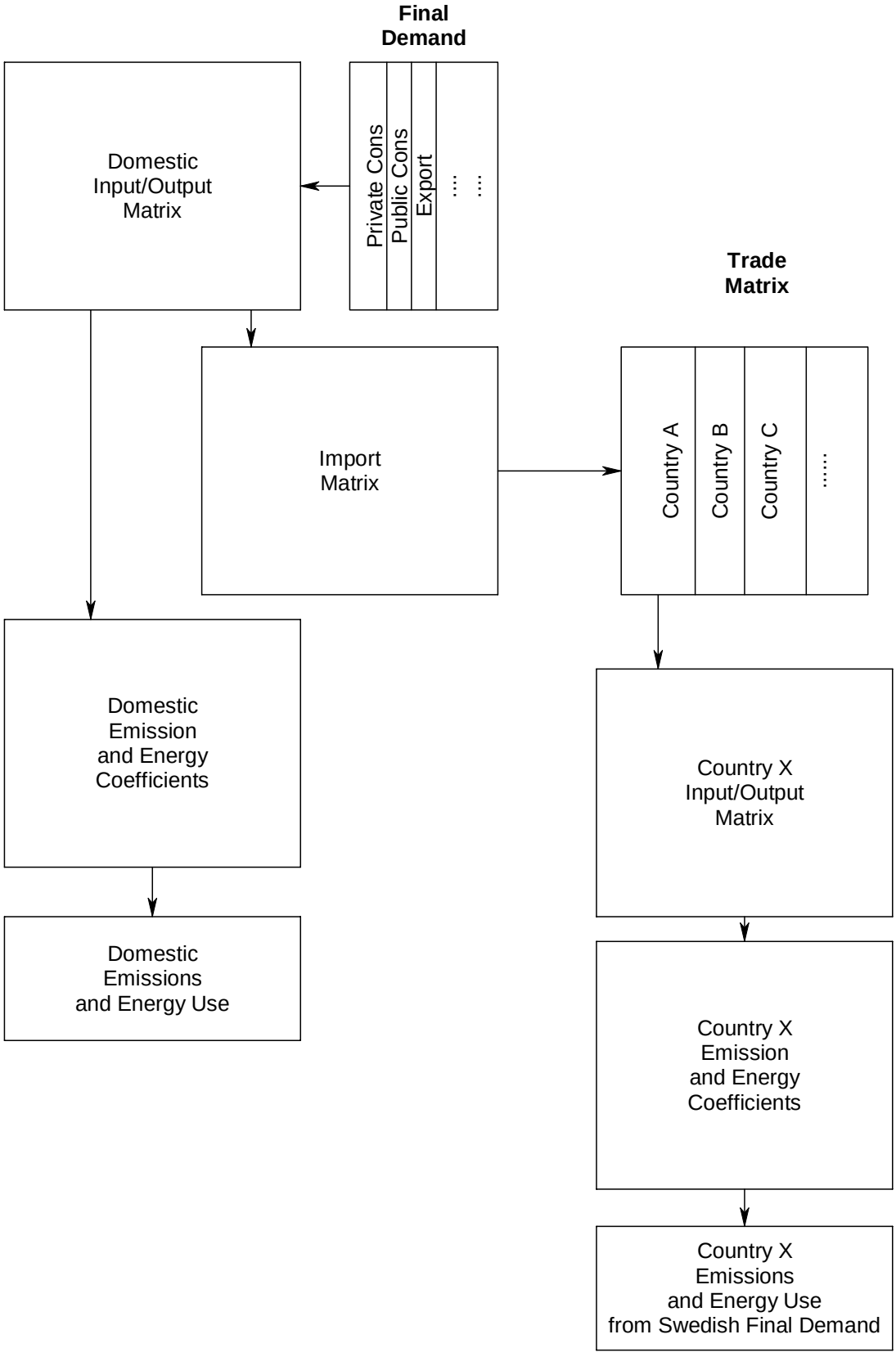

Figure 1. Outline of Model 1 (ideal) to calculate emissions caused in other countries due to Swedish consumption. (Environmental Accounts, Statistics Sweden).

A second best solution of carrying out these types of calculations is therefore to use the domestic IO-tables and emissions coefficients and calculate emissions in other countries by calculating these emission as if imported products were produced domestically. This model is referred to as Model 2, illustrated in Figure 2.

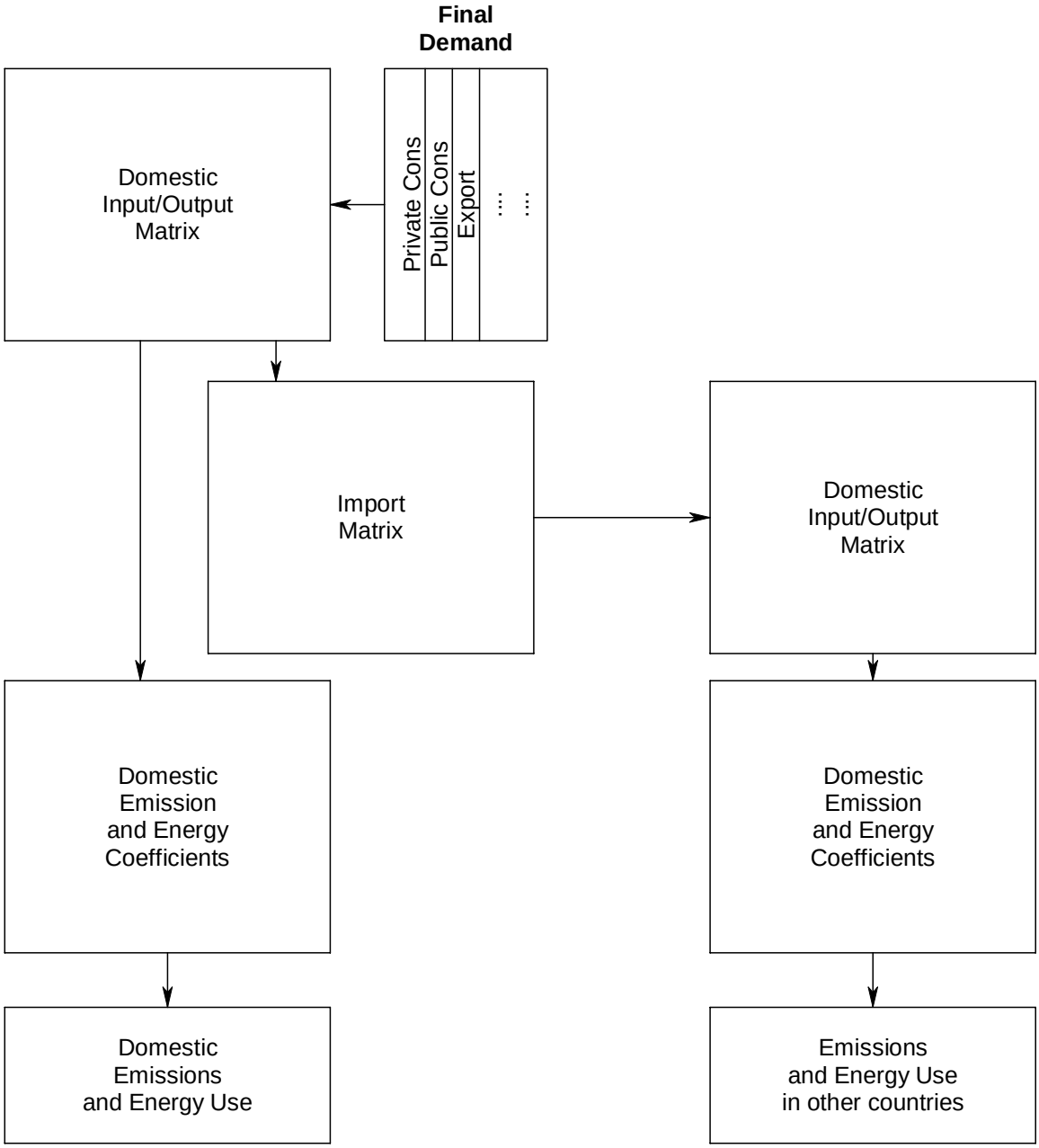

Figure 2. Outline Model 2, use of domestic IO-tables and emissions coefficients as a basis for calculating emissions in other countries due to Swedish consumption, i.e. imported products are handled as they were domestic (Environmental accounts, Statistics Sweden).

Model 2, gives an expanded basic algorithm for calculating emissions in Sweden (E^d) and abroad (E^f) is:

$$\begin{pmatrix} E^d & E^f \end{pmatrix} = \begin{pmatrix} e^d & e^f \end{pmatrix} \begin{pmatrix} \mathbf{I} - \mathbf{A}^d \end{pmatrix}^{-1} \begin{pmatrix} y^{dd} \\ \mathbf{A}^m \begin{pmatrix} \mathbf{I} - \mathbf{A}^d \end{pmatrix}^{-1} y^{dd} + y^{fd} \end{pmatrix}$$

with:

e^d vector of domestic emission coefficients as emissions per domestic gross output x^d
e^f vector of emission coefficients for imported products

$\begin{pmatrix} \mathbf{I} - \mathbf{A}^d \end{pmatrix}^{-1}$ is the domestic inverse matrix
T^d - the domestic interindustry transaction table
T^m - is the interindustry transaction table for intermediate imports
x^d - vector of gross domestic production values
these are then used to create

$A^d = T^d \hat{x}^{d\,-1}$
and
$A^m = T^m \hat{x}^{d\,-1}$

y^{dd} - domestic final demand of domestic products
y^{fd} - domestic final demand of imported products

If Model 1(ideal) would have been possible, we would use the actual e^f , i.e. the emission coefficients for the different trading partners, together with a weighed matrix to allocate import and export over the different trading partners to get a more accurate estimate of the emissions in other countries (Statistics Sweden, 2002).

3.3 Household use

The household use of fossil fuels has been allocated to petroleum products (NACE 23). The household use of electricity is allocated to electricity (NACE 40). The environmental pressure from the use phase occurring before the final demand, the so-called indirect environmental pressure, is included in the calculations. Some emissions from the use phase are however not included, for example emissions of organic substances from paints. Emissions from the waste phase are partly included, just as they are in the national inventories, and attributed to the waste management industry and (as part of final demand) to the service of waste management.

3.4 Fossil fuels, biomass and electricity use

The energy data is expressed in a common energy unit, TJ (terajoule). Gross consumption of primary energy and equivalents is calculated from the following items: Inland supply plus import, minus export and changes in stocks. Concerning the fuels wood, wood waste, sulphite and sulphate lyes, peat and waste the total consumption for energy purpose is recorded as inland supply of primary energy. Bunkering for foreign shipping covers supply to bunkers for seagoing ships of all flags. Supplies for international air traffic are evaluated as final inland consumption.

Consumption by energy producing industries covers the consumption of electric energy, fuel oils, gases etc. for the operation of power stations, thermal power plants, refineries, coke-oven plants and gasworks. Energy data by industry can be found in the statistical database on the web-site of Statistics Sweden (www.scb.se).

3.5 Emissions to air, Swedish data

The data on emissions is based largely on the Swedish primary emissions inventory reported according to the recommendations of the IPCC (Intergovernmental Panel of Climate Change), which are calculated based on the energy consumption and process emissions for broad sectors such as agriculture, transport, housing and industry. However, additional emissions from bunkering of fuel for international shipping and aviation are also included, as these activities are exempted from the IPCC system boundary, but included in the system boundary of the national accounts. As the IPCC do not require data that is disaggregated by industry, this disaggregation is made specifically for the environmental accounts. For the large companies in the manufacturing industry the energy data and process data are collected in surveys. For smaller companies and for the industries in the service sector the disaggregation of the energy data is made with help information from registers on employment and financial records, as well as surveys on energy use in housing. For road transports, the energy data is disaggregated by help of the car register. The car register provides information on which industries own the vehicles. The disaggregation is based on the reported distance that the registered vehicles have travelled. For energy use for housing, the help data is taken from economic surveys on the cost for fuels. The emissions data by industry is available at Statistics Swedens' data-base at www.scb.se/mi1301-en .

3.6 International emissions and energy data

Traditionally, the environmental accounts have described the activities inside Sweden (or inside any other country calculating environmental accounts). Emissions to air, for example are produced on the basis of the emissions in Sweden due to Swedish production and consumption. As discussed in "3.2 Calculations of emissions" we would ideally use environmental account data from the countries that provide the goods and services imported to Sweden, Model 1 (ideal). This would generate the possibility to adjust the calculations to cover the emissions that occurs in other countries due to Swedish consumption.

In this study an inventory was made on what data that were available for air emissions and energy use in other EU member countries' Environmental Accounts (cf. section 5.1 Inventory of European data). Data were collected from Eurostat and no direct contact with other statistical offices and their Environmental Account departments where taken. Due to lack of data on energy use and lack of time series this material was not used. Instead the Swedish data has been used as a proxy for the international data.

4. Assessment of data quality

4.1 Introduction

The quality of data can be assessed from different, and often conflicting, criteria (see for example Table 1 that presents the different dimensions of data quality in the quality framework of Eurostat. Statistics Sweden has published a document (in Swedish) which is a quality guideline for the official statistics (MIS 2001:1). The quality is assessed from the perspective of the users and more specifically for the planned uses of the statistics. Even if a quantitative measure of the quality is always wished for, in reality it is often impossible to provide an overall measure for the many different aspects. Descriptions of the data processing and a documentation of sources and references to international classifications and guidelines are also part of the data quality.

To ensure a good quality it is necessary to have a good contact with the main users. In Sweden, the contact with users is assured in several ways. A council with representatives for many of the most important users such as the National Institute of Economic Research, the Swedish EPA, the ministry of sustainable development, ministry of industry and of finance, as well as representatives from Universities, the regions and NGOs meets twice a year to discuss and take part in the latest developments of the environmental accounts. When governmental committees are assigned projects that may benefit from the use of the accounts data, we make contacts with them to assure that they are aware of this possibility.

Reports in English and Swedish have been put on the web-site of Statistics Sweden, in order to enhance the availability (see http://www.scb.se/mi1301-en for the English reports and http://www.scb.se/mi1301 for all the reports). The results are published in three main publication series. Time series are presented in the ordinary publications for official statistics, with only some comments to the tables. These are in Swedish with a very short English summary, and English names on the tables. The more reader-friendly analysis of different areas in the environmental accounts are published in the series ‘Miljöräkenskaper’, mostly in Swedish, but also in English. There are English summaries available for most reports in Swedish. Other reports in English, dealing mostly with methodological issues, are published in Eurostat working papers. (The work with these reports have partly been financed by the European Commission.)

Dimension	Description
Relevance	Statistics are relevant if users' needs are met and if subject-matter areas are covered by statistics illuminating different perspectives
Accuracy	Closeness between the value finally retained and the true, but unknown, population value
Timeliness and punctuality	Time length between the release time and the end of the reference period; the agreement between the actual release time and the target release time
Accessibility and clarity	Accessibility refers the physical conditions in which users can obtain data. Clarity refers to the information environment.
Comparability	Comparability over time, between geographical areas, and between domains.
Coherence	The adequacy of statistics, especially from different sources, to be combined.

Table 1. Quality Issues in the European Statistical System
(Svante Öberg, Director General, Statistics Sweden, December 2005
http://www.scb.se/Grupp/Omscb/_Dokument/Quality%20Issues%20in%20the%20ESS_Svante%20Oberg.doc.

The data underlying the indicators in this report are collected from many different statistical areas. Trade statistics, national accounts, environmental accounts and the underlying primary data sources such as energy statistics, economic statistics by industry and by product categories are all necessary for these assessments (see Methods). The inherent accuracy measures for the survey data in the statistical areas are mixed in the calculations, and we do not have a quantitative error measure for the accuracy of the results. However, the strong reliance on time-series and national comparisons gives a good base for finding outliers and inconsistencies in the data.

The accounts are designed to provide for comparability, relevance and coherence. They are built according to internationally harmonized concepts and follow guidelines to ensure that the statistics are comparable between nations and between industries as well as over time (See Methods). The processing of the data takes time and so the timeliness of the data suffer from this, causing a delay of approximately two years between publications year and the data year.

4.2 Trade in goods

Before Sweden's entry into EU, the flows of goods to EU were analysed via customs and shipping documents reported by firms to the Customs and Tax Authorities. Since Sweden's entry to the EU in 1995, foreign trade statistics for imports have included goods that
a) arrive in Sweden via trade with other EU countries (single market) or b) are imported

from countries outside the EU and released for free circulation within the single market or released for free consumption on the Swedish domestic market.

Exports includes goods that
a) are dispatched from Sweden via trade with other EU countries or
b) are exported or re-exported, after import, to countries outside the EU.

In the databases, both arrivals from the EU and imports from non-EU countries are called imports, while both dispatches to the EU and exports to non-EU countries are called exports.

4.3 Trade in services

Statistics on Sweden's exports and imports of services are compiled by Sweden's Riksbank (Central Bank), see www.riksbank.se, and are not published in Statistics Sweden's databases. The Riksbank also compiles Sweden's current account balance of payments, in which Statistics Sweden's statistics on total exports and imports of goods are included. Information on the sources and methods used by Sweden's Riksbank are presented on their web-site: http://www.riksbank.com/pagefolders/15620/BoP_källor_och_metoder_engelska.pdf

4.4 Business statistics[4]

Since the start of 1997 the Business statistics (Företagsstatistiken – FS) conforming to the EU regulation on Structural Business Statistics (SBS) have been the main source for the output calculations. However, the statistics are considerably more comprehensive than is required by the Regulation. They cover all industries apart from agriculture, forestry, fishing and financial corporations. In the Business statistics all enterprises with a minimum of 50 employees are surveyed by questionnaire. Enterprises with fewer than 50 employees are surveyed through administrative material from the National Tax Board. The material is known as Standardised accounting statements (Standardiserade räkenskapsutdrag – SRU), consisting of annexes to the enterprises' income declarations. The Business statistics are scrutinised jointly with the product-based output statistics (Industrins varuproduktion – IVP). Prior to 1997 the Business statistics only covered the corporations sector and were known as Financial statistics for enterprises. In order to cover the whole of industry, therefore, supplementary inquiries were undertaken.

For certain industries, however, sources other than the Business statistics are used. For agriculture, forestry and fishing, material from the Swedish Board of Agriculture, the Swedish University of Agricultural Sciences, the National Board of Forestry and the National Board of Fisheries are used. For NACE 40-41 Electricity, gas, heat, water and sewage plants, the Business statistics are used but the energy statistics also play an important role here. NACE 45 Construction is calculated from the use side as the sum of investment in and repairs to buildings and structures. For the service industries, the Business statistics are the main source, but for NACE 61 Transport by sea and NACE 62 Air transport detailed special statistics are used and, for NACE 65-67 Financial activity, the main source are financial market statistics. For Mining and Manufacturing, the Industrial output statistics are used with effect from 1996 – when they replaced, inter alias, the product-based output data in the previous Industrial statistics – and the Business statistics from 1997.

[4] The text below on business and product statistics is based on the GNI inventory desription, which is available from the National Accounts at Statistics Sweden.

The Business statistics are structured somewhat differently for different industries. Industry as a whole is surveyed by establishments, whereas service industries are surveyed mainly on an enterprise level. Service industries are supplemented in the Business statistics by those establishments in industrial enterprises, which are classified as service industry units and reduced by those establishments in service enterprises, which are classified as industrial units.

Several other inquiries apart from the Business statistics have been used in order to verify and supplement the Business statistics. Statistics Sweden produces intermittent sample surveys of the service industries, in which data is collected on turnover, consumption, investment etc. on a more detailed level than is possible from the Business statistics.

4.5 Product statistics

The Household budget statistics (HBS) constitute the only consistent inquiry, which measures household consumption expenditure as such. One of the problems in using other data sources, e.g. turnover, is that it is difficult to show the exact proportion of total sales income accounted for by households. As the HBS is a relatively small sample survey, the HBS material produced is subjected to critical scrutiny. In those cases in which the HBS estimate is not up to the standard of data from other sources and there are sound reasons to place more confidence in other sources instead, the HBS estimate is discarded. Special attention is of course focused on items which are habitually underestimated in HBS inquiries and expenditure which has poor coverage because of the composition of the sample, for example in households with persons aged over 75.

Direct measurement methods are used for most expenditure in household consumption. However, indirect methods are applied in order to calculate a utility value for all dwellings other than rented accommodation. Indirect methods are further used to record the utility value of car benefits and of PC benefits. In addition an indirect method is used to calculate charges to households for the consumption of dental, medical and child-care services produced by private operators.

The Swedish national accounts are based on product-by-product supply and use tables, which means that all production and use of goods and services is arranged in a system of product balances. This provides an opportunity to check the calculated consumption of goods and services for household consumption and other use against the supply of the corresponding goods and services. If there are differences between supply and use, a residual item arises and special analysis is then devoted to the good or service in question and the required measures are taken in order to bring about a better balance between supply and use.

The product balancing technique is such that benchmarks in household consumption can be affected. In the 1995 benchmarking, an important criterion for the evaluation of household budget data, for example, were the results of the product balance reconciliation.

The calculations for household petroleum consumption are carried out in the national accounts special energy balances. For petroleum products there are statistics from a number of sources, and these are coordinated into five different product balances in which the allocation to different user groups is specified.

Analysis, reconciliation and adjustments thus arise for all of the 230 product groups, which make up the smallest building blocks of household consumption allocated to purposes.

GDP and GNI are calculated and compiled in that part of the national accounts system known as the product accounts. The annual calculation is performed and balanced in a system of supply and use tables. The supply and use tables (SUT) are the basic tables which can subsequently be

further processed to Input-Output tables. The table system also includes employment calculations with the average numbers of employees and hours worked per industry/purpose.

The degree of detail in the Swedish system is such that the output calculations are performed on around 400 product groups and 134 industries; household consumption expenditure is recorded for 147 purposes in accordance with COICOP; consumption expenditure of departments and agencies of government is allocated to sectors, industries and functions (COFOG), which makes 58 uses. Gross fixed capital formation is broken down by sector, industry and function (COFOG), split on 128 uses in the economy.

The calculations and balancing in SUTs mainly affects products from market output and production for own final use, and sales by other non-market producers (departments and agencies of government and non-profit institutions serving households). They also include value added components and employment for market producers and producers for own final use. The value added components for other non-market producers, which do not affect the balancing, are added at a somewhat later stage.

4.6 Energy statistics

The energy statistics are based on several surveys covering different economical sectors and different types of fuels. The manufacturing enterprises (NACE 10-40) are the most well-covered, while agriculture, forest, and fishing industry do not have yearly survey's but are calculated from less frequent sampling. The service sectors are covered by surveys to the large housing companies and by surveys on economic statistics rather than by quantities of fuel use.

4.7 Air emissions statistics

The air emission statistics can be divided into three areas: stationary emissions, mobile emissions and process emissions. The main source of activity data for stationary emissions is the energy statistics and industry statistics. For mobile emissions, fuel data from the energy statistics are being processed in a number of ways. For the land transports a model from the Road authority is used to calculate the emissions from cars, buses and light and heavy lorries. This information is then disaggregated on industry by data on mileage from the car register. Process emissions, finally, are collected from environmental reports from the companies. The calculation of emissions are guided by the principles stipulated by IPCC, which is part of the international obligatory reporting. However, since the accounts have a somewhat broader definitions, including also data on international shipping and air traffic, additional data is collected for these areas. IPCC has also recommended methods for assessing the uncertainty of the emissions. In Sweden, work has been carried out to estimate the uncertainty in the total emission figure, by the method labeled as Tier 1. The uncertainty in the activity data and emission factors were estimated by the expert that calculates the statistics and combined in Equation 1 for different years and emissions. The results indicate an uncertainty for the total CO2-emissions in 1990 and 2004 of between 2 and 3 % (Gustafsson, 2005). For the environmental accounts, the total figure should be the same, if we disregards the international shipping and airport data. For the different industries it is expected that the uncertainty will vary however, depending on the quality of the emission factors and the quality of the fuel data.

The Tier 1 method aims at providing a simple as well as time efficient procedure of estimating uncertainties associated with activity data, emission factors and direct emissions. Once the uncertainties in the source categories have been determined, they may be combined to provide uncertainty estimates for the entire inventory in any year and the uncertainty in the overall

inventory trend over time. The Tier 1 method for combining estimating uncertainty is based on the error propagation equations as presented in the IPCC Good Practice Guidance. Equation 1 is used when uncertainties are combined by multiplication (for example activity data multiplied with emission factors).

Equation 1 in the Tier 1 method:

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \ldots + U_n^2}$$

Where:

U_{total} is the percentage uncertainty in the product of the quantities (half the 95% confidence interval divided by the total and expressed as a percentage);

5. Results

5.1 Inventory of European data

In order to improve calculations of emissions for the IPP indicators we searched for data available at the time of the study for EU25. Both data on emissions to air and energy data in the framework of environmental accounts were searched for. Unfortunately, it would show that the number of pollutants as well as the number of industries being covered did vary to a large extent in the data that were possible to collect. Environmental account data on energy was not found. Hence, Model 1 (ideal) for calculation of the emissions (cf. Figure 1, Method) was not possible to achieve within the frames of this project.

In Table 2, an overview of emission parameters covered by EU25 is presented. Detailed tables[5] on the availability of air emission data as well as a brief overview of economic data are available in Appendix, Table A1 – A2. Of the collected data emissions of CO2, N2O and CH4 for EU15 had been certified by Eurostat, cf. Appendix Table A3-A5. Since February 2006 these data are also available on the Eurostat web-site. For future calculations on indicators for IPP this data is planned to be included.

Table 2. Air emission data for EU25 (plus Bulgaria and Norway), 2000. Based on data from collected from Eurostat (CO2, N2O and CH4 for the EU15 are available at Eurostat[6]).

	EU 15	Austria, AT	Belgium, BE	Cyprus, C	Czech Republic, CR	Denmark, DK	Estonia, EST	Finland, FI	France, FR (1998)	Germany, DE	Greece, GR (1998)	Hungary, H	Ireland, IE	Italy, IT	Latvia, LA	Lithuania, LTU	Luxemburg, LU (estimation)	Malta, M	Poland, PL	Portugal, PT (estimation)	Slovakia, SLV	Slovenia, SLO	Spain, ES	Sweden, SE	the Netherlands, NL	United Kingdom, UK	Bulgaria, BG	Norway, N
CO2	x	x	x			x		x	x	x	x		x	x		x	x		x	x			x	x	x	x		x
N20	x	x	x			x		x	x	x	x		x	x			x		x	x			x	x	x	x		x
CH4	x	x	x			x		x	x	x	x		x	x		x	x		x	x			x	x	x	x		x
NOx		x	x	x		x		x	x	x	x		x	x		x			x					x	x	x		x
SOx		x	x	x		x		x	x	x	x		x	x		x			x					x	x	x		x
NH3		x	x	x		x			x	x			x	x		x			x					x	x	x		x
CO		x	x	x		x		x	x	x				x		x								x		x		x
NMVOC		x	x	x		x		x	x	x	x			x		x			x					x		x		x

[5] Air emission according to NACE 1 and NAMEA definitions, Air emission from transport activities and Household air emissions according to NAMEA definitions

[6] Since February 2006 the CO2, N2O and CH4 data is available on the Eurostat web-site and the database of NewCronos.

5.2 IPP-indicators by product groups

In Table 3 the emissions of carbon dioxide from Swedish private and public consumption are shown, by product NACE. The direct emissions from fossil fuel use by households have been allocated to NACE 23, which is the largest group. Other product groups with a large share of the emissions are electricity and heat generation with approximately 15% of emissions from Swedish consumption, followed by housing and food. The total emissions are 44 million tonnes of which the private consumption stands for 80%. For many product groups the emissions from the private and public consumption are of similar size though, and for some (Construction, Defense, Education and Health services, NACE 45, 74, 80 and 85) the public emissions are higher. The interpretation of the figures is not always straightforward. Especially not for some of the machinery categories, it is difficult to grasp what products are included. Waste treatment and water use is included in the housing group, because of national accounting standards. By using purpose categories instead of NACE, a finer disaggregation of consumption groups are possible.

Table 3. Carbon dioxide emissions (tonnes) from Swedish private and public consumption by NACE, 2002.

		Private consumption	Public consumption	Total P&P	Private C	Public C	P&P
01	Agricultural products	1 096 036	42 865	1 138 901	2,92%	0,64%	2,57%
02	Forest products	7 985	22	8 007	0,02%	0,00%	0,02%
05	Fish	229 148	10 557	239 705	0,61%	0,16%	0,54%
10+11+12	Peat	8 666	0	8 666	0,02%	0,00%	0,02%
13-14	Stone, sand and gravel	5 525	35 126	40 651	0,01%	0,52%	0,09%
15-16	Food	4 176 512	337 548	4 514 060	11,13%	5,01%	10,19%
17	Textiles	171 725	54 765	226 490	0,46%	0,81%	0,51%
18	Clothes	312 033	14 535	326 568	0,83%	0,22%	0,74%
19	Leather merchandise	131 336	12 535	143 871	0,35%	0,19%	0,32%
20	Wood, cork	26 695	6 917	33 613	0,07%	0,10%	0,08%
21	Paper	58 987	89 310	148 297	0,16%	1,32%	0,33%
22	Publishing	177 380	94 983	272 363	0,47%	1,41%	0,62%
23	Petroleum products	14 537 761	1 173 301	15 711 062	38,73%	17,40%	35,48%
24	Chemicals	291 417	279 988	571 405	0,78%	4,15%	1,29%
25	Rubber and plastics	60 908	61 256	122 164	0,16%	0,91%	0,28%
26	Glass and glass fiber	92 856	63 717	156 573	0,25%	0,94%	0,35%
27	Steel and metall	6 637	30 014	36 652	0,02%	0,45%	0,08%
28	Metal goods	65 590	64 806	130 396	0,17%	0,96%	0,29%
29	Machines	79 148	68 053	147 201	0,21%	1,01%	0,33%
30	Computers	27 009	6 279	33 289	0,07%	0,09%	0,08%
31	Electronics	68 839	25 905	94 744	0,18%	0,38%	0,21%
32	Telephones	103 584	57 230	160 814	0,28%	0,85%	0,36%
33	Watches, clocks / Office equipments	24 443	86 367	110 810	0,07%	1,28%	0,25%

Table 3, Continuation. Carbon dioxide emissions (tonnes) from Swedish private and public consumption by NACE, 2002.

		Private consumption	Public consumption	Total P&P	Private C	Public C	P&P
34	Motor vehicles	630 679	4 668	635 347	1,68%	0,07%	1,43%
35	Other vehicles	102 809	111 402	214 211	0,27%	1,65%	0,48%
36	Furniture	382 103	53 737	435 839	1,02%	0,80%	0,98%
40	Electricity and heat	5 080 328	883 208	5 963 536	13,53%	13,10%	13,47%
41	Water	0	23 400	23 400	0,00%	0,35%	0,05%
45	Construction	719	408 248	408 966	0,00%	6,05%	0,92%
50	Maintenance of vehicles	2 536 958	254 905	2 791 863	6,76%	3,78%	6,30%
55	Hotel and restaurants	1 046 058	97 000	1 143 057	2,79%	1,44%	2,58%
60	Land transport	826 119	453 842	1 279 962	2,20%	6,73%	2,89%
61	Sea transport	188 905	2 321	191 226	0,50%	0,03%	0,43%
62	Air transport	410 423	322 170	732 592	1,09%	4,78%	1,65%
63	Travel agencies	778 317	51 880	830 197	2,07%	0,77%	1,87%
64	Post and telecom	269 658	121 077	390 735	0,72%	1,80%	0,88%
65	Finance services	56 068	1 670	57 738	0,15%	0,02%	0,13%
66	Insurance	103 323	2 678	106 001	0,28%	0,04%	0,24%
67	Activities auxiliary to financial intermediation	5 380	0	5 380	0,01%	0,00%	0,01%
70	Housing	2 414 801	436 418	2 851 219	6,43%	6,47%	6,44%
71	Car rentals	288 326	43 159	331 484	0,77%	0,64%	0,75%
72	Computer treatment	7 758	59 099	66 857	0,02%	0,88%	0,15%
73	R & D	0	9 774	9 774	0,00%	0,14%	0,02%
74-75	Defence, Social insurance	33 858	338 248	372 106	0,09%	5,02%	0,84%
80	Education	30 253	141 003	171 257	0,08%	2,09%	0,39%
85	Health care	155 996	253 899	409 895	0,42%	3,76%	0,93%
90	Waste treatment	0	21 772	21 772	0,00%	0,32%	0,05%
92	Recreation	259 786	3 557	263 344	0,69%	0,05%	0,59%
93	Other service	167 299	28 896	196 194	0,45%	0,43%	0,44%
95-99	Embassies and intern. Organisations	15	8	24	0,00%	0,00%	0,00%
Total		37 536 160	6 744 119	44 280 279	100,00%	100,00%	100,00%

In Table 4, the energy use for private and public consumption is shown by product NACE. The direct energy use of fossil fuels and of bio-fuels have been allocated to NACE 23 (petroleum products) and NACE 2 (forest products) respectively.

The total energy use of Private and Public consumption in Sweden is around 700 000 TJ. Private consumption is by far the largest energy user (about 85% of the energy use is connected to private consumption). Petroleum products (NACE23), Electricity and heat (NACE40) together

with Food (NACE15-16) are the three largest products group with almost 60% of the total private and public consumption. As shown in Table 3, the categories Petroleum products, Electricity and heat and Food are also associated with the largest share of carbon dioxide emissions. For private consumption it can be noted that that forest products represents about 6% of energy use products (i.e. Biomass for fuels).

The mix within Public consumption to some extent differs from the Private consumption. For the total Petroleum products (NACE 23) together with Electricity and heating (NACE 40) represents the largest shares. However, for Public consumption these are then followed by energy use in Housing (NACE 70) and Land transport (NACE 60) with approximately the same magnitude of TJ used. The large share of energy use for housing is explained by heating of public places of work. There are few product groups where the energy use by Public consumption exceeds the Private Consumption in absolute TJ. However, it can be seen in categories such as paper Paper (NACE 21), Construction (NACE 45), Social Insurance-Defence (NACE 74-75) and Education and Health (NACE 80 + NACE 85)

The fact that there is no energy use for products of water (NACE 41) and waste treatment (NACE 90) in Private consumption is a result of that this is already included in the Housing (NACE 70), because of national accounting standards. Thus water provision and waste management are seen as functions of housing, that land-lords buy from the industries.

Table 4. Energy use, for private and public consumption, by NACE 2002 [TJ]

		Private consumption [TJ]	Public consumption [TJ]	Total P&P [TJ]	Private C	Public C	P&P
01	Agricultural products	15 573	609	16 182	2,60%	0,57%	2,29%
02	Forest products	38 599	921	39 520	6,44%	0,86%	5,59%
05	Fish	2 842	131	2 973	0,47%	0,12%	0,42%
10+11+12	Peat	125	0	125	0,02%	0,00%	0,02%
13-14	Stone, sand and gravel	61	386	447	0,01%	0,36%	0,06%
15-16	Food	60 603	4 805	65 408	10,11%	4,50%	9,26%
17	Textiles	2 659	843	3 503	0,44%	0,79%	0,50%
18	Clothes	4 649	217	4 865	0,78%	0,20%	0,69%
19	Leather merchandise	2 185	209	2 394	0,36%	0,20%	0,34%
20	Wood, cork	636	201	837	0,11%	0,19%	0,12%
21	Paper	1 159	2 048	3 206	0,19%	1,92%	0,45%
22	Publishing	3 159	1 744	4 903	0,53%	1,63%	0,69%
23	Petroleum products	202 915	20 886	223 801	33,84%	19,58%	31,68%
24	Chemicals	4 388	4 310	8 698	0,73%	4,04%	1,23%
25	Rubber and plastics	985	980	1 964	0,16%	0,92%	0,28%
26	Glass and glass fiber	1 086	573	1 659	0,18%	0,54%	0,23%
27	Steel and metall	65	253	319	0,01%	0,24%	0,05%
28	Metal goods	728	735	1 463	0,12%	0,69%	0,21%
29	Machines	1 026	899	1 925	0,17%	0,84%	0,27%
30	Computers	348	81	429	0,06%	0,08%	0,06%
31	Electronics	887	343	1 230	0,15%	0,32%	0,17%
32	Telephones	1 496	823	2 319	0,25%	0,77%	0,33%
33	Watches, clocks	329	1 177	1 506	0,05%	1,10%	0,21%

Table 4, Continuation. Energy use, for private and public consumption, by NACE 2002 [TJ]

		Private consumption [TJ]	Public consumption [TJ]	Total P&P [TJ]	Private C	Public C	P&P
34	Motor vehicles	8 374	62	8 436	1,40%	0,06%	1,19%
35	Other vehicles	1 324	1 520	2 843	0,22%	1,42%	0,40%
36	Furniture	6 373	858	7 230	1,06%	0,80%	1,02%
40	Electricity and heat	100 018	17 385	117 403	16,68%	16,30%	16,62%
41	Water	0	343	343	0,00%	0,32%	0,05%
45	Construction	8	4 688	4 696	0,00%	4,39%	0,66%
50	Maintenance of vehicles	36 901	3 708	40 608	6,15%	3,48%	5,75%
55	Hotel and restaurants	14 940	1 385	16 325	2,49%	1,30%	2,31%
60	Land transport	12 202	6 463	18 666	2,03%	6,06%	2,64%
61	Sea transport	2 498	31	2 529	0,42%	0,03%	0,36%
62	Air transport	5 697	4 472	10 169	0,95%	4,19%	1,44%
63	Travel agencies	10 939	731	11 669	1,82%	0,68%	1,65%
64	Post and telecom	4 069	1 817	5 886	0,68%	1,70%	0,83%
65	Finance services	843	25	868	0,14%	0,02%	0,12%
66	Insurance	1 618	42	1 660	0,27%	0,04%	0,23%
67	Activities auxiliary to financial intermediation	80	0	80	0,01%	0,00%	0,01%
70	Housing	33 337	6 482	39 818	5,56%	6,08%	5,64%
71	Car rentals	4 113	616	4 729	0,69%	0,58%	0,67%
72	Computer treatment	115	876	991	0,02%	0,82%	0,14%
73	R & D	0	138	138	0,00%	0,13%	0,02%
74-75	Defence, Social insurance	496	5 010	5 506	0,08%	4,70%	0,78%
80	Education	466	2 172	2 638	0,08%	2,04%	0,37%
85	Health care	2 392	3 889	6 281	0,40%	3,65%	0,89%
90	Waste treatment	0	323	323	0,00%	0,30%	0,05%
92	Recreation	3 996	55	4 051	0,67%	0,05%	0,57%
93	Other service	2 396	414	2 810	0,40%	0,39%	0,40%
TOTAL		599 697	106 677	706 374	100,00%	100,00%	100,00%

5.3 IPP-indicators for private consumption by purpose

In Table 5 the indirect and direct CO2-emissions for private consumption *by purpose* are listed. The emissions are connected to the use of different fuels, but also electricity, heating, district heating and food such as meat, milk and bread. Two factors are important in this, both the intensity (emissions per Euro) and the amount of products that is bought. Other disaggregations would of course give different listing of which products are most intensive.

Looking at the data by purpose it is easier to see the allocation depending on the volume of consumption (the amount bought). However, there is need for some caution as the underlying environmental data is by industry. That is, the environmental data for the food sector does not separate between food coming from different agricultural practices, but constitute the footprint of the agriculture in the nation and in imported goods as two parts. Still, the merit is that the amounts bought are also of great importance for the environmental impact of the consumption and can be seen in the data.

Table 5. Carbon dioxide emissions by purpose, Swedish private consumption 2002, (tonnes).

		Tonnes CO2	Percent CO2
01.1.1	Bread and cereals	595 013	2%
01.1.2	Meat	945 185	3%
01.1.3	Fish	859 955	2%
01.1.4	Milk, cheese and eggs	955 051	3%
01.1.5	Oils and fats	129 196	0%
01.1.6	Fruit	342 806	1%
01.1.7	Vegetables	606 097	2%
01.1.8	Sugar and confectionery	426 840	1%
01.1.9	Food products n.e.c.	191 496	1%
01.2.1	Coffee, tea and cocoa	152 091	0%
01.2.2	Soft drinks, juices	303 874	1%
02.1.1	Spirits	49 123	0%
02.1.2	Wine	125 438	0%
02.1.31	Beer strong	73 340	0%
02.1.32	Beer light	90 926	0%
02.2.0	Tobacco	103 334	0%
03.1	Clothing	749 443	2%
03.2	Footwear	159 874	0%
04.1	Actual rentals for housing	1 382 798	4%
04.2.	Rentals cottages	1 030 804	3%
04.3	Maintenance & repair of dwelling	73 980	0%
04.5.1	Electricity	3 365 966	9%
04.5.2	Gas	26 250	0%
04.5.3	Liquid fuels	3 558 602	9%
04.5.4	Solid fuels	20 080	0%
04.5.5	Heat energy	1 688 112	4%
5	Furnishings & household eq.	1 015 982	3%
6	Health	295 041	1%
07.1	Purchase of vehicles	769 851	2%
07.2	Operation of vehicles	11 642 089	31%
07.3	Transport services	1 419 397	4%
08.1	Postal, telephone, telefax services	40 150	0%
09.1-09.2	Media Equipment and musical instrument	597 682	2%
09.3-09.6	Games and hobbies	2 005 563	5%
10	Education	3 758	0%
11.1	Catering services	902 485	2%
11.2	Accommodation services	143 572	0%
12.	Personal care	694 914	2%
	Total	37 536 160	100%

In**Table 6** the indirect energy use for private consumption is presented by purpose. For district heating the largest category is housing.

Table 6. The fuel, electricity and distance heating use for private consumption, 2002 [TJ].

		Fuel [TJ]	Percent	Electricity [TJ]	Percent	District heating TJ	Percent
01.1.1	Bread and cereals	17 849	2%	3 925	1%	546	0%
01.1.2	Meat	27 334	2%	5 005	2%	678	1%
01.1.3	Fish	21 957	2%	1 407	0%	340	0%
01.1.4	Milk, cheese and eggs	27 820	2%	4 864	2%	798	1%
01.1.5	Oils and fats	4 183	0%	854	0%	116	0%
01.1.6	Fruit	9 834	1%	1 643	1%	177	0%
01.1.7	Vegetables	17 442	2%	2 870	1%	311	0%
01.1.8	Sugar and confectionery	12 818	1%	2 896	1%	441	0%
01.1.9	Food products n.e.c.	5 660	0%	1 172	0%	145	0%
01.2.1	Coffee, tea and cocoa	4 520	0%	906	0%	113	0%
01.2.2	Soft drinks, juices	8 887	1%	1 835	1%	257	0%
02.1.1	Spirits	1 429	0%	316	0%	47	0%
02.1.2	Wine	3 647	0%	851	0%	121	0%
02.1.31	Beer strong	2 136	0%	483	0%	72	0%
02.1.32	Beer light	2 648	0%	578	0%	89	0%
02.2.0	Tobacco	3 074	0%	792	0%	102	0%
03.1	Clothing	22 172	2%	6 465	2%	977	1%
03.2	Footwear	5 066	0%	1 650	1%	359	0%
04.1	Actual rentals for housing	41 360	4%	9 807	3%	14 515	11%
04.2.	Rentals cottages	25 279	2%	6 168	2%	726	1%
04.3	Maintenance & repair of dwelling	2 015	0%	625	0%	84	0%
04.5.1	Electricity	132 653	11%	169 379	56%	284	0%
04.5.2	Gas	183 383	16%	212	0%	7	0%
04.5.3	Liquid fuels	189 888	16%	1 595	1%	75	0%
04.5.4	Solid fuels	39 414	3%	180	0%	44	0%
04.5.5	Heat energy	66 584	6%	4 262	1%	94 924	75%
5	Furnishings & household eq.	30 663	3%	9 581	3%	1 343	1%
6	Health	8 854	1%	2 881	1%	718	1%
07.1	Purchase of vehicles	20 585	2%	7 494	2%	1 145	1%
07.2	Operation of vehicles	47 538	4%	11 631	4%	958	1%
07.3	Transport services	40 622	4%	9 245	3%	481	0%
08.1	Postal, telephone, telefax services	1 179	0%	340	0%	59	0%
09.1-09.2	Media equipment and musical instrument	17 589	2%	5 671	2%	803	1%
09.3-09.6	Games and hobbies	58 932	5%	13 119	4%	1 846	1%
10	Education	118	0%	59	0%	15	0%
11.1	Catering services	25 778	2%	6 200	2%	1 191	1%
11.2	Accommodation services	4 101	0%	987	0%	190	0%
12.	Personal care	20 956	2%	7 104	2%	1 860	1%
	Total	1 155 968	100%	305 051	100%	126 957	100%

5.4 Time series

By looking at the emissions for a longer time period, the importance of yearly variations is seen (Figure 3 and 4).The variations can be due to factors such as business cycles, depending on prices of goods and of world market behavior. They can also be due to weather conditions, where cold periods may demand more peak energy which is often of fossil origin. The amount of rain and snow is also of importance for the potential for hydro power.

The indirect emissions that are connected to the goods and services bought are of importance when compared with the direct emissions from heating houses (stationary) and from transports (mobile). For both public and private consumption a trend of decreasing emissions of fossil carbon dioxide emissions, mainly in the stationary emissions can be seen. This can be due to a shift of fuels from oil to more biofuel and heat pumps. It can also be an effect of a gradually warmer climate.

The public consumption has around seven million tons of carbon dioxide connected to it. The size shows the potential for green procurement. As was noted in chapter 5.3 the profile of public spending and private spending is in some cases different, and there are some areas such as defense where the public consumption is of vast importance.

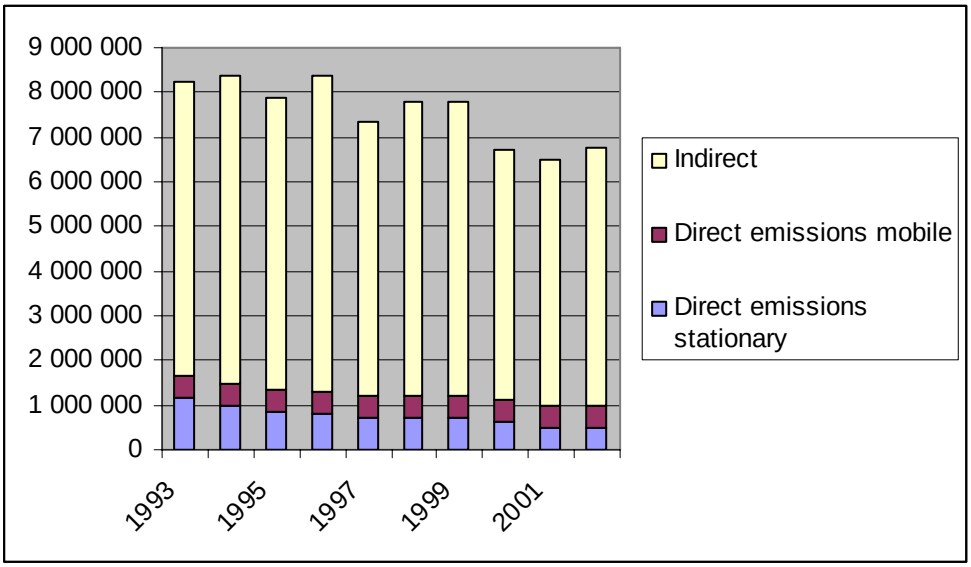

Figure 3. The indirect and direct carbon emissions from public consumption from 1993-2002 [tonnes].

The private consumption stands for between 36 and 44 million tonnes per year during this time period or between 4 and 5 tonnes of carbon emission per person and year. For private consumption the indirect emissions are also of great importance (Figure 4). The direct emissions from transport and heating houses are around 15 million tonnes.

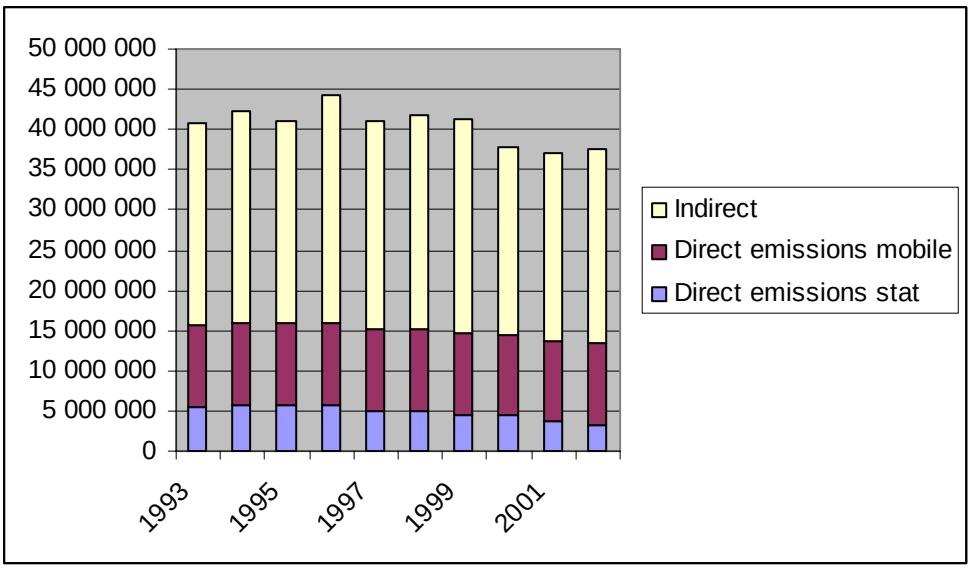

Figure 4.The indirect and direct carbon emissions from private consumption from 1993-2002 [tonnes].

As can be seen in figure 5 meat, milk, cheese and eggs are large groups among the food products. Also fish, bread and vegetables can be noted. Food in general is connected to emissions of around 5 million tones of carbon dioxide or 0,5 tonnes per capita.

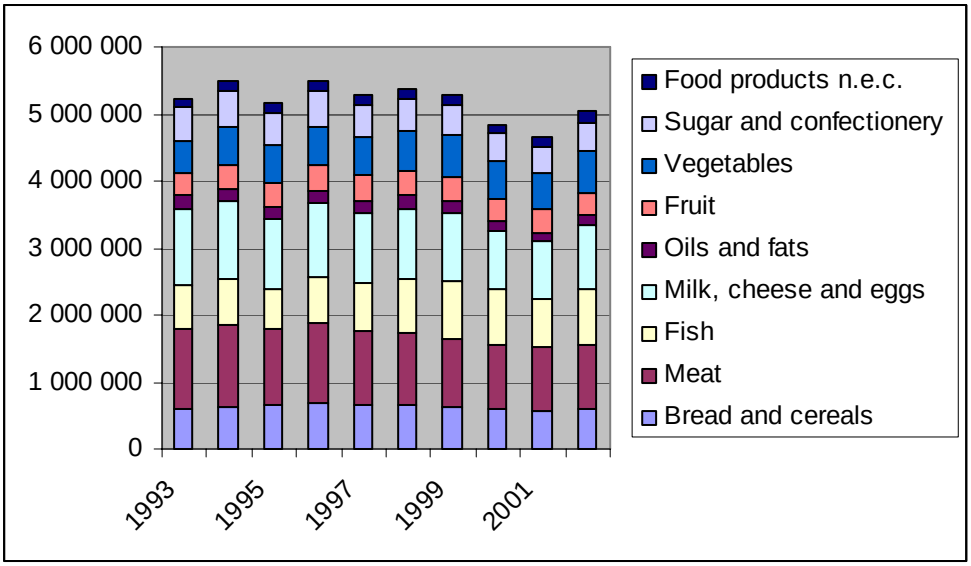

Figure 5. The carbon emissions for producing food from 1993-2002, [tonnes].

6. Discussion

The data show how environmental pressure and resource use can be connected to the consumption of goods and services. By comparing the different policy initiatives with these product groups it is possible to see how important the IPP- initiatives can become in a total consumption perspective. The categories of transport, housing and food are of evident importance. The economic goals are to increase the GDP leading to increasing consumption. The key question for IPP policies is how to decouple the increasing economic consumption from the corresponding environmental pressure and energy use. Such decoupling can be accomplished in different ways: by switching to less carbon intensive fuels, by consuming services rather than goods, by efficiency measures etc. Partly, the energy use in a country such will also vary between years due to weather conditions as will the availability of hydro power.

This method makes it possible to see the potential for green procurement as it explicitly shows the environmental pressure from public consumption. It can also be seen how public and private consumption differ and thereby serve as information for policy makers on how to best device IPP measures, as well as to follow up on the results of the policies.

The underlying data comes from many different sources, and are based both on questionnaires to involved industries, but also on emission factors for CO2-content in fuels and model assumptions for smaller enterprises. The data quality is good in the respect that the data is generated every year and that the methods and coverage is as good as the economic standards in the national accounts demand. Comparability between nations is also possible due to international classifications of industries, fuels, emission inventories and product groups. However, it is wise to treat the absolute figures with caution, and concentrate on comparisons between groups of products and between years.

Compared to the results of Weidema et al. 2005 and EIPRO, the general pattern is the same. However, the level of the total environmental pressure in these studies has not been available for comparison. The lack of European data of broad and detailed data on environmental impacts of economic activities is also highlighted in the conclusions of the EIPRO-study (Tukker et al., 2005).

The energy mix in Sweden is not typical in a European sense in that it has more biofuels for heating (approximately one fourth of the fuels are biofuels) but also more district heating. The electricity is mainly generated by hydro power and nuclear power. Thus the energy system is relatively low in carbon dioxide emissions

As mentioned before, the availability of international data is still not sufficient to really produce the kind of indicators we have presented here for the whole of EU or for a single member state with accurate calculations of the environmental pressures caused in other countries. Basically three sources of data would need to be completed or developed further:

- Symmetric Input-Output tables for all member states, which is something that most have committed to, and eventually will be, delivering every 5 years.

- Environmental Accounts data for energy use, emissions and other data in the harmonized system, which most have agreed on. Data is available but not for all member states at 2-digit NACE level to link into the IO tables.

- Trade data for single country, bilateral and multilateral trade analysis of environmental pressures caused among trading partners. EU-wide analysis of trade with the rest of the world is probably easier to come by.

In future projects the potential importance of investments have to be further elaborated. Investments would ideally be handled specifically in the analysis and the indicators. Gross investments are classified as final demand but a part of this, e.g. replacements, could be attributed to the production of goods and services in the current year. This would mean a reallocation of indirect emissions from gross investments to the other components of final demand. In this project however, it has not been possible to do this reallocation.

7. Conclusions

The indicators show how environmental pressure and resource use can be connected to the consumption of goods and services. By comparing the different policy initiatives with these product groups it is possible to see how important the IPP- initiatives can become in a total consumption perspective. The categories of transport, housing and food are of evident importance.

An advantage of this method is that it is designed for regular updating with standard statistics. By looking at the emissions over a time period, the importance of yearly variations is seen .The variations can be due to factors such as business cycles, depending on prices of goods and of world market behavior. They can also be due to weather conditions, where cold periods may demand more peak energy which is often of fossil origin.

The indirect emissions that are connected to the goods and services bought are of importance when compared with the direct emissions from heating houses and from transports. For both public and private consumption a trend of decreasing emissions of fossil carbon dioxide emissions, mainly in the stationary emissions can be seen.

The private consumption stands for between 36 and 44 million tonnes per year during 1993-2002 or between 4 and 5 tonnes of carbon emission per person and year. The direct emissions from transport and heating houses are around 15 million tonnes. Meat, milk, cheese and eggs are large groups among the food products. Food in general is connected to emissions of around 5 million tones of carbon dioxide or 0,5 tonnes per capita.

The public consumption has around seven million tons of carbon dioxide connected to it. The size shows the potential for green procurement. The profile of public spending and private spending is in some cases different, and there are some areas such as defense where the public consumption is of vast importance.

The underlying data comes from many different sources, and are based both on questionnaires to involved industries, but also on emission factors for CO2-content in fuels and model assumptions for smaller enterprises. The data quality is good in the respect that the data is generated every year and that the methods and coverage is as good as the economic standards in the national accounts demand. Comparability between nations is also possible due to international classifications of industries, fuels, emission inventories and product groups.

In order to get good data also on the imported products and goods, more environmental accounts data is needed. The discussions on making a regulation for this type of statistics is a clear example of something that could rapidly increase the availability of country data in the EU.

Basically three sources of data would need to be completed or developed further:

- Symmetric Input-Output tables for all member states.
- Environmental Accounts data for energy use, emissions and other data in the harmonized system.
- Trade data for single country, bilateral and multilateral trade analysis of environmental pressures caused among trading partners.

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Table A1. Overview of Economic data by industry from the National Accounts according to NACE rev 1 and ESA 95, EU member countries, plus Norway and Bulgaria.

EU Member	Data available for year	Table 1a. Economic data by industry from the National Accounts according to NACE rev 1 and ESA 95	Table 2a. Household consumption expenditure data from the national accounts
Austria, AT	1980-2001		
Belgium, BE	1995 and 2000	output, value added and intermediate consumption in current prices and constant prices, employment figures in '000persons.	
Cyprus, CYP	2000	occasional observations for some industries on output, value added and intermediate consumption in current prices and constant prices.	final consumption in current prices for heating.
Czech Republic, CR			
Denmark, DK	1995 and 2000	output, value added and intermediate consumption in current prices and constant prices, employment in man hours and '000persons.	final consumption in current and constant prices for transport and heating.
Estonia, EST			
Finland, FIN	2000		
France, FR	1998		
Germany, DE	1995 and 2000	output, value added and intermediate consumption in current prices and constant prices, employment '000persons.	final consumption in current and constant prices for transport and heating.
Greece, GR	1998	output, value added and intermediate consumption in current prices.	
Hungary, HU			
Ireland, IE	2000	almost no data	final consumption in current and constant prices for transport and heating.
Italy, IT	2000	output, value added and intermediate consumption in current prices and constant prices, employment in full-time jobs and '000 persons.	final consumption in current and constant prices for transport and heating.
Lithuania, LTU	2000	output, value added and intermediate consumption current prices and constant prices.	final consumption in current and constant prices.
Luxenburg, LU			
Malta, M			
Poland, PL	2000	output, value added and intermediate consumption in currant prices and constant prices for most industries.	final consumption in current and constant prices for transport and heating.
Portugal, PT			
Slovakia, SLV			
Slovenia, SLO			
Spain, ES	1995-2000		

Table A1 continuation.

EU Member	Data available for year	Table 1a. Economic data by industry from the National Accounts according to NACE rev 1 and ESA 95	Table 2a. Household consumption expenditure data from the national accounts
Sweden, SE	2000	output, value added and intermediate consumption current and constant prices, employment '000manhours and full-time jobs	final consumption in current and constant prices for transport and heating.
Netherlands, NL	2000	output, value added and intermediate consumption in current and constant prices, employment.	final consumption in current prices for transport and heating.
United Kingdom, UK	2000	output, value added and intermediate consumption in current prices, employment in '000 persons.	final consumption in current prices for transport and heating.
Bulgaria, BG (none EU-member)	2000	output, value added and intermediate consumption in current and constant prices.	final consumption in current and constant prices for transport and heating.
Norway, NO (none EU-member)	2000	output, value added and intermediate consumption current and constant prices, employment '000manhours and full-time jobs and '000persons.	final consumption in current and constant prices for transport and heating.

Data collected from Eurostat, 2005.

Table A2. Overview of NAMEA air emission data in EU member countries, cf. Table 2 in the main report for a quick overview of some key emission parameters. Please observe that notes about the data are not included in the table. (Data is collected from Eurostat, however only data on CO2, CH4 and N2O for year 2000 has been controlled by Eurostat).

EU Member	Data available for year	Table 1b. Air emission according to Nace rev 1 and NAMEA definitions			Table 1bt. Air emissions from transport activities	Table 2b. Household air emissions according to NAMEA definitions.
		1st Priority (CO2, of which CO2 from biomass as fuel, N20, CH4, HFCs, PFs, SF6)	**2nd Priority** (NOx, SOx, NH3, NMVOC, CO, PM10, CFCs, HFCFs)	**3rd Priority** (As, Hg, Pb, Zn, Cd, Cr, Se, Cu, Ni)	for a list of parameters cf. heading 'Table 1b' - all priorities.	for list of parameters cf. heading 'Table 1b' - all priorities.
Austria, AT	1980-2001	CO2, N2O	NOx, SO2, NH3, NMVOC, CO, NH4,			
Belgium, BE	1995 and 2000	CO2, N20, CH4, HFCs, SF6	NOx, SOx, NH3, NMVOC, CO, CFCs, HFCFs			CO2, N2O, CH4, NOx, SOx, NH3, NMVOC, CO, CFCs, HCFs [1995 only]
Cyprus, CYP	2000		NOx, SOx, NH3, NMVOC, CO [for some industries]	Pb [for some industries]		NOx, SO2, NMVOC, CO from heating
Czech Republic, CR	No data					
Denmark, DEN	1995 and 2000	CO2, of which CO2 from biomass as fuel, N20, CH4.	NOx, SOx, NH3, NMVOC, CO		CO2, N2O, NOx, SO2, NMVOC, CO [2000 only]	CO2, of which CO2 from biomass as fuel, N2O, CH4, NOx, SOx, NH3, NMVOC, CO [2000 only]
Estonia, EST	No data					
Finland, FIN	2000	CO2, of which CO2 from biomass as fuel, N20, CH4, (HFCs, PFs, SF6 only total)	NO_x, SO_x, NMVOC, CO, PM10			
France, FR	1998 (2000)	CO2, N20, CH4 Estimations by Eurostat	NOx, SOx, NH3, NMVOC, CO			CO2, N2O, CH4, NOx, SOx, NH3, NMVOC, CO
Germany, DE	1995 and 2000	CO2, N20, CH4	NOx, SOx, NH3, NMVOC, CO, PM10		CO2, N2O, NOx, SO2, NMVOC, CO, PM10 [2000 only]	CO2, N2O, CH4, NOx, SOx, NH3, NMVOC, CO, PM10 [only totals for 2000]
Greece, G	1998	Estimations by Eurostat on CO2, N20, CH4	NOx, SOx, NMVOC, CO			CO2, N2O, CH4, NOx, SOx, NMVOC, CO
Hungary, H	No data					

Table A2, continuation. Overview of NAMEA air emission data in EU member countries.

EU Member	Data available for year	Table 1b. Air emission according to Nace rev 1 and NAMEA definitions			Table 1bt. Air emissions from transport activities	Table 2b. Household air emissions according to NAMEA definitions.
		1st Priority (CO2, of which CO2 from biomass as fuel, N20, CH4, HFCs, PFs, SF6)	**2nd Priority** (NOx, SOx, NH3, NMVOC, CO, PM10, CFCs, HFCFs)	**3rd Priority** (As, Hg, Pb, Zn, Cd, Cr, Se, Cu, Ni)	for a list of parameters cf. heading 'Table 1b' - all priorities.	for list of parameters cf. heading 'Table 1b' - all priorities.
Ireland, IRL	2000	CO2, N2O, CH4	NOx, SOx, NH3			CO2, N2O, CH4, NOx, SOx and NH3 [only totals]
Italy, IT	2000	CO2, of which CO2 from biomass as fuel, N20, CH4	NOx, SOx, NH3, NMVOC, CO, PM10	Pb	CO2, N2O, NOx, SO2, NMVOC, CO, PM10, Pb	CO2 (+CO2 from biomass), N2O, CH4, NOx, SOx, NH3, NMVOC, CO, PM10, Pb
Latvia, LA	No data					
Lithuania, LTU	2000	CO2, CH4 [only some industries]	NOx, SOx, NH3 [only some industries]		CO2, NOx, SOx, NMVOC, CO and Pb for [NACE 60-64]	
Luxenburg, LU	(2000)	Estimations by Eurostat on CO2, N20 and CH4.				
Malta, M	No data					
Poland, PL	2000	CO2, N20, CH4, HFCs, PFs, SF6 [only some industries]	NOx, SOx, NH3, NMVOC, CO, PM10, CFCs, HFCFs [only some industries]	As, Hg, Pb, Zn, Cd, Cr, Se, Cu, Ni [only some industries]	CO2, N2O, NOx, SOx, NMVOC, CO and Pb [Some data for NACE 60-64]	
Portugal, PT	(2000)	Estimations by Eurostat on CO2, N20 and CH4.				
Slovakia, SLV	No data					
Slovenia, SLO	No data					
Spain, ES	1995-2000	CO2, CH4, N2O				
Sweden, SE	2000	CO2, of which CO2 from biomass as fuel, N20, CH4	NOx, SOx, NH_3, NMVOC, CO		CO2, N2O, NOx, SO2, NMVOC, CO	CO2, N2O, CH4, NOx, SOx, NH3, NMVOC, CO
Netherlands, NL	2000	CO2, CH4, N2O	NOx, SOx, NH3, CFCs		CO2, N2O, NOx,SOx	CO2, N2O, CH4, NOx, SOx, NH3
United Kingdom, UK	2000	CO2,N20, CH4, HFCs, PFs, SF6	NOx, SOx, NH3, NMVOC, CO, PM10, CFCs, HFCFs	As, Hg, Pb, Zn, Cd, Cr, Se, Cu, Ni	CO2, N2O, NOx, SOx, NMVOC, CO, PM10, Pb	CO2, N2O, CH4, HFCs, PFCs, SF6, NOx, SOx, NH3, NMVOC, CO, PM10
Bulgaria, BG	2000					
Norway, NO	2000	CO2, N20, CH4, HFCs, PFs, SF6	NOx, SOx, NH3, NMVOC, CO, PM10	As, Hg, Pb, Cd, Cr, Cu	CO2, N2O, NOx, SOx,NH3 NMVOC, CO, PM10, Pb	CO2, N2O, CH4, HFCs, PFCs, SF6, NOx, SOx, NH3, NMVOC, CO, PM10, Pb, Cd, As, Cr, Cu

Table A3. CO2 emissions per industries for EU15, year 2000, [thousand tonnes]. (e.) indicate that the data is an estimation.
Please observe that comments about the data that are available in the original files are not included here.

	EU15	BE	DK	DE	GR (e.)	ES	FR (e.)	IE
Grand total	**3 566 235**	137 971	81 420	854 915	106 980	293 817	475 239	44 520
Households total	**816 558**	32 224	12 261	203 714	9 608	56 430	158 225	5 067
Total Industries	**2 749 677**	105 747	69 159	651 201	97 373	237 387	317 014	39 452
NACE								
A-B 01-05	**133 043**	2 687	3 185	7 905	8 735	17 725	59 114	1 320
C 10-14	**47 621**	112	2 348	8 878	499	891	2 207	570
DA 15-16	**53 228**	1 880	1 780	9 518	1 235	5 239	12 662	1 181
DB 17-18	**12 780**	678	104	988	708	1 520	2 561	74
DC 19	**1 013**	0	5	75	28	360		
DD 20	**14 005**	461	548	1 132	156	894	3 323	9
DE 21-22	**64 970**	597	257	8 052	452	2 838	9 403	9
DF23-DG24		16 336	1 532	42 173	4 402		42 188	
DH 25	**10 603**	215	133	1 688	115	586	1 688	18
DI 26	**192 120**	12 648	3 232	33 941	1 198	40 566	21 344	2 512
DJ 27-28	**207 978**	16 852	392	61 354	758	15 094	23 752	351
DK 29	**10 095**	98	227	3 048	52	829	1 128	34
DL 30-33	**9 192**	203	97	3 644	65	765	1 349	63
DM 34-35	**15 379**	323	66	6 319	76	1 032	1 359	8
DN 36-37	**11 887**	273	216	1 624	83	1 184	3 734	56
E 40-41	**1 055 152**	20 290	26 743	341 606	60 812	89 949	48 420	16 926
F 45	**33 051**	811	1 090	8 163	904	3 327	6 569	0
G 50-52		1 826	1 094	19 166	2 473	4 335	8 380	3 501
H 55		346	82	3 320	1 261	1 116	2 800	
I 60-64	**353 864**	18 224	24 541	35 482	10 150	17 947	30 665	11 009
J 65-67		254	35	2 008	714	263		
K 70-74		1 567	340	17 635	332	405	10 711	
L 75		1 076	357	9 504	927	666		
M 80		1 162	136	6 259	304	481	11 787	
N 85		1 075	203	7 712	525	698	6 098	
O 90-93		2 686	246	10 005	408	1 430	5 773	
P 95		0	0	0				
Q 99		164	0	0			0	
Not allocated	**9 606**	2 904	171					109

Table A3. Continuation, CO2 emissions per industries for EU15, year 2000, [thousand tonnes].

	IT	LU (e.)	NL	PT (e.)	FI	SE	UK	AT
Grand total	474 616	6 690	201 978	67 001	91 562	58 487	606 111	64 928
Households. total	110 362	1 054	36 178	6 860	12 008	14 525	147 692	10 351
Total industries	364 254	5 635	165 799	60 142	79 554	43 962	458 418	54 577
NACE								
A-B 01-05	8 588	106	10 047	1 576	4 360	2 001	4 789	905
C 10-14	569	2	2 201	206	3 661	547	24 000	929
DA 15-16	2 169	44	4 620	1 115	329	896	9 895	665
DB 17-18	1 729	48	390	1 143	40	98	2 439	259
DC 19	361			19	1		148	15
DD 20	564	8	150	310	961	262	4 902	323
DE 21-22	6 399	15	2 305	1 335	23 659	2 085	4 373	3 194
DF23-DG24		39			4 357	2 256	36 427	3 692
DH 25	1 359	81	263	234	26	109	3 675	414
DI 26	36 883	1 505	3 031	10 574	2 671	2 931	15 719	3 366
DJ 27-28	23 689	954	7 310	1 074	6 066	7 027	33 185	10 118
DK 29	1 925	25	378	256	46	240	1 623	185
DL 30-33	934	4	390	34	9	114	1 383	139
DM 34-35	2 087	1	250	31	43	434	3 228	122
DN 36-37	715	8	314	82	12	202	3 382	3
E 0-41	182 072	83	48 037	19 284	22 411	5 640	160 836	12 041
F 45	2 512	37	1 699	1 844	964	1 559	3 458	114
G 50-52	17 768	158	2 909	520	50	1 604	13 855	415
H 55	2 333	167	2 520	122		105	3 679	534
I 60-64	39 297	621	30 101	11 894	6 424	12 447	89 198	15 862
J 65-67	980	738	3 472	51		62	4 212	74
K 70-74	5 605	128		409	54	1 366	7 381	30
L 75	2 608	213	2 953	716	174		11 028	
M 80	780	107	959	61	4	120	5 606	
N 85	1 921	157	1 672	1 031	26		5 984	
O 90-93	2 931	386	7 896	117	232	335	4 014	282
P 95	0		0		0			
Q 99	0		0		0	0	0	
Not allocated			1 028		2 976	1 523		895

Data collected from Eurostat, 2005.

Table A4. CH4 emissions per industries for EU15, year 2000, [tonnes]. (e.) indicate that the data is an estimation.
Please observe that comments about the data that are available in the original files are not included here.

	EU15	BE	DK	DE	GR (e.)	ES	FR (e.)	IE
Grand total	**17 188 169**	502 759	273 394	4 121 157	551 347	1 870 885	2 616 581	608791
Households. total	**479 027**	7 720	7 291	99 349	5 414	34 474	144 513	2728
Total industries	**16 709 141**	495 038	266 103	4 021 808	545 933	1 836 411	2 472 069	606063
NACE								
A-B 01-05	**9 725 854**	331 529	183 462	2 534 531	308 050	1 113 222	1 698 288	540288
C 10-14	**1 313 511**	9	3 495	541 643	55 198	56 843	109 666	50
DA 15-16	**62 922**	21	379	481	637	3 524	634	545
DB 17-18	**22 240**	5	24	46	425	3 154	117	57
DC 19	**10 022**	0	1	4		3 053		
DD 20	**20 721**	4	345	139	106	89	1 159	
DE 21-22	**16 993**	9	63	442	212	3 233	488	
DF23-DG24	**70 465**	856	158	5 461	849		4 458	
DH 25	**4 413**	0	31	69	106	3 067	72	
DI 26	**28 361**	388	381	1 296	637	4 054	1 021	506
DJ 27-28	**47 275**	4 017	81	2 298	318	6 266	3 091	22
DK 29	**1 313**	6	45	153		64	44	29
DL 30-33	**1 111**	2	24	190		72	46	
DM 34-35	**2 431**	8	15	305		77	66	
DN 36-37	**3 327**	12	104	76		129	226	32
E 40-41	**1 066 209**	42 117	15 002	235 022	2 760	22 335	97 734	2512
F 45	**75 091**	42	135	632	531	371	367	
G 50-52	**68 790**	290	383	1 165	2 123	600	669	58528
H 55	**3 253**	28	63	225	743	206	284	
I 60-64	**55 413**	1 839	758	809	3 503	18 689	2 023	2590
J 65-67	**1 766**	20	29	136	425	61		
K 70-74	**4 887**	141	145	1 100	106	89	1 123	
L 75	**3 723**	145	121	1 168	531	149		
M 80	**3 539**	137	95	554	212	110	1 350	
N 85	**3 199**	123	144	606	318	159	680	
O 90-93	**3 693 242**	111 885	57 583	693 258	168 143	585 276	548 462	
P 95	**0**	0		0				
Q 99	**12**	12		0				
Not allocated	**399 059**	1 395	3 038					

Table A4. Continuation, CH4 emissions per industries for EU15, year 2000, [tonnes].

	IT	LU (e.)	NL	PT (e.)	FI	SE	UK	AT
Grand total	1 740 294	22 894	972 196	601 994	259 999	281 276	2 329 633	434 967
Households. total	49 598	481	19 603	24 263	14 828	18 158	38 566	12 043
Total industries	1 690 697	22 413	952 593	577 731	245 172	263 118	2 291 067	422 925
NACE								
A-B 01-05	876 609	16 972	413 035	273 562	86 441	158 075	971 749	220 041
C 10-14	5 113	1	133 660	74 689	1 020	18	332 032	74
DA 15-16	34 219	9	560	18 220	31	44	662	2 956
DB 17-18	4 121	6	48	14 077	6	9	135	11
DC 19	72			6 877	0		10	5
DD 20	68	3	16	15 837	376	512	683	1 383
DE 21-22	1 195	1	273	7 243	1 278	1 318	338	899
DF23-DG24		5	2 854		686	67	4 844	89
DH 25	164	13	33	568	3	30	245	13
DI 26	1 496	10	406	16 833	79	43	1 154	58
DJ 27-28	12 811	37	955	7 877	579	131	8 691	101
DK 29	267	2	38	496	4	41	121	4
DL 30-33	154	0	45	428	1	16	118	14
DM 34-35	180	0	25	1 492	5	18	227	15
DN 36-37	102	3	31	2 333	2	39	237	
E 40-41	264 509	1 936	4 842	3 673	1 438	2 502	364 426	5 400
F 45	258	5	150	70 403	1 664	262	233	36
G 50-52	2 492	38	295	24	373	532	1 145	132
H 55	498	46	310	59		29	262	501
I 60-64	3 299	85	712	6 839	376	1 257	10 488	2 144
J 65-67	168	172	393	7		10	344	2
K 70-74	1 012	28		60	10	491	575	8
L 75	630	58	167	104	13		637	
M 80	162	25	125	9	0	417	344	
N 85	437	39	214	94	3		381	
O 90-93	449 677	2 919	396	49 192	149 547	96 992	590 988	188 924
P 95								
Q 99								
Not allocated			393 008		1 238	266		115

Data collected from Eurostat, 2005.

Table A5. N2O emissions per industries for EU15, year 2000, [thousand tonnes]. (e.) indicate that the data is an estimation.
Please observe that comments about the data that are available in the original files are not included here.

	EU15	BE	DK	DE	GR (e.)	ES	FR (e.)	IE
Grand total	1 092 494	37 679	28 847	179 821	34 409	84 967	250 960	34711
Households. total	61 720	3 036	1 026	12 597	1 140	5 824	8 926	1204
Total industries	1 030 774	34 642	27 821	167 224	33 269	79 143	242 033	33507
NACE								
A-B 01-05	704 263	16 033	21 947	116 976	21 246	54 939	180 329	27447
C 10-14	2 127	9	45	59		50	70	63
DA 15-16	2 384	16	50	214	104	302	461	171
DB 17-18	868	4	3	25	104	161	94	37
DC 19	100	0	0	2		40		
DD 20	1 039	3	23	34		67	87	23
DE 21-22	2 730	6	8	194		280	293	15
DF 23	5 802	847	33	493	415	1 707	795	11,25
DG 24	178 631	13 589	3 249	16 750	1 969	8 700	48 864	2707
DH 25	520	0	4	32		72	54	29
DI 26	6 084	264	61	477	104	1 672	155	58
DJ 27-28	5 416	146	13	1 337		1 249	499	62
DK 29	658	5	9	100		87	41	85
DL 30-33	455	0	4	99		44	40	69
DM 34-35	612	6	2	125		118	52	7
DN 36-37	764	4	9	49		79	154	3,75
E 40-41	42 471	170	733	12 117	7 877	2 490	1 845	164
F 45	2 360	54	59	371	104	172	300	5
G 50-52	5 766	149	72	814	207	324	779	851
H 55		30	4	65	104	119	266	
I 60-64	21 844	1 281	1 423	1 265	829	1 000	833	1200
J 65-67		38	2	44		35		
K 70-74		134	24	919		50	1 004	
L 75		85	18	240	104	85		
M 80		81	6	367		63	1 095	
N 85		340	9	6 364	104	1 511	564	
O 90-93		717	10	7 691		3 728	3 358	
P 95		0		0				
Q 99		13		0				
Not allocated	2 719	619						499

Table A5. Continuation. N2O emissions per industries for EU15, year 2000, [thousand tonnes].

	IT	LU (e.)	NL	PT (e.)	FI	SE	UK	AT
Grand total	135 582	729	49 510	38 359	22 760	27 477	146 835	19 849
Households. total	10 969	127	1 215	2 136	1 303	1 594	9 580	1 044
Total industries	124 613	602	48 296	36 223	21 457	25 883	137 255	18 806
NACE								
A-B 01-05	75 387	516	23 292	31 028	12 853	18 923	94 393	8 954
C 10-14	86	0	5	3	7	98	1 610	21
DA 15-16	402	1	27	262	27	54	256	37
DB 17-18	251	1		123	2	5	53	6
DC 19	47				0		8	2
DD 20	71	0		15	24	92	499	100
DE 21-22	132	0	6	217	524	628	156	271
DF 23	761		58	66	104	115	397	
DG 24	27 757	1	23 035	2 239	4 518	2 122	20 528	2 602
DH 25	118	2		4	1	9	173	19
DI 26	2 584	4	11	173	49	243	223	6
DJ 27-28	589	15	43	16	183	445	686	134
DK 29	223	1	6	5	3	13	72	9
DL 30-33	111	0	22		0	5	52	8
DM 34-35	156	0		2	2	23	112	7
DN 36-37	109	0	5	43	0	25	283	
E 40-41	7 010	1	365	265	1 236	908	6 905	384
F 45	320	2	48	49	484	80	293	17
G 50-52	1 496	4	56	30	1	105	817	61
H 55	215	3	12	8		6	60	208
I 60-64	2 416	20	414	521	708	701	4 321	4 911
J 65-67	89	9	144	2		2	269	3
K 70-74	512	2		41	3	649	436	4
L 75	346	4	75	68	26		359	
M 80	75	1	14	6	0	27	111	
N 85	168	2	334	70	1		118	
O 90-93	3 184	9	176	964	371	488	4 064	34
P 95								
Q 99								
Not allocated			147		329	119		1 006

Data collected from Eurostat, 2005.