EUROPEAN COMMISSION
EUROSTAT

Directorate F: Agricultural, environmental, food and regional statistics
Unit F-3: Environment and sustainable development

Room Document
Doc. ENV/WG/029/8.4 (2003)
Original in EN
Point 8.8 of the agenda

NAMEA for Air Emissions

Compilation guide

Draft version

August 2003

Joint Meeting of the
Working Groups "Environment Statistics» and
"Environmental Accounts"
Joint Eurostat/EFTA group
Meeting of 10 - 12 September 2003
BECH building – Room

NAMEA for Air Emissions

Compilation Guide

Draft version

August 2003

Preface

Rainer MUTHMANN
Head of Unit F3
Environment and sustainable development

Contents

INTRODUCTION **11**

STRUCTURE OF THE DOCUMENT 12

1. NAMEA-AIR CONCEPTUAL FRAMEWORK **13**

1.1. NAMEA FRAMEWORK 13
1.1.1. Origins of NAMEA *13*
1.1.2. NAMEA in the SEEA *14*
1.1.3. NAMEA (for air emissions) within Eurostat's environmental accounts *15*
1.2. AIR EMISSION ACCOUNTS FOR NAMEA 16
1.2.1. Economically-oriented emission accounts *16*
1.2.2. Difference in the totals to other air emission statistics *17*

2. DATA SOURCES AND METHODS TO COMPILE AIR EMISSION ACCOUNTS **21**

2.1. AIR EMISSION DATA MOSTLY BASED ON ENERGY ACCOUNTS 21
2.2. ARRANGEMENT OF PROCESS-ORIENTED INVENTORIES 26
2.2.1. Arrangement of air emissions registered in CORINAIR *26*
2.2.1.1 A short presentation of CORINAIR 26
2.2.1.2. SNAP codes' emissions attributed to a unique economic category 27
2.2.1.3. SNAP codes' emissions broken down into several economic categories 34
Attribution of CORINAIR emissions to several economic categories using energy data 35
Attribution of CORINAIR emissions to several economic categories using non-energy data 38
2.2.2. Arrangement of air emissions registered in inventories other than CORINAIR *39*
2.3. OTHER SPECIFIC SOURCES 40
2.3.1. Own account (road) transport emissions *40*
2.3.1.1. Own account transport in energy-based air accounts 41
2.3.1.2. Own account transport in inventory-based air accounts 41
Distribution of own account transport emission using energy data 42
Distribution of own account transport emissions using non-energy data on transport 42
2.3.2 International transport emissions *43*
2.3.2.1 Road transport 44
2.3.2.2 Water transport 45
2.3.2.3 Air transport 46

3. THE EU NAMEA AIR EMISSION ACCOUNTS STANDARD TABLES **49**

3.1. EUROSTAT NAMEA-AIR STANDARD TABLES 49
3.2. GUIDANCE ON HOW TO FILL IN THE TABLES 51
3.2.1 Industries economic and emission data (tables 1a and 1b) *51*
3.2.1.1 The same industry classification for both tables 51
3.2.1.2 Economic data consistent with the ESA 1995 52
3.2.2 Households economic and emission data (tables 2a and 2b) *53*
3.2.3 Isolation of emissions from transport activities (table 1bt) *54*
3.2.3.1 A definition of transport for NAMEA 54
3.2.3.2 Transport emissions in NAMEA 54
3.2.3.3 A table isolating transport emissions in NAMEA 55
3.2.4 Bridging air emission totals in NAMEA and for international reporting (table 3) *55*
3.2.4.1 Difference in coverage between NAMEA and international air emission reporting 55
3.2.4.2 The bridge table 57
3.2.5 Data on energy use in NAMEA (table 1be) *58*
3.2.5.1 Why energy accounts in NAMEA for air emission standard tables? 59
3.2.5.2 Presentation of the energy table 59
3.2.5.3 Illustration of the difference between energy statistics and energy use data for NAMEA-air 60
3.2.5.4 Example to illustrate the treatment of electricity 62

4. PRESENTATION OF THE RESULTS AND ANALYSIS BASED ON NAMEA 65

4.1. DETAILED DATA INDUSTRY BY INDUSTRY AND HOUSEHOLDS CONSUMPTION CATEGORY 65
4.1.1. Households and industries' respective contributions *65*
4.1.2. Environmental profiles of industries *68*
4.1.3. Linkage between economic and emission trends *70*
4.2. NAMEA-BASED INPUT-OUTPUT ANALYSIS 71
4.2.1. Indirect emissions allocated to final users *71*
4.2.2. Indirect emissions embedded in international trade *74*
4.2.3. Decomposition analysis of emission trends *76*

REFERENCED DOCUMENTS 79

ANNEXES 83

ANNEX 1 – LIST OF ABBREVIATIONS 85
ANNEX 2 – NACE BASED CLASSIFICATION FOR NAMEA-AIR 86
ANNEX 3 – SELECTED NOMENCLATURE FOR SOURCES OF AIR POLLUTION (SNAP 97) 87
ANNEX 4 – NOMENCLATURE FOR AIR POLLUTION OF FUELS (NAPFUE) 94
ANNEX 5 – EUROSTAT'S NAMEA FOR AIR EMISSIONS STANDARD TABLES 96
ANNEX 6 – DIFFERENCE IN THE COVERAGE OF AIR EMISSIONS BETWEEN THE IPCC GUIDELINES AND NAMEA 103
ANNEX 7 – TABLE ON ENERGY USE FOR THE NAMEA-AIR STANDARD TABLES 104

List of tables

Table 2.1.A – Proportions of emissions stemming from fuel combustion 21
Table 2.1.B – Calculation of energy-related CO_2 emissions in Denmark for a selection of industries and for households 23
Table 2.1.C – Carbon from fuel oil in the United Kingdom (2000) 25
Table 2.2.A – Proportions of total CORINAIR emissions attributed to unique economic sector 27
Table 2.2.B – Allocation of SNAP-based CORINAIR emission data into the NACE-based classification for NAMEA 29
Table 2.2.C – SNAP-based emissions allocated into several economic categories 35
Table 2.3.A – Percentage of transport emissions (UNFCC) and emissions of transport industry (NAMEA) 40
Table 2.3.B – Contribution of national residents abroad to air emission totals in NAMEA 43
Table 3.2.A – Different carbon dioxide emission totals in the Netherlands 57
Table 3.2.B (a) – Total use of energy product (excluding electricity) 61
Table 3.2.B (b) – Energy use table for NAMEA 61
Table 3.2.B (c) – Comparison between total energy use and fuel consumption relevant for NAMEA-air 62
Table 3.2.C – Illustration of the treatment of data on electricity in the energy table 63
Table 4.2.A – Comparison of producers' emissions and direct plus indirect emissions allocated to the final demand of industries' output in Denmark (CO_2, 1997) 72
Table 4.2.B – Illustration of the differences between the methods tested by the United Kingdom 75
Table 4.2.C – Illustration of the differences between the methods tested by Sweden 75

List of figures

Figure 1.1.A – Schematic description of a simplified NAMEA 15
Figure 2.1.A – Calculation of air emissions based on energy accounts 22
Figure 2.2.A – Energy based allocation of CORINAIR processes' emissions into several NACE categories 37
Figure 2.3.A – Adjustment from fuel purchases and related emissions on the national territory to residents' basis 44
Figure 3.1.A – Overview of the NAMEA-air standard tables 50
Figure 4.1.A – Households' contribution to CO_2 emissions as percentage of total emissions 66
Figure 4.1.B – CO_2 emission intensities of household consumption among some of the EU countries 66
Figure 4.1.C – Structure of air emissions from aggregated economic sectors 67
Figure 4.1.D – Comparison of some aggregated economic sectors' environmental profile in EU plus Norway 68
Figure 4.1.E – Air emission intensities of output as indicator of coupling / de-coupling 70
Figure 4.2.A – Comparison of direct and indirect emissions allocated to the final demand in Denmark (CO_2, 1997) 73
Figure 4.2.B – Factors influencing the trend of CO_2 emissions of economic sectors in Germany 76

Introduction

In 1994, the NAMEA (National Accounting Matrix including Environmental Accounts) system was identified by the European Union as a relevant part of the framework for environmental satellite accounts of the National Accounts (Commission of the European Community, 1994). In NAMEA, environmental information is compiled consistently with the way economic activities are represented in national accounts. This framework divides the economy into industry and household categories and shows how each industry or the households contribute to a variety of environmental concerns.

The first Eurostat Workshop on NAMEA was held in 1995. Since then, there has been extensive development of NAMEAs in Member States. In 1999, the 11 pilot studies on NAMEA for air emissions that were available then were synthesised in the publication *Pilot studies on NAMEAs for air emissions with a comparison at European level* (Eurostat, 1999). In 2001, Eurostat published a second compilation of pilot studies on *NAMEAs for air emissions - Results of pilot studies* (Eurostat, 2001) that takes account of all Member States plus Norway and the Czech Republic. These publications focused on air emissions, which is the most far advanced area as far as environmental accounts for NAMEA are concerned. They also presented some of the basic principles prevailing in NAMEA framework, as well as general information on the data sources used by the countries, but they did not go too far into the technical details on the production of the figures.

In 2000, a set of NAMEA for air emissions standard tables was prepared by Eurostat and was finalised at the fourth NAMEA workshop in June. These tables that focus on air emissions also cover some economic data, but they are not to be reported in a matrix format (Eurostat, 2000a, 2000b). Afterwards, the tables were sent out the countries in order to collect all the data available on NAMEA for air emissions. The standard tables were revised in 2002 in order to improve the comparability of data between countries as well as with other air emission statistics. The new set of tables was sent out in June as a starting point for a collection of NAMEA data on a regular basis.

Now all Member States are indeed involved in the compilation of air emission accounts for NAMEA. Some of them even produce and publish NAMEA data on an annual basis. However, for other EU countries the compilation of NAMEA for air emissions is still at the stage of pilot applications. The main audience for the compilation guide presented in this volume is mainly targeted at compilers: especially the newcomers, but also those that have already developed expertise in the field of NAMEA. This guide, firstly, reminds compilers with the basic principles that apply in NAMEA framework in general and, secondly, provides them with an in-depth presentation of the methods on which are based the two main approaches used by EU countries in the compilation of air emission accounts. The latter aspect of the guide is heavily inspired by techniques implemented in countries; especially those that are the most advanced in the production of air emission accounts. “Like the national accounts recommendations in general, Eurostat’s approach to NAMEA is therefore top-down. NAMEA seeks to define the target concepts and tables to fill in, but leaves it to national statisticians to make the best use of all data available in their country to assign values to the entries.” (Eurostat, 1996c).

The present guide also offers to the experts in charge of NAMEA in national statistical offices guidance on how to fill in Eurostat’s standard tables. Information given here is largely complementary to the notes accompanying the tables. Beyond the presentation of the set of tables – i.e. its consistency through the interconnection between the different tables and the data that are to be reported, elements are given, or repeated once again, about difficult points. The first one concern transport related emissions that are dealt with here in the perspective of the isolation in a separate table. The second difficulty is about the differences with totals given in air emission inventories used for international reporting and how bridging both data sets.

NAMEA users are also invited to read this guide, at least some sections in the first and last chapters. This would provide them with detailed enough information so that they would be aware of what is the exact coverage of NAMEA data. The presentation of NAMEA-based analysis that are now commonly developed in EU countries would also show the users what are some of the opportunities offered by NAMEA, especially in terms of input-output analysis.

Structure of the document

This compilation guide on NAMEA for air emissions is split in four chapters dealing respectively with the general framework, the compilation of air emission accounts, Eurostat standard tables and analysis that NAMEA makes it possible. Information on the compilation of air emissions accounts is largely to be found in chapter 2 that, consequently, constitutes the core of the document. However, the principles on how environmental data should be prepared consistently with the way data are allocated in national accounts are also dealt with in chapter 1 and chapter 3.

Chapter 1 is a general presentation of the NAMEA framework. The first section briefly draws the context in which NAMEA emerged – i.e. from it origins at statistics Netherlands to the Eurostat's project focusing so far on air emission, and how it is considered in the new SEEA. In the second section, the guide rapidly comes to the preparation of air emissions accounts for NAMEA. It provides the general principles that structure such accounts that are economically oriented and that cover only emissions of the national units (residents), wherever they operate, on the national territory or abroad (international transport).

Chapter 2 focuses on the compilation of air emission accounts. The first two sections deal with the two main approaches respectively based on energy accounts and air emission inventories. Schematically, in the first case, emissions are calculated by multiplying data on energy use industry by industry with relevant emissions factors. Whereas, in the second situation, process-oriented emissions are allocated to economic activities thanks both to the connection between inventory's and economic classifications and energy data. There is additional information on some more difficult aspects, such as own account transport emissions and international transport related emissions.

Chapter 3 is dedicated to the set of standard tables prepared by Eurostat in order to collect NAMEA data on a regular basis according to a harmonised format. After a general presentation in first section, the second section provides guidance table by table on how to report the data. It is once again the occasion of additional developments on some of the most difficult aspects, such as transport emissions and the connection with other air emission statistics. A section is also dedicated to the table on energy use data that is included in the set of standard tables from 2003 onwards.

Chapter 4, in its first section, gives elements on what has become a traditional pre-analysis of NAMEA data: identifying households' and industries' respective contributions, "profiling" industries by comparing their contribution both to total economic activity and total emissions and, finally, observing the linkage between economic activity and emissions over time (or the trends of emission intensities industry by industry). In its second section, this last chapter offers a brief presentation of the NAMEA-based input-output analysis, looking at what is done so far by EU countries in terms of emissions allocated to the final demand, emissions associated to imports and decomposition analysis of factors driving emission trends.

1. NAMEA-air conceptual framework

NAMEA stands for National Accounting Matrix including Environmental Accounts. It is a framework in which different types of statistical data are consistently organised bringing together economic and environmental information that come from different parts of the statistical system. The core of the framework is a set of tables containing economic data and forming a national accounting matrix (NAM) as compiled in national accounts. The environmental accounts (EA) consist of tables containing data that are frequently physical units (mass, volume or energy units).

In NAMEA, the NAM could be extended with almost all kind of environment related data, expressed either in physical (as is mostly the case) or in monetary units. In the pilot applications reported so far to Eurostat, the type of physical environmental data taken into account in the NAMEA framework include emissions to air, emissions of waste, wastewater and water use. Energy balances, showing supply and use of energy, have also been included, as well as stock data on subsoil assets and forest. Concerning water, both physical and monetary data are collected. A few trials were also made for including other monetary data such as environmental taxes and expenditure can also be shown separately within the NAM.

However, the most far advanced area in the compilation of environmental accounts for NAMEA concerns atmospheric polluting emissions. This compilation guide is therefore largely dedicated to air emissions accounts (Chapter 2 focuses on their compilation and Chapter 3 deals with Eurostat's *NAMEA air emissions standard tables*) and the current Chapter ends by pointing out the differences between standard air emission inventories and air emissions accounts for NAMEA.

The first chapter, which is structured in two sections, starts by presenting what is the NAMEA framework, from its origins in the Netherlands to the simplified version used by EU countries within Eurostat's environmental accounts project (1.1). The second section focuses on the basic principles prevailing in air emission accounts for NAMEA (1.2).

1.1. NAMEA framework

The NAMEA framework that was initially developed by the Dutch national statistical office (CBS) in the early nineties has been adopted and adapted by EU countries within Eurostat environmental accounting project. In the "full" Dutch NAMEA, which is based on a rather sophisticated matrix accounts that cover production and distribution issues, symmetrical environmental accounts are balanced between origin and destination of the polluting emissions (1.1.1). For the simplified version of the NAMEA adopted at EU level, which is identified as hybrid flow accounts in the revised United Nations' System of Economic and Environmental Accounts (1.1.2), Eurostat recommends using the supply-use or input-output tables available and expanding it with environmental accounts formatted like air emissions accounts in standard tables presented in Chapter 3 (1.1.3).

1.1.1. Origins of NAMEA

Following the conceptual design made especially by Steven Keuning, the NAMEA framework was developed and initially implemented at *Statistics Netherlands* (CBS) in the early nineties. The first pilot application for the Netherlands was compiled for 1993. Since 1994, the National Accounts and the Environment Statistics Department at CBS jointly compile NAMEA on a yearly basis (Keuning et al., 1999).

The NAMEA is a statistical information system that combines conventional national accounts and environmental accounts, but neither includes any modelling assumption nor estimate of money value imputed to natural flows and assets. This green accounting framework is based on the idea that, although national accounts do not cover free welfare issues, such as environment related issues, it is preferable to expand them with non-monetary data than modifying economic aggregates by assigning hypothetical prices to pollution (Keuning, 2000). In NAMEA, environmental accounts therefore are mostly in physical units. It is nonetheless worthwhile taking monetary data, such as environmental expenditure or environmental taxes and subsidies into account, as experimented for instance by the Netherlands and Denmark (de Haan, Boer and Hiemstra, 1998, Hornum, 2000).

Dutch NAMEA is based on a very comprehensive input-output framework closely related to the Social Accounting Matrix (SAM) of the European System of Accounts (*ESA 1995*) (Eurostat, 1996) and covers therefore production, consumption as well as distributional issues. Moreover, in the supply and use table, which is an integral part of the Dutch National Accounting Matrix (NAM), some environmental data (environmental protection services) are even shown separately. Initially, the Dutch NAM was extended with two kinds of environmental accounts (EA). In the first one, resources used (gas and oil) and substances emitted, mostly air emissions, are given in mass. In the second kind of environmental accounts, relevant substances or resources are aggregated either according to two global environmental themes (greenhouse effect and ozone layer depletion) or four national environmental themes (acidification, eutrophication, waste and loss of natural resources).

Fulfilling requirements for matrix accounts of the System of National Accounts (United Nations e al., 1993), NAMEA shows receipts in rows and outlays in columns. Likewise, in the "full symmetrical" Dutch NAMEA, environmental data are balanced between origin (columns) and destination (rows). Therefore, air emissions accounted for that come from production and consumption are respectively put alongside branches and household consumption categories (rows), and emissions entering the territory through transboundary flows are connected to the row in which are registered the current flows from 'Rest of the world'. On the other hand, the absorption of substances in the production (e.g. natural resources or waste recycled or incinerated) are placed at the intersection between rows of relevant environmental items and the columns of branches, and outwards transboundary flows are shown in the column of current flows from the 'Rest of the world' (for a detailed presentation based on an aggregated version, see De Haan and Keuning, 1996 or Keuning et al., 1999).

Like national accounts, NAMEA is firstly an integrated accounting framework designed for providing a consistent and summary picture of the economy-environment interface. It also aims at allowing analytical investigation, of which the most fruitful are based on input-output approaches (see Chapter 4).

1.1.2. NAMEA in the SEEA

According to the SEEA (System of Economic and Environmental accounts) NAMEA has become a generic term for accounting tables that extend matrix format national accounts by including physical data on the environment (use of natural resources and generation of residuals), which, prior the Dutch proposal in the early 1990s, actually find their roots in the hybrid accounting structure first implemented by Wassily Leontief (Leontief, 1970; UN, 2003). The latter, who founded the input-output approach in economics, tested the combination of input-output tables, and subsequent input-output analysis (see section 4.2), with environmental accounts especially with data on air emissions (Leontief, Ford, 1972).

In its chapter 4 dedicated to *hybrid flow accounts*, the SEEA concentrates its presentation on two forms of NAMEA-types accounts: *hybrid supply and use tables* and *hybrid input-output tables* (UN, 2003). The above-mentioned fully fledged Dutch NAMEA is presented elsewhere in the SEEA. The term *hybrid accounts* is used to denote that monetary and physical data are included in the same accounting framework, as well as to differentiate them from the physical flow accounts. The latter that are presented in the previous chapter of the SEEA contain only physical data, but compiled according to a matrix format like data of the NAM (national accounts data expressed in monetary units) in NAMEA. Supply and use table and input-output table have their own advantage as regards either the association with environmental data or analytical purposes.

A combined supply and use table consists of a pair of tables, one showing economic units that supply goods and services, the other showing units that use them. Two different classifications are used respectively for the industries (NACE) and commodities (CPA). An input-output table results from the transformation of the supply and use table in which either the industry or the product dimension is removed. Therefore, in the input-output table, both data on supply and demand are shown according to the same classification (either the NACE or the CPA) in a single table presented either industry by industry or product by product. An input-output table relates directly consumption and production.

As said in the ESA 1995 (Eurostat, 1996) supply and use table and symmetric input-output table have both statistical and analytical purposes. On the one hand, the ESA 1995 (§ 9.13) and the new SEEA (§ 4.14) agree that the input-output table is more appropriate than supply and use table as far as analysis is concerned, especially when it is used to calculate indirect effects (see chapter 4 in the present guide). On the other hand,

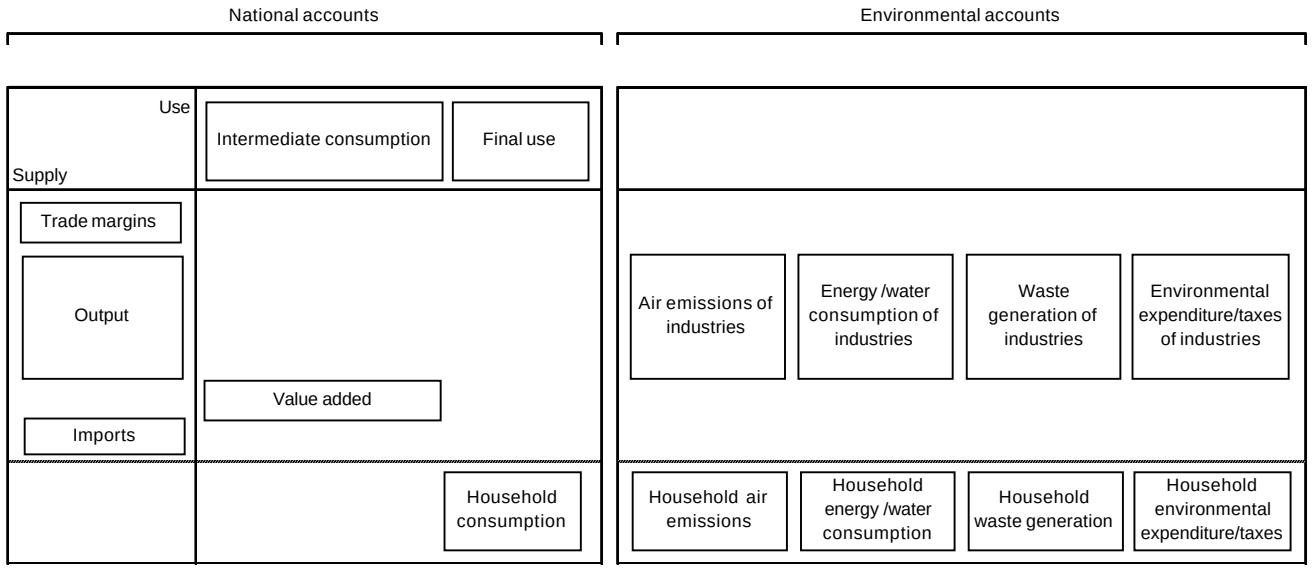
both documents (respectively § 9.13 and § 4.114) acknowledge too that, although input-output has a greater analytical power, combined supply and use table is easier associated with data from other areas, such as the environment. However, the new SEEA does not make any explicit recommendation on whether supply and use or input-output table is preferable. No recommendation is made either within Eurostat's environmental accounting; countries are merely invited to use the most they can the input-output framework domestically available.

Also in its chapter 4, the new SEEA deals with the compilation of environmental accounts as well as NAMEA-based analysis (these analytical aspects – especially NAMEA-based input-output analysis - are also dealt with the chapter 4 at the end of the present document). As concerns the environmental accounts, the SEEA points out that it is legitimate to include only a limited set of environmental data, since it is unnecessary and even useless to try to complete an exhaustive set of accounts on natural resources use and residuals poured into the environment. When it comes to the compilation of environmental accounts for NAMEA, the SEEA focuses on air emissions since it is actually the most far advanced area in this field.

1.1.3. NAMEA (for air emissions) within Eurostat's environmental accounts

In 1994, NAMEA was identified by the European Union as a relevant part of the framework for environmental satellite accounts of the national accounts (Commission for the European Communities, 1994). The first NAMEA workshop organised by Eurostat and Statistics Netherlands that held in Voorburg in October 1995 aimed at introducing to national accountants and environmental statisticians from all EU Member States the concept of the Dutch NAMEA and the implementation undertaken by Statistics Netherlands. Several EU countries were already working on similar projects and the general opinion was that NAMEA constituted a good framework to describe the connection between economy and environment, in particular for linking emissions (e.g. to air) and economic activities by industries. A second workshop was help at Eurostat (Luxembourg) in March 1997, aiming to share experiences and to initiate the convergence process between the different approaches in the countries. All EU Member States plus Norway met again in November 1998 and agreed on a framework for compiling NAMEA for air emissions, or at least air emission accounts for NAMEA. The 11 pilot applications available in 1999 were brought together and summarised in the first Eurostat publication on NAMEA-air (Eurostat, 1999). In June 2000, the fourth Eurostat NAMEA workshop was essentially dedicated to finalise the first version of the standard tables prepared in order to collect the NAMEA-air data available in all EU countries plus Norway in a harmonised framework (Eurostat, 2000a, 2000b).

Figure 1.1.A – Schematic description of a simplified NAMEA



Source: adapted from Eurostat, 1999 (figure 1.1) and 2001a (figure A.1).

The collection of NAMEA-air data on an annual basis has started with the revised standard tables (Eurostat, 2002b) sent out in June 2002. However, for the NAMEA reported to Eurostat, no specific requirement is made on the NAM and each country is invited to use the input-output framework available in its national accounts. Some of the EU countries do not have any matrix format economic data, or, at least, do not produce them on regular basis. Therefore, within Eurostat NAMEA-air project, a "full NAMEA" consists merely in a supply and use or input-output table extended to environmental accounts (in this case, mostly air emission accounts). Figure 1.1.A schematically illustrates how the combined supply and use table of the ordinary national accounts (Eurostat, 1996b) are extended to form a simplified NAMEA.

The right side (NAM) of the figure shows that production activities in industries result in emissions as well as in goods and services covered by the traditional national accounts. The NAM could also include even more national account matrices, for example showing income, saving and financial flows. Alternatively, instead of the supply and use matrices, it could include input-output tables. The left side covers environmental data that are mostly provided in physical terms, e.g. air emissions, energy and water consumption or waste generation. However, the environmental account can also contain monetary data, such as environmental expenditure or environmental taxes. Household consumption by purpose (e.g. transport, heating when it is about air emissions) and related environmental data are singled out at the bottom of the table.

1.2. Air emission accounts for NAMEA

The compilation of emissions to air accounts is markedly the most far advance area in environmental accounts for NAMEA. All EU Member States have now compiled air emissions accounts. The second Eurostat publication on NAMEA-air includes pilots applications from all EU countries plus Norway and the Czech Republic that were available in early 2001 (Eurostat, 2001a). Some of these countries already publish such data on a regular basis and time series covering the nineties are available for 9 of them, of which 2 countries have series even going backwards up to 1980.

However, data for NAMEA do not have necessarily the same coverage as data reported either to the UNFCCC (United Nations Framework Convention on Climate Change) or the UNECE/EMEP for the CLRTAP (Convention on Long-range Transboundary Air Pollution). Firstly, air emission inventories are rather process-oriented data whereas emissions accounts are economically oriented data – i.e. they are presented according to national account industry classification or household consumption purposes where they are attributed to the economic agents actually carrying out the activity from which emissions are stemming (1.2.1). Secondly, inventories more or less cover national territory-oriented data, whereas NAMEA takes into account data related to domestic economic activity, no matter where national residents operate. Some of the totals in NAMEA differ to air emission inventories' totals, mostly because of international transport activity (1.2.2).

1.2.1. Economically-oriented emission accounts

A **classification based on NACE Rev. 1** (Statistical classification of economic activities in the European Community, Eurostat, 1996a) was proposed at the second NAMEA workshop as a common starting point for the pilot studies. This classification (see Annex 2) is based on the two-digit level of NACE Rev. 1. The NACE is derived from the world-level ISIC (International Standard Industry Classification) and indeed is identical to ISIC at the 2-digit level. The classification proposed for NAMEA tries to take environmental aspects into consideration with more details for some of the manufacturing industries, as well as for the transport and energy branches (three-digit level). Less detail is requested when it comes to service industries.

For instance, on the one hand, *Manufacture of glass and glass products* (26.1) and *Manufacture of non-metallic mineral products* (26.2-8), and, on the other hand, *Manufacture of basic iron and steel* (27.1-3) and *Other manufacture of basic metals* (27.4-5) are heterogeneous regarding their emissions to air. Extra breakdowns are consequently proposed for NACE 26 and 27 industries. Additional breakdowns could be filled in also in NACE 40 industry (*electricity, gas and water supply*). It would be relevant to isolate the *Production and distribution of electricity* (40.1) especially. Finally, extra breakdowns are suggested for NACE 60 and 61 in order to distinguish each kind of transport included in those industries.

In air accounts for NAMEA, emissions are to be attributed to industries similarly as economic data. Therefore emissions related to the production of goods and services undertaken as an **ancillary activity** - i.e. produced by

firms for their own use, such as e.g. transport and electricity, in order to support their principal (and secondary) activity - should be grouped with emissions of the concerned principal activity. The same applies to emissions stemming from production undertaken as a **secondary activity** – production of goods and services that are delivered to the market, despite it is not the principal activity[1] of the firm –, as far as economic data are allocated to (heterogeneous) industries. When national accounts data are presented according to (homogeneous) branches, emissions related to secondary activities should be placed under the industry that groups all production of the same kind.

Households are also taken into account in the classification for NAMEA. Air emissions produced by households themselves can be divided into emissions related to *Transport*, *Heating* or *Other* purposes. Transport emissions are allocated to households only when they use their private cars and motorbikes; emissions caused by public transport are attributed to the relevant transport industry. Heating emissions are allocated to households when they use fuels themselves. Emissions from the production of electricity purchased by households are not allocated to households but to electricity producers.

Emissions stemming from the **production of electricity** are to be attributed to electricity producers (not to the users). Therefore they are mostly placed under the NACE 40.1. Emissions from electricity produced as secondary activity have to be allocated the NACE 40.1 industry, only as far as economic data do so - i.e. when industries are homogeneously defined. On the other hand, when economic data is of a heterogeneous nature, or when emissions are stemming from electricity production as an ancillary activity (own account), emissions have to be allocated to the industry that undertakes this production.

The same principles prevail for **transport emissions** that have to be allocated to economic agents that carry out the activities that cause emissions. Consequently, transport emissions are partly allocated to the industries whose principal activity is transport (NACE 60-62 - via railways, on roads, via pipelines, on sea and inland waterways, and in the air).

Another part of the air emission from transport production is allocated to other industries, when they carry out transport activities. This part includes, firstly, emissions from transport as a secondary activity – i.e. transport services produced and sold by industries whose principal activity is not transport –, but only in the case of heterogeneous industries. Secondly, this includes also emissions from transport as an ancillary activity, when transport is produced by industries for their own use – *own account transport* – in order to support their principal and secondary activities.

When transport equipment is rented out, emissions are allocated to the industry of the ordering company (or households) and not to the NACE 70-75 (NACE 71.1-2 - *Renting automobile and other transport equipment*); renting companies do not derive their value added and income from transport production, and the users of the transport equipment will buy and use the fuels themselves.

Additionally, in NAMEA, environmental data must be connected with the domestic economic activity instead of transport operated within the national territory. This point is dealt with in section 1.2.2 below.

1.2.2. Difference in the totals to other air emission statistics

Key conventions on air pollution include the CLRTAP (Convention on Long-Range Transboundary Air Pollution) with reporting to UNECE/EMEP and the UNFCCC (United Nations Framework Convention on Climate Change), with reporting based on the UNFCCC CRF (Common Reporting Format). The UNFCCC CRF covers the 6 greenhouse gases (CO_2, N_2O, CH_4, HFCs, PFCs and SF_6) plus 4 indirect greenhouse gases (NO_x, CO, NMVOC,

1 - According the European System of Accounts (Eurostat, 1996), "*The principal activity of a local KAU* [kind-of-activity unit] *is the activity whose value added exceeds that of any other activity carried out within the same unit. The classification of the principal activity is determined by reference to the NACE rev. 1…*" (p. 38). "*The local kind-of-activity unit (local KAU) is the part of a KAU which corresponds to a local unit* [establishment in the System of National Accounts (UN, 1993)]. *The KAU groups all the parts of an institutional unit* […] *and corresponds to one or more operational subdivisions of the institutional unit.*" (p. 34). "*Most institutional units in their capacity as producers carry out more than one activity; to emphasise relationships of a technico-economic kind, they have to be partitioned with regard to the type of activity. Local kind-of-activity units are intended to meet this requirement as an operational approach. A local KAU groups all parts of an institutional unit* […] *which are located in a single or closely located sites…*" (p. 9). "*A secondary activity is an activity carried out within a single local KAU in addition to the principal activity* […]. *The output of an ancillary activity is not intended for use outside the enterprise. An ancillary activity is a supporting activity undertaken within an enterprise in order to create the conditions within which the principal or secondary activities of local KAUs can be carried out.*" (p. 38).

SO_2). The UNECE/EMEP reporting no longer covers the 6 greenhouse gases, but includes NO_x, CO, NMVOC and SO_2 plus NH_3 plus 9 heavy metals as well as 17 POPs (persistent organic pollutants). UNFCCC requires the Parties to apply the *IPCC* (Intergovernmental Panel on Climate Change) *Revised 1996 guidelines for national greenhouse gas inventories* (IPCC, 1996a; UNFCCC, 2000). The reporting formats for the UNFCCC and CLRTAP differed in the past but are now fully harmonised.

Total emissions for both international reporting and air accounts for NAMEA do not actually differ for all pollutants. Differences should essentially concern the three main greenhouse gases (CO_2, N_2O and CH_4), two acid rain precursors (NO_x and SO_2), as well as NMVOC, CO, PM and to a lesser extent Pb. Prior to text in Chapter 3, one can have a look at the *bridge table* (see annex 5) that has been developed for showing the components that make up the above-mentioned differences in the NAMEA-air standard tables. It focuses on the pollutants that are likely to differ.

Totals in NAMEA-type air emission accounts are likely to differ from the corresponding totals compiled according to the IPCC guidelines because of the definitions used by national accounts. National accounts refer only to *economic activities* and further only *domestic economic activities* (i.e. activities of residents economic units) whereas air emission inventories basically present emissions from **all** sources on the national territory. Since the NAMEA framework encompasses **only emissions that can be traced to economic activities**, emissions from non-economic agents (e.g. nature) are not to be included. Furthermore, nature's absorption of substances is not taken into account in NAMEA emission accounts. For instance, sequestration of carbon in biomass should not be deducted from CO_2 emissions in NAMEA whereas emissions from nature and the removal of CO_2 are both to be reported under UNFCCC.

Emissions covered must be those stemming from **national economic activities** (i.e. those generated by resident units) rather than from sources on the *national territory*. Emissions by resident units abroad, essentially covering tourists driving abroad and companies engaged in international transport activities, should be fully included in the accounts either under the industry earning the value added from these activities or under households (transport). Conversely, all emissions by non-resident entities (foreign lorries and tourists) within the national boundary should be excluded.

Coverage between NAMEA and e.g. the UNFCCC format differs mainly with respect to carbon dioxide emissions and due to international transport, including households driving abroad for tourism, in the following respects:

The treatment of CO_2 emissions from biomass in UNFCCC are not the actual emissions but the (positive or negative) net balance of new timber growth and timber harvest. UNFCCC totals also include the (positive or negative) net effect of land-use changes and carbon storage in soil.

The organic component of the waste incinerated is not counted in CO_2 emissions for UNFCCC. For plastics in waste incinerated, countries have a choice to either include emissions already upstream based on the refinery feedstock or to not account for these 'non-energy' uses but to include emissions from incineration downstream. The same applies to CO_2 emissions from the decomposition of waste in landfills.

International transport activities lead to emissions by non-residents on the national territory and emissions by residents abroad, both companies transporting freight or passengers and households driving their own cars. The emissions by residents abroad can represent a significant proportion of the NAMEA totals. In the case of CO_2 (it is also true for SO_2 and NO_x), for example, results range from around 5% of the total in the UK and Sweden to 15% in Denmark, or even more than 25% in Norway (Eurostat, 1999).

Table in annex 6 gives an overview of which kind of transport emissions are included or not in the NAMEA and UNFCCC totals. From this table we can also see what the *residence principle* means for NAMEA: all emissions from transport activities carried out by residents, wherever they are, should be included. On the other hand, all emissions of non-residents are to be excluded.

For the UNFCCC total, emissions from all international water transport as well as air transport are excluded, even when carried out by national companies. Only emissions from 'national' air and water transport should be included, even when carried out by non-resident companies. The IPCC guidelines used for the UNFCCC do not say anything about the nationality of the road vehicle owners that are to be taken into consideration. Road transport emissions, when based on fuel sales, should be expected to include emissions of non-residents on the

territory and exclude residents' emissions abroad. Emissions from international bunker fuels are reported separately as a *memo item* to the UNFCCC. However, these data are based on fuel sales and thus satisfy neither residence nor territory principle. This *memo item* covers emissions related to the fuel bunkered domestically for international transport. Bunkering abroad by ships of resident units is not included.

There should in principle be no difference between UNFCCC and NAMEA totals as far as fishing is concerned. Emissions of fishing vessels are to be reported to the UNFCCC in the *Other sectors* category (1A4iii) and are allocated to the fishing industry in NAMEA. The IPCC guidelines state that all emissions *'from domestic inland, coastal and deep-sea fishing'* should be included. It is worth mentioning that discrepancies may nonetheless appear if estimates in national emission inventories are based on fuel sales rather than the fuel consumption of domestic vessels.

2. Data sources and methods to compile air emission accounts

Emissions to air is the most far advanced area in the compilation of environmental accounts for NAMEA. In this context, the two first Eurostat publications on NAMEA were dedicated to air emissions (Eurostat, 1999, 2001). Now, all EU Members States are involved in the compilation of air emissions for NAMEA and some of them already produce and publish these data on an annual basis. In the data reported to Eurostat using standard tables (see Chapter 3) or that are compatible with them, time series covering from half to almost all the 1990s for 8 of the most common atmospheric pollutants (3 greenhouse gases, 3 acid rain precursors plus NMVOC and CO) are available for 10 countries.

Among EU countries, there are basically two main approaches for compiling air emissions accounts for NAMEA. Some of the EU countries have a tradition of compiling energy accounts, and therefore emission accounts, in the context of national accounts. In the other countries, air accounts are based on air emission inventories. Therefore, emission data are reclassified using, on the first hand, the correspondence between categories of process-oriented classifications generally used by inventories and economic categories based on NACE plus households consumption categories used for NAMEA. On the other hand, when a category in the inventory is to be connected to several industries, data are allocated using factors such as fuel consumption, but also economic or technical information, whether it is included or not in the basic data of the concerned inventory.

Especially in the case of energy-based accounts, additional data are necessary for non-fuel related emissions and for directly measured emissions within large industrial installations such as electric power plants. Also, transport statistics could be used in both cases, since NAMEA emissions of national resident operating abroad and emissions of foreigners on the national territory, which are respectively to be included and excluded, concern mostly transport activities.

This second chapter starts with the compilation of air accounts mostly based on energy accounts and, in this context, the first section (2.1) actually focuses on energy related emissions. The arrangement of emissions inventories for NAMEA is dealt with in the second section (2.2). This section is mostly dedicated to air emission accounts based on CORINAIR data that are used by more than half of the EU countries. Finally the third section (2.3) takes into consideration additional data (non-energy related emissions, emissions by residents abroad…) needed for both approaches.

2.1. Air emission data mostly based on energy accounts

In 4 of the EU countries - Denmark, Germany, Sweden and the United Kingdom -, plus Norway, air emissions accounts for NAMEA are mostly based on energy accounts data. On the 8 main pollutants currently included in NAMEA, 5 emission types - CO_2, SO_2, NO_x, CO and, to a lesser extant NMVOC - are almost totally related to the combustion of fuel (table 2.1.A). In this context, the relevant air emission data are calculated combining energy use industry by industry with relevant emission factors.

Table 2.1.A – Proportions of emissions stemming from fuel combustion

	CO_2	CH_4	N_2O	SO_2	NO_x	NH_3	NMVOC	CO
Denmark	99%	5%	16%	99%	99%	2%	80%	94%
Germany	97%	2%	17%	91%	98%	3%	31%	90%
UK	95%	3.5%	14%	98%	99%		37%	99%
Norway*	79%	4%	10%	38%	96%	4%	25%	94%

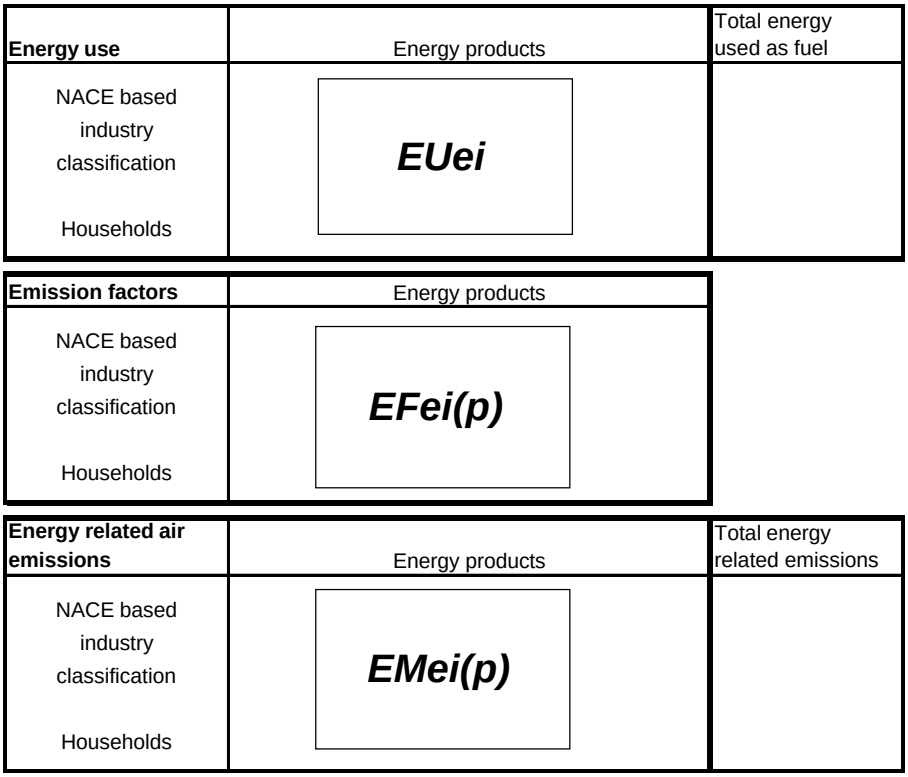
Source: Denmark (Ole Gravgård at Statistics Denmark, about 1998 NAMEA data - i.e. including emissions from Danish ships bunkering abroad); Germany (Carmen Bush at Statistisches Bundesamt, 1998 data); UK (ratios based on total reported to the UNFCCC in European Environment Agency, 2001); Norway (1996 emissions by sources in Flugsrud et al., 2000; * based on data excluding transport abroad and it is also worth mentioning that electricity production is mostly based on hydro-power).

Data on energy use by industry and households activities form the basis for the calculation. In the energy accounts, when they are available at a level of detail compatible with the industry classification used for NAMEA-air, relevant data can be found in the energy use table. Energy supply data are not needed for the calculation of air emissions in NAMEA. Moreover, only the data related to the combustion of fuels causing air emissions are to

be taken into consideration[2]. The transformation of energy from one form into another (e.g. refining of crude oil into petroleum products, conversion of coal into coke) and fuels used as raw materials, such as petroleum products in the chemical and plastics industries or wood for construction and furniture manufacturing, are to be excluded. Also, no emission factor is to be applied to the use of electricity or district heating. When electricity/heating production is based on fuel combustion, the corresponding energy data are recorded under the relevant energy items in the energy use table and the related emissions are calculated then.

Mathematically, the calculation of air emissions energy accounts data is merely a multiplication of the energy amounts by the relevant factors. If *EUei* is the amount of energy of type *e* used by the industry (or by households) *i* and *EFeip* the quantity of pollutant *p* emitted by the combustion of each unit of energy *e* (emission factor) in the industry *i*, then, *EMei(p)* the total amount of the pollutant *p* resulting from the total consumption of *e* by the industry *i* is given by: *EMei(p)* = *EUei* x *EFei(p)*.

Figure 2.1.A – Calculation of air emissions based on energy accounts



In **Denmark**, the energy satellite accounts used for the calculation of most energy-related air emissions details the use of 40 energy items given in Giga Joules (GJ) for a 130-industry classification plus households. The Danish energy use table excludes energy products used as raw material (e.g. wood for furniture manufacturing or construction), but it shows data related to the transformation of one form of energy into another (e.g. crude oil by the refining industry). Although the 40 energy items also include a triple counting of natural gas (extracted, high pressure gas and low pressure gas to end users), natural gas consumption is counted for only once for the calculation of air emissions.

2 - Additional elements on the energy use data that are relevant for air emission accounts are given in chapter 3. Section 3.2.5 is dedicated to the table on energy use prepared the NAMEA air emissions standard tables.

Table 2.1.B – Calculation of energy-related CO_2 emissions in Denmark for a selection of industries and for households

	Danish energy use table for 1998 (GJ)	LPG	Motor fuel	Kerosene and jet fuel	Gas oil and marine diesel	Fuel oil and waste oil	Coke and orimulsion	Natural gas and town gas	Coal	wood, wood-waste, straw	waste	Total
01	Agriculture	289 387	898 382	21 124	19 599 765	2 798 975	201 054	4 758 207	1 285 343	2 768 734	0	32 620 971
…												
11	Extrac. of crude oil	0	2 152	0	5 667	0	0	21 430 290	0	0	0	21 438 109
…												
26	Non metallic mineral prod.	651 285	120 648	0	3 074 749	2 465 415	4 800 687	5 930 858	8 639 407	5 708	202	25 688 960
…												
40	Electricity, gas, hot water	1 590	118 761	0	2 062 400	13 063 381	32 704 583	72 976 504	221 669 942	13 124 201	26 534 683	382 256 044
…												
60-63	Transport services*	99 049	839 067	30 277 528	40 490 914	4 045 539	313	197 376	0	0	0	75 949 786
…												
90-93	Health and social work	17 795	433 332	0	1 184 374	178 548	313	1 671 420	0	0	0	3 485 783
…												
	Households	810 831	75 282 771	394 387	48 958 425	43 266	293 462	29 637 981	217 325	8 470 577	0	164 109 026
	Danish CO2 emission factors for 1998 (Kg/GJ)											
01	Agriculture	65	73	72	74	78	102	56.9	95	102	117	
…												
11	Extrac. of crude oil	65	73	72	74	78	102	56.9	95	102	117	
…												
26	Non metallic mineral prod.	65	73	72	74	78	102	56.9	95	102	117	
…												
40	Electricity, gas, hot water	65	73	72	74	78	80	56.9	95	102	117	
…												
60-63	Transport services	65	73	72	74	78	102	56.9	95	102	117	
…												
90-93	Health and social work	65	73	72	74	78	102	56.9	95	102	117	
…												
	Households	65	73	72	74	78	102	56.9	95	102	117	
	Danish energy-related CO2 emissions for 1998 (1000 tonnes)											
01	Agriculture	19	66	2	1 450	218	21	271	122	282	0	2 450
…												
11	Extrac. of crude oil	0	0	0	0	0	0	1 219	0	0	0	1 220
…												
26	Non metallic mineral prod.	42	9	0	228	192	490	337	821	1	0	2 119
…												
40	Electricity, gas, hot water	0	9	0	153	1 019	2 616	4 152	21 059	1 339	3 105	33 451
…												
60-63	Transport services*	6	61	2 180	2 996	316	0	11	0	0	0	5 571
…												
90-93	Health and social work	1	32	0	88	14	0	95	0	0	0	229
…												
	Households	53	5 496	28	3 623	3	30	1 686	21	864	0	11 804

Source: adapted from detailed Statistics Denmark's data.

* Excluding ships bunkering abroad.

** Orimulsion for the NACE 40 and coke for the other industries

Energy factors used for the Danish air accounts generally correspond to the factors available in the CORINAIR database. They are given in kilograms of pollutant per Giga Joule (Kg / GJ) and, in most cases, but not all, they are the same for the different industries, as well as for households. Except for CO_2 and SO_2, emissions factors vary across industries for propellant fuels burnt in road transport equipment and some other mobile sources: petrol (leaded and unleaded), LPG and gas oil (road transport uses and other uses). There is, for instance, a significant variation in NO_x emission factors of gas oil. In all these cases, emission factors depend on the kind of vehicle that are used by industries and households.

Table 2.1.B illustrates the above-described calculation method with CO_2 data adapted from the Danish situation. Useless energy items for NAMEA are excluded and items showing the same energy factor are grouped together. Moreover, this illustration does not show the whole accounts, but gives the energy use, the corresponding emission factors and the resulting emissions for a selection of industries plus households.

Emissions from Danish ships bunkering abroad, which are taken into account in NAMEA, are not included in the calculation of emissions from the satellite energy accounts as illustrated above (table 2.1.B). They are nonetheless calculated using energy data – i.e. fuel consumption by Danish ships abroad -, but multiplied by a specific emission factor for international marine transport. On the other hand, data on non-energy-related emissions generally come from the Danish CORINAIR database (Vadmand Jensen and Gravgård Pederesen, 1998).

In the **United Kingdom**, where air emission accounts are also mostly energy-based, the needed energy accounts are not available beforehand. NAMEA compilers have first of all to arrange energy data used in the National Atmospheric Emission Inventory (NAEI) - i.e. to allocate functionally oriented data on energy use into national accounts categories - before estimating the corresponding emissions by applying the relevant emission factors.

In the NAEI, more than 350 sources are identified. Many of these sources, approximately half of them, can be mapped directly to a unique economic category. For the other sources, the corresponding energy use has to be split into 2 or several economic industries or household consumption categories (ONS, 2002). Such an apportionment, which is usually based on additional (unpublished) estimates on energy used made by the UK's Department of Industry, is undertaken for each of the numerous types of "fuel"[3] registered in the NAEI. The result gives a sort of energy accounts by economic category and energy product, like the data in the table of energy use (*EUei*) in figure 2.1.A. Then, for each of the pollutants (*p*) taken into consideration, the relevant emission factor (the equivalent of *EFeip* in table 2.1.A) enable to obtain the corresponding air emissions (the equivalent of *EMeip* in table 2.1.A).

In the illustration given with table 2.1C, energy data from the NAEI are classified into 10 sources, of which 6 (agriculture, international shipping, refineries combustion, iron and steel, power stations and domestic) are clearly attributed to a unique economic categories (in the 4th column, the proportion equal 1). The 4 other sources are either split into 2 categories or allocated into several industries. Emissions of *coastal shipping* are split *between water transport* and *oil and gas exploration* on the basis of unpublished estimates of fuel used. The apportionment is much more complex for *other industrial combustion*, *commercial and light industry* and *public services*. As far as manufacturing industries are concerned, it is based on Department of Industries estimates of the amounts of fuel used by each industry published in energy unit. For both commercial and service industries, total use of fuel oil is broken down into national accounts categories thanks to estimates of amounts of fuel used too, but also using employment data for the finest splits.

Such a procedure could seem to be rather similar as the one used for CORINAIR-based air accounts (see later in the text, section 2.2.1). However, in this case, this is not the emission inventory that is arranged, but energy data used for the inventory. It is only once energy data are allocated to economic categories (forming a kind of energy use accounts) that emissions are calculated using emission factors (by fuel, pollutant and, when necessary, economic category).

3 - In the NAEI, the category "fuel" corresponds to energy products actually used as fuel, i.e. of which the emissions result from their combustion, but it also corresponds to products such as solvent and other chemical products that are not energy products. The NAEI covers all emissions: those stemming from combustion as well as from volatile chemical evaporation and from other processes. However, for the British NAMEA, data on non-energy related emissions are produced similarly as for energy related emissions. Then, relevant "activity values" (purchases of emitting products, e.g. paints, varnishes, printing ink…) are used instead of energy values that are also to be attributed either to a unique or several economic categories, before being transformed into emission quantities thanks to (non-fuel) emission factors.

Table 2.1.C – Carbon from fuel oil in the United Kingdom (2000)

Source in the NAEI	Fuel value (mt)	Allocation to economic sector	Propor-tion	Fuel value	Fac-tor	Carbon (kt)	Agregation to sectors in NAMEA	Carbon (kt)
Agriculture: stationary combustion	0.010	Agriculture	1.000	0.010	850	8.5	Agriculture	8.5
Coastal shipping	0.043	Oil and gas exploration	0.103	0.004	850	3.8	Oil and gas exploration	3.8
		Water transport	0.897	0.039	850	32.8	Other mining and quarrying	6.2
International shipping	1.754	Water transport	1.000	1.754	850	1491.0	Food and beverages	48.0
Refineries combustion	1.470	Refined petroleum products	1.000	1.470	850	1249.5	Tobacco products	0.2
Iron and steel combustion plant	0.280	Iron and steel	1.000	0.280	850	238.0	Textiles	23.4
Other industrial combustion	0.345	Other mining and quarrying	0.021	0.007	850	6.2	Clothing manufacture	3.7
		Food and beverages	0.164	0.056	850	48.0	Leather, luggage and footwear	0.7
		Tobacco products	0.001	0.000	850	0.2	Timber	23.0
		Textiles	0.080	0.028	850	23.4	Pulp and paper	13.6
		Clothing manufacture	0.013	0.004	850	3.7	Publishing and printing	2.1
		Leather, luggage and footwear	0.003	0.001	850	0.7	Refined petroleum products	1249.5
		Timber	0.078	0.027	850	23.0	Industrial gases, dyes, pigments	0.1
		Pulp and paper	0.046	0.016	850	13.6	Other inorganic chemicals	33.6
		Publishing and printing	0.007	0.002	850	2.1	Other organic basic chemicals	30.2
		Industrial gases, dyes, pigments	0.000	0.000	850	0.1	Fertilisers, nitrogen compounds	2.6
		Other inorganic chemicals	0.115	0.040	850	33.6	Plastics and synthetic rubber	2.6
		Other organic basic chemicals	0.103	0.036	850	30.2	Pesticides, agro-chemicals	0.2
		Fertilisers, nitrogen compounds	0.009	0.003	850	2.6	Paints, varnishes, ink etc	0.4
		Plastics and synthetic rubber	0.009	0.003	850	2.6	Pharmaceuticals	1.9
		Pesticides, agro-chemicals	0.001	0.000	850	0.2	Soap and detergents	0.9
		Paints, varnishes, ink etc	0.002	0.001	850	0.4	Chemical products nes	1.3
		Pharmaceuticals	0.006	0.002	850	1.9	Man-made fibres	0.1
		Soap and detergents	0.003	0.001	850	0.9	Rubber products	5.3
		Chemical products nes	0.004	0.001	850	1.3	Plastic products	7.6
		Man-made fibres	0.000	0.000	850	0.1	Glass and glass products	5.1
		Rubber products	0.018	0.006	850	5.3	Ceramic goods	0.4
		Plastic products	0.026	0.009	850	7.6	Structural clay products	0.7
		Glass and glass products	0.018	0.006	850	5.1	Concrete, stone etc	2.3
		Ceramic goods	0.001	0.000	850	0.4	Iron and steel	238.0
		Structural clay products	0.002	0.001	850	0.7	Non-ferrous metals	0.6
		Concrete, stone etc	0.008	0.003	850	2.3	Aluminium	2.5
		Non-ferrous metals	0.002	0.001	850	0.6	Casting of metals	0.6
		Aluminium	0.008	0.003	850	2.5	Fabricated metal products	7.3
		Casting of metals	0.002	0.001	850	0.6	Machinery and equipment	5.0
		Fabricated metal products	0.025	0.009	850	7.3	Office machinery, computers	1.8
		Machinery and equipment	0.017	0.006	850	5.0	Electrical machinery and apparatus	3.2
		Office machinery, computers	0.006	0.002	850	1.8	Radio, television and comms	1.9
		Electrical machinery and apparatus	0.011	0.004	850	3.2	Medical, precision, optical instrume	1.2
		Radio, television and comms	0.007	0.002	850	1.9	Motor vehicles and trailers	2.6
		Medical, precision, optical instrument	0.004	0.001	850	1.2	Other transport equipment	3.7
		Motor vehicles and trailers	0.009	0.003	850	2.6	Manufacture of other products	23.9
		Other transport equipment	0.012	0.004	850	3.7	Recyling	19.9
		Manufacture of other products	0.081	0.028	850	23.9	Water supply	2.0
		Recyling	0.068	0.023	850	19.9	Construction	0.6
		Water supply	0.007	0.002	850	2.0	Electricity generation	774.2
		Construction	0.002	0.001	850	0.6	Buses and coaches	0.3
Power stations	0.911	Electricity generation	1.000	0.911	850	774.2	Taxis operation	0.1
Commercial and light industry	0.062	Buses and coaches	0.006	0.000	850	0.3	Freight transport by road	1.2
		Taxis operation	0.002	0.000	850	0.1	Water transport	1523.8
		Freight transport by road	0.023	0.001	850	1.2	Air transport	0.4
		Water transport	0.001	0.000	850	0.1	Supporting transport activities	1.6
		Air transport	0.007	0.000	850	0.4	Post and telecomms	2.2
		Supporting transport activities	0.031	0.002	850	1.6	Financial intermediation	2.7
		Post and telecomms	0.043	0.003	850	2.2	Insurance and pensions	1.0
		Financial intermediation	0.051	0.003	850	2.7	Auxiliary finance activities	1.0
		Insurance and pensions	0.019	0.001	850	1.0	Real estate activities	1.4
		Auxiliary finance activities	0.020	0.001	850	1.0	Renting of machinery	0.7
		Real estate activities	0.028	0.002	850	1.4	Computer and related activities	1.9
		Renting of machinery	0.013	0.001	850	0.7	Research and development	0.4
		Computer and related activities	0.036	0.002	850	1.9	Other business activities	11.5
		Research and development	0.008	0.000	850	0.4	Public administration, not defence	29.9
		Other business activities	0.219	0.014	850	11.5	Public administration, defence	14.9
		Sewage, treatment of liquid waste	0.003	0.000	850	0.1	Education	19.3
		Solid waste	0.003	0.000	850	0.1	Health and vet services, social work	84.4
		Other sanitary services	0.003	0.000	850	0.1	Sewage, treatment of liquid waste	0.1
		Activities of membership organisations	0.000	0.000	850	0.0	Solid waste	0.1
		Recreation and sporting activities	0.462	0.029	850	24.3	Other sanitary services	0.1
		Other service activities	0.025	0.002	850	1.3	Activities of membership organisatic	0.0
Public services	0.175	Public administration, not defence	0.201	0.035	850	29.9	Recreation and sporting activities	24.3
		Public administration, defence	0.101	0.018	850	14.9	Other service activities	1.3
		Education	0.130	0.023	850	19.3	Consumer expenditure (not travel)	2.2
		Health and vet services, social work	0.568	0.099	850	84.4	Total	4294.2
Domestic	0.003	Consumer expenditure (not travel)	1.000	0.003	850	2.2		
Total	5.052	Total		5.052		4294.2		
Source: Rocky Harris (Office for National Statistics)								

2.2. Arrangement of process-oriented inventories

When air accounts for NAMEA are not based on energy accounts, basic air emission data come from inventories usually produced for national purpose as well as international reporting obligations. In this context, producing air emission account for NAMEA consists in arranging functionally classified or process-oriented data in order to make them fit into the NACE-based classification (plus households) adopted for NAMEA.

In nine of the EU countries - Belgium, Greece, Spain, France, Ireland, Italy, Luxembourg, Austria and Portugal - air emission accounts prepared for NAMEA are mostly based on emissions data from CORINAIR (CORe INventory of AIR emissions), in which they are classified according to the *Selected Nomenclature for sources of Air Pollution* (SNAP). Therefore, emissions registered into SNAP categories need to be connected to NACE-based industry or group of industries, plus households consumption categories, used for NAMEA (2.2.1). Most of the SNAP categories concern a unique economic activity registered in only one NACE industry, but for a certain number of them, emissions have to be split into several industries of the NAMEA.

Other countries – the Netherlands and Finland – also use, even partially, their national inventory, but it is not based on CORINAIR methodology. However, the same principle applies – i.e. attribution of functionally oriented data to NACE-based categories -, and it should be even easier thanks to rather detailed economic-oriented information already included in the concerned inventories. Also, these countries make an extensive use of energy data in order to produce air emission accounts for their NAMEA (2.2.2).

2.2.1. Arrangement of air emissions registered in CORINAIR

The connection between SNAP-classified emissions and their related economic activities in NAMEA is more or less specific to each country's situation. However, there are systematically two categories of connections, simple and complex allocations. On the first hand, some of the CORINAIR data can rather straightforwardly be connected to a unique NACE industry or a unique household consumption purpose (2.2.1.2). On the other hand, some of the SNAP codes are to be connected to several economic activities (2.2.1.3).

As mentioned earlier (section 1.2.2), totals in NAMEA do not necessarily equal CORINAIR totals, since the latter has a rather national territory-oriented coverage, whereas air accounts for NAMEA covers emissions related to national residents' economic units wherever they operate, i.e. within national borderlines or abroad. However, this section does not take this point into consideration, which is dealt with in chapter 3 in relation with Eurostat's standard tables.

2.2.1.1 A short presentation of CORINAIR

The CORINE (CO-ordination d'INformation Environnementales) work programme that was established in 1985 included a project dedicated to gather and organise information on air emissions relevant to acid deposition. This project that was given the name CORINAIR covered then 3 pollutants (SO_2, NO_x, VOC), but it was also intended to develop relevant nomenclatures, a default emission factor handbook and a computer software package for the calculation of air emission estimates. The CORINAIR 85 was developed in collaboration with EU member states, Eurostat, the OECD, and the UNECE/EMEP.

Since 1995, CORINAIR project is performed under the European Topic Centre on Air Emissions (ETC/AE, now the ETC in Air and Climate Change) under contract to the European Environment Agency (EEA), that aims to "collect, maintain, manage and publish information on emissions to air, by mean of a European air emission inventory and database system." (EEA, 2000a, p. AGLO-1). Its geographical scope is the 18 EEA members (EU15 plus Iceland, Liechtenstein and Norway) and other (Baltic Central and East) European countries sharing the same objectives and, therefore, to whom the EEA is open for participating in the activities.

Now CORINAIR covers air emissions from all sources relevant to the environmental problems of climate change, acidification, eutrophication, tropospheric ozone layer depletion, and air quality dispersion of hazardous substances. Therefore, the following pollutants are inventoried in the CORINAIR system: methane (CH_4), carbon monoxide (CO), carbon dioxide (CO_2), hydrofluorocarbons (HFCs), heavy metals (especially lead, cadmium and mercury), ammonia (NH_3), non-methane volatile organic compounds, (NMVOCs), oxides of nitrogen (NO_x), nitrous oxide (N_2O), nitric oxide or nitrogen monoxide (NO) nitrogen dioxide (NO_2), persistent organic pollutants

(POPs, especially polychlorinated biphenols, dioxins), sulphur hexafluoride (SF_6), sulphur dioxide (SO_2) and volatile organic compound (VOCs).

The up-date of the CORINAIR system (CORINAIR 1990), was performed in co-operation with EMEP in relation with preparation of the inventories required under the Long Range Transboundary Air Pollution (LRTAP) and with the IPCC/OECD as concerns the United Nation Framework Convention on Climate change (UNFCCC). Also, in the 1990s, the ETC/EA has been collaborating closely with the IPCC/OECD/IEA in order to ensure compatibility between CORINAIR and the UNFCCC reporting formats. This was achieved especially by the revision of the SNAP (*Selected Nomenclature for sources of Air Pollution*), of which the 1997 version (see annexe 3) available from 1998 onwards is fully compatible with the *Revised 1996 IPCC guidelines* (IPCC, 1996a). The joint EMEP/CORINAIR *Atmospheric Emissions inventory Guidebook* gives in detail the correspondence between SNAP-97 and IPCC 1996 emission source categories (EEA, 2000).

2.2.1.2. SNAP codes' emissions attributed to a unique economic category

Air emission inventories prepared following CORINAIR methodology are rather process-oriented. In the SNAP (annex 3), most of the 6-digit level emissions are classified either according to the power developed by the combustion processes (combustion plants under the headings 01 and 02, plus most of the 03), their technical characteristics (under the headings 04 and 05) or their condition of use (e.g. transport equipment and most of the other mobile sources under the heading 07 and 08). However, at different levels of the SNAP, many of the criteria taken into consideration clearly identify the concerned industries or could help to do so.

Most of the 4-digit level categories under the headings 01 and 05 are in fact rather economically oriented. Moreover, some of the 6-digit level sub-categories in the above-mentioned headings, as well as under the headings 06 and 09 are defined by the output of the processes.

Thanks to these pre-economic-oriented categories in the SNAP, for the main air pollutants commonly included in NAMEA, significant proportions of total CORINAIR emissions are straightforwardly attributed to a unique industry or to households. The table 2.2.A shows these proportions for 3 of the countries of which the transfer of SNAP-based emissions to the classification for NAMEA serves as an illustration in this section (table 2.2.B). Despite totals in CORINAIR and NAMEA do not strictly correspond to each other, because of differences in their respective coverage[4], these figures highlight the importance of economic information that is in fact included in the SNAP, and therefore its relevance for the compilation of air accounts for NAMEA.

Table 2.2.A – Proportions of total CORINAIR emissions attributed to unique economic sector

	CO_2	CO_2 bio-fuel	CH_4	N_2O	HFCs	PFCs	SF_6	SO_2	NO_x	NH_3	NMVOC	CO
France	53%	--	99%	95%	100%	100%	100%	81%	43%	99%	62%	53%
Italy	74%	98%	92%	93%	--	--	--	91%	50%	99%	50%	24%
Austria	83%	--	99%	95%	--	--	--	74%	86%	99%	98%	86%

Sources: France (Ifen, 2000); Italy (Angelica Tudini at Istat) and Austria (Wolf, Hanauer, Ahamer, 2000).

There is no standard connection between SNAP and NACE categories. Attribution of SNAP-based emission data to NACE-based accounts depends on the economic structure of the countries and on whether their NAMEA is based on economic accounts with homogenous branches or (heterogeneous) industries. However, in the comparison undertaken below between France, Italy and Austria[5] (table 2.2.B), it is nonetheless possible to observe many useful similarities[6].

In table 2.2.B below, when SNAP codes are uniquely connected to one NACE industry or household consumption purpose, most of the time it is basically the same NACE 2-digit economic category or household

4 - The differences between air emission inventories prepared for international reporting (CORINAIR, IPCC/UNFCCC, EMEP/CLRTAP) are presented earlier in the text (section 1.2), as well as in the next chapter in relation with the *bridge table* in the set of NAMEA-air standard tables (section 3.2.4).

5 - The 1998 Austrian document used here is based on the SNAP-94, whereas the French and Italian documents are based on the latest version (SNAP-97). However, only a few differences appear especially in relation to emissions from agriculture *versus* nature (SNAP 10 and 11)

6 - This comparison does not refer to the air pollutants that are likely to be involved. It focuses on the connection between SNAP and NACE classification. Anyway, the relevant pollutants are given in CORINAIR.

consumption purpose for the three countries (grey shaded cells). Three main kinds of reasons – statistical, structural and misallocation - can explain the differences.

Firstly, some of the dissimilarities in the simplest connection between SNAP code and NACE industries or households consumption purposes can come from differences in the definition or the use of statistical categories. As far as production as a secondary activity is concerned, e.g. electricity production combined with combustion plants in other industries, economic data are either actually attributed to the responsible (heterogeneous) industry (grouping productions as a principal and as a secondary activity) or allocated to the (homogeneous) branch that covers all the corresponding production. Accordingly, emissions stemming from the same kind of process can be allocated to different economic categories when a country uses industries and another uses branches. In table 2.2.B, no difference are actually of this kind, but Italy places most of its SNAP 01 03 (*petroleum refining plants*) and 01 04 (*solid fuel transformation plants*) emissions under the NACE 40 (*electricity, gas, steam and hot water supply*), whereas France and Austria use the NACE 23 (*manufacture of coke, refined petroleum products and nuclear fuel*), because, in the Italian input-output table, electricity production as an ancillary activity is allocated into NACE categories as if it were a secondary production (Coli et al. 2001).

Secondly, differences in the economic structure of the countries is also a reason explaining that emissions from SNAP processes are not allocated to the same economic category between countries. It is the case for instance when processes can be found in different industries, e.g. like *blast furnace cowpers* (SNAP 02 02 03) used either for *non-metallic mineral products* (NACE 26) or *basic metals* (NACE 27); or *coke ovens* (SNAP 04 02 01) used in the refining industry (NACE 23) as well as, again, for the production of basic metals. Also, some companies are rather vertically integrated and others horizontally integrated. Therefore, some of them produce the input for their own principal activity, like in Austria where companies in the *construction* industry (NACE 45) apparently possess their *asphalt concrete plants* (SNAP 03 01 13), whereas in France and Italy such a production is undertaken within the refining industry. In Italy it is the case for *roof covering with asphalt materials* (SNAP 04 06 11) of which the emissions are placed under the construction industry, but under the production of *non-metallic mineral products* in Austria. The same applies as concerns the ownership of transport and distribution means like pipelines or dispatch stations. In France, it seems that pipelines are possessed (see *pipeline compressor* in SNAP 01 05) by companies in the mining industries (NACE 11), but they are part of the *land transport* industry (NACE 60) in the two other countries. On the other hand, *liquid fuel distribution* (05 04) and *gasoline distribution* (05 05) are undertaken by the land transport companies in France and by refining companies in Italy and Austria, except for the gasoline that is considered as a trade activity (NACE 50) in the latter.

Finally, misallocation of the CORINAIR data into the economic classification for NAMEA is also a potential source of differences in the one-to-one connection between SNAP and NACE categories shown in table 2.2.B. It is, for instance, unlikely that Italian *chipboards* (SNAP 04 06 01) were actually produced by firms within the *manufacture of pulp, paper and paper products* (NACE 21), but rather within the *manufacture of wood and products of wood* (NACE 20) as in France and Austria. Also, Austrian emissions stemming from mobile sources used within *national fishing* activities (SNAP 08 04 03) should actually be attributed to the *fishing* industry (NACE 05) instead of *water transport* (NACE 61). It is true that sometimes it seems difficult to choose whether an industry or another is actually responsible for the emissions, like for *sludge spreading* (SNAP 09 10 03). Is it the service industry *of sewage and refuse disposal, sanitation and similar activities* (NACE 90) that produces sludge, as assumed in the French and Italian accounts? Or is it agriculture (NACE 01) that uses sludge as fertiliser, as recorded in the Austrian accounts? Since agriculture uses sludge as nutrient, *sludge spreading* related air emissions should be attributed to agriculture. In such a case, sludge is used as intermediate consumption like energy of which the combustion causes emissions.

Currently, the occasional lack of detail in French industry classification implies that there are differences when, in fact, the same industry used by the other countries is included in the French group of branches. For instance, as far as *paint application* in *car repairing* activity (06 01 02), the related emissions are to be attributed to the branch including the *repair of motor vehicles* (NACE 50-52), as in Italy and Austria. However, In France, they were placed under the sectors grouping trade and services (excluding transport) activities (NACE 50-55+65-95) because of a lack of detail in the basic data. The same applies *for dry cleaning* (SNAP 06 02 02), use of *anaesthesia* (SNAP 06 05 01) and the *incineration of hospital wastes* (SNAP 09 02 07).

Table 2.2.B – Allocation of SNAP-based CORINAIR emission data into the NACE-based classification for NAMEA

			Categories of the NACE and households consumption purposes		
SNAP		**Headings**	**France**	**Italy**	**Austria**
	01	**COMBUSTION IN ENERGY AND TRANSFORMATION INDUSTRIES**			
01 01		Public Power	40.1	40	40.1
01 02		District heating plants	40.1	40	40.3
01 03		Petroleum refining plants	23		23.2
	01 03 01	*Combustion plants >= 300 MW (boilers)*		*40*	
	01 03 02	*Combustion plants >= 50 and < 300 MW (boilers)*		*40*	
	01 03 03	*Combustion plants < 50 MW (boilers)*		*40*	
	01 03 04	*Gas turbines*		*--*	
	01 03 05	*Stationary engines*		*--*	
	01 03 06	*Process furnaces*		*23*	
01 04		Solid fuel transformation plants	23		23.1
	01 04 01	*Combustion plants >= 300 MW (boilers)*		*40*	
	01 04 02	*Combustion plants >= 50 and < 300 MW (boilers)*		*--*	
	01 04 03	*Combustion plants < 50 MW (boilers)*		*40*	
	01 04 04	*Gas turbines*		*--*	
	01 04 05	*Stationary engines*		*--*	
	01 04 06	*Coke oven furnaces*		*23+27*	
	01 04 07	*Other (coal gasification, liquefaction, ...)*		*--*	
01 05		Coal mining, oil/gas extraction, pipeline compressor	11+40.2	60.2-3	60.3
	02	**NON-INDUSTRIAL COMBUSTION PLANTS**			
02 01		Commercial and institutional plants	50-55+65-93 (excl. 90)	10-95	10-95
02 02		Residential plants	H. excl. transport	H. heating	Households
02 03		Plants in agriculture, forestry and aquaculture	01-05	01-05	01-05
	03	**COMBUSTION IN MANUFACTURING INDUSTRY**			
03 01		Comb. in boilers, gas turbines and stationary engines	01-95	40	10-12 +13 +15-17 +20-21 +24-25 +27
03 02		Process furnaces without contact (a)			
	03 02 03	*Blast furnace cowpers*	*26.2-8*	*27*	*27*
	03 02 04	*Plaster furnaces*	*26.1*	*26.2-8*	*26.5*
	03 02 05	*Other furnaces*	*--*	*--*	*?*
03 03		Processes with contact			
	03 03 01	*Sinter and pelletizing plants*	*27.1-3*	*27*	*27*
	03 03 02	*Reheating furnaces steel and iron*	*27.1-3*	*27*	*27*
	03 03 03	*Gray iron foundries*	*27.1-3*	*27*	*27*
	03 03 04	*Primary lead production*	*27.4-5*	*27*	*27.4*
	03 03 05	*Primary zinc production*	*27.4-5*	*27*	*27.4*
	03 03 06	*Primary copper production*	*27.4-5*	*27*	*27.4*
	03 03 07	*Secondary lead production*	*27.4-5*	*27*	*27.4*
	03 03 08	*Secondary zinc production*	*27.4-5*	*27*	*27.4*
	03 03 09	*Secondary copper production*	*27.4-5*	*27*	*27.4*
	03 03 10	*Secondary aluminium production*	*27.4-5*	*27*	*27.4*
	03 03 11	*Cement (f)*	*26.2-8*	*26.2-8*	*26.5*

	03 03 12	*Lime (includ. iron and steel and paper pulp industr.)(f)*	*15-16 +21+26+27*	*26.2-8+27*	*26.5*
	03 03 13	*Asphalt concrete plants*	*23*	*23*	*45*
	03 03 14	*Flat glass (f)*	*26.1*	*26.1*	*26.1*
	03 03 15	*Container glass (f)*	*26.1*	*26.1*	*26.1*
	03 03 16	*Glass wool (except binding) (f)*	*26.1*	*26.1*	*26.1*
	03 03 17	*Other glass (f)*	*26.1*	*26.1*	*26.1*
	03 03 18	*Mineral wool (except binding)*	*26.1*	*--*	*26.8*
	03 03 19	*Bricks and tiles*	*26.2-8*	*26.2-8*	*26.4*
	03 03 20	*Fine ceramic materials*	*26.2-8*	*26.2-8*	*26.2*
	03 03 21	*Paper-mill industry (drying processes)*	*21*	*27*	*21*
	03 03 22	*Alumina production*	*--*	*--*	*27.4*
	03 03 23	*Magnesium production (dolomite treatment)*	*27.4-5*	*--*	*27.4*
	03 03 24	*Nickel production (thermal process)*	*27.4-5*	*--*	*27.4*
	03 03 25	*Enamel production*	*--*	*--*	*26.8*
	03 03 26	*Other*	*15-16*	*--*	*?*
	04	**PRODUCTION PROCESSES**			
04 01		Processes in petroleum industry	23	23	23.2
04 02		Processes in iron and stell industries and colliries			
	04 02 01	*Coke oven (door leakage and extinction)*	*27.1-3*	*23+27*	*23.1*
	04 02 02	*Blast furnace charging*	*27.1-3*	*27*	*27.1*
	04 02 03	*Pig iron tapping*	*27.1-3*	*27*	*27.1*
	04 02 04	*Solid smokeless fuel*	*--*	*--*	*27.1*
	04 02 05	*Open hearth furnace steel plant*	*27.1-3*	*--*	*27.1*
	04 02 06	*Basic oxygen furnace steel plant*	*27.1-3*	*27*	*27.1*
	04 02 07	*Electric furnace steel plant*	*27.1-3*	*27*	*27.1*
	04 02 08	*Rolling mills*	*27.1-3*	*27*	*27.1*
	04 02 09	*Sinter and pelletizing plant (except comb. 03.03.01)*	*--*	*--*	*27.1*
	04 02 10	*Other*	*--*	*--*	*27.1*
04 03		Processes in non-ferrous metal industries	27.4-5	27	27.4
04 04		Processes in inorganic chemical industries		24	
	04 04 01	*Sulfuric acid*	*24+27.4-5*		*24*
	04 04 02	*Nitric acid*	*24*		*24*
	04 04 03	*Ammonia*	*24*		*24*
	04 04 04	*Ammonium sulphate*	*13-14 + 24 +27.1-3*		*24*
	04 04 05	*Ammonium nitrate*	*24*		*24*
	04 04 06	*Ammonium phosphate*	*--*		*24*
	04 04 07	*NPK fertilisers*	*24*		*24*
	04 04 08	*Urea*	*24*		*24*
	04 04 09	*Carbon black*	*24*		*24*
	04 04 10	*Titanium dioxide*	*24*		*24*
	04 04 11	*Graphite*	*--*		*24*
	04 04 12	*Calcium carbide production*	*--*		*24*
	04 04 13	*Chlorine production*	*24*		*24*
	04 04 14	*Phosphate fertilizers*	*24*		*24*
	04 04 15	*Storage and handling of inorganic chemical prod. (o)*	*--*		*24*
	04 04 16	*Other*	*24*		*24*
04 05		Processes in organic chemical industries (bulk production)	24	24	24
04 06		Processes in wood, paper pulp, food, drink and other industries			
	04 06 01	*Chipboard*	*20*	*21*	*20*

	04 06 02	*Paper pulp (kraft process)*	*21*	*21*	*21*
	04 06 03	*Paper pulp (acid sulfite process)*	*21*	*--*	*21*
	04 06 04	*Paper pulp (Neutral Sulphite Semi-Chemical process)*	*21*	*21*	*21*
	04 06 05	*Bread*	*15-16*	*15-16*	*15*
	04 06 06	*Wine*	*15-16*	*15-16*	*15*
	04 06 07	*Beer*	*15-16*	*15-16*	*15*
	04 06 08	*Spirits*	*15-16*	*15-16*	*15*
	04 06 10	*Roof covering with asphalt materials*	*--*	*45*	*26.8*
	04 06 11	*Road paving with asphalt*	*45*	*45*	*45*
	04 06 12	*Cement (decarbonizing)*	*26.2-8*	*26-2.8*	*26.5*
	04 06 13	*Glass (decarbonizing)*	*26.1*	*26.1*	*26.1*
	04 06 14	*Lime (decarbonizing)*	*15-16 +21+26+27*	*26.2-8*	*26.5*
	04 06 15	*Batteries manufacturing*	*30-33*	*--*	*31*
	04 06 16	*Extraction of mineral ores*	*--*	*--*	*13*
	04 06 17	*Other (including asbestos products manufacturing)*	*--*	*--*	*15*
	04 06 18	*Limestone and dolomite use*	*--*	*--*	*--*
	04 06 19	*Soda ash production and use*	*17-19+24*	*--*	*--*
04 08		Production of halocarbons and sulphur hexafluoride	24	--	--
	05	**EXTRACTION AND DISTRIBUTION OF FOSSIL FUELS AND GEOTHERMAL ENERGY**			
05 01		Extraction and first treatment of solid fossil fuels	10	10	10
05 02		Extraction, first treatment and loading of liquid	11	11	11
05 03		Extraction, first treatment and loading of gaseous fossil fuels	11	11	11
05 04		Liquid fuel distribution (except gasoline distribution)	63	23	23
05 05		Gasoline distribution			50
	05 05 01	*Refinery dispatch station*	*63*	*23*	
	05 05 02	*Transport and depots (except 05.05.03)*	*63*	*23*	
	05 05 03	*Service stations (including refuelling of cars)*	*50-55*	*50-52*	
05 06		Gas distribution network	40.2	40	40.2
05 07		Geothermal energy extraction	--	40	Households
	06	**SOLVENT AND OTHER PRODUCT USE**			
06 01		Paint application			
	06 01 01	*Paint application : manufacture of automobiles*	*34*	*34*	*34*
	06 01 02	*Paint application : car repairing*	*50-55+65-95 (excl. 90)*	*50-52*	*50*
	06 01 03	*Paint application : construction and buildings (except item 06.01.07)*	*45*	*45*	*45*
	06 01 04	*Paint application : domestic use (except 06.01.07)*	*H. excl.transport*	*H. Other*	*Households*
	06 01 05	*Paint application : coil coating*	*27.1-3*	*28*	*35*
	06 01 06	*Paint application : boat building*	*35*	*35*	*--*
	06 01 07	*Paint application : wood*	*--*	*20*	*20 and/or 36*
	06 01 08	*Other industrial paint application*	*20+28-35+36-37*	*28+29*	*?*
	06 01 09	*Other non industrial paint application*	*--*	*--*	*?*
06 02		Degreasing, dry cleaning and electronics			
	06 02 01	*Metal degreasing*	*27.4-5+28*	*28*	*27*
	06 02 02	*Dry cleaning*	*50-55+65-95 (excl. 90)*	*93*	*93*
	06 02 03	*Electronic components manufacturing*	*30-33*	*--*	*32*
	06 02 04	*Other industrial cleaning*	*--*	*--*	*?*
06 03		Chemical proucts manufacturing or processing			

	06 03 01	*Polyester processing*	*17-19*	*25*	*25*
	06 03 02	*Polyvinylchloride processing*	*15-16+25*	*25*	*25*
	06 03 03	*Polyurethane processing*	*28-35+36-37*	*25*	*25*
	06 03 04	*Polystyrene foam processing (c)*	*25*	*25*	*25*
	06 03 05	*Rubber processing*	*25*	*25*	*25*
	06 03 06	*Pharmaceutical products manufacturing*	*24*	*24*	*24*
	06 03 07	*Paints manufacturing*	*24*	*24*	*24*
	06 03 08	*Inks manufacturing*	*24*	*24*	*24*
	06 03 09	*Glues manufacturing*	*24*	*24*	*24*
	06 03 10	*Asphalt blowing*	*--*	*--*	*23*
	06 03 11	*Adhesive, magnetic tapes, films and photographs*	*24*	*--*	*24*
	06 03 12	*Textile finishing*	*--*	*17*	*17*
	06 03 13	*Leather tanning*	*--*	*19*	*19*
	06 03 14	*Other*	*25*	*19*	*24*
06 04		Other use of solvent and related activities			
	06 04 01	*Glass wool enduction*	*--*	*26.1*	*45*
	06 04 02	*Mineral wool enduction*	*--*	*--*	*45*
	06 04 03	*Printing industry*	*22+25+28-35*	*22*	*22*
	06 04 04	*Fat, edible and non edible oil extraction*	*15-16*	*15-16*	*15 or 24*
	06 04 05	*Application of glues and adhesives*	*17-19 +20+22 +36-37+50-95*	*19+20+35+36 +50-52*	*?*
	06 04 06	*Preservation of wood*	*20*	*--*	*20 and/or 36*
	06 04 07	*Underseal treatment and conservation of vehicles*	*35*	*--*	*50*
	06 04 08	*Domestic solvent use (other than paint application)(k)*	*--*	*H. Other*	*Households*
	06 04 09	*Vehicles dewaxing*	*35*	*50-52*	*50*
	06 04 10	*Pharmaceutical product manufacturing (SNAP 94)*			*(24)*
	06 04 11	*Domestic use of pharmaceutical products (k)*	*--*	*--*	*Households*
	06 04 12	*Other (preservation of seeds,...)*	*63*	*--*	*01*
06 05		Use of HFC, N_2O, NH_3, PFC and SF_6			
	06 05 01	*Anaesthesia*	*50-55+65-95 (excl. 90)*	*--*	*85*
	06 05 02	*Refrigeration and air conditioning equipments using halocarbons (e)*	*H+15-16+50-95*	*--*	*15*
	06 05 03	*Refrigeration and air conditioning equipments using other products than halocarbons (e)*	*15-16+24+60-64*	*--*	*--*
	06 05 04	*Foam blowing (except 060304)*	*90*	*--*	*--*
	06 05 05	*Fire extinguishers*	*23+27+40 +50-55+65-95*	*--*	*--*
	06 05 06	*Aerosol cans*	*28-35+60-64*	*--*	*--*
	06 05 07	*Electrical equipments (except 060203)*	*all*	*--*	*--*
	06 05 08	*Other*		*--*	*--*
	07	**ROAD TRANSPORT**			
07 01		Passenger cars (r)	H. transp+01-95	H. transp+01-95	H. + 01-95
07 02		Light duty vehicles < 3.5 t (r)	H. transp+01-95	H. transp+01-95	01-95
07 03		Heavy duty vehicles > 3.5 t and buses (r)	H. transp+01-95	H. transp+01-95	01-95
07 04		Mopeds and Motorcycles < 50 cm3	H. transport	H. transp+01-95	Households
07 05		Motorcycles > 50 cm3	H. transport	H. transp+01-95	Households
07 06		Gasoline evaporation from vehicles	H. transp+01-95	H. transp+01-95	
07 07		Automobile tyre and brake wear	--	--	
08		**OTHER MOBILE SOURCES AND MACHINERY**			
08 01		Military	--	75	

08 02		Railways	60.1	60.1	60.1
08 03		Inland waterways	61.2	61	61.2
	08 03 01	*Sailing boats with auxilliary engines*	*61*		
	08 03 02	*Motorboats / workboats*	*61*		
	08 03 03	*Personal watercraft*	*H. excl. transport*		
	08 03 04	*Inland goods carrying vessels*	*61.2*		
08 04		Maritime activities			
	08 04 02	*National sea traffic within EMEP area*	*61*	*61*	*61*
	08 04 03	*National fishing*	*05*	*05*	*61*
	08 04 04	*International sea traffic (international bunkers)(h)*	*excl. / total indus*	*61*	*61*
08 05		Air traffic		62	
	08 05 01	*Domestic airport traffic (LTO cycles - <1000 m)*	*62*		*62*
	08 05 02	*International airport traffic (LTO cycles - <1000 m)*	*excl. / total indus*		*62*
	08 05 03	*Domestic cruise traffic (>1000 m)*	*62*		*62*
	08 05 04	*International cruise traffic (>1000 m)(i)*	*excl. / total indus*		*62*
08 06		Agriculture	01	01	01
08 07		Forestry	02	02	02
08 08		Industry	45	10-37+45	45
08 09		Household and gardening	H. excl. transport	Households	Households
08 10		Other off-road	--		?
	09	**WASTE TREATMENT AND DISPOSAL**			
09 02		Waste incineration			
	09 02 01	*Incineration of domestic or municipal wastes*	*90*	*90*	*90*
	09 02 02	*Incineration of industrial wastes (except flaring)*	*90*	*24+90*	*90*
	09 02 03	*Flaring in oil refinery*	*23*	*23*	*23*
	09 02 04	*Flaring in chemical industries*	*24*	*--*	*24*
	09 02 05	*Incineration of sludges from waste water treatment*	*90*	*24+90*	*24*
	09 02 06	*Flaring in gas and oil extraction*	*11*	*--*	*11*
	09 02 07	*Incineration of hospital wastes*	*50-55+65-95 (excl. 90)*	*90*	*90*
	09 02 08	*Incineration of waste oil*	*90*	*90*	*26+90*
09 04		Solid Waste Disposal on Land	90	90	--
09 07		Open burning of agricultural wastes (except 10.03)	01	01	01
09 09		Cremation		--	93
	09 09 01	*Incineration of corpses*	*50-55+65-95 (excl. 90)*		
	09 09 02	*Incineration of carcasses*	*01*		
09 10		Other waste treatment			
	09 10 01	*Waste water treatment in industry*	*90*	*15-16+17+21*	*?*
	09 10 02	*Waste water treatment in residential/commercial sect.*	*90*	*--*	*90*
	09 10 03	*Sludge spreading*	*90*	*90*	*01*
	09 10 05	*Compost production*	*90*	*90*	*90*
	09 10 06	*Biogas production*	*90*	*--*	*90*
	09 10 07	*Latrines*	*90*	*--*	*90*
	09 10 08	*Other production of fuel (refuse derived fuel,...)*	*90*	*--*	*90*
	10	**AGRICULTURE**			
10 01		Cultures with fertilizers	01	01	01
10 02		Cultures without fertilizers	01	01	01

10 03		On-field burning of stubble, straw,...	01	01	01
10 04		Enteric fermentation	01	01	01
10 05		Manure management regarding organic compounds	01	01	01
10 06		Use of pesticides and limestone	01	--	01
10 09		Manure management regarding nitrogen compounds	01	01	--
	11	**OTHER SOURCES AND SINKS**			
11 01		Non-managed broadleaf forests	excluded		
11 02		Non-managed coniferous forests	excluded		
11 03		Forest and other vegetation fires	excluded		
1104		Natural grassland and other vegetation	excluded		
11 05		Wetlands (marshes - swamps)	excluded		
11 06		Waters	excluded		
11 07		Animals	excluded		
11 08		Volcanoes	excluded		
11 09		Gas seeps	excluded		
11 10		Lightning	excuded		
11 11		Managed broadleaf forests	02	02	(02)
11 12		Managed coniferous forests	02	02	(02)
11 21		Changes in forest and other woody biomass stocks		--	~~(02)~~
	11 21 01	*Tropical forests*	--		
	11 21 02	*Temperate forests*	~~02~~		
	11 21 03	*Boreal forests*	--		
	11 21 04	*Grassland/tundra*	--		
	11 21 05	*Other*	--		
11 22		Forest and grassland conversion	~~H. exc. Trans +02~~		~~(02)~~
11 23		Abandonment of managed lands	--		~~(02)~~
11 24		CO_2 emiss. from/or removals into soils (except 10.06)	~~01~~		~~(02)~~
11 25		Other	--		~~(02)~~

Sources: France (Ifen, 2000 and Allemand, 2002); Italy (Lauretis, Tuduni, Vetrella, 2002); Austria (Ahamer, Hanauer, Wolf, 1998) and (Wolf, Hanauer, Ahamer, 2000)

NACE codes reported consistently with level of detail in the standard classification for NAMEA-air, plus optional groupings in the standard tables.

	: emissions in a SNAP code that are broken down into several economic categories (when several NACE codes are included in a cell without any outline, the corresponding emissions are either grouped together or, despite the lack of detail in the air emission accounts, they are likely to stem only from one of these industries).
--	: activities that do not exist in the concerned national economy.
	: situations for which the SNAP-based emissions are attributed to the same NACE 2-digit economic category in the different countries.
~~NACE~~	: emissions that should not be included in air accounts for NAMEA.
(NACE)	: since the Austrian document is based on the SNAP-94, the brackets inform that, here, the NACE code was transferred to the corresponding category in the SNAP-97.
NACE	: are coloured in grey, one the one hand, categories referring to SNAP-94 and, on the other hand, very aggregated NACE-based groups that avoid to identify the only industry concerned.

For some of the SNAP categories, emissions have to be split into several economic categories. Most of these emissions are attributed to NACE codes or households activities either using fuel consumption data or thanks to technical data contained in CORINAIR as well as experts' knowledge. In some cases, other data, like the numbers of employees, are used as allocation factor. Here again, comparing France, Italy and Austria, it is possible to observe certain similarities in the way emission data are split into economic categories (table 2.2.C).

2.2.1.3. SNAP codes' emissions broken down into several economic categories

Emissions of *non-industrial combustion plants* (SNAP 02) are in fact related to heating of buildings occupied either for economic or residential purposes. Therefore, it seems logical, as it is for the 3 countries studied here, that these emissions are apportioned into economic categories using data on energy consumption. However,

detailed data are needed, firstly because many industries are included in the category *commercial and institutional plants* (SNAP 02 01). For instance, in Italy and Austria it covers almost all industries except agriculture, forestry and fishing that have their own category (SNAP 02 03). Secondly, it could be difficult, even impossible, to identify energy consumption by small shops or workshops among actual residential energy use. In France, Italy and Austria, emissions of *residential plants* (SNAP 02 02) are nonetheless all attributed to households.

Table 2.2.C – SNAP-based emissions allocated into several economic categories

	Attribution either based on CORINAIR basic data or on point source data			**Allocation based on energy data**		
SNAP	FRANCE	ITALY	AUSTRIA	FRANCE	ITALY	AUSTRIA
Combustion in energy and transformation industries (01)		01.04.06				
Non industrial combustion plants (02)				02.01	02.01 02.03	02.01
Combustion in manufacturing industry (03)	03.03.12	03.03.12		03.01		03.01 03.02.05 03.03.26
Production processes (04)	04.04.01 04.04.04 04.06.14 04.06.19	04.02.01				
Solvents and other products use (06)	06.01.08 06.03.02-03 06.04.03 06.04.05 06.05.05-06	06.01.08 06.04.05	06.01.07-09 06.02.04 06.04.04-05			
Road transport (07)	07.01-06				07.01-06	07.01-05
Other mobile sources and machinery (08)					08.08	08.10
Waste treatment and disposal (09)		09.02.02 09.02.05 09.10.01	09.10.01			

As said earlier in the text, most emissions related to the *combustion in manufacturing industry* (SNAP 03) are directly attributed to the right NACE category thanks to the economic-oriented information given in this case at the SNAP 6-digit level. However there are some difficulties when the processes concerned, like boilers (SNAP 03 01) or other equipment (SNAP 03 02 05 and SNAP 03 03 26), are used in many different industries. As expected, data on energy use prevail in such a situation, but it requires detailed enough data. Firstly, since emission factors are not the same for all energy products, it is necessary to isolate, fuel by fuel, energy burnt in boilers among total energy use in manufacturing industries. Secondly, such data needed to be broken down into economic categories compatible with the classification used for NAMEA.

When emissions are not related to fuel combustion, but to *production processes* (SNAP 04) or to the use of emitting products like solvent (SNAP 06), as well as, to a lesser extent, to waste treatment (SNAP 09), attribution to economic categories is based either on basic information included in CORINAIR and obtained from experts' knowledge or thanks to point source data.

Attribution of CORINAIR emissions to several economic categories using energy data

As far as fuel combustion is concerned – *non industrial combustion plants* (SNAP 02), *combustion in boilers, gas turbines and stationary engines* for the manufacturing industries (SNAP 03 01), *road transport* (SNAP 07) (except for France) and other *mobiles sources and machinery* used in the industry (SNAP 08 08) -, energy use logically appears to be the relevant data to breakdown the related CORINAIR emissions into the NACE-based industry classification for NAMEA.

In CORINAIR, for each SNAP category recording combustion related emissions, emission total (*EMI(p)*), which arises from the use of several fuels, adds up emissions stemming from all of them, as in the following equation[7]:

$$EMI(p) = EMI_1(p)+EMI_2(p)+\ldots+EMI_e(p)+\ldots+EMI_n(p)$$

EMI(p) is the total of emissions from SNAP process *p*;
$EMI_e(p)$ is the amount of emissions arising from the use of the energy product *e* in the process *p* (*e* = 1, 2, …, n)

Therefore for each of the energy product *e*, it is necessary to estimate the weight ($W^i_e(p)$) that represents the emissions stemming from the combustion of the fuel *e* used in the process *p* by the industry *i*. When information on economic activities in the energy statistics are compatible with the NACE based industry classification used for NAMEA (i.e. when each activity *a* in the prepared energy data corresponds to only one NAMEA industry *i*; see graph 2.2.A), such a weight merely corresponds to the proportion of the energy *e* used by the industry *i* (use^i_e) in the total use of *e* ($\bullet\ use^i_e$) by the m industries (i = 1, 2, …m). For each e used in the process *p*:

$$W^i_e(p) = use^i_e \,/\, \sum_{i=1}^{i=m} use^i_e$$

However, there are usually two kinds of difficulties in implementing such a procedure. The first one is related to the correspondence between energy items that we can respectively find in the *nomenclature for air pollution of fuels* (NAPFUE, see annex 4) used in CORINAIR and in the national energy statistics in the relevant countries. The second difficulty is the connection between economic activities identified in the energy statistics and the industry classification used for NAMEA.

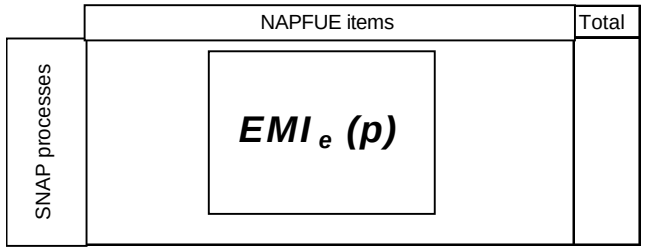
As shown in figure 2.2.A below, the first stage of the above-mentioned procedure consists in preparing data on energy use that should be both compatible with CORINAIR energy items and detailed enough as far as economic activities are concerned in order to allow their connection to NACE categories. At the second stage, CORINAIR emission data, energy product by energy product, are actually apportioned into the NAMEA industry classification using ratios calculated once energy data were adapted to this classification.

In France (Ifen, 2000), energy data from many different sources were compiled in order to produce a sort of energy accounts covering manufacturing industries for two years (the resulting proportions were applied all over the time series). In such accounts, the data are recorded according to a nomenclature for energy consumption[8] that does not directly and strictly match to the category *manufacturing* in the NACE, but of which each of the items can fit into a manufacturing industry of the NACE-based classification for NAMEA. In Italy (Coli, et al., 2001), the connection to the NACE is rather straightforward, since data on energy use by economic activities were derived from existing energy use tables.

7 - Adapted from the presentation made by Italy (Coli, et al. 2001) and (De Lauretis, Tudini and Vetrella, 2002).
8 - *Nomenclature de consommations d'énergies* (NCE).

Figure 2.2.A – Energy based allocation of CORINAIR processes' emissions into several NACE categories

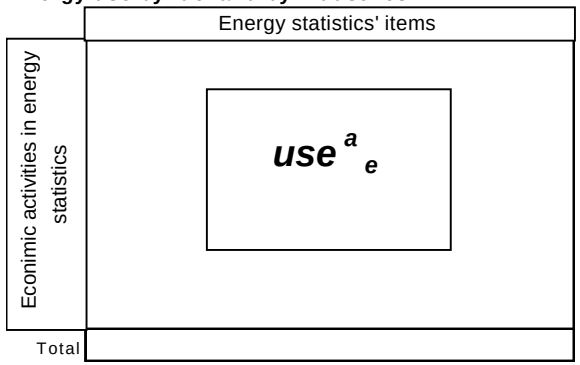
CORINAIR emissions



SNAP: Selected Nomenclature for sources of Air Pollution

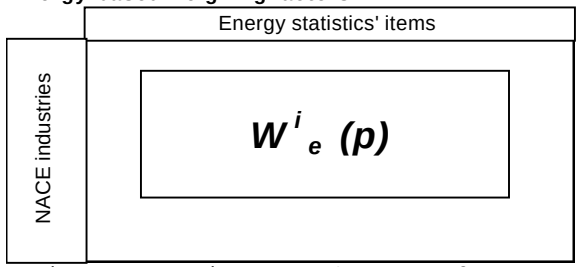
$$EMI(p) = EMI_1(p) + EMI_2(p) + \ldots + EMI_j(p) + \ldots + EMI_n(p)$$

Energy use by fuel and by industries

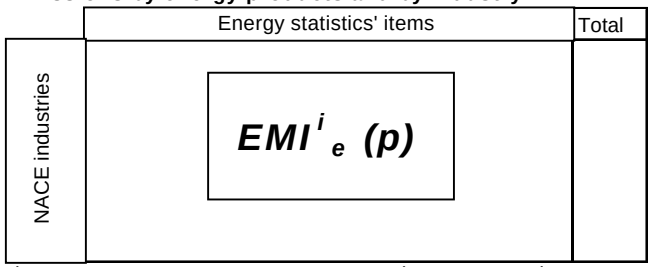


$$Use^1_e = (use^1_e + use^2_e + use^3_e)$$
$$Use^2_e = (use^4_e + use^5_e + \ldots)$$
$$\ldots$$
$$Use^i_e = (\ldots + use^{a-1}_e + use^a_e + use^{a+1}_e + \ldots)$$
$$\ldots$$
$$Use^m_e = (\ldots + use^{z-2}_e + use^{z-1}_e + use^z_e)$$

Energy-based weighing factors



Emissions by energy products and by industry



$$W^i_e(p) = use^i_e / (use^1_e + use^2_e + \ldots + use^i_e + \ldots + use^m_e) \qquad EMI^i_e(p) = W^i_e(p) \times EMI_e(p)$$

Attribution of CORINAIR emissions to several economic categories using non-energy data

Energy is actually burnt in ovens to produce *lime* (SNAP 03 03 12) and lime producers are registered in the *manufacture of non-metallic mineral products* (NACE 26) when it is their principal activity. However, other firms produce lime for their own use, like producers of sugar (in the NACE 15), pulp and paper (NACE 21) and iron and steel (NACE 27.1-3). The energy-related air emissions (non energy-related emissions of lime production are placed under SNAP 04 06 14) can be split between the different responsible industries thanks to the basic information included in CORINAIR. In Italy, energy-related emissions stemming from lime production as an ancillary activity are point source data – i.e. directly collected at establishment level.

In CORINAIR, *Road transport* (SNAP 07) emissions are indeed calculated from fuel consumption. They can consequently be attributed to the relevant economic agents (partly the land transport industry, but also the other industries when producing transport for their own use, as well as households)[9] using propellant fuel consumption data by households and industries following the same method as described above. However it is also possible to use data on the ownership of vehicles. For instance, in France, apportionment of emissions from *passenger cars* (SNAP 07 01) and *light duty vehicles* (SNAP 07 02) was made thanks to surveys on the use of vehicles i.e. combining information on the owners and distances covered. A study made on a regular basis helped to split emissions from *heavy-duty vehicles* (SNAP 07 03) between transport of freight and passengers. Own account freight transport was allocated to responsible industries using data on distances covered by nature of freight. Estimations of own account transport of passengers (employees) were made proportionally to numbers of employees for firms above 500 people.

On the other hand, some of the emissions that are to be distributed into several economic categories are not related to the combustion of energy, but to the process of production (SNAP 04) or the products (SNAP 06) used, as well as the waste treatment (SNAP 09). Therefore, technical data, either included or not in CORINAIR basic material, are necessary when data on air emissions are neither directly measured at the production site nor even collected at the establishment level.

In the three examples shown in the table 2.2.B earlier in the text, emissions from *production processes* (SNAP 04 at the 6-digit level) are generally attributed to a unique economic category. However, also as seen above, emissions from certain SNAP categories are sometimes to be apportioned between several producers placed under different industries, either because

- the polluting process concerned – e.g. *coke oven* (SNAP 04 02 01) - can by definition be used in different industries;
- or the production - like *lime* (SNAP 04 06 14) - can, also by definition, be carried out by different industries;
- or, also, when productions - like *sulphuric acid* (04 04 01), *ammonium sulphate* (04 04 04) that require implementing emitting processes are not only made within industries of which it is the principal activity.

In the first case, it could be relevant to allocate emissions in accordance with the level of activity of the concerned equipment. However, since the latter is likely to be used differently whether it is directly related to the principal activity or not, it seems that it is not quite relevant to do it using industries' respective production level. In Italy, which is the only country concerned in the above table 2.2.B, emissions stemming from coke ovens are of different sources for the two concerned industries (*area source* for NACE 23 and *point source* for NACE 27). In the two other cases, if not already included in the basic material for CORINAIR estimates, it seems rather appropriate to look for additional statistics dealing either with the production or the consumption of the emitting good in question. Also, when energy related emissions were already treated for the process concerned, as for lime production (SNAP 03 03 12), the same proportions could apply for non-energy related emissions (SNAP 04 06 04).

Some emissions registered in a SNAP category are also to be split for NAMEA when the same polluting products are used as input in several industries. Many of the emissions registered under the heading *solvents and other products* (SNAP 06), which covers such kind of inputs, should be broken down into several NACE categories. Despite economic-oriented information included in most of the items under the SNAP 06, some of

9 - The attribution of emissions to the responsible economic agents producing transport for their own account is dealt with in general in section 2.3, as well as in the next chapter (section 3.2) when presenting the table on transport emissions that is now included in the set of NAMEA-air standard tables.

the products like e.g. paint (06 01 08-09), polyvinylchloride (SNAP 06 03 02), polyurethane (SNAP 06 03 03), glue (06 04 05) or aerosol (06 05 06) are used by several industries.

When the basic data used for CORINAIR do not provide us with detailed enough information, once again, the most relevant solution is to look for additional statistics on the quantity of the source products (e.g. paint, glue, etc.) used by each industry in question. Such information may be available, even partially, in industries' own statistics or in technical literature. It is also possible to call for experts' knowledge. Sometimes it is also worth developing specific studies, like Austria had to do it in relation to paint application (SNAP 06 01 07-09).

Finally, waste treatment is generally carried out by firms of the waste treatment industry (NACE 90). However it is sometimes internally undertaken by firms of which the production is rather waste intensive, like food processing, textiles, pulp and paper, refining and chemical industries. Under the SNAP 09, other industries than the waste treatment industry - extraction industry (flaring), refinery, chemical industry - have their own sub-category as far as waste incineration is concerned (SNAP 09 02), as well as agriculture in relation with open burning (SNAP 09 07). On the other hand, when firms of the food processing, textiles or pulp and paper industries internally incinerate their solid waste or treat their wastewater, the related emissions especially registered under *incineration of industrial wastes* (SNAP 09 02 02) or *waste water treatment in industry* (SNAP 09 10 01) need to be apportioned accordingly.

In this case also, allocation of emissions could be made either thanks to experts' knowledge, as for waste incinerated by the Italian chemical industry (SNAP 09 02 02 and 09 02 05), or by using technical literature and databases, like in Austria about *incineration of waste oil* (SNAP 09 02 08). However, the relevant information is sometimes already included in CORINAIR basic data. In Italy and Austria, the distribution of emissions from *wastewater treatment in industry* is given by CORINAIR since emissions registered under SNAP 09 10 01 merely result from the sum of the relevant industries' contributions.

2.2.2. Arrangement of air emissions registered in inventories other than CORINAIR

Other countries, like e.g. the Netherlands, start compiling their air accounts for NAMEA from their national air emission inventory, but the latter is not produced following CORINAIR methodology. In Finland, air emission inventory is not either based on CORINAIR methodology, but the Finnish air accounts are based both on the arrangement of data from this inventory and on calculations based on energy use.

In the Dutch emissions register (ER), emissions are recorded by very detailed types of sources. Emissions used to be presented only according to a functional classification, but now almost all stationary source codes also contain, besides a functional description of the source, the industry classification (SBI) code from which these emissions originate. More than 400 of the 600 codes in the ER concern stationary sources, of which 270 contain a SBI code and 91 are related to agricultural and household activities. The remaining stationary sources are attributed to economic categories either with the help of additional national account categories or, when the latter are not detailed enough, using complementary data such as energy use, employment and figures from national accounts. Mobile sources in the ER contain a very detailed functional description that serves as input for the distribution to NACE categories. Other input sources are data on fuel use both in the national accounts and in the *energy supply in the Netherlands* (ESN), as well as vehicle fleet information.

ER data are produced using environmental annual reports, production statistics and data on ESN. Energy related emissions in the ER are mostly based on the ESN that although needs to be adjusted since its industry classification and energy sources classification do not totally fit into national accounts industry and energy classifications. A specific study is carried out in order to integrate energy statistics in the national accounts, enabling to establish the link between the ESN and national accounts definitions that prevail for NAMEA (Verduin, 1999). The main result of this study is the production of an energy supply and use table in physical unit. Such a table is very useful for the consistency of NAMEA-air data, especially as regards own account transport emissions and the residence principle (see section 2.3) and it is worth mentioning here that the second step of this study corresponds to what is earlier described in section 2.2.1.2, when CORINAIR emissions are attributed to several economic categories using energy data (connection of energy items between CORINAIR and energy statistics and connection between economic activities in the energy statistics and the industry classification used for NAMEA). A twofold adaptation is also needed to make the ESN consistent with national accounts' classifications:

§ Harmonisation of the ESN and national accounts' industry classification;

§ Harmonisation of the ESN energy sources with the national accounts' (energy) commodity.

Data in the ESN are broken down into an industry classification of around 100 categories that roughly correspond to the NACE 3-digit level. Although this classification is not uniquely transformable to the national accounts' classification, both could be aggregated in order to form a common classification compatible with the level of detailed required for NAMEA-air. The same problem appears with the respective classification of energy items in the ESN and the national accounts. An aggregated classification compatible with both of them was also found here.

2.3. Other specific sources

As far as energy-based air emission accounts are concerned, other data than energy accounts and emission factors are to be collected for non-energy related emissions. NAMEA compilers can use emission data from their national inventory, as Denmark does using CORINAIR data in this case, and the attribution to economic activities can be made as described in section 2.2. This concerns particularly N_2O, CH_4, NH_3 and, to a lesser extent, NMVOC (see table 2.1.A earlier in the text). Also, for large and energy consuming installation such as power plants, emissions are sometimes directly measured thanks to monitoring process located on the site, but, in this case, the attribution to the relevant industry does not show any difficulty.

Irrespective of the method used, additional data are needed in order to fulfil national accounts principles that prevail for NAMEA: attribution of ancillary activities related emissions to the industries responsible and the residence principle. Both of these aspects are mostly related to transport activities. As said earlier (section 1.2), firstly, transport emissions are functionally allocated in air emission inventories – i.e. grouped together in a specific category for transport. Secondly, air emission inventories are more or less geographically oriented, so that most emissions from national units abroad – mostly for international transport – are not included whereas emissions of foreigners operating on the territory are not excluded. Energy data used for energy-based air accounts do not necessarily enable NAMEA compilers to fulfil such principles (especially the residence principle).

Therefore, this section focuses firstly on the data required for the allocation of emissions related to own account transport activities carried out by industries and households (2.3.1). Secondly, a specific attention is paid to the data that can help NAMEA compilers to estimate the amount of emissions stemming from national residents operating abroad, as well as those of foreigners emitting on the national territory (2.3.2).

2.3.1. Own account (road) transport emissions

According to the NAMEA principles, emissions have to be allocated to economic agents that carry out the activities that cause emissions. Transport activities – especially road transport - are in particular carried out by many economic agents that do not necessarily take part of the transport industry. Therefore, as illustrated for CO_2 in table 2.3.A, for most countries[10], the proportion of emissions allocated to the transport industry in NAMEA total is lower than the proportion of transport emissions in the total reported under the UNFCCC.

Table 2.3.A – Percentage of transport emissions (UNFCC) and emissions of transport industry (NAMEA)

	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK
CO_2	**1998**	**1998**	**1998**	**1998**	**1998**	**1998**	**1996**	**1992**	**1998**	**1998**	**1997**	**1998**	**1995**	**1995**	**1998**
UNFCCC	20%	21%	20%	22%	30%	33%	20%	25%	25%	19%	24%	31%	18%	32%	22%
NAMEA	7%	24%	5%	3%	5%	6%	19%	9%	9%	13%	9%	13%	11%	19%	13%

Source: EEA, *Annual European Community Greenhouse Gas Inventory 1990-99, (submission to the secretariat of the UNFCCC)*, Technical report n° 60, 35 p. + CD-ROM (in Summary 1.A, total national emissions and removals / 1.A.3 (energy) transport). NAMEA data reported to Eurostat with the standard tables or in pilot studies (total industries plus households / transport industries (NACE 60-63)).

10 - It is not the case for Denmark because of the significant amount of emissions stemming from Danish ships bunkering abroad that are not included in the data reported to the UNFCCC, but included in NAMEA under the transport industry.

Road transport emissions are first of all split between industries and households that are also responsible for transport emissions when they use their own cars. As far as firms are concerned, road transport emissions are partly allocated to the industries whose principal activity is transport (NACE 60). Another part of the air emission from road transport activities is allocated to other industries, either producing transport as secondary activity (sold to other, although it is not their principal activity) or for their own use (own account transport). In order to ease the presentation hereafter, the expression *own account transport* will be used for all transport emissions that are not to be attributed to transport industries. More details on the different situations are given in the next chapter when it comes to the presentation of the table on emissions from transport in the standard tables (section 3.2.3).

Like emissions that stem from other activities, the alternative between energy-based and inventory-based approaches prevail also here for the attribution of transport emissions to the responsible economic agents. Either energy use for transport are allocated to the different agents carrying out transport activities and then emission factors are applied, or transport emissions are split between economic agents, even using proportions of energy use among other means.

2.3.1.1. Own account transport in energy-based air accounts

When transport related energy data used for NAMEA directly come from energy accounts compiled in the context of national accounts, they are consistent with NAMEA principle as regards own account transport. The relevant energy consumption is already attributed to the economic agents that actually undertake transport for their own use. In the Danish case, which is used earlier as an illustration of energy accounts-based air emission accounts (section 2.1), own account transport of industries and households are taken into account through their respective consumption of propellant fuel, such as leaded and unleaded petrol, liquid petroleum gas or gas oil, several emissions factors being applied to each of these types of fuel.

However, even when producing energy-based air accounts, basic data on energy use for transport are not necessarily allocated to economic categories (including economic agents producing transport for their own use), but are functionally-oriented. Therefore, transport energy data are firstly to be apportioned between these agents since the corresponding emission data result from the application of emission factors per kinds of fuel. Then, like for transport emission data from inventories (see later in this section), such an apportionment, could be made using either data on transport when they are available (e.g. vehicles' ownership and distances covered, but also complementary energy data related to transport) or economic data that are potentially related to own account transport (number of employees, quantities of freight by nature…). As seen in section 2.1, in the United Kingdom energy data use for NAMEA come from the National Atmospheric Emission Inventory (NAEI). Road transport energy data (petrol and diesel) are therefore functionally classified. A first split is operated between households and business sector with the help of distances covered figures from the National Travel Survey. Business transport petrol and diesel consumption is then further subdivided across industries using their intermediate consumption of the services of the *Garages, car showrooms industry* (ONS, 2002)[11].

2.3.1.2. Own account transport in inventory-based air accounts

Transport is one of the main categories of air emission inventories and it covers all emissions related to transport activities. Although they are divided into sub-categories of transport means, as e.g. in the SNAP for CORINAIR (annex 3), all transport emissions are basically grouped together - i.e. including transport services industries and other industries plus households carrying out their own transport activities. When NAMEA-air compilers use inventory as basic air emission data, they have necessarily to distribute a share of these emissions, firstly, between households and non-transport industries and, secondly, among those industries outside the transport sector. Transport air emissions are basically energy-related emissions. Therefore, the above-mentioned distribution can be made using data on energy consumption when they are detailed enough to be connected the industry classification. Otherwise, compilers have to look for transport statistics and surveys that can help to identify the distribution of own account transport activities among non-transport producers.

It is in fact rather insufficient to distribute transport emissions among the economic agent responsible considering merely the types of vehicles. It is even not sufficient enough to split between households and

11 - The British desk instructions (ONS, 2002) also say that this point could be further investigated, especially to know whether National transport Survey's data on the distance covered by occupation couldn't be linked with national account sectors.

industries. Although it is really tempting to attribute mopeds, motorcycles and passenger cars to households, all these kinds of vehicles are also used professionally, even mopeds and motorcycles, e.g. in the public administration (police). On the other hand, most light duty vehicles might be used for business activities, but not only too. Once total transport emissions are identified, the split between transport and non-transport industries can hardly be based only on vehicle types; light and heavy vehicles are used by both and non-transport firms can transport their employees with their own buses. Anyway, further details are definitely needed for the distribution of own account transport related emissions among the non-transport industries.

Distribution of own account transport emission using energy data

Unlike energy-based transport emissions (section 2.3.1.1), but like earlier in the text when dealing with the distribution of emissions of SNAP categories into several economic sectors (section 2.2.1.2), data on energy use serve as allocation factors. Emissions are broken down into the industry classification proportionally to the consumption of propellant fuel by industries and households.

Referring to the figure 2.2.A, *EMI(p)* concern here road transport emissions only (SNAP 07 when following CORINAIR) and use^{a}_{e} are propellant fuels only (e.g. petrol, LPG and diesel). Therefore, the weighting factors ($W^{i}_{e}(p)$) correspond to the proportion of the propellant fuel *e* used by the economic category *i* in the total consumption of *e*. Once again the problem is the availability of data on energy use broken down industry by industry and isolating household consumption.

When road transport emission data are estimated following COPERT methodology, which is recommended for the compilation of CORINAIR inventory, basic data should enable to identify emissions by type of propellant fuel for most of the vehicles (e.g. *gasoline*, *diesel* or *LPG passenger cars*; *gasoline* or *diesel light* or *heavy duty vehicles*) (EEA, 2000b). However, this requires having data on fuel consumption by type of vehicles identifying at least households and total industries respective contribution. Otherwise, complementary data on the ownership of vehicles are necessary (see the following paragraph). Afterwards, total road transport emissions of industries can be distributed into the NACE categories using national account data on intermediate consumption of propellant fuel. Such data are often available in monetary unit only. Therefore, when estimating physical quantity, a special attention is to be paid on the differences in the prices according to which fuel is purchased by economic agents.

Distribution of own account transport emissions using non-energy data on transport

Otherwise, when consumption of propellant fuel are not available at the above-required level of detail, the distribution of transport emissions can be based on other transport data representative enough of the level of transport activities industry by industry and by households. In air emission inventories, such as CORINAIR, road transport emissions are usually presented split into a few vehicle categories like passengers cars or private cars, light and heavy duty vehicles and mopeds plus motorcycles (see e.g. SNAP 07 in annex 3). Therefore it seems best having data combining vehicles' ownership and distances covered in order to be able to distribute emissions stemming from each of the categories of vehicles identified across the different economic agents.

The distribution of vehicles by owner and identifying their economic activity (including private used of households) is nonetheless not sufficient enough. All of them do not have the same usage of their vehicles. Then, data on the distances yearly covered by vehicle owners appears to be necessary. When data on the ownership are not available, other statistics e.g. on freight transported or number of employees can be useful as far as they help to identify both the economic category and the distances. Sometimes, air emission inventories also identify different driving conditions (e.g. highway, rural and urban driving), but they are unlikely to be taken into consideration for the apportionment of transport emissions in NAMEA. All economic agents are therefore assumed to drive in average conditions.

In France (Ifen, 2000; Allemand, 2001), for instance, the distribution of emissions stemming from passenger cars and light duty across industries plus households is based on surveys about cars owners that are combined with statistics on average annual distances covered by economic categories. The distribution of heavy-duty vehicles' emissions is made using statistics on freight transported (quantities and distances). Then, nature of freights helps to do the connection with economic sectors. About the own account transport of employees, emissions are apportioned in relation with the numbers of employees in firms employing more than 500 people.

2.3.2 International transport emissions[12]

In accordance with the national accounts data to which they are connected, environmental data in NAMEA are related to national economic activities, i.e. including resident units operating abroad and excluding foreigners emitting from the national territory (residence principle). About air pollution, as highlighted later in the text with the table bridging total in NAMEA and totals reported to the UNFCCC (see section 3.2.4) most, if not all, adjustments that are to be made on national territory-oriented air emission inventories concern international transport activities (road, water and air transport).

Emissions of national residents operating abroad (driving, shipping or flying) are sometimes quite substantial so that their contribution represents then a significant proportion of NAMEA totals (table 2.3.B). However, in the adjustment countries should focus on the main issues: water transport for countries like Denmark, Norway, and, to a lesser extent, the United Kingdom, possessing a relative large fleet of ships engaged in international transport (the same applies for countries with large air transport companies); or land transport either for countries where a large number of lorries and private tourists' cars pass through (and by fuel), as in Austria and Luxembourg, or for countries of which the residents drive long distances abroad (e.g. the Netherlands). For items that are unimportant, simplifying assumptions may be used (e.g. that the effect of tourism is zero on balance).

Table 2.3.B – Contribution of national residents abroad to air emission totals in NAMEA

1998	Denmark	Netherlands	United Kingdom	Norway
Carbon dioxide (CO_2)	18.74%	12.59%	8.48%	22.62%
Nitrous oxide (N_2O)	4.28%	0.99%	1.18%	1.86%
Methane (CH_4)	0.18%	0.08%	0.23%	0.26%
Nitrogen oxides (NO_x)	61.55%	41.42%	22.39%	51.52%
Sulphur dioxide (SO_2)	77.30%	55.83%	13.20%	66.99%

Source: *Statistics Denmark* (shipping abroad), *Statistics Netherlands* (land, water and air transport abroad), *Office for National Statistics* (fishing vessels plus land, water and air transport abroad) and *Statistics Norway* (water and air transport abroad). Data reported to Eurostat with the *NAMEA for air emissions standard tables*, 2000 and 2002.

When energy accounts are compiled within national accounts, they cover the consumption of domestic units wherever the delivery occurs, on the national territory or abroad. Therefore, air emission accounts based on such energy accounts automatically apply the residence principles. However, it is nonetheless not necessarily the case. In Denmark, for instance, the satellite energy system used for NAMEA does not include the fuel consumption of Danish ships bunkering abroad. The corresponding air emissions are therefore lacking in the illustration given in section 2.1, but, for the actual Danish NAMEA, they are based on additional energy data. When air accounts are compiled from the arrangement of air emission inventories complying the IPCC guidelines (IPCC, 1996a), complementary data are necessarily to be found concerning transport activities of national units abroad and foreign units carrying out transport activities on the national territory. Since, all emissions stemming from activities undertaken on the national territory are included, irrespective of nationality criterion, when following IPCC guidelines, they are to be identified and excluded for NAMEA. Also, since international water and air transport related emissions should be excluded still following IPCC guidelines[13], emissions of residents engaged in such activities are to be estimated and added for NAMEA.

Generally speaking, adjusting national territory-based data (Rd + NRd, on figure 2.3.A) to national residents' basis (Rd + Ra) necessitates adding residents fuel consumption/air emissions abroad (Ra) and subtracting fuel consumption/air emissions of non residents purchasing fuel on the national territory (NRd). However, since

12 - Developments in this section are heavily inspired by results presented on the British situation in Harris R., *Adjustments to the UK's atmospheric emissions and energy accounts to bring them on to a National Accounts "residents" basis*, Office for National Statistics (ONS), Report to Eurostat, London (UK), April 2002, 23 p.

13 - As concerns water or air transport, international transport related emissions are to be reported separately (memory items – i.e. not included in total emissions) for the UNFCCC (following IPCC guidelines). However, these emissions do not correspond to the emissions of residents abroad. They cover emissions of both residents and non-residents, as far as the fuel needed is purchased on the national territory. See annex 6 for a comparison between IPCC and NAMEA rules as regards international transport activities.

international water and air transport emissions should be excluded from UNFCCC totals, it is also necessary to distinguish between domestic and international transport.

Figure 2.3.A – Adjustment from fuel purchases and related emissions on the national territory to residents' basis

	Residents		Non-Residents		
Transport / Fuel delivered	national (n)	international (i)	national (n)	international (i)	
domestically	Rd(n)	Rd(i)	NRd(n)	NRd(i)	Total fuel purchases in / air emissions from the national territory = Rd(n) + Rd(i) + NRd(n) + NRd(i)
abroad	Ra(n)	Ra(i)	NRa(n)	NRa(i)	
	Total fuel purchases in / air emissions by national residents = Rd(n) + Rd(i) + Ra(n) + Ra(i)				

Road transport:

UNFCCC = [Rd(n) + Rd(i)] + [NRd(n) + NRd(i)]
NAMEA = Rd(n) + Rd(i) + Ra(n) + Ra(i)
Adjustment: + [Ra(n) + Ra(i)] - [NRd(n) + NRd(i)]

Water and air transport:

UNFCCC = Rd(n) + NRd(n)
NAMEA = Rd(n) + Rd(i) + Ra(n) + Ra(i)
Adjustment: + Rd(i) + [Ra(n) + Ra(i)] - NRd(n)

Adapted from Harris (2002), Box 1, p. 2.

2.3.2.1 Road transport

No reference is made on international road transport in the IPCC. Consequently, road transport emissions reported to the UNFCCC include emissions related to the combustion of propellant fuel purchased all by users of road transport equipment (lorries, coaches, cars and motorcycles) on the national territory. Therefore, when the preparation of air accounts for NAMEA are based either on energy statistics limited to purchases made on the territory or on IPCC-based air inventory, it is firstly necessary to estimate and include emissions produced by national residents operating transport services abroad (mostly lorries and coaches registered under the NACE 60.2) and national residents driving their cars abroad e.g. for tourism (household transport) (+ [Ra(n) + Ra(i)]). It is also necessary to estimate emissions of foreign units driving on the national territory, but in order to exclude them (- [NRd(n) + NRd(i)]). In the case of road transport, emissions of resident units on the territory could be related to fuel purchased abroad (Ra(n)), when they fill in their tanks abroad just before re-entering in their home country. This applies reciprocally for non-residents filling their tanks just before leaving the country (NRd(i)). When significant price differences exist between neighbouring countries, this is likely to result in unbalanced emissions between residents and non-residents both driving across the borderline.

A "first best" solution would consist in using statistics in physical units, when they are available, on propellant fuel purchased abroad by resident driving either for business or tourism. These data should preferably be detailed by type of fuel (petrol and diesel) enabling then to apply relevant emissions factors. It is worth mentioning that emission factors could also differ from country to country. Therefore, it would also be preferable using countries respective emissions factors, but, when data on purchases of propellant fuel abroad are available, they are unlikely to be split by country. However, since residents driving abroad mostly do this in neighbouring countries,

national factors could be used as a relevant approximation. As far as non-residents driving on the national territory are concerned, the same applies, i.e. it would also be preferable having physical data on their propellant fuel purchases.

A "second best" solution would be to use energy statistics in monetary units. The conversion in physical quantities is then made thanks to prices of fuel. At this stage, the application of emission factors is the same as above. However, differences in energy prices by type of purchasers is very common, preventing to use average prices by types of fuel. Since the largest purchaser are likely to pay lower prices than individual consumers, using retail trade prices would lead to underestimate total fuel consumption either by resident abroad or by non-residents on the territory.

When energy statistics are not sufficient enough, estimates have to be made using indirect indicators of transport activities by residents abroad versus non-residents on the territory, such as the number of visits abroad and the length of the trips. It is therefore necessary to find and use emission factors giving quantities of emissions per unit of distance (tonnes / km) by type of vehicle. This distances-based approach may overestimate or underestimate residents' emissions in the case differences in prices between neighbouring countries are such that it is either economical to buy fuel domestically or abroad – i.e. to leave with full tanks and come back with empty tanks or the other way round. The comparison made for instance in the Netherlands, showed that calculated fuel consumption based on distances travelled were lower than the amount reported in the Dutch energy statistics (Verduin, 1999).

When emissions of lorries are estimated from numbers of trips and distances travelled, that data need to be detailed enough to distinguish between types of vehicles. Fuels and related emissions are sufficiently different between e.g. heavy and light duty vehicles, diesel and petrol light duty vehicles to produce significant differences in emissions factors per distance unit. As regards the balance between residents and non-residents' vehicles going across the frontier either leaving with empty tanks and (re-)entering with full tanks or the other way round, tank capacities can have a significant impact.

Estimates for private cars should be less complex, if data on the number of residents driving abroad and non-residents driving on the territory are available, as well as data on the distances travelled (by residents abroad and by non-residents on the territory). Vehicles have nonetheless to be distinguished at least between those working with diesel and those using petroleum fuel that do not show the same emission factor.

The adjustment from national territory basis to the residence principle basis would necessitate to investigate the balance between cars hired by residents abroad and cars hired by foreigners on the territory. In this case it seems necessary to estimate the related emissions from the distances covered anyway. Since, emissions stemming from hired cars are to be attributed to the ordering economic agent, because it purchases the fuel and carries the transport itself, the result of the adjustment is likely to be entirely put under household transport emissions.

In the UNFCCC CRF, emissions related to military road transport activities (under 1A5b) have the same coverage as civil transport emissions[14]. However, like civil transport means, national military vehicles can be used abroad and foreign visiting troops can refuel on the national territory. Basic information is likely to be unavailable because of secrecy. However, if data are accessible, they should cover all kind of vehicles, whether they are used for transport or not, and the result is to be attributed the *public administration and defence…* (NACE 75).

2.3.2.2 Water transport

When following IPCC guidelines, emissions from shipping vessels engaged in international transport should be excluded. They are to be reported under a memory item in the UNFCCC CRF. However, since these international water transport emissions take both national (Rd(i)) and overseas vessels (NRd(i)) into account as

14 - In the IPCC guidelines (IPCC, 1996a, pp. 1.5-6), "*emissions from military fuel use*" are not reported under the transport item (1A3), but they grouped with "*All remaining emissions from non-specified fuel combustion*" (1A5). Under this item, '*Mobile sources*' (1A5b) covers emissions stemming from "*Vehicles and other machinery, marine and aviation*" that are "*not included in 1A4cii* [off-road vehicles and other machinery] *or elsewhere*". Therefore, consistently with the way (civil) transport emissions should be reported to the UNFCCC, military transport emissions should be related to military activities (movements) occurring on the national territory, undertaken either by national troops or visiting forces.

far as their purchase fuel on the territory, they do not cover the emissions of national vessels bunkering abroad (Ra(n) + Ra(i)) that should be included in NAMEA (likely NACE 61). They do not exactly correspond either to the amount of foreign vessels operating within the national waters (i.e. when shipping between domestic ports) that should be excluded from NAMEA. Therefore, if UNFCCC is the starting point, the adjustment relates to residents filling in their tanks on the territory but for international journey, residents purchasing fuel abroad - both for national (refuelling just before re-entering in national waters) and international trip – of which the related emissions are to be added (+ Rd(i) + [Ra(n) + Ra(i)]; and emissions of non-residents refuelling on the national territory and operating in national waters that are to be subtracted (- NRd(n)).

As for road transport, a “first best” solution would be to have the energy statistics needed in physical units. However, data on imports (residents purchasing abroad) and exports (non-residents refuelling on the national territory) of fuel by water transport industry are likely to be given in monetary unit only, but price difference is unlikely to be as significant as for road transport operators. It would nonetheless be necessary to pay attention on the difference between domestic and international prices. In the United Kingdom for instance, on the one hand, the *Department of trade and Industry* energy statistics gives the amount of total marine fuel purchased domestically - i.e. including fuel sold to non-residents - in physical units. On the other hand, emissions of British water transport producers abroad should be estimated using relevant exports energy data produced in monetary terms by the *Office for National Statistics*’ balance of payment division (Harris, 2002). Once the amount of fuel is estimated using e.g. average prices, relevant emission factors are applied, considering the type of engines concerned. Emissions factors may also be different between fuel purchased domestically or abroad.

Emissions stemming from foreign vessels, which purchase their fuel on national territory, should be excluded. This is the case whether they are fishing on national waters or not. Also, emissions of national vessels purchasing fuel abroad need to be included (under the NACE 05). When emissions abroad of fishing vessels registered under the national flag and emissions of foreign vessels in national waters are likely to be unbalanced, it is preferable to estimate both of them in order to add (or deduct) the difference as necessary.

Like for shipping vessels, the adjustment is preferably made with energy-based estimates when sufficient data on fuel use are available. In Norway, of which the fishing fleets are relatively significant, emissions of the fishing industry are adjusted using fuel sales statistics giving separately residents’ domestic purchases and purchases abroad (there are no estimates of foreign fishing vessels in Norway) (Hass, Sørensen, 2002b). However, when required energy data are not available, indirect indicators could be used like above for road transport or, at least, a combination of both energy data and indirect indicators for estimating the proportion of fuel potentially used by national and foreign vessels. It is the approach adopted by the United Kingdom (Harris, 2002). On the one hand, the proportion of the total fuel purchased domestically by the fishing industry attributed to foreign vessels is estimated proportionally to their contribution of the total catches landed in the UK. On the other hand, the use of fuel by British vessels overseas is also estimated proportionally to the catches they land abroad, assuming that they buy a proportionate amount of fuel in the countries of landing.

In the UNFCCC CRF, emissions relating to military shipping (1A5b) should have the same coverage as for civil shipping. However, national navy (included in NACE 75) can sail and refuel overseas, being then responsible for emissions abroad, whereas visiting forces are responsible for emissions that should be excluded as far as they stem from the combustion of fuel already counted for in energy data used for inventorying emissions such as those reported to the UNFCCC. As previously said in the case of road transport, needed information is unlikely to be available because of secrecy. However, if navy’s domestic fuel purchases are known, like in the British energy statistics, a rough estimate can be made assuming that its purchases abroad represent a proportionate amount of total marine fuel bought abroad (Harris, 2002).

2.3.2.3 Air transport

Like for water transport, international aviation (*international bunkers*) should not be included in UNFCCC totals. The related amount of emissions (Rd(i) + NRd(i)), which are to be reported in a memory item, does not correspond to the emissions of national aircraft bunkering abroad (Rd(i)) that should be covered by NAMEA (NACE 62). Also, emissions of foreign air transport companies operating domestic flights (NRd(n)) should be excluded for NAMEA. When the UNFCCC serves as a starting point, adjustment required for NAMEA is the same as for water transport.

Once again, it would be best bringing national territory-oriented air emission data to national accounts residents basis using energy-based estimates. As for water transport, the British domestic sales to non-residents air transport companies are identified as such in the data on fuel use published in physical terms by the *Department of trade and Industry*, but emissions of British air transport producers abroad are estimated starting from relevant exports energy data produced in monetary terms by the *Office for National Statistics*' balance of payment division. The assumption on the prices of aircraft's fuel abroad is based on information from the British aviation industry (Harris, 2002). In Norway, the basic energy data that are directly collected (survey) from the major air transport operator in the Norwegian market cover Norwegian fuel purchases abroad. Non-residents air companies' fuel purchases are deducted from the difference between total sales in Norway and purchases by residents units (Hass, Sørensen, 2002b). As for other water transport means, appropriate emission factors that are to be used then may be different when applied respectively to fuels purchased domestically or abroad, but may also depend upon the respective proportion of take-off/landing and cruising activities of domestic and international flights.

Like road and water transport, emissions relating to military aviation reported to the UNFCCC (1A5c) have a rather national territory-oriented coverage. In this case too, it therefore may be worth taking military activities (NACE 75) into consideration.

3. The EU NAMEA air emission accounts standard tables

Chapter 3 is dedicated to the set of tables prepared within Eurostat environmental accounting programme for collecting NAMEA data from all EU countries on an annual basis. So far, the environmental data collected focus on air emissions and related fuel consumption. As already said earlier in this guide, atmospheric pollution is at the moment the most far advanced area in the compilation of environmental accounts for NAMEA.

The first section gives a general presentation of the revised set of *NAMEA for air emissions standard tables* (3.1). Afterwards, the second section provides NAMEA compilers with elements on how the standard tables should be filled in (3.2). These elements are complementary to the notes accompanying the tables (Eurostat, 2002b). They are presented in a way that highlights the close connection between the tables on economic and emission data. And details given on the new tables (transport emissions and *bridge table*) are also useful to understand the impact of national accounts principles on the data reported in the tables dealt with earlier in the section.

3.1. Eurostat NAMEA-air standard tables

The first set of NAMEA standard tables was adopted by the countries in 2000 and sent out to them for collecting all data available then – i.e. including the time series. The tables were revised in 2002 in order to improve the comparability of data across countries and with air emission inventories used for international reporting. For this purpose, a table bridging total air emissions in NAMEA and total reported to the UNFCCC, as well as table isolating transport emissions were introduced (see below sections 3.2.3 and 3.2.4, respectively). The sending of the revised tables in early June 2002 initiated Eurostat's collection of NAMEA data on a annual basis. A table for data on energy use will be added to the set of standard tables from 2003 onwards (section 3.2.5).

The 2002 version of the set of NAMEA for air emissions standard tables is composed of 6 tables (annex 5) – 7 tables when including the energy table tested in 2003 (annex 7) – plus accompanying information, either general or technical, presented on 5 additional sheets in the electronic version (Excel format)[15]. The introduction (*Intro*) presents the tables of contents and gives some practical information. An overview of tables (*Set of tables*, see also figure 3.1.A below) is given on the second electronic sheet in order to show the structure of the NAMEA-air standards tables and to highlight the connection between the tables (see below). The third and fourth sheets respectively remind the reader with the economic classification adopted for NAMEA-air (*NACE-NAMEA*) and recapitulate the variables included (*Variables*) in the standard tables. The fifth sheet contains a large number of notes provided in order to guide NAMEA experts in filling in the tables (*Notes*).

In the electronic version, each of the tables is placed on a single sheet that is entitled in a way that combines the numbering of the tables (e.g. 1a, 1b, etc.) already used in the previous version of the standard tables (Eurostat, 2000a, 2000b) with elements giving information on the content (e.g. NACEeco, NACEemis), NACE referring to the classification used for data on industries, *eco* to economic data and *emis* to air emissions, as well as *H* meaning households (*Heco* and *Hemiss*). The table on emissions from transport activities (*1bt-NACEtransp*) is new and the *bridge table* is Revised Version of the former table 3.

15 - In the electronic version of the tables, links between sheets are implemented, so that they enable to go directly to the corresponding table or note by clicking on the blue coloured text. This is especially made to ease the connection between the tables and the notes on how to fill in them. The reader can therefore go directly to the text of the note (and go back to the table) by clicking on its reference in blue on the table.

eurostat

Figure 3.1.A – Overview of the NAMEA-air standard tables

Table 1a - Economic data by industry

Industries	*Current prices* Output - VA - IC	Employ.	*Constant prices* Output - VA - IC
NACE based industry classification	Excel sheet: **1a-NACEeco**		

Table 1b - Emissions by industry

Industries	Emissions to air by pollutants
NACE based industry classification	Excel sheet: **1b-NACEemis**

Table 1bt - Transport emissions by industries and households

Industries	Emissions to air by pollutants
NACE based industry classification	Excel sheet: **1bt-NACEtransp**
Households	

Table 1be - Energy use by industries and households

Industries	Energy consumption by energy products
NACE based industry classification	Excel sheet: **1be-NACEenergy**
Households	

Table 2a - Household consumption expenditure

Households	*Current prices* Final consumption expenditure	*Constant prices*
Transport Heating	Excel sheet: **2a-Heco**	

Table 2b - Household emissions

Households	Emissions to air by pollutants
Transport Heating	Excel sheet: **2b-Hemis**

Table 3 - Bridge table NAMEA - UNFCCC/CLRTAP

	Emissions to air by pollutants
UNFCCC total Biomass adjustment Residence principle adjust. NAMEA total	Excel sheet: **3-bridgetable**

In Eurostat NAMEA-air standard tables, economic data are not presented according a matrix format (see section 3.2.1.2). Therefore they do not actually correspond to the shape of the NAMEA shown earlier on figure 1.1.A. however, the different tables are closely linked to each other, as if they formed a unique table. Figure 3.1.A gives an overview of the *set of tables* formed by the six detailed tables (the names of the corresponding Excel sheets are indicated). This presentation enables the reader to bear in mind the close relationship between economic and emission data through the common industry and final consumption classification in which both kind of data have to be broken down. This presentation also shows the additional table on transport emissions and the table bridging totals in air emission inventories prepared for international reporting and totals in air emission accounts for NAMEA.

3.2. Guidance on how to fill in the tables

As mentioned in the previous section, notes on how to fill in the tables are directly included in the electronic version of the set of standard tables. This section repeats the notes. There are of course some overlaps, but the section is rather complementary to the notes, presenting the main principles and, especially for the table on transport emissions and the *bridge table*, the objectives.

Although economic and emission data are presented in separate tables (see annex 5), the unity of the framework is essentially based on the classification (by industries and by household consumption categories) and the concepts of national accounts applied for NAMEA (see also section 1.2.). Emission data on industries are to be reported consistently to their corresponding economic data – i.e. according to the same level of detail and both applying national accounts principles (3.2.1), as if they were in a unique table. The same applies for household consumption and related emissions (3.2.2). Economic variables are not of the same kind for industries and households, but both emission data of industries and households cover the same pollutants.

Two additional tables that are not part of the original NAMEA framework have been included. However, in the table showing separately emissions of transport activity (3.2.3), data are to be reported consistently with the above-mentioned economic and total emissions data. They are also broken down into the same classification. The *Bridge table* is aimed to show what the components that make up the discrepancies between totals in NAMEA and air emission totals reported under international frameworks on climate change and transboundary pollution are (3.2.4).

Also, a table dedicated to data on energy use has been prepared to be included in the NAMEA air emissions standard tables. This table focuses on the consumption of fuel of which the combustion causes air emissions. However, additional energy data are also required in order to put the above-mentioned fuel consumption into the perspective of the total energy use industry by industry and by household consumption purpose (3.2.5).

3.2.1 Industries economic and emission data (tables 1a and 1b)

Economic and emission data on industries are presented in separate tables, but both tables are based on the same NACE-based industry classification, adapted to air emission issue and to be as flexible as possible (3.2.1.1). The way emission data are to be reported is in fact already dealt with in detail elsewhere in the guide through (above in section 1.2 and chapter 2, as well as, in sections 3.2.3 and 3.2.4 below). Therefore, the second sub-section here focuses on economic data reported in NAMEA-air standard tables in the perspective of the national accounts data transmitted to Eurostat (3.2.1.2).

3.2.1.1 The same industry classification for both tables

The classification adopted for NAMEA-air that is mostly based on the 2-digit level of NACE Rev. 1. takes special environmental aspects into consideration with more details for some of the manufacturing industries, as well as for the energy and transport branches (three-digit level). Less detail is requested when it comes to service industries (see section 1.2.1 and annex 2).

In order to be as flexible as possible, additional interim aggregations of industries have been *nested* in the proposed classification. These extra interim aggregations of industries are underlined (annex 5, e.g. 01-05, 12-14 etc.). Aggregations that are not underlined are part of the above-mentioned standard industry classification

proposed for NAMEA on air emissions. Also, some voluntary extra selective breakdowns were added (in 23, 24, 26, 27 and 75) following discussions at the 4th NAMEA Workshop the 20-21 June 2000.

As it is explained in the chapter 1, NAMEA is an integrated framework that combines data on economic activities by branches and corresponding environmental data, in this case air emission data. Therefore, both table 1a (economic) and table 1b (emissions) have the same industry classification and economic and emission data are to be filled in according to the same level of detail, as is if the two tables formed a unique table.

3.2.1.2 Economic data consistent with the ESA 1995

In NAMEA, economic data of the NAM (*national accounting matrix*) are mostly based on the input-output framework (input-output table or combined supply-use table) available in the reporting country (see chapter 1). However, such tables are not necessarily available in each of the EU countries or not produced on an annual basis. Therefore, in the NAMEA-air standard tables, economic data on industries are not to be reported according to a matrix format. As far as monetary data on producers are concerned, only output, value added and total intermediate consumption is requested industry by industry. Some employment data are also taken into consideration. Monetary data are to be reported both in current and constant prices, which are essential for investigating changes over time (the same applies for household consumption, see section 3.2.2 below).

Economic data requested in the NAMEA-air standard tables are consistent with the *European System of* (national*) Accounts - ESA 1995* (Eurostat, 1996). It is an internationally compatible accounting framework for a systematic and detailed description of a total economy, which is fully consistent with the revised world-wide guidelines on national accounting, the *System of National Accounts* (UN, 1993). The ESA 1995 is being implemented in all Member States. However, the national accounts data transmitted to Eurostat do not automatically correspond with NAMEA standard tables' format.

According to the ESA 1995 Transmission Programme of Data - TPD ESA 1995 (Eurostat, 1997) - a range of national accounts data are or will be transmitted to Eurostat from the Member States. The TPD ESA 1995 started in the beginning of 1999 with the transmission of the main aggregates of the national accounts and the range of data will continue to be extended until 2003 where all the data the Member States are required to transmit will be transmitted on a yearly or five-yearly basis[16].

Within this programme, tables by industry showing e.g. output, value added and employment figures had to be transmitted to Eurostat in 2000. The industry classification used is with a breakdown of 31 industries (A31, NACE rev. 1 by sections). Yearly supply and use tables and five-yearly symmetric input-output tables, using a classification with a breakdown of 60 industries, are to be reported from 2002 onwards.

Using the aggregation with a breakdown on 31 industries means that approximately 35 industries will be more aggregated than the 52 NACE 2-digit industries (or group of industries) targeted for NAMEA and used in the standard tables. When the A60 aggregation (which is basically the 2-digit NACE rev. 1) is used, it is almost compatible with the proposed classification for NAMEA. A60 is even more detailed for the service industries. However, the subdivisions of NACE 26, 27, 40, 60, 61 are not included in A60 as in the proposal for NAMEA (also subdivisions under NACE 23, 24 and 75 in the standard tables).

In the TPD ESA 1995, *Annual tables by industry*[17] will have the A31 classification. These tables have to be transmitted annually to Eurostat from 2000. Among other things, current prices data cover output (in basic prices) and intermediate consumption (at purchaser' prices). Only value added is reported both in current and constant prices (in basic prices). Hours worked are also reported at 31-industry level (until 2003 on a voluntary basis).

From 2002 the TPD ESA 1995 requires the Member States to report both Supply and Use tables[18], using A60. The economic data of industries requested in NAMEA-air standard tables (Table 2a) are covered by table 15 and 16 in TPD ESA 1995. These tables will be annual and in both current and constant prices. It is then possible

16 - A transition period will run up to January 2005, where *derogations* from the base programme have been given to certain Member States concerning the detail and forms of transmission of certain data.
17 - Table 3 in the TPD ESA 1995 (Eurostat, 1997).
18 - Tables 15 and 16 in the TPD ESA 1995 (Eurostat, 1997).

to foresee developing a NAMEA, whose national accounting matrix would be based on the combined supply-use table of the ESA 1995.

Symmetric Input-Output tables, which are the most appropriate for analytical purposes, will be reported to Eurostat[19] too in current and constant prices. They are based on the classification of 60 products (P60) according to Classification of Products by Activities (CPA) in the European communities. However they will be reported every five years starting in 2002 with the year 1995, and in 2003 with 2000 Input-Output table.

3.2.2 Households economic and emission data (tables 2a and 2b)

In environmental accounts for NAMEA, data are partly broken down across industries, but they are also partly attributed to households. Environmental data on households are to be accounted for in a way that indicates when household consumption is *directly* responsible for environmental pressures, avoiding double counting with data on industries. Therefore, when households carry out themselves polluting activities, e.g. implying fuel consumption, as far as air pollution is concerned, the corresponding environmental and economic data are to be reported under the relevant household consumption category.

Air emissions produced by households themselves can be divided into emissions from *Transport*, *Heating* and *Other* purposes. Transport emissions are allocated to households only when they use their private cars and motorbikes; emissions caused by public transport are attributed to the relevant transport industry. Heating emissions are allocated to households when they use fuels themselves. Emissions from the production of electricity purchased by households are not allocated to households but to electricity producers.

Classifications in tables 2a and 2b are apparently different, but in both tables data are basically split between *transport*, *heating* (plus cooking) and *other* households consumption purposes. In table 2a, additional sub-categories were included in order to insure the consistency between household expenditure and household emissions – i.e. to avoid that any non-fuel related transport or heating expenditure is reported under the category *other*. Such details also put the transport and heating fuel consumption, which are responsible of the bulk of household emissions, into perspective (e.g. consumption of fuel for personal equipment compared to transport services, consumption of gas and other fuel used for domestic purposes and electricity consumption). In table 2a, the classification is based on the *Classification Of Individual COnsumption Purposes* (COICOP) (UN, 2000), of which an aggregated form is used within the above-mentioned TPD ESA 1995 (Eurostat, 1997).

In table 2a, expenditure data should be consistent with the emission data (tables 2b). The definition of *transport fuels* (item 07.2.2- *Fuels and lubricants for personal transport equipment*) includes also the fuels used for boats, leisure aircraft, camper vans, lawn mowers and other major tools such as chainsaws, pumps or cutters. Therefore, the category *transport* (emissions) in table 2b should include all emissions from transport fuels. This introduces a (usually relatively small) inconsistency with the table on transport emissions where only emissions related to transport are to be recorded (tables 1bt, see above in section 3.2.3). For some pollutants the share of emissions from boats or lawn mowers may be higher than the corresponding share in the fuels used. Depending on the way the air emission data are estimated it may be difficult to separate these non-transport emissions. However, an optional extra row *of which leisure-gardening equipment* has been added in order to make the link to the transport table explicit. It is also in itself useful to isolate household emissions stemming from the combustion of propellant fuel that are not used for transport. In table 2b, heating category includes also emissions related to cooking. Fuel consumption respectively related to heating and cooking could not be separated to each other in the COICOP (table 2a).

Several of the pollutants are not relevant for households. This includes SF_6 and all heavy metals except lead (Pb). In the electronic version, all cells corresponding to these pollutants are shaded in order to show that no data are to be reported there (annex 5). Cells for HFCs, PFCs, CFCs and HCFCs are also shaded except for the category *others*, in the case some countries have estimates of such emissions by households.

19 - Tables 17 to 19 in the TPD ESA 1995 (Eurostat, 1997).

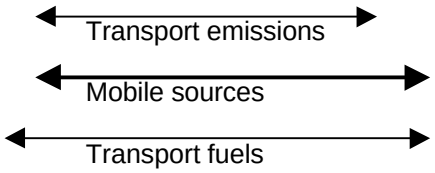
3.2.3 Isolation of emissions from transport activities (table 1bt)

In NAMEA, emissions are allocated to economic activities as defined in national accounts. The emissions from transport are allocated to the industries that undertake the transport activities and to households, when households use their own motorised vehicles. Emissions from own account transport are allocated to industries other than the *Transport* industries (NACE 60-63). The NAMEA air standard tables do not show a total for transport emissions. Air emission inventories such as those based on the CORINAIR methodology provide data on the total emissions from a functional *transport sector*. As a large part of pollutants to air comes from transport activities, it is relevant to isolate transport emissions of all industries in the NAMEA set of standard tables, as in Table 1bt (see annex 5).

3.2.3.1 A definition of transport for NAMEA

In line with the way transport is seen by transport statisticians, one definition of transport for NAMEA could be that it includes all movements of passengers and goods on land, on water, and in the air, using either motorised engines or not. For air emissions only motorised transport is relevant. When using motorised vehicles, transport implies the use of infrastructures accessible to the public such as roads, railways, pipelines, inland waterways, seaports and airports. This includes movements of empty vehicles for repositioning but excludes movements of passengers and goods within private property and installations.

Key data sources for compiling NAMEA transport emissions may include national air emission inventories, transport statistics, vehicle registers and energy statistics or a combination of these sources. The various data sources may cover slightly different fields. Basic data could come from mobile sources other than cars, buses, vans and trucks. Examples would include tractor use in agriculture and forestry, or machinery used in the construction industry. Such mobile equipment items are likely to be mostly used for purposes other than transport (ploughing, digging or lifting…). Therefore it might be very difficult to distinguish between transport use and non-transport use of mobile sources, especially when calculations are based on fuel consumption[20]. In the same way, movements of passengers and goods within private property and installations will be difficult to separate, when energy statistics or fuel consumption data are used. On the other hand, fuels used as propellant for vehicles (gasoline, diesel, LPG, jet fuel) may also be used for stationary sources (e.g. for emergency power generators or pumps). The figure below illustrates this.



The concept of *transport* adopted for NAMEA excludes mobile sources used for other purposes than transport. Emissions from mobile sources that are not transport mainly concern agriculture (off-road use of tractors), forestry (harvesting machines), fisheries (fishing vessels), mining and quarrying (equipment for extraction), construction (bulldozers, etc.) and defence (tanks, warships, etc.)

3.2.3.2 Transport emissions in NAMEA

According to the NAMEA principles, emissions from transport have to be allocated to economic agents that carry out the activities that cause emissions. Consequently, transport emissions are partly allocated to the industries whose principal activity is transport (NACE 60-62 - via railways, on roads, via pipelines, on sea and inland waterways, and in the air). Emissions related to the movements of empty vehicles for repositioning have to be included.

Another part of the air emission from transport production is allocated to other industries, when they carry out transport activities. This part includes, firstly, emissions from transport as a secondary activity - when transport services are produced and sold by industries whose principal activity is not transport. Secondly, this includes

20 - The 1996 IPCC guidelines request separation of emissions from agricultural traction vehicles into ‘on highways’ and ‘off-road’. For agriculture, also stationary use of fuels is to be separated. Military fuel use is also to be separated (IPCC, 1996a, pp. 1.5-6).

also emissions from transport as an ancillary activity - when transport is produced by industries for their own use - *own account transport* - in order to support their principal and secondary activities. It should be added that transport industries could perform own account transport too.

When transport equipment is rented out, emissions are allocated to the industry of the ordering company (or households) and not to the NACE 70-75 (NACE 71.1-2 - *Renting automobile and other transport equipment*). Renting companies have not got their value added from transport production, and the users of the transport equipment will buy and use the fuels themselves.

Additionally, in NAMEA, environmental data must be connected with the national economic activity. Hence, emissions of residents abroad should be included in the appropriate industry, according to national accounts definitions and practices. This is most important for NACE 61 - *Water transport* and NACE 62 - *Air transport* but also applies to emissions from road transport abroad, including trucking and transport by households in connection with e.g. tourism. Emissions of non-resident units on the national economic territory in connection with international flying, trucking, inland water transporting and foreign tourists must be excluded (see in section 3.2.4).

3.2.3.3 A table isolating transport emissions in NAMEA

The industry classification used is the same as in tables 1b, but only data on seven of the emission types included in the NAMEA *standard tables* are to be isolated: CO_2, NO_x, SO_2, NMVOC, CO, particulate matter, and Pb emissions are significantly related with transport activities. As mentioned earlier in the text it might be a rather complex task to separately identify emissions from mobile sources that are not used for transport. However, they should as far as possible be excluded from the data reported in table 1bt. Otherwise it should be clearly mentioned in countries' notes what is actually included. Transport emissions from households are to be reported at the bottom of the table. Since emissions reported here are only related to transport activities, they may therefore differ from data reported in table 2b under the category '*transport*, which in table 2b includes all emissions related to the use of propellant fuels - i.e. including some emissions from leisure and gardening equipment. However, in the transport table, households' emissions cover emissions stemming from the use of all types of transport equipment, i.e. including other equipment than road transport vehicles such as snow scooters and small boats when they are used for transport purpose.

In table 1bt, when homogeneous branches are used instead of industries, branches other than transport will only include emissions from transport as ancillary activity (*own account transport*). All transport activities executed either as principal or secondary will be recorded under the homogeneous branch *Transport*. When industries are used, industries other than transport will include emissions from transport as ancillary activity as well as secondary activity.

Emissions of the transport industry (NACE 60 to 62) are mostly related to actual transport activities, but they will also include some other emissions – e.g. related to heating and cooling of buildings or mobile equipment used for purposes other than transport. Those non-transport emissions should be excluded.

3.2.4 Bridging air emission totals in NAMEA and for international reporting (table 3)

National air emission inventories and international reporting formats differ to some extent. These emission inventories and formats also differ from the national account concepts as applied in NAMEA-type emission accounts. The consequence is that for a country several official figures for the total emissions of key air pollutants may co-exist. The differences among these figures are often perfectly justified as each of the figures responds to a specific objective. However, for users of the data the differences may be confusing.

3.2.4.1 Difference in coverage between NAMEA and international air emission reporting

Key conventions on air pollution include the CLRTAP (Convention on Long-Range Transboundary Air Pollution) with reporting to UNECE/EMEP and the UNFCCC (United Nations Framework Convention on Climate Change), with reporting based on the UNFCCC CRF (Common Reporting Format). This submission is used within the Kyoto protocol on greenhouse gases mitigation. UNFCCC requires the Parties to apply the *IPCC*

(Intergovernmental Panel on Climate Change) *Revised 1996 guidelines for national greenhouse gas inventories* (IPCC, 1996a; UNFCCC, 2000). The reporting formats for the UNFCCC and CLRTAP differed in the past but are now fully harmonised.

NAMEA-type air emission totals differ from emission totals as reported to UNFCCC and they *should differ* because of the definitions used by national accounts. National accounts include *only economic activities* and further only *national economic activities* whereas air emission inventories basically present emissions from all sources on the national territory

Since the NAMEA framework encompasses only emissions that can be traced to economic activities, emissions from non-economic agents (e.g. nature) are not to be included. Furthermore, nature's absorption of substances is not taken into account in NAMEA emission accounts. For instance, sequestration of carbon in biomass should not be deducted from CO_2 emissions in NAMEA whereas also emissions from nature and the removal of CO_2 are to be reported under UNFCCC.

In NAMEA, emissions covered must be those stemming from *national economic activities* (i.e. those generated by resident units) rather than from sources on the *national territory*. Emissions by resident units abroad, including tourists and transport activities, should be fully included in the accounts under the industry earning the value added from these activities or under households. Conversely, all emissions by non-resident entities (foreign lorries and tourists) within the national boundary should be excluded.

Coverage between NAMEA and the UNFCCC format differs mainly with respect to carbon dioxide emissions and due to international transport, in the following respects:

- § CO_2 emissions from bio-fuels in UNFCCC are not the actual emissions but the (positive or negative) net balance of new timber growth and timber harvest. UNFCCC totals also include the (positive or negative) net effect of land-use changes and carbon storage in soil.

- § CO_2 emissions from waste incineration: the organic component of the waste incinerated is not counted in CO_2 emissions for UNFCCC. For plastics in waste incinerated, countries have a choice to either include emissions already upstream based on the refinery feedstock or to not account for these 'non-energy' uses but to include emissions from incineration downstream. The same applies to CO_2 emissions from the decomposition of waste in landfills.

- § Treatment of emissions from international transport differs in several respects. International transport activities lead to emissions by non-residents on the national territory and emissions by residents abroad. The emissions by residents abroad can represent a significant proportion of the NAMEA totals. In the case of CO_2 for example, results range from around 8% to more than 22%, but proportions are even significantly higher for SO_2 and NO_x that are strongly related with transport activities, especially water transport for the first of these two gases (see table 2.3.B earlier in sub-section 2.3.2).

Annex 6 gives an overview of which kind of transport emissions are included or not in the NAMEA and UNFCCC totals. Also, we can see what the *residence principle* means for NAMEA: all emissions from transport activities carried out by residents, wherever they are, should be included. On the other hand, all emissions of non-residents are to be excluded.

For the UNFCCC total, emissions from all international water transport as well as air transport are excluded, even when carried out by national companies. Only emissions from 'national' air and water transport should be included, even when carried out by non-resident companies. The IPCC guidelines used for the UNFCCC do not say anything about the nationality of the road vehicle owners that are to be taken into consideration. Road transport emissions, when based on fuel sales, should be expected to include emissions of non-residents on the territory and exclude residents' emissions abroad. Emissions from international bunker fuels are reported separately as a *memo item* to the UNFCCC. However, these data are based on fuel sales and thus satisfy neither residence nor territory principle.

There should in principle be no difference between UNFCCC and NAMEA totals as far as fishing is concerned. Emissions of fishing vessels are to be reported to the UNFCCC in the *Other sectors* category (1A4iii) and are

allocated to the fishing industry in NAMEA. The IPCC guidelines state that all emissions *from domestic inland, coastal and deep-sea fishing* should be included (IPCC, 1996a)[21].

3.2.4.2 The bridge table

Differences are especially expected for the emissions reported under the UNFCCC. The UNFCCC Common Reporting Format (CRF) covers the 6 greenhouse gases (CO_2, N_2O, CH_4, HFCs, PFCs and SF_6) plus 4 indirect greenhouse gases (NO_x, CO, NMVOC, SO_2). For HFCs, PFCs and SF_6 no differences are expected in relation to the territory versus residence principle, but only in relation to actual emissions (Tier 2 approach) versus potential emissions (Tier 1 approach)[22]. These differences are to be included under *Other adjustments* at the bottom of the table. In table 3 (see in annex 5), the full set of pollutants shown in the tables 1b (industries) and 2b (households) is included here, but pollutants for which the UNFCCC/CLRTAP and the NAMEA totals are unlikely to differ are shaded (grey shaded cells do not need to be filled in).

Table 3 is inspired by the table bridging the different emission totals published in the Netherlands (table 3.2.A below). For CO_2 emissions, the total fulfilling IPCC guidelines adds up emission data that are reported under the UNFCCC. The Research institute for Health and the Environment (RIVM) publishes the IPCC total corrected for changes in annual average temperature, providing users with consistent times series for investigating annual changes of emission trends. The Dutch statistical office (CBS) produces NAMEA data, but highlighting the significant contribution of national residents abroad. The same applies for the other greenhouse gases, except CO_2 specific items (i.e. *carbon cycle* and *potential CO_2*). As regards the other air pollutants, it is also relevant for some of them to show the difference between emissions within the national territory and emissions by national residents (Eurostat, 2001b).

Table 3.2.A – Different carbon dioxide emission totals in the Netherlands

		1995	1996	1997	1998
1	**Total, IPCC (Kyoto protocol)**	**177**	**185**	**183**	**183**
2	Temperature correction	3	-5	3	3
3	**Total – Annual environment report (RIVM)**	**180**	**180**	**186**	**186**
1	**Total, IPCC (Kyoto protocol)**	**177**	**185**	**183**	**183**
4	Emissions related to short term carbon cycles (wood burning)	4	5	4	4
5	Statistical discrepancies in the ESN energy balance	-2	-3	-6	-4
6	Potential CO_2 from the combustion of plastics	-3	-3	-2	-3
7	**Total actual emissions in the Netherlands (CBS)**	**177**	**184**	**179**	**181**
8	Residents in the rest of the world	23	23	25	26
9	Non-residents in the Netherlands	-4	-3	-4	-3
10	**Total emissions by residents, NAMEA (CBS)**	**196**	**204**	**201**	**203**

Source: Statistics Netherlands in UN, 2001, Table 4.6, Million tonnes (Figures may not add due to rounding).

21 - However, it is not quite clear how this is implemented in practice. National emission inventories may base their estimates on fuel sales (including foreigners bunkering in filling stations located on the territory) rather than the fuel consumption of 'domestic' vessels.

22 - According to the IPCC guidelines (IPCC, 1996b), "*Potential emission calculations* [tier 1 approach] *are regarded as the basic methodology for HFC and PFC emission estimates, which any country should apply. However, if relevant information is available, it is recommended that emissions are reported according to the Tier 2 methodology* [actual emissions]…" (p. 2.47). "*Potential emissions* [tier 1] *of a certain chemical are equal to the amount of virgin chemical consumed in the country minus the amount of chemical recovered for destruction or export in the year of consideration.* […] *However, the method does not take into account accumulation or possible release of chemical in various products and equipment* […]*. Since accumulation is thought to be the dominant process at the present time, potential emission calculations will strongly overestimate emissions* […] *Actual emissions estimates* [tier 1] *take into account the time lag between consumption and emission, which may be considerable in some application areas, e.g. closed cells foams, refrigeration and fire extinguishing equipment. The time lag results from the fact that a chemical is placed in new products and then slowly leaks out over time.* […] *The amount of chemical escaping to the atmosphere in a given year will only be similar to the quantity consumed in a static situation with respect to chemical usage pattern, market development, system or product design and tightness, servicing and recovery practices, etc.*" (p. 2.46)

In the NAMEA-air standard tables, the *bridge table* (table 3) starts also with the totals by emission types reported to UNFCCC following the IPCC guidelines[23]. The first transformation towards NAMEA totals concerns CO_2 emissions from biomass and CO_2 sequestration. The transformation continues with adjustments that are related to transport emissions (residence versus territory). At the bottom of the table, there are two additional rows for (usually small) adjustments connected to non-fuel-related emissions as well as statistical discrepancies.

In NAMEA, *actual* air emissions are taken into account – i.e. including CO_2 emissions from biomass used as fuel and ignoring carbon sequestration. Therefore, CO_2 emissions from biomass (which should be reported separately to UNFCCC) are firstly to be added to the UNFCCC total CO_2 emissions. In the next step, the net CO_2 take-up by biomass (the difference between CO_2 removal and CO_2 emissions from biomass) and the effect of land use changes are to be cancelled – i.e. the net CO_2 removal estimate is to be added to the UNFCCC CO_2 total emissions. This item may be positive or negative, depending on the size of CO_2 take-up by biomass compared to CO_2 emissions from biomass and the effect of land-use changes[24].

As noted above (see also annex 6), emission inventories that are to be reported to the UNFCCC are basically national territory-oriented data - i.e. they take most air emission sources located on the national territory into account and exclude all emissions occurring outside this territory. In table 3, transport activities (on land, water and in the air) are successively taken into consideration.

§ For land transport the emissions of non-residents – e.g. foreign tourists and lorries driving in the country – are deducted and the emissions of residents driving abroad, including for tourism are added.

§ For water and air transport, the emissions stemming from residents' activities abroad are added and the emissions of non-residents subtracted.

Differences can also arise from non-fuel related emissions, such as estimate of emissions stemming from the future incineration (or decomposition in waste dumps) of plastics, as in the Dutch bridge table (UN, 2003). The last row before the NAMEA total relates to statistical discrepancies in the data sources - e.g. between energy statistics and energy accounts or between energy balances and international trade statistics on fuels, etc.

3.2.5 Data on energy use in NAMEA (table 1be)

As seen earlier in chapter 2, the combustion of fuel is an important source of air emissions (table 2.1.A). Therefore, data on energy consumption are extensively used for the compilation of NAMEA type air accounts, either combining energy accounts by industry with relevant emission factors or apportioning inventory-based air emission data thanks to energy statistics.

In October 2002, EU countries agreed upon a table on energy use that will be included in the NAMEA-air standard tables from 2003 onwards. This additional table covers the demand side of energy. Moreover, it focuses on energy use, of both industries and households, that cause polluting emissions to air – i.e. only energy combusted, of which emissions are stemming, are counted for. Energy products transformed in another form of energy or used as raw material are not taken into consideration.

The production side is introduced only when the table comes to electricity. However, emission-free electricity production as well as the net consumption (electricity purchased minus electricity sold) are taken into account in order to calculate total energy consumption by industry and household category. This aimed to put the energy combusted, which causes air emissions, into perspective.

23 - As concerns greenhouse gases, the *Total UNFCCC or CLRTAP* in table 3 is to be taken from '*Total Emissions/Removals with LUCF*' in the table 10s1 of the UNFCCC CRF. As concerns pollutants reported under the CLRTAP, it is to be taken from the '*National total*' at the bottom of table IV 1A.

24 - As concerns the item *CO_2 net removal accounted for in UNFCCC total* in table 3, the corresponding data is to be taken from '*Land-Use Change and Forestry*' in the UNFCCC CRF (item 5 in table 10s1). The same obligation does not hold for *CO_2 from biomass* in table 3, i.e. this item does not necessarily correspond to the '*CO_2 from biomass*' reported in the UNFCCC CRF (*memo item*).

3.2.5.1 Why energy accounts in NAMEA for air emission standard tables?

Setting energy accounts, or at least an energy use table, alongside the air emission accounts in NAMEA is useful to show the connection of air emissions with energy use. It is also very useful to expand the scope for NAMEA-based analysis.

The energy use table enables NAMEA users to investigate in detail the connection between air emissions and energy use, industry by industry and by household consumption purpose. The compilation of such energy table should even precede the preparation of the air emission accounts. It is in fact the case when the latter are based on energy accounts. When emission accounts result from the arrangement of inventories like CORINAIR, such energy use table can also be very useful to apportion some of the processes' emission data into several economic categories[25]. Energy accounts also allow expanding the number of variables available in NAMEA by adding the use of individual energy products as well as total energy use for each industry, for households and for the whole economy.

Energy accounts are also relevant for the development of NAMEA-based decomposition analysis of emission trends (section 4.2.3 below). Among EU countries that are the most advanced in the use of NAMEA-air, many are currently developing such kind of analysis. Decomposition analysis aims at quantifying the factors that drive the changes in emissions over time and energy data are important for this purpose. Energy mix (proportion of different fuels) and energy intensity are usually among the key factors that explain changes in emissions over time. It is possible to use a simplified method for decomposition analysis that does not require input-output tables but that can be implemented with data from the NAMEA-air standard tables, when energy data are included.

3.2.5.2 Presentation of the energy table

The table (1be) on energy use by industries and households (annex 7) is designed similarly to tables 1b and 2b (air emissions of industries and households). The same economic classification as adopted for NAMEA-air is used. Households have been moved underneath the industries, like in the table on emissions from transport activities (1bt), but showing the same breakdown into transport, heating and other as the table 2b.

The main purpose of table 1be is for reporting data on energy use in a way that is consistent with the corresponding air emissions. Therefore, the focus of the table is on fuels combusted to produce heat or power (and consequently air emissions). This means that, except for electricity production, the inputs of energy products that are transformed from one form of fuel into another (e.g. crude oil for refining into petroleum products, coal for conversion into coke and coke gas, etc.) are not recorded. For industries where such transformation takes place, only the combustion of fuels for the transformation processes is recorded. Combustible fuels that are not used for energy purposes but as raw materials, such as petroleum products in the chemical and plastics industries or wood e.g. for construction, are also not recorded (see the illustration in the next sub-section).

Although table 1be is focusing on energy use by industries and households some elements of the energy supply side are to be taken into consideration in if we want to cover the total consumption of energy, and then put energy combustion that causes air emissions into perspective. Therefore, in addition to the consumption of fuels combusted, *primary* electricity, i.e. emission free electricity from sources other than combustion of fuels such as hydro, nuclear, wind, etc. (the same applies for steam, hot water and heat from geothermal, nuclear source or solar panels) as well as *sold and purchased* electricity, heat and hot water are included in order to get for each industry and for households the total energy consumed.

Therefore, energy accounts for NAMEA are not the same as the traditional use tables of energy products in monetary units available in national accounts that record the total purchases of energy products (including those for transformation purposes or for use as raw material). The energy accounts are not identical to energy statistics either. Energy statistics is a comprehensive system describing the supply, transformation and use of fuels and other energy products. The NAMEA energy table uses energy categories and definitions that are compatible to the headings in energy statistics published by Eurostat (2002a) but the data collected are a sub-

25 - Both aspects are respectively dealt with in section 2.1 and 2.2 (sub-section 2.2.1.2) of chapter 2.

set of energy statistics, focusing primarily on the energy actually consumed (fuels combusted and electricity and heat finally consumed).

The structure of table 1be enables adding up all energy uses industry by industry or by category of final consumption (households) to show total energy consumption per category and also for the total economy. No double counting appears across the different items of fuels used for combustion and the additional categories for electricity and heat and hot water, because[26]:

§ Fuels (e.g. coal and crude oil) used to produce another form of energy product (such as coke or petroleum products) are not recorded. Only the consumption of the corresponding energy products (e.g. coke and petroleum products) is taken into account by user category. An exception is electricity and heat: fuels used (causing air emissions) to produce electricity and heat are included in the table, while the resulting electricity and heat are not (only the net uses of electricity are taken into account, see below).

§ The set-up of the table makes sure that electricity and heat produced on own account (i.e., for own consumption) from the combustion of fuels is excluded as the fuels combusted to generate this electricity or heat are already taken into account in the table.

§ Only the net uses of electricity are taken into account by user category. This is done by adding *primary* electricity (i.e., hydro, wind, solar or nuclear) produced and the electricity purchased, and deducting electricity sold for each category of users. The same principle is applied to heat (heat sold is deducted and heat purchased is added to the energy use of each user category).

The possibility for adding up and comparing the contributions that make up total energy use by industry or grand total energy use by energy product is a reason why the data should be reported in a common energy unit rather than in specific mass or volume units. Terajoules are used in table 1be.

3.2.5.3 Illustration of the difference between energy statistics and energy use data for NAMEA-air

The German energy data shown in table 3.2.B (a, b and c) below offer the opportunity to see to what extent energy use data required for NAMEA-air are different from traditional energy statistics. Table 3.2.B is based on the structure of the above-presented table 1be. However, the columns on *Air emission free energy forms and net balance* are not taken into consideration. Therefore, no total industry by industry is presented. The comparison undertaken here focuses on *Primary* and *Secondary energy forms combusted* and the differences related to energy transformation. The same structure is used for each of the three sub-tables, but only the part (b) actually contains data that are required for NAMEA-air in table 1be. Part (a) is mainly based on official energy statistics[27] and part (c) highlights where are the differences between data from such statistics and air emission relevant energy use for NAMEA-air.

The data reported in sub-table 3.2.B (a) cover the total consumption of energy of the relevant items – i.e. including energy used to be transformed in another form for of energy or energy used as raw material. In the *primary energy forms*, e.g. data on lignite and coal include the (intermediate) consumption dedicated to the production of coal coke. In the *secondary energy forms* include petroleum products used as raw material e.g. for the production of plastics.

26 - No double counting appears in the formula entered for the calculation of the *Total by industry* (column AD). Firstly, it adds up all fuels combusted (columns H to Q), to which, secondly, the net use of electricity is added. The *primary* – emission free – electricity (column X) and hot water and heat (column Y) production, as well as total electricity, heat and hot water *purchased* (column AA and AC, respectively) are entered with a positive sign, whereas total electricity, heat and hot water *sold* (columns Z and AA, respectively) are deducted (negative sign in the formula).

27 - However, it should be mentioned that a few modifications have been made in the sub-table (a) for the purpose of the present illustration. In the original German data on coal coke and coke gas, figures on production were entered with a negative sign in order to highlight where energy transformations occur. About coal coke, -526 278 TJ and -406 392 TJ were reported respectively for NACE 10 and NACE 23. Concerning coke gas, -147 528 TJ and –23 154 TJ were reported respectively for NACE 23 and NACE 27. Instead, we put the actual amount of coke burnt in these industries.

Table 3.2.B (a) – Total use of energy product (excluding electricity)

D 1991 Germany	Notes	Primary energy forms							Secondary energy forms		
		Lignite	Coal	Natural gas	Biofuels: Wood	Biofuels: Other bio-fuels	Peat and other	Waste	Coal coke	Coke gas and other gases	Petroleum prod. Total
			1be.10			1be.11	1be.12	1be.13		1be.14	1be.15
		Tera Joules								Tera Joules	
Grand total		2 493 524	2 341 765	2 420 722	30 951	0	0	113 638	1 095 713	398 383	5 547 241
Total Industries		2 493 524	2 325 670	1 747 442				113 638	914 871	398 383	3 309 372
Industry clas	1be.2										
A-B 01-05		0	2 304	6 838				0	52 816	0	128 897
10		569 535	27 374	916				543	8 499	2 449	5 375
11	1be.4	0	0	105 274				0	0	0	72
12		0	0	0				0	0	0	0
13		31	121	242				0	101	4	87
14		2 009	8 406	15 450				0	15 175	242	29 314
15-16		6 657	9 689	56 464				0	9 497	4 146	113 201
17-19		3 579	1 541	8 237				0	3 583	814	14 854
20		2 508	1 786	5 771				2 830	3 049	570	14 713
21-22		4 198	20 729	64 290				2 157	8 053	1 231	42 828
23-24		55 166	672 573	469 888				16 327	152 898	89 967	970 662
25		2 136	2 176	17 734				0	1 874	229	11 848
26		15 970	39 436	67 831				142	54 113	5 718	74 232
27		10 693	46 577	94 692				0	408 958	136 512	52 422
28		2 011	895	35 145				0	5 152	3 499	39 481
29		7 948	3 389	30 327				0	4 878	2 929	43 983
30-33		7 661	3 636	24 298				0	7 907	1 743	41 830
34-35		8 980	3 395	66 351				0	3 088	1 473	23 275
36		1 767	786	7 856				0	1 879	402	16 834
37		132	82	1 095				0	152	30	3 088
E 40-41		1 758 831	1 469 306	446 470				83 566	76 243	83 009	218 125
F 45		0	2 798	4 794				0	61 245	0	262 292
G 50-52		0	1 636	54 435				0	1 209	0	291 441
H 55		0	856	18 688				0	540	0	30 155
I 60-64		0	1 169	6 674				0	816	0	521 724
J 65-67		0	0	11 437				0	0	0	18 792
K-Q 70-99		33 713	5 008	126 244				8 072	33 146	63 416	339 847
Households, total		0	16 095	673 280	30 951				180 842	0	2 237 869

Source: Statistisches Bundesamt.

Table 3.2.B (b) – Energy use table for NAMEA

D 1991 Germany	Notes	Primary energy forms combusted							Secondary energy forms combusted		
		Lignite	Coal	Natural gas	Biofuels: Wood	Biofuels: Other bio-fuels	Peat and other	Waste	Coal coke	Coke gas and other gases	Petroleum prod. Total
			1be.10			1be.11	1be.12	1be.13		1be.14	1be.15
		Tera Joules								Tera Joules	
Grand total		1 929 588	1 697 369	2 258 474	30 951	0	0	111 494	1 050 770	397 875	4 823 098
Total Industries		1 929 588	1 681 274	1 585 194				111 494	869 928	397 875	2 585 229
Industry clas	1be.2										
A-B 01-05		0	2 304	6 838				0	52 816	0	128 897
10		22 396	2 095	916				543	8 499	2 449	3 139
11	1be.4	0	0	26 347				0	0	0	72
12		0	0	0				0	0	0	0
13		6	121	242				0	101	4	87
14		2 009	8 406	15 450				0	15 175	242	29 314
15-16		6 657	9 689	56 464				0	9 497	4 146	113 201
17-19		3 579	1 541	8 237				0	3 583	814	14 854
20		2 508	1 786	5 771				2 830	3 049	570	14 713
21-22		4 198	20 729	64 290				2 157	8 053	1 231	42 828
23-24		38 394	58 325	386 567				14 184	110 200	89 459	410 143
25		2 136	2 176	17 734				0	1 874	229	11 848
26		15 970	39 436	67 831				142	54 113	5 718	74 232
27		10 693	46 577	94 692				0	406 713	136 512	52 422
28		2 011	895	35 145				0	5 152	3 499	39 481
29		7 948	3 389	30 327				0	4 878	2 929	39 119
30-33		7 661	3 636	24 298				0	7 907	1 743	41 830
34-35		8 980	3 395	66 351				0	3 088	1 473	23 275
36		1 767	786	7 856				0	1 879	402	16 834
37		132	82	1 095				0	152	30	3 088
E 40-41		1 758 831	1 464 437	446 470				83 566	76 243	83 009	218 125
F 45		0	2 798	4 794				0	61 245	0	125 822
G 50-52		0	1 636	54 435				0	1 209	0	291 441
H 55		0	856	18 688				0	540	0	30 155
I 60-64		0	1 169	6 674				0	816	0	501 669
J 65-67		0	0	11 437				0	0	0	18 792
K-Q 70-99		33 713	5 008	126 244				8 072	33 146	63 416	339 847
Households, total		0	16 095	673 280	30 951				180 842	0	2 237 869

Source: Statistisches Bundesamt

The comparison between the total energy use (a) and air emission relevant energy for NAMEA-air (b), which is summarised in the sub-table 3.2.B (c), enable to illustrate some of the differences between the two sets of data that are pointed out by the above presentation as well as notes accompanying table 1be.

Coal coke is produced either for hard coal or lignite. Table 3.2.B (c), shows that only 9% of the coal used in NACE 23-24 (NACE 23 – *Manufacture of coke…*) is actually burnt, and therefore produced emissions to air. The remaining 91% correspond to the intermediate consumption of coal transformed in another form of energy and are therefore not to be included in the energy data for NAMEA-air (table 3.2.B (b)). In Germany, coke is also produce by companies in the NACE 10 (*Mining of coal and lignite*) when percentages are even 10%. The same applies for the production of coke gas. 82% of the gas used in NACE 23-24 is burnt there, the remaining part is included in the coke gas production process.

As far as gas is concerned, energy lost in flaring should be excluded for the data reported in table 1be. This explains why only 25% of the gas used in NACE 11 (*Extraction of crude oil*) is actually relevant for NAMEA air emissions.

Energy is also consumed as raw material – i.e. without any energy purpose. It is the case for the production of plastics. Consequently, in the sector covering NACE 23-24 (NACE 24 – *Manufacture of chemicals and chemical products*), 42% of total petroleum products are burnt to produce heat or power. The remaining 68% percent that were likely included in the production of plastics are actually to be excluded from the energy data reported in relation with NAMEA air emissions.

Table 3.2.B (c) – Comparison between total energy use and fuel consumption relevant for NAMEA-air

1991 D Germany	Notes	Primary energy forms combusted							Secondary energy forms combusted		
		Lignite	Coal	Natural gas	Biofuels: Wood	Biofuels: Other bio-fuels	Peat and other	Waste	Coal coke	Coke gas and other gases	Petroleum prod. Total
			1be.10			1be.11	1be.12	1be.13		1be.14	1be.15
		%								%	
Grand total		77	72	93	100			98	96	100	87
Total Industries		77	72	91				98	95	100	78
Industry clas	1be.2										
A-B 01-05		--	100	100				--	100	--	100
10		4	8	100				100	100	100	58
11	1be.4	--	--	25				--	--	--	100
12		--	--	--				--	--	--	--
13		20	100	100				--	100	100	100
14		100	100	100				--	100	100	100
15-16		100	100	100				--	100	100	100
17-19		100	100	100				--	100	100	100
20		100	100	100				100	100	100	100
21-22		100	100	100				100	100	100	100
23-24		70	9	82				87	72	99	42
25		100	100	100				--	100	100	100
26		100	100	100				100	100	100	100
27		100	100	100				--	99	100	100
28		100	100	100				--	100	100	100
29		100	100	100				--	100	100	89
30-33		100	100	100				--	100	100	100
34-35		100	100	100				--	100	100	100
36		100	100	100				--	100	100	100
37		100	100	100				--	100	100	100
E 40-41		100	100	100				100	100	100	100
F 45		--	100	100				--	100	--	48
G 50-52		--	100	100				--	100	--	100
H 55		--	100	100				--	100	--	100
I 60-64		--	100	100				--	100	--	96
J 65-67		--	--	100				--	--	--	100
K-Q 70-99		100	100	100				100	100	100	100
Households, total		--	100	100				0	100	--	100

3.2.5.4 Example to illustrate the treatment of electricity

This simple example illustrates the treatment of electricity in Table 1be (heat and hot water would be treated in the same way). The example assumes that the industry NACE 40.10 (Production and distribution of electricity) generates 250 TJ of electricity from burning 800 TJ of lignite. Also, 330 TJ of electricity are produced from emission-free sources (e.g. nuclear or hydro). In addition, NACE 40.10 imports 50 TJ of electricity. The total

electricity available for distribution is therefore 630 TJ. Of this, 30 TJ are used by NACE 40.10 (own use and losses during distribution) and 600 TJ are made available to other users.

The table 3.2.C below is a simplified version of Table 1be and shows how this information is recorded.

Total energy actually consumed by NACE 40.10 is 580 TJ = 800 TJ (the lignite combusted) plus [330 (primary electricity produced) plus 50 TJ (imports) minus 600 TJ (electricity delivered to other users)].

This energy actually consumed by NACE 40.10 corresponds to the losses of primary energy during generation of electricity of 550 TJ (800 TJ of lignite less 250 TJ of electricity generated from burning the lignite) plus the 30 TJ distribution losses and own use of electricity by NACE 40.10.

In the example table below, energy actually consumed by the other industries and households is 900 TJ = 200 TJ (lignite) plus 50 TJ (coal) plus 50 TJ (coal coke) plus 600 TJ (electricity purchased).

Total energy consumed by the whole economy is 1480 TJ, of which 1100 TJ are fuels combusted and therefore relevant for emission accounts, and 380 TJ emission-free energy (330 TJ primary electricity plus 50 TJ electricity imported).

Table 3.2.C – Illustration of the treatment of data on electricity in the energy table

	Primary energy forms combusted			**Secondary energy forms combusted**		**Air emission-free energy forms and net balance**				**Total by industry**
	Lignite	**Coal**	**……**	**Coal coke**	**…..**	**Primary electricity produced**	**(-) Electricity sold**	**(+) Electricity purchased**	**……**	
	Terajoules									
NACE 40.10 (electricity supply)	800	0	0	0	0	330	600	50	0	**580**
Other (electricity consumers)	200	50	0	50	0	0	0	600	0	**900**
Total	**1000**	**50**	**0**	**50**	**0**	**330**	**600**	**650**	**0**	**1480**

Note: The difference between total sales and total purchases of electricity (50 Terajoules in the example above) corresponds to net trade (imports less exports of electricity). Losses during distribution are allocated to the industry undertaking the distribution.

4. Presentation of the results and analysis based on NAMEA

The compilation of NAMEA is intended to analyse the interrelationship between economic activities and their environmental consequences. As presented all along the previous chapters, NAMEA is a framework enabling to bring together of economic data and the corresponding environmental data industry by industry, as well as by household consumption category. The present guide in focusing on air emissions and the compilation of air accounts (see chapter 2), but what follows applies for NAMEA in general, irrespective of the environmental data taken into consideration.

As previously stressed (section 3.1), in NAMEA-air standard tables, economic data do not include matrix form national accounts data. Such a simple version of NAMEA-type data nonetheless already offers a first insight of the relationship between economic activities and their resulting pressure on the environment. As far as air emissions are concerned, the first advantage of air accounts for NAMEA, compared to inventories used for international reporting, consists in the presentation of data broken down industry by industry and in showing separately households' direct contribution. The more so as the connection with economic data, which are directly taken into account in the same framework, is reinforced by national accounts principles that prevail for both of them (4.1). However, one of the other great advantages of NAMEA is related to its matrix form national accounts data when it can actually be developed from the input-output or combined supply-use tables available. This enables then extending economic input-output analysis to the interface between economy and environment (4.2).

4.1. Detailed data industry by industry and households consumption category

The presentation of environmental data by economic category (industries and households) is a particularity and one of the advantages of compiling NAMEA-type data. Moreover, once environmental accounts are compiled fulfilling national account principles, they can straightforwardly be connected to the corresponding economic data (production, intermediate and final consumption…) enabling then to put each contribution to emission totals into the perspective of the corresponding contribution to economic activity. When such data are produced on a regular basis, the resulting time series make it possible to compare the changes of emissions trends and production trends or other economic indicators over time, although further investigation (see later in section 4.2.2) are required to identify the factors of changes.

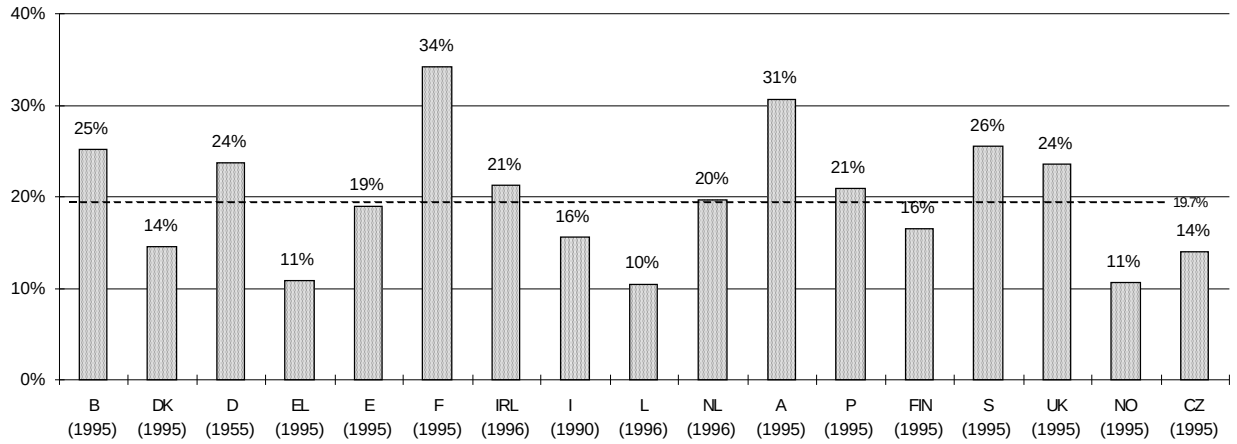
In the inventory prepared for the UNFCCC, household emissions are not shown separately. It is a particularity of air accounts for NAMEA to isolate households' contribution (4.1.1) As far as industries are concerned, NAMEA-type data help to identify what is commonly named as *environmental profiles* (4.1.2). When time series are available, data as in the NAMEA-air standard tables enable to give a first picture of the linkage - *coupling/de-coupling* - between production and emission trends (4.1.3)

4.1.1. Households and industries' respective contributions

In the emission data reported to the UNFCCC, household emissions are not isolated as such, but they are included in *fuel combustion activities* related to *transport*[28] and *other sectors*[29]. However, a first broad overview of the structure of air emissions is given by showing what proportion of the total are being directly produced by households. In NAMEA, as in the standard tables (see chapter 3), transport and heating are identified as the main sources of air emissions of which households are directly responsible for, carrying out themselves these activities (i.e. excluding consumption of transport services and consumption of district heating services). Households' contribution to the total of emissions by country depends on the size of total emissions (industries plus households) which is determined by the structure of the production and especially by the electricity production processes used (free emissions processes, like hydro or nuclear, or not). Households' contribution also depends on the structure of building heating production (rather on individual or provided by district heating) and the more or less keenness of households for individual motorised transport.

28 - 1A3bi - *Cars* (*Passenger cars with* and *without 3-way catalysts*) and 1A3biv – *Motorcycles* (IPCC, 1996a, p. 1.5).
29 - 1A4b – *Residential* (IPCC, 1996a, p. 1.6).

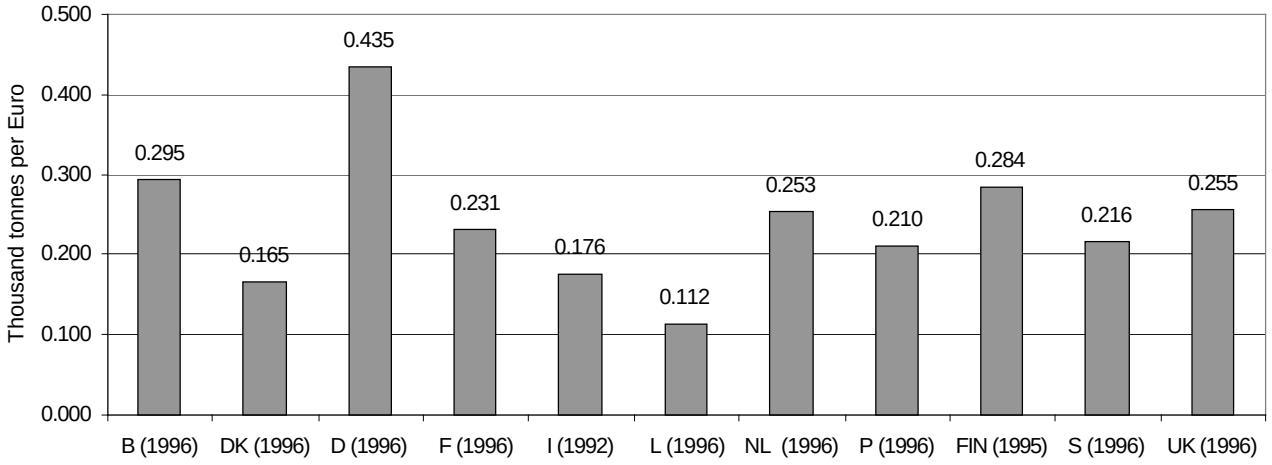
Figure 4.1.A – Households' contribution to CO_2 emissions as percentage of total emissions



Source: Eurostat (2001).

Since NAMEA include both economic and emission data also for households, it is possible to compare the intensities of household consumption (figure 4.1.B).

Figure 4.1.B – CO_2 emission intensities of household consumption among some of the EU countries

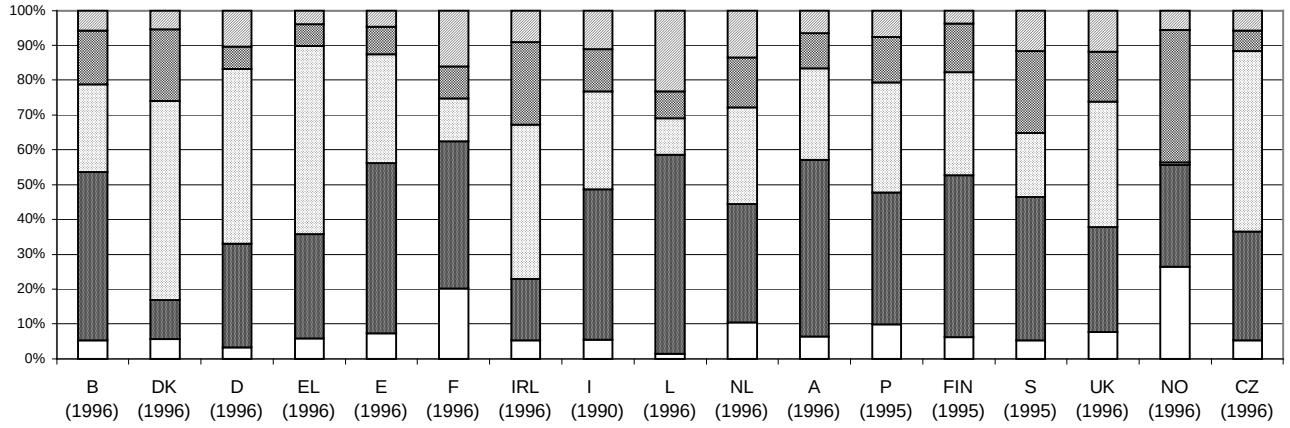


Source: Eurostat, NAMEA for air emissions standard tables (ratios based on total emissions by households and total final consumption in purchasers' prices)

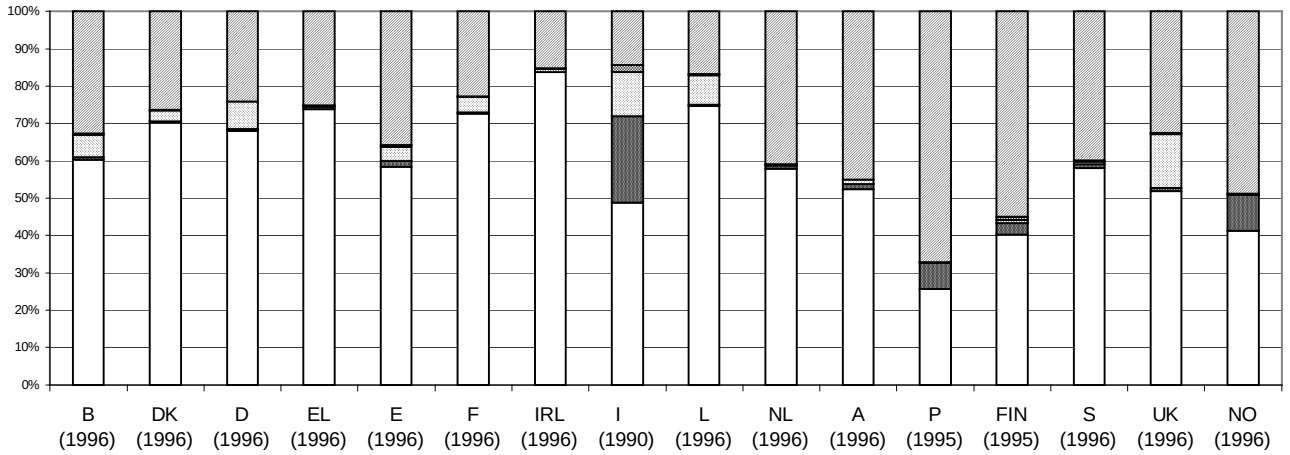
The NAMEA framework is also intended to identify industries' individual responsibility in the environmental issues taken into consideration. The following figure (4.1.C) shows an overview of the structure of emissions for 3 of the greenhouse gases stemming from industries in the EU plus Norway and the Czech Republic. In order to make the graphs easier to read, NACE industries have been grouped according to five very aggregated sectors.

Figure 4.1.C – Structure of air emissions from aggregated economic sectors

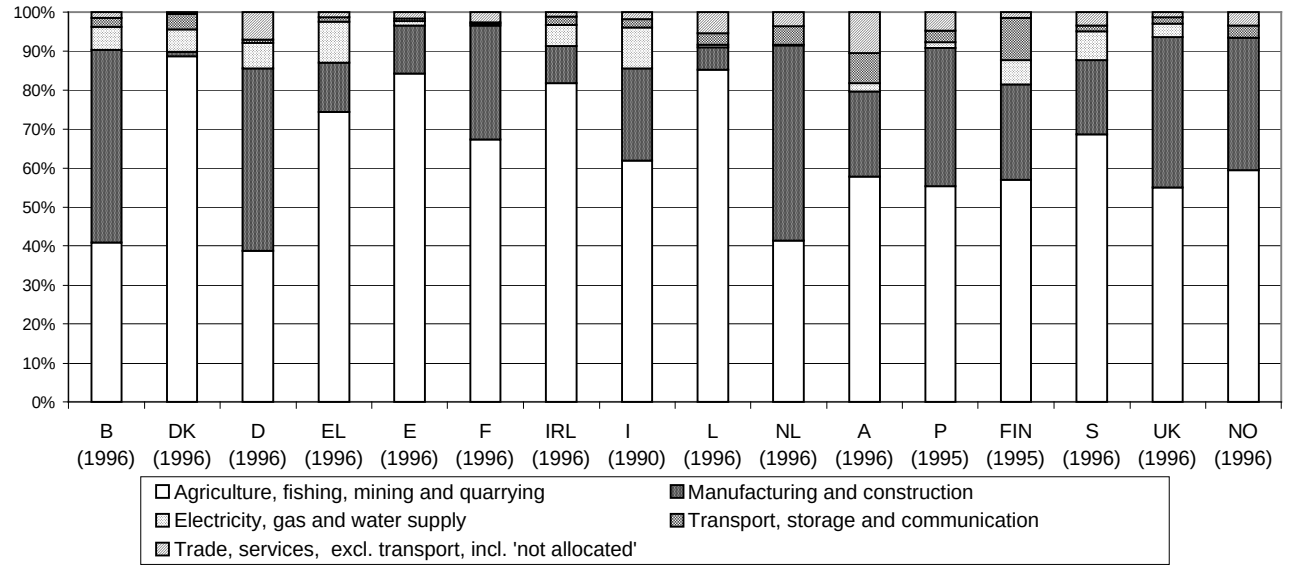
Carbon dioxide (CO_2)



Methane (CH_4)



Nitrous oxide (N_2O)

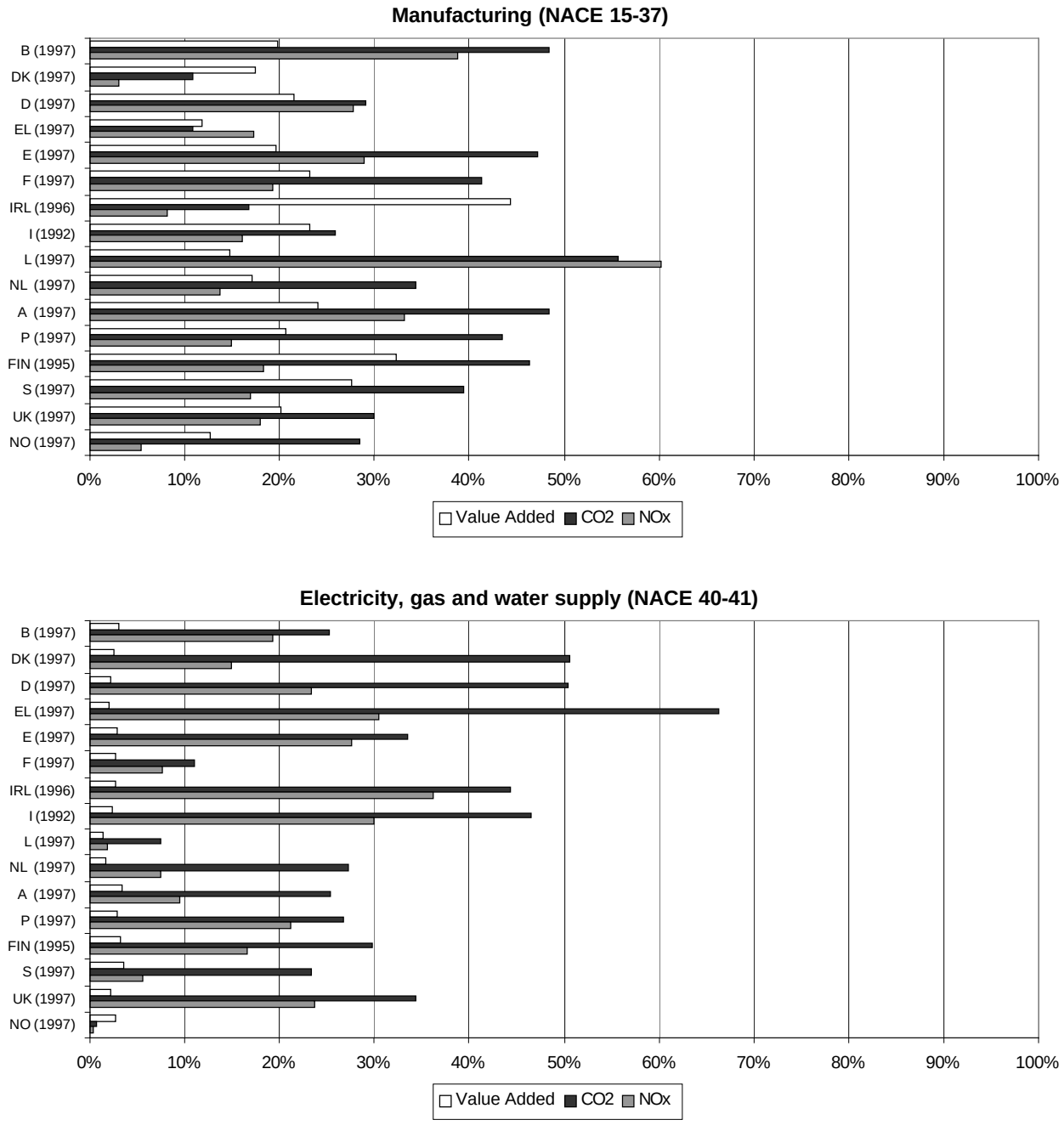


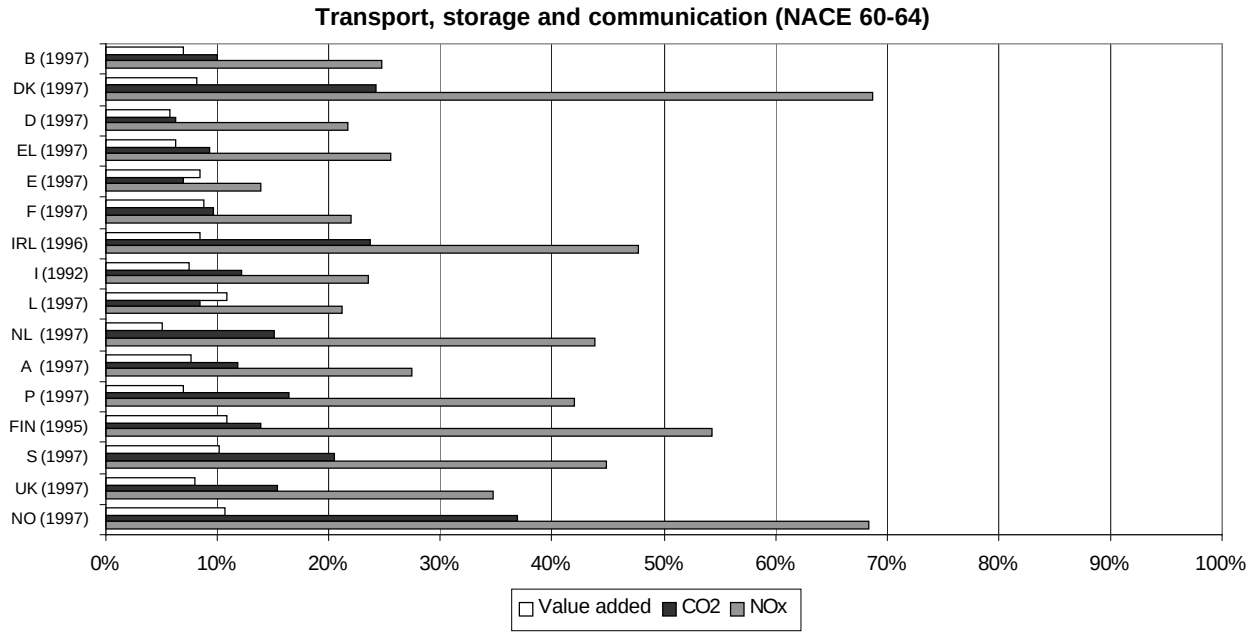
Source: Eurostat (2001) and Eurostat NAMEA-air emissions standard tables.

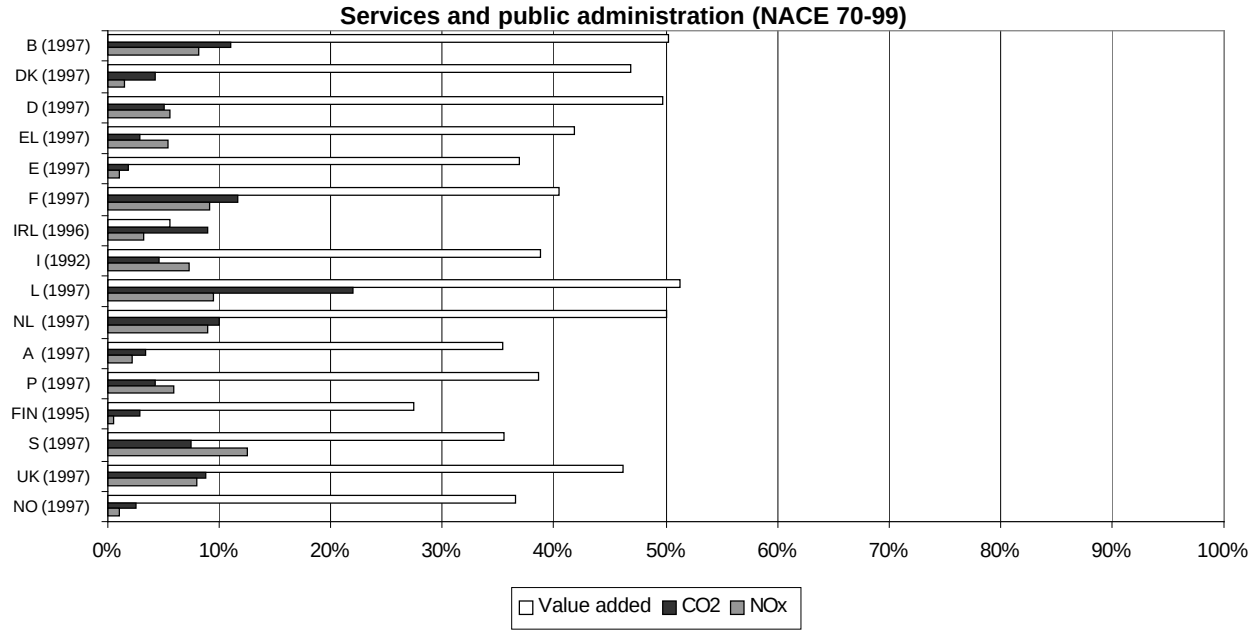
4.1.2. Environmental profiles of industries

Environmental profiles of industries has become a common way of presenting NAMEA data. For such *profiles*, economic and environmental data are shown as percentages of national total of industries. Households are not necessarily taken into consideration, since household consumption is not comparable with data on output or value added by industry. As seen earlier in this chapter, only households' contribution to environmental pressure, like household air emissions, could be compared with industries' contribution.

Figure 4.1.D – Comparison of some aggregated economic sectors' environmental profile in EU plus Norway







Source: Eurostat, NAMEA-air emissions standard tables and Eurostat (2001).

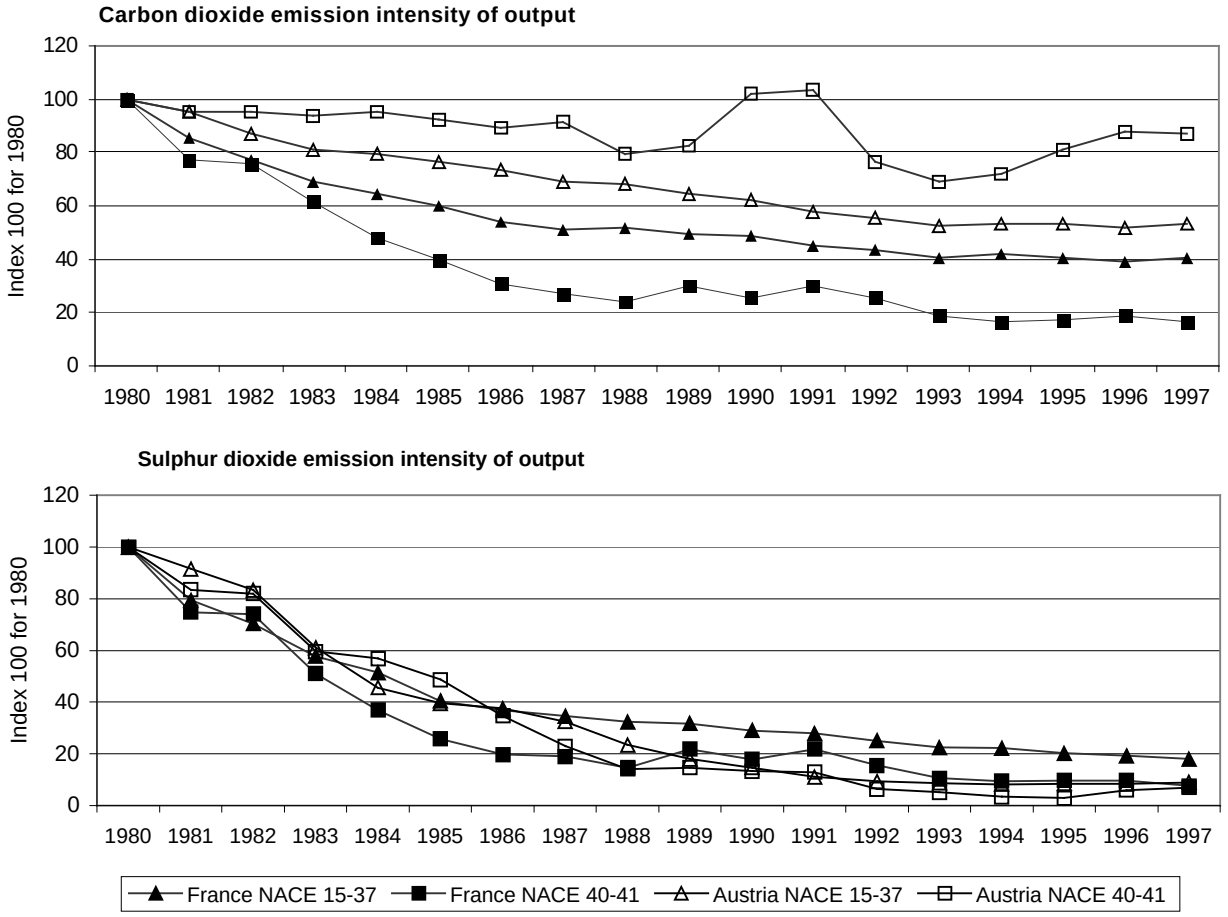
The four charts in figure 4.1.D do not cover all economic activities. The groups of industries that have been selected are characteristic of the information that such *profiles* can help to emphasise. For example, they highlight, on the one side, the relative significance of emissions from electricity production compared to its contribution in the domestic product and, on the other side, the relative low contribution of services industries to the total of emissions compared to their share in total value added; these charts also point out the significant contribution of transport services to NO_x emissions compared to CO_2; or the specific situation in some countries, such as France, Luxembourg and Norway as concerns electricity production (their low emissions are respectively explained by nuclear-based production, electricity mainly imported and hydropower-based production).

Figure 4.1.D compares EU countries plus Norway, but *environmental profiles* are often plotted with data from only one country. Also, they can be extended to other pollutants, including other than air emissions, but instead of being shown separately they can then be aggregated into theme indicators (e.g. warming potential or acid potential equivalent as far as air pollution is concerned). *Environmental profiles* are even more interesting when they can also include monetary environmental data, such as environmental taxes and expenditure.

4.1.3. Linkage between economic and emission trends

One of the key aims of extending national accounts with environmental data such as air emissions accounts, is to monitor trends in their connection or disconnection and to investigate the reasons of changes. The simple graph-based presentation as in figure 4.1.E below presupposes reasonably long time series (ten years or more) of both economic data in constant prices and environmental data, in this case air emissions. The decomposition analysis of emissions trends presented in the next section (4.2.3) helps to investigate what are the determining factors of changes and their respective contribution.

Figure 4.1.E – Air emission intensities of output as indicator of coupling / de-coupling



Source: Eurostat, NAMEA for air emissions standard tables and Eurostat (2001).

Evolution of emission intensity (e.g. emissions/output) indicates whether emissions are coupled or de-coupled with economic activity. Figure 4.1.E shows for instance that both SO_2 emissions are clearly disconnected from output in *manufacturing* industries as a whole (NACE 15-37) and *electricity, gas and hot water supply* (NACE 40-41) in both Austria and France, whereas it is not the case for the Austrian electricity production as far as CO_2 is

concerned (nuclear-based production in France). However, such graphs do not necessarily give information on the resulting trends of emissions. Production may become less emission intensive, but the environment load also depends on consumption trends. For instance the top graph does not say that CO_2 emissions went up by about 35% in Austria over the period. Therefore, it could also be useful to merely plot graphs comparing absolute values of output and emissions. Also, as said above for the environmental profiles, NAMEA framework enables to make the same thing as above but at a finer level of detail as concerns the classification of economic activities.

4.2. NAMEA-based input-output analysis

As presented at the beginning of the guide (section 1.1.1), a complete NAMEA is compiled from national account data in matrix form extended with environmental accounts. When input-output table or combined supply-use table is available to be adapted, then one of the greatest advantages of the resulting NAMEA consists in the possibility for input-output analysis. The latter is based on Leontief model and NAMEA offers in fact a revival to the proposal made in the early 1970s by Leontief himself to apply input-output calculation to the interface between economy and environment (Leontief, 1970), and in particular to air pollution (Leontief, Ford, 1972). In this case, NAMEA not only helps to identifies who directly contributes to what (production and related pollution), but, thanks to its input-output basis, it also enables to highlight the indirect role played by intermediate consumption. The more an industry uses products of which the production is intensive in terms of pollution the higher is the pollution indirectly caused by the production necessary to satisfy the final demand of its product.

Approximately half of the countries involved in Eurostat's environmental accounts programme has a complete NAMEA framework. Most of them undertake NAMEA-based input-output calculations in order to estimate total (directly plus indirectly) emissions generated by each unit of final demand (4.2.1). Some of them have also started to investigate how emissions embedded in international trade – i.e. generated by unit of final demand exported or by foreign final demand for imported products – could be estimated (4.2.2). In the first part of the chapter (4.1.3), we have seen how NAMEA-type data provide a first insight of the linkage between production and emissions trends. Further investigation can also be undertaken to estimate the relative importance of relevant factors, such as production, final demand, energy consumption, etc., in emissions trends (4.2.3).

4.2.1. Indirect emissions allocated to final users

As stressed earlier in the text, emissions that can directly be attributable to household consumption (i.e. fuel consumption) are observable in air emission accounts included in NAMEA. Households' direct contribution to air emissions is mostly related to fuel consumption for transport and heating. However, household consumption is also indirectly responsible for other air emissions that are attributed, in the air emission accounts, to the producers of the products they consume. In Sweden and Norway for instance, the analysis presented below, offers a possibility to investigate whether households adopt a more or less environment friendly behaviour as regards their consumption (Bergstedt, Eriksson, Wadeskog, 1999) (Hass, Sørensen, 2002a). NAMEA-based input-output calculation can be made in order to re-allocate emissions to final users, then being referred to as *indirect emissions*. These emissions are traced through the production chain - the successive intermediate consumption of industries - thanks to the input-output national account data and the Leontief approach-based input-output calculation. The outcome gives, product by product or industry by industry, total (direct plus indirect) emissions per each unit of final demand of the output.

All EU countries, as well as Norway, are now involved in the compilation of air emission accounts for NAMEA, but they do not necessarily have the national accounts data in matrix form that would enable them to re-allocate emissions to the final demand. However, most of the countries that have the required national account data produce such a re-allocation. For some of them, such calculations are even produced and published on a regular basis. A Statistics Denmark's yearly publication dedicated to input output tables and analysis (*Input-output tabeller og analyser*) that was recently extended to air emissions, now provides among others the results of emissions re-allocated to the different components of the final demand: private consumption, government consumption, investments in buildings and construction, other investment, exports and others. The German Federal Statistical Office also publishes emissions allocated to final demand categories, including in a report for the annual press conference on environmental accounting results (Statistiches Bundesamt, 2000).

Table 4.2.A below, which is extracted form the above-mentioned Danish yearly publication, illustrates what are the estimates that result from input-output-based allocation of emissions to final demand product by product. It compares producers' emissions – i.e. air accounts for NAMEA (first column) – and direct plus indirect emissions caused by the production both in Denmark and abroad (*globally*) required to satisfy Danish final demand. In the latter case, imported good are assumed to be produced as in Denmark (see section 4.2.2 below).

Table 4.2.A – Comparison of producers' emissions and direct plus indirect emissions allocated to the final demand of industries' output in Denmark (CO_2, 1997)[30]

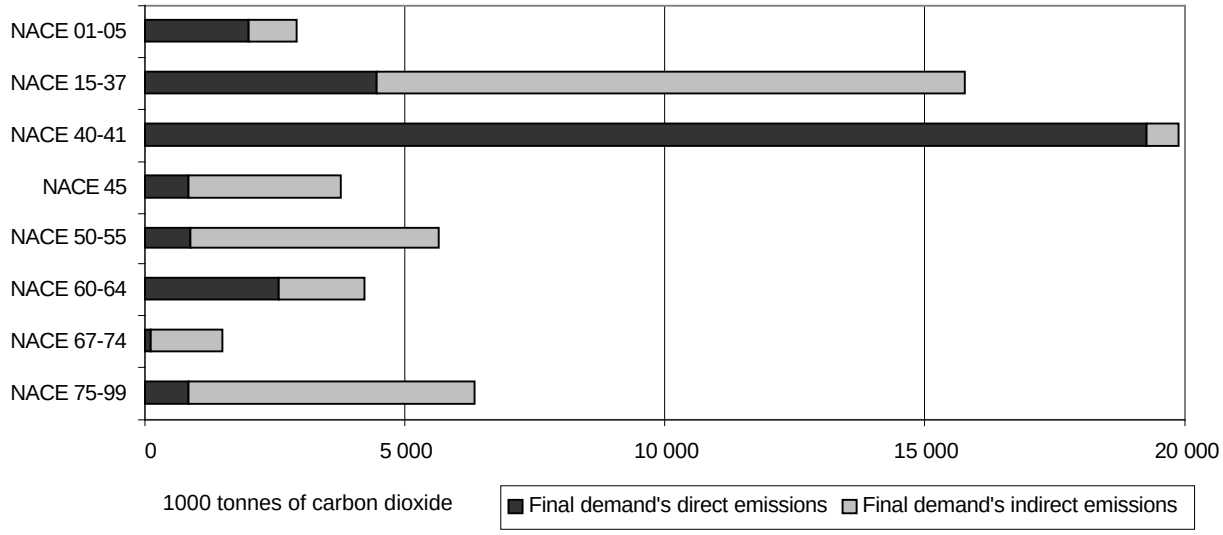
		Direct			Direct and indirect			
		In production	In deliveries to final demand		Globally		In Denmark	
		1000 tonnes	1000 tonnes	1000 tonnes per mill. DKK	1000 tonnes	1000 tonnes per mill. DKK	1000 tonnes	1000 tonnes per mill. DKK
	By main groups of industries							
1	Agriculture, fishing and quarrying	**5 049**	**2 001**	**0.06**	**4 413**	**0.15**	**2 922**	**0.12**
0109	Agriculture, horticulture and forestry	2 488	849	0.04	2 743	0.15	1 629	0.11
0500	Fishing	682	332	0.16	544	0.21	403	0.19
1009	Mining and quarrying	1 879	820	0.11	1 125	0.13	891	0.12
2	Manufacturing	**7 804**	**4 463**	**0.02**	**33 914**	**0.08**	**15 770**	**0.05**
1509	Mfr. of food, beverages and tobacco	1 927	1 393	0.02	11 759	0.11	6 758	0.07
1709	Mfr. of textiles, wearing apparel, leather	114	86	0.01	1 741	0.06	345	0.03
2009	Mfr. of wood products, printing and publ.	750	307	0.01	1 577	0.07	821	0.05
2309	Mfr. of chemicals, plastic products etc.	1 682	1 115	0.02	5 929	0.10	2 877	0.06
2600	Mfr. of other non-metallic mineral products	2 260	825	0.13	1 562	0.23	1 179	0.24
2709	Mfr. of basic metals and fabr. Metal prod.	842	529	0.01	9 503	0.05	2 897	0.03
3600	Mfr. of furniture; manufacturing n.e.c.	230	208	0.01	1 843	0.06	892	0.04
3	Electricity, gas and water supply	**37 542**	**19 283**	**0.97**	**20 780**	**0.96**	**19 882**	**0.93**
4	Construction	**1 053**	**831**	**0.01**	**5 763**	**0.06**	**3 763**	**0.04**
5	Wholesale and retail trade; hotels, restaurants	**1 327**	**889**	**0.01**	**7 541**	**0.04**	**5 648**	**0.03**
5000	Sale and repair of motor vehicles etc.	234	179	0.01	979	0.04	674	0.03
5100	Ws. and commis. trade, exc. of m. vehicles	717	394	0.01	3 033	0.04	2 249	0.03
5200	Re. trade and repair work exc. of m. vehicles	269	246	0.00	2 260	0.04	1 912	0.03
5500	Hotels and restaurants	107	70	0.00	1 268	0.06	813	0.04
6	Transport, storage and communication	**5 897**	**2 581**	**0.03**	**15 078**	**0.17**	**4 217**	**0.05**
6009	Transport	5 793	2 550	0.04	14 797	0.19	4 025	0.05
6400	Post and telecommunications	104	31	0.00	282	0.03	191	0.02
7	Financial intermediation, business activities	**374**	**114**	**0.00**	**2 125**	**0.01**	**1 517**	**0.01**
6509	Financial intermediation and insurance etc.	42	31	0.00	740	0.01	548	0.01
7009	Real estate and renting activities	99	46	0.00	922	0.01	624	0.01
7209	Business activities etc.	234	37	0.00	463	0.02	345	0.02
8	Public and personal services	**1 019**	**845**	**0.00**	**8 058**	**0.02**	**6 345**	**0.02**
7500	Public administration etc.	360	319	0.00	1 982	0.02	1 428	0.02
8000	Education	160	148	0.00	1 684	0.03	1 421	0.02
8519	Health care activities	85	82	0.00	1 273	0.02	986	0.02
8539	Social work activities	125	124	0.00	1 565	0.02	1 228	0.02
9009	Other community, social and personal act.	290	172	0.00	1 555	0.04	1 282	0.03
	Industries, total	**60 065**	**31 007**	**0.03**	**97 672**	**0.07**	**60 065**	**0.05**

Source: Statistics Denmark

30 - The first column of data ('Direct' 'In production') corresponds to the actual emissions from industries (i.e. NAMEA-type air accounts). The second column shows direct emissions attributed to the final demand of Danish industries' output i.e. amounts of emissions that are directly caused by the production delivered to the final demand (excluding intermediate consumption). Figures in the second column are therefore to be compared with figures in the fourth and sixth columns showing the sum of direct and indirect emissions (similarly the third column – monetary data – is to be compared with the fifth and seventh columns). Data in the fourth column cover only domestic indirect emissions ('In Denmark') whereas the sixth column includes also indirect emissions caused abroad for the production of Danish imports ('Globally').

Figure 4.2.A, which is based on data from table 4.2.A, compares direct and indirect CO2 emissions of the Danish final demand for aggregated categories of the economic activities. It highlights how the proportion of direct and indirect emissions (respectively the second column and the difference between the sixth and second columns in table 4.2.A) can vary across industries. On the one hand, there are industries like electricity, gas and water supply (NACE 40-41) and to a lower extent transport (NACE 60-64) of which direct emissions represent the larger share of total emissions allocated to the final demand of products because their productions is mostly based on fuel combustion. On the other hand, for most of the manufacturing industries (NACE 15-37) as well as trade (NACE 50-55) and services (NACE 67-74 and NACE 75-99) activities, indirect emissions cover the major part of total final demand's emissions since only a minor part of their intermediate consumption produce emissions, but they rather come from industries that are themselves directly responsible of emissions or that consume goods of which the production is emission intensive.

Figure 4.2.A – Comparison of direct and indirect emissions allocated to the final demand in Denmark (CO_2, 1997)



Source: Statistics Denmark (table 4.2.A above)

The same approach and calculation method is also undertaken by other EU countries using their NAMEA for air emissions. For the Netherlands (Keuning, Van Dalen, De Haan, 1999), which is the precursor in NAMEA, but also e.g. for Sweden (Hellsten, Ribacke, Wickbom, 1999) it even seems to be an unavoidable outcome following NAMEA compilation. Also, in Greece (Nikos Mylonas (dir), 2001) and France (Pasquier, 2002), input-output calculations of air emissions allocated to the final demand are now available for the whole time series of the NAMEA-air they have reported to Eurostat.

Input-output calculation of *emissions content* of final demand by product aim to point out what are the leading industries not only in terms of emission intensities (translating a sort of technical effect), but also regarding their own intermediate consumption of goods and services produced by polluting industries (structural effect), as well as considering the level of the demand of their product (scale effect). Once leading industries are identified, i.e. industries of which the products show the highest amount of emissions per unit of final demand (named above *emission content* of final demand), it is then possible to search for the above determining factors in the basic data resulting from the calculation: *emission intensities* (amount of emissions per unit of output) of industries are the first ratios required in the calculation procedure, shares of the products considered in total final demand and, finally, the *coefficients of interdependence* between industries (so called *Leontief-inverse* matrix resulting from the inversion of the matrix of *technical* or *input coefficients*). Further investigation can also enable to estimate the respective contribution of these factors (and others related e.g. to the use of energy) in the overall changes of emissions over time (see below section 4.2.3).

Total emissions resulting from input-output calculation are sometimes considered to be “a little like the ‘cradle to grave’ environmental burden discussed in life cycle analyses” (Vaze, 1997, p. 13). However, the comparison undertook by statistics Norway between final demand’s input-output-based emissions for some products with life-cycle analysis’ (LCA) figures (Hoem, Erlandsen, Smith, 2002) shows that results could differ substantially. This confirms more general findings in this area on the truncation error that conventional process-analysis-type techniques suffer from for compiling life-cycle inventories (Lenzen, 2000). Such a conventional approach covers in fact a limited part of the whole system that is affected by the activity (omits resource requirements or pollution releases of higher-order upstream stages of the production process) and, according to Manfred Lenzen, the magnitude of this truncation error, which varies with the type of product or process, can be on the order of 50%. This author even suggests incorporating input-output analysis into the LCA framework in order to solve the truncation error.

Eurostat encourages countries to produce such allocation of emissions to the final demand. The calculation of indirect emissions is now a straightforward and mature technique and the only supplementary data needed is the monetary input-output table. EU Member States’ input-output tables will have to be transmitted to Eurostat by the end of 2002 (Eurostat, 1997).

Final demand is partly satisfied by imports. Therefore the allocation of emissions to the final demand using the above-mentioned Leontief approach’s input-output calculation leads to assume that the production of imported goods and services has the same *emission intensities* has domestic production. It is as if imported products were elaborated following the same production process – i.e. using the same energy product and the same amount of fuel per unit of output – as domestic producers.

4.2.2. Indirect emissions embedded in international trade

The allocation of emissions to final demand components, as presented in the previous section, directly provides an estimate of emissions associated to exports. However, calculating a sort of *emission trade balance* (exports’ emissions minus imports’ emissions) requires estimates of emissions embedded in the production of imported products. Within Eurostat’s NAMEA project, several countries have investigated this field and Eurostat has recently published the report made by the British ONS (Harris, 2001). This report presents three approaches.

The simplest method is to use the domestic coefficients for imports. This gives an estimate of the emissions from *displaced production* or *emissions saved* due to the imports. This estimate refers to a hypothetical closed economy. For example, in the case of Denmark domestic electricity generation is mainly based on coal and assuming that the aluminium imported may have been produced nationally makes these imports very polluting, but, as far as energy related emissions are concerned, it is not necessarily the case, since this aluminium could come from Norway where it is produced using electricity mostly from hydropower (Hass, Skarborg, 2000). However, the comparison of emissions *saved* by importing products with emissions caused by the exports produces a balance of international trade that shows whether a country makes a net gain or loss of pollution due to its international trade. This method does not produce the *actual* emissions associated to imports but the emissions *saved* due to imports. The two concepts have quite different meanings. The quantitative difference between these two concepts is strongly influenced by the structure of domestic production and by the exact way electricity is generated. For small, open, economies the differences may be larger and some emission-intensive products imported may not be produced at all domestically. In extreme cases (such as Luxembourg), the emissions *saved* will make rather little sense.

One result of earlier mentioned Statistics Norway’s work (Hass, Sørensen, 2002a) on emissions allocated to final demand categories was that the relation between the emissions from domestic production and emissions directly and indirectly caused by household consumption is very weak in Norway. This is probably due to the importance of exports of primary materials (oil, paper, aluminium, etc.) and of maritime transport. Only about 15% of Norwegian CO_2 and NO_x emissions are directly or indirectly due to consumption of Norwegian households. Thus the major part of air emissions that could be attributed to household consumption is embedded in the Norwegian imports. In such a case, using domestic coefficients for estimating the emissions associated to imports does not produce very useful results given the specific structure of the Norwegian economy.

Estimates based on domestic coefficients were used as starting point (method 1) both in the above-quoted British study (Harris, 2001) and the Swedish (Westin, Wadeskog, 2002) investigating the same issue. Both

studies converged seeing that the "ideal" solution for estimating the *actual* emissions associated to imports would be the use of environmental accounts for the trading partners. It is what they tested as third a method, the ONS making a first trial with Danish data (table 4.2.B) and Statistics Sweden having the opportunity to use the second Eurostat compilation of pilot application (Eurostat, 2001). Nevertheless, they also both stress that using trading partners' emissions allocated to the final demand by product, as presented in the previous section (4.2.1) would really be the best solution.

Table 4.2.B – Illustration of the differences between the methods tested by the United Kingdom
Figures relate to 1990; amounts are CO_2 emissions in terms of kilo-tonnes carbon

	Total Danish emissions (based on Danish environmental accounts)	Danish exports to UK as percentage of production (based on data from the COMPASS model)	Emissions re exports to UK assuming UK rates apply (**Method 1**) (based on data from the COMPASS model)	Emissions re exports to UK using energy consumption data **(Method 2)** (based on data from the COMPASS model)	Emissions re exports to UK based on Danish environ-mental accounts (**Method 3**)
Agriculture	740	2.1%	6	8	15
Food production	620	9.4%	41	38	58
Textiles	40	7.2%	5	3	3
Wood products	150	6.0%	0	2	9
Paper, printing	120	1.6%	2	1	2
Chemicals	140	5.2%	63	9	8
Mineral products	540	3.0%	12	13	16
Iron and steel	30	4.2%	11	2	1
Non-ferrous metal products	4	6.0%	1	0	0
Machinery	130	5.5%	13	4	7
Transport equipment	20	6.6%	3	1	1
Total	2,540		157	80	121

Table 7 from Harris (2001), p. 29.

However, data requirements are large and, except for the EU, data will be limited. Simpler methods may include correcting national coefficients using available information on the trading partners' aggregate emissions, aggregate energy intensity or structure of fuel use. On the one side, the ONS tries to overcome the weakness of method 1 by using fuel use of relevant industries. However, this approach can therefore be used only for estimating energy related emissions. This method needs energy accounts of (a representative share of) the UK's trading partners that are, in fact, not yet often explicitly shown in countries' environmental accounts. On the other side, the second Swedish approach consists in adjusting method 1 emission coefficients, using a kind of weighting factors resulting from the comparison between a calculated overall emission coefficient for Swedish trading partners and the Swedish coefficient (overall coefficient of imports / Swedish coefficient). The overall emission coefficient of imports is a weighted average of the national emission intensities (total emissions / GDP) of its trading partners (taken into consideration proportionally to their share in total Swedish imports). Therefore, the resulting estimates are available only at macroeconomic level (table 4.2.C). It is nonetheless possible to observe, like for the British study, how results can change significantly according to the method used. However, in the Swedish estimates, results obtained from method 2 and 3 are rather close to each other and they clearly differ to the domestic emission coefficients-based approach (method 1).

Table 4.2.C – Illustration of the differences between the methods tested by Sweden
(Net trade emissions estimated by the different methods 1995, 1000 tonnes)

	Method 1	Method 2	Method 3
CO_2	4 272	- 5 595	- 6 232
SO_2	21	- 38	- 52
NO_x	48	58	43

Source: Westin, Wadeskog, 2002, p. 22.

Furthermore, the countries that *produced* the imported products are not always well known as there may be a lot of re-exports and as the production chain may include several countries. The *actual* emissions associated to imports also need to be interpreted with great care. For example, differences across countries may be the result of different countries of origin for the same product which in turn can be the result of geographical location, traditional trade links or trade agreements (including preferential treatment of developing countries and economies in transition). One option could be to work with average emission intensities of products.

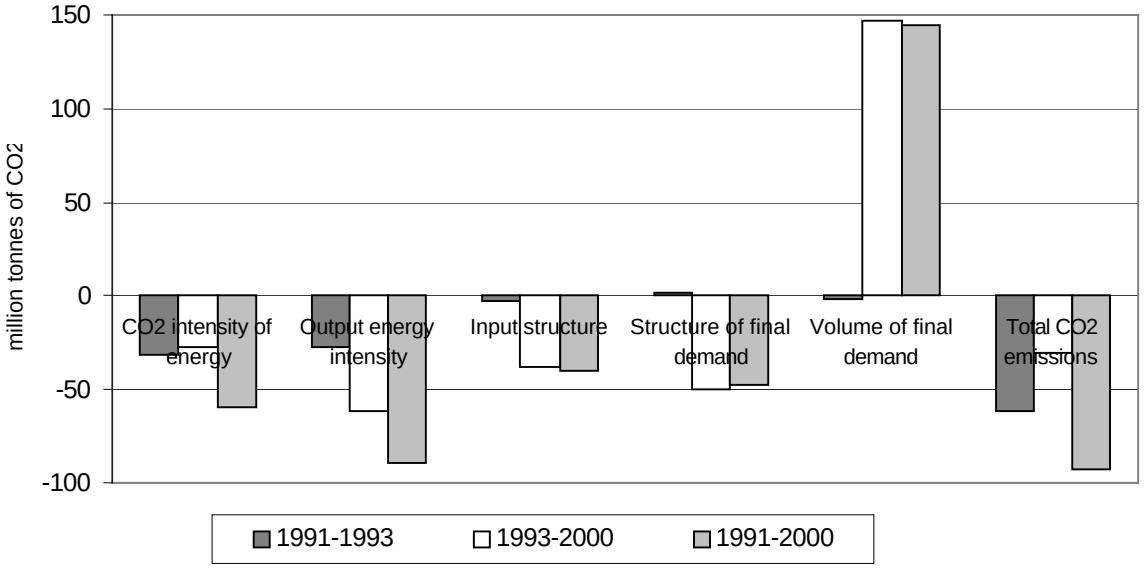
Emissions due to international transport (services) are also important, as they may account for an important part of emissions related to imports (and exports). Eurostat thinks it is important to further investigate the issue and encouraged countries to work together to develop common approaches.

4.2.3. Decomposition analysis of emission trends

In section 4.2.1 above, we have started to see how NAMEA-based input-output analysis could help to identify the leading role played, in environmental terms, by some industries either because of their own pollution or their consumption of goods and services produced by more or less pollution industries and of the level of the final demand for their products. The structural decomposition analysis can also help to assess the respective contribution of the above mentioned driving forces in the total change of air emissions over time. Such a technique requires NAMEA time series, including preferably economic data in constant prices.

The structural decomposition analysis gives the general framework, but it is rather flexible. The choice in the factors according to which changes in emissions are investigated depends on the data available and the analyst's view (Seibel, 2003). With NAMEA that cover only air emissions, as in the standard tables (chapter 3), total changes in emission levels could be decomposed in intensity, structural and growth effects that respectively translate the changes in emission intensity (amount of emissions / unit of output), inter-industrial relationship (input-output structure, or simply the structure of the final demand in case input-output table is not available) and the growth of output by industry. When investigating the factors causing changes in air emissions, energy data are really appreciated in NAMEA enabling further interesting decomposition into factors such as energy intensity (amount of energy use / unit of output), efficiency of energy use (amount of emissions / unit of fuel) as well as changes in energy products (contribution of each fuel total energy use).

Figure 4.2.B – Factors influencing the trend of CO_2 emissions of economic sectors in Germany



Source: Statistisches Bundesamt (2002)

It should be stressed that each of the factors' contribution is assessed individually. When changes in a factor are taken into consideration, the other factors are assumed to remain fixed. In the German example for instance (table 4.2.B), total industries' emissions have decreased by 92 million tonnes from 1991 to 2000, but would have seen a 145 million tonnes rise if the effect resulting from the final demand increase had not been offset by the other effects. The structural effects (from changes both in the final demand and the intermediate consumption of branches), the improvement in the energy intensity of the output and the growing use of natural gas that has lowered the CO_2 intensity of the energy used would have respectively provoked a 48 and 40, 90 or 59 million tonnes decline if each of them were considered alone.

However, such a decomposition of effects should be taken with care. Some changes could be interpreted in different ways. For instance, the switch from a fossil fuel to electricity in an industry would be interpreted as a change in the composition of fuel used from the point of view of this industry. Whereas it would be seen as a change in the economic structure (lower fossil fuel use and higher demand for electricity, therefore higher electricity production) regarding energy supply. The level of industry breakdown can therefore have an impact on the relative importance of the factors of change. Also, as pointed out in a Dutch report to Eurostat (de Haan, 2000), in the decomposition analysis presented above, when products with high pollution requirements are no longer domestically produced but imported, this substitution will be interpreted as an improvement in the environmental performance of the domestic economy, despite it may not always be optimal as concerns the environment, since the source of pollution is in fact transferred abroad and not necessarily diminished. Consequently, the incorporation of environmental effects related to the production of goods and services imported presented earlier (section 4.2.1) would also be useful to widen the scope of the structural decomposition analyses of emission trends.

The result of the decomposition analysis is sensitive to the order in which the factors are taken into consideration. The above-quoted Dutch report (de Haan, 2000) that is also published elsewhere (de Haan, 2001) analyses these issues and recommends using the mean of all possible decomposition sequences.

It is worth mentioning that the method of decomposition analysis can be simplified when no input-output table is available. Therefore, the structural component, which is otherwise apprehended thanks to the input-output-based inter-industries relationships, could either be left out or characterised by the structure of output by industry. In Germany, the investigations undertaken prior to 2000 were based on the simplified method (Statistisches Bundesamt, 2000), but the results shown above (figure 4.2.B) were obtained following the method presented in the Dutch report (de Haan, 2000, 2001). Therefore, in addition to the effects resulting from the changes in the emission intensity of energy use, in the energy intensity of the production, in the final demand structure and volume, this non-simplified approach enable to identify an effect related to the change in the structure of intermediate consumption of branches (input-output table).

The simplified solution has been adopted by the United Kingdom[31] and Norway (Bruvoll, Medin, 2000). However, the Norwegian emissions are decomposed in a large numbers of factors: population, per capita GDP, production structure, energy intensity, the combination of energy products, combustion methods and technical changes. This last item is in fact split into 2 items, the first capturing the effect of political action and the second the other technological changes not capture by the other components, such as the use of catalytic converters, the reduction of the sulphur content in fuels. The Norwegian paper also makes an interesting connection between the structural decomposition analysis and the environmental Kuznets' curve problematic, the latter postulating that economic growth and pollution follow an inverted U-curve. In this context, the question is then to know, for a selection of air emission types, whether economic growth eventually coincides with a decrease of emissions (de-coupling) and when the turning point occurs? But also, what is the respective contribution of the above-mentioned factors?

31 - The results were presented at the NAMEA-air Task force meeting the 20 and 21 February 2002, but the Rocky Harris' report on "The impact of the economy upon changes in the levels of Greenhouse Gas and Acid Rain precursor emissions between 1990 and 1998" has not been published by the ONS.

Referenced documents

Allemand N., *Inventaire des émissions dans l'air au format NAMEA France métropolitaine 1980-1999*, Tome 1, *Méthodologie et résultat de synthèse*, Etude réalisée pour l'Institut français de l'environnement, CITEPA, Paris, mars 2002, 39 p. + annexes.

Ahamer G., Hanauer J., Wolf M.E. (1998): *NAMEA Methodology for Atmospheric Pollutants 1994*, Working Document, Austrian Central Statistical Office, January 1998, 70 p + annexes.

Bergstedt E., Erikssson M., Wadeskog A., *Environmental accounts Households*, Report to Eurostat, Statistics Sweden, Stockholm, January 1999, 52 p.

Brånvall G., Rudander H., Ribacke S., Wickbom G., *Extented time series in the Swedich environmental accounts*, Report to Eurostat, Statistics Sweden (SCB) – Environmental Statistics, Stockholm, January 1999, 35 p. + appendices.

Bruvoll A., Medin H., *Factoring the Environmental Kuznets Curve, Evidence from Norway*, Discussion Paper n° 275, Statistics Norway (Research Department), Oslo, June 2000, 34 p.

Coli A., De Lauretis R., Femia A., Greca G., Romano D., Tudini A., Vannozzi M. Vetrella G., *Italian NAMEAs: 1991, 1992; enlarged and revised 1990 data*, Istituto Nazionale di Statistica (ISTAT) – National Accounts Department – Environmental Accounting Unit, Roma, December 2001, 64 p.

Commission for European Communities, *Directions for the EU on environmental Indicators and Green National Accounting; The Integration of Environmental and Economic Information Systems*, Communication from the Commission to the Council and the European Parliament, COM (94) 670, Brussels, 1994.

De Haan M.*, Decomposing Annual Changes in Pollution according to their Causes: a NAMEA Time Series Analysis*, Final report to Eurostat concerning the project entitled "The Further development of the NAMEA and its Application in the Netherlands", Module 2, Statistics Netherlands (CBS), Voorburg, August 2000, 16 p.

De Haan, "A structural Decomposition Analysis of pollution in the Netherlands", *Economic Systems Research*, Volume 13, June 2001, pp. 181-196.

De Haan M., Boer S., Heimstra Leo*, Environmental expenditure revisited in the Dutch national accounts and NAMEA*, Report to the European Commission, Statistics Netherlands, Voorburg, April 1998, 9 p.

De Lauretis R., Tudini, A., Vetrella, G., *NAMEA air emission accounts: the Istat methodology*, ISTAT, Roma (italy), 13 p.

EEA, *Atmospheric Emission Inventory Guidebook*, Prepared by the EMEP Task Force on Emissions Inventories, Edited by S. Richardson, Second edition (September 1999), Office for the Official Publications of the European Communities, EMEP/CORINAIR/EEA Technical Report n° 30, 2000a, 3 Volumes.

EEA, *COPERT III, Computer programme to calculate emissions from road transport – methodology and emission factors (Version 2.1)*, Prepared by Ntziachristos L., Samaras Z.(with contributions from Gorißen N., Hassel D., Hickman A.-J, Jourmard R., Rijkeboer R., White L., Zierock K.-H.), European Topic Centre on Air Emissions (ETC/AEM), European Environment Agency (EEA), Technical Report n° 49, Copenhagen (Denmark), November 2000b, 86 p.

EEA, *Annual European Community Greenhouse Gas Inventory 1990-99*, Submission to the secretariat of the UNFCCC, prepared by Manfred Ritter and Bernd Gugele of the ETC on Air and climate Change, European Environment Agency, Technical Report n° 60, Copenhagen (Denmark), 11 April 2001, 34 p. + CD-Rom.

Eurostat, *NACE Rev. 1 – Statistical classification of economic activities in the European Community*, Theme 2 - Economy and Finance/Series E – Methods, Office for Official Publications of the European Communities, Luxembourg, May 1996a, 189 p.

Eurostat, *European System of Accounts - ESA 1995*, Office for Official Publications of the European Communities, Luxembourg, June 1996b, 383 p.

Eurostat, "Environmental accounting in the framework of national accounts past, present and future work in Eurostat 1995 – 1996 – 1997", in the *Third Meeting of the London Group on Natural Resource and Environmental Accounting*, Proceedings Volumes, Stockholm, May 28-31, 1996c, pp. 27-30.

Eurostat , *European system of national accounts ESA - 1995. Transmission programme of data*, Office for Official Publications of the European Communities, Luxembourg, 1997.

Eurostat, *Pilot studies on NAMEAs for air emissions with comparison at European level*, Office for Official Publications of the European Communities, Theme 2: Economy and finance, Collection: Studies and research, Luxembourg, 1999, 139 p. (Catalogue number : CA-23-99-338-EN-C)

Eurostat, *NAMEA 2000 for air emissions – Set of standard tables*, Luxembourg, July 2000a, 32 p.

Eurostat, *NAMEA 2000 for air emissions – Manual*, Luxembourg, July 2000b, 35 p.

Eurostat, *NAMEAs for air emissions - Results of pilot studies*, Office for Official Publications of the European Communities, Theme 2: Economy and finance – Collection: Detailed Tables, Luxembourg, 2001a, 231 p. (Catalogue number: KS-39-01-093-EN-N)

Eurostat, "Explaining the differences among the formats for reporting air emissions with bridge tables", Room document at the Joint Meeting of the Working Party 'Economic Accounts for the Environment' and the Working Group 'Statistics of the Environment', Luxembourg, 19-21 September 2001b, 5 p.

Eurostat, *Energy statistics – 1985-2000 data*, Office for Publications of the European Communities, CD-ROM, 2002a.

Eurostat, *The 2002 NAMEA-air emissions standard tables*, Eurostat-Unit B1Luxembourg, June 2002b.

Flugsrud K, Gjerald E., Haakonsen G., Holstkog S., Høie H., Rypdal K., Tornsjø B. and Weidmann F., *The Norwegian Emission Inventory – Documentation of methodology and data for estimating emissions of greenhouse gases and long range*, Reports, Norwegian Pollution Control Authority (Oslo) / Statistics Norway (Oslo - Kongsvinger), January 2000, 84 p.

Hoem B., Erlandsen K., Smith T., "Comparison between two Calculation Methods: LCA using EPIS-data and Input-Output Analysis using Norway's NAMEA-air data", Statistics Norway, *Documents 2002/1*, February 2002, 28 p.

Harris R., "Methods for estimating air emissions from the production of goods imported into the UK", Prepared for the DG Regional Policy and Eurostat, Office for National Statistics (London), *Eurostat Working Papers*, 2/2001/B/5, 11 September 2001, 62 p.

Harris R., *Adjustments to the UK's atmospheric emissions and energy accounts to bring them on to a National Accounts "residents" basis*, Office for National Statistics (ONS), Report to Eurostat, London (UK), April 2002, 23 p.

Hass J. (Editor-in-chief, Statistics Norway), and Skarborg V. (Statistics Sweden), with contributions from Gravgård Ole (Statistics Denmark), Manninen Harri (Statistics Finland), Eriksson Marianne (Statistics Sweden), *Nordic Environment-Economic Indicators. Nordic Natural and Environment Accounts – Part III*, Report to the Nordic Council of Ministers, Copenhagen, 2000, 71 p. (TemaNord, 2000:515).

Hass J., Sørensen K. (with a contribution from K. Erlandsen), *Norwegian Economic and Environment Accounts (NOREEA) project 2001*, Final Report to Eurostat, Statistics Norway, 2002a, 75 p.

Hass J., Sørensen K., *Norwegian Hybrid Accounts: NAMEA for air emissions*, Final Draft of Technical Report to Eurostat, Statistics Norway, Oslo, April 2002b, 58 p.

Hellsten E., Ribacke S., Wickbom G., "SWEEA - Swedish Environmental and Economic Accounts", *Structural Change and Economic Dynamics*, vol. 10, n° 1, 1999, pp. 39-72.

Hornum H., "Environmental taxes and subsidies in the Danish NAMEA", Prepared by Statistics Denmark for the DG Environment and Eurostat*, Eurostat Working Paper, 2/2000/B/12*, Luxembourg, 15 December 2000, 22 p.

Ifen, *Environmental Accounts in France – NAMEA pilot study for France (Phase III)*, Prepared by Jean-Marie Bouchereau (project manager) and Mark Tuddenham, Final report to Eurostat, French Institute for the Environment (Ifen), Orléans, October 2000, 82 p. + 6 annexed floppy disks.

IPCC, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories – Greenhouse Gas Inventory Reporting (Volume 1)*, Edited by Houghton J.T., Meira Filho L.G., Lim B., Treanton, K., Mamaty I., Bonduky Y., Griggs D.J. and Callender B.A, IPCC/OECD/IEA, 1996a.

IPCC, *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories – Greenhouse Gas Inventory Reference Manual (Volume 2)*, Edited by Houghton J.T., Meira Filho L.G., Lim B., Treanton, K., Mamaty I., Bonduky Y., Griggs D.J. and Callender B.A, IPCC/OECD/IEA, 1996b.

Keuning S.J., Steenge A.E. (Guest editors), Special Issue on 'Environmental Extension of National Accounts: The NAMEA Framework', *Structural Change and Economic Dynamics*, vol. 10, n°1, March 1999, 161 p.

Keuning S.J., Van Dalen J., De Haan M., "The Netherlands' NAMEA; Presentation, Usage and Future Extensions", *Structural Change and Economic Dynamics*, vol. 10, n° 1, 1999, pp. 15-37.

Keuning S.J., "Indicators and Accounts of sustainable Development: the NAMEA approach", in Sandrine Simon and John Proops (eds), *Greening the Accounts*, Edward Elgar, Cheltenham (UK), 2000, pp. 71-98.

Lenzen M., "Error in Conventional and Input-Output-based Life-Cycle Inventories", *Journal of Industrial Ecology*, Vol . 4, issue 4, Fall 2000, pp. 127-148.

Leontief, W., "Environmental repercussions and the economic structure - An input-output approach", *The review of Economics and Statistics,* vol. 52, n°. 3, August 1970, pp. 262-271.

Leontief W., Ford D., "Air Pollution and the Economic Structure: Empirical Results of Input-Output Computations", in Brody A., Carter A. (eds), *Input-Output Techniques*, North-Holland, Amsterdam, 1972, pp. 9-30.

Mylonas N. in co-operation with M. Economakou, N. Frankoupoulos, A. Krasadakis, K Molfetas, N. Stromplos, P. Vlachos (National Statistical Services of Greece) and D. Koutentaki (Athens National Observatory), *Natural Resources Accounts and Environmental Input-Output tables for Greece 1988-1998.* Institute of Computer and Communication and Operational Research at the National Technical University of Athens (ICCS/NTUA), Report to Eurostat, December 2001, 94 p. + annexes (including Greek and English versions).

ONS, *UK atmospheric emissions (air) accounts methodology*, Office for National Statistics' internal document, London (UK), Draft August 2002, 60 p.

Pasquier J.-L., *Exploitation des données de la comptabilité nationale pour la NAMEA française*, Rapport pour l'Institut français de l'environnement (Orléans), Planistat, Paris, Juillet 2001, 46 p. + annexes + tableaux pour 1980-1998.

Seibel S., *Decomposition analysis of carbon-dioxide emission changes in Germany – conceptual framework and empirical results*, Report of the Federal Statistical Office of Germany/environmental Economic Accounting Division (Wiesbaden), Eurostat's Working Papers and Studies, Office for Official Publications of the European Communities (catalogue N° KS-DB-03-002-EN-N), Luxembourg, 2003, 32 p.

Statistisches Bundesamt, *Environmental-Economic Accounting in Germany 2000*, Results of the Statistical Office presented on the press conference in Frankfurt am in October 2000, 29 p.

Statistisches Bundesamt, *Umweltökonomische Gesamtrechnungen 2002*, Results presented at a press conference on 5th November 2002.

Tjahjadi B., Schäfer D., Radermacher W., Höh H., "Material and Energy Flow Accounting in Germany – Database for applying the National Accounting Matrix including Environmental Accounts Concept", *Structural Change and Economic Dynamics*, Vol. 10, N° 1, March 1999, pp. 73-97.

UN, *System of National Accounts*, United Nations, Eurostat, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank, United Nations publications Series F, N° 2, Rev. 4, New York, 1993, 711 p.

UN, *Handbook of National Accounting – Integrated Environmental and Economic Accounting 2003*, United Nations, Eurostat, International Monetary Fund, Organisation for Economic Co-operation and Development and World Bank, United Nations publications Series F, n° 61, rev. 1, Final draft circulated for information prior to official editing, March 2003, 591 p.

UN, *Classification of Expenditure according to Purpose: COFOG, COICOP, COPNI, COPP*, United Nations - Department of Economic and Social Affairs - Statistics Division, New York, 2000, 159 p.

UNFCCC (2000), *UNFCCC common reporting format*, Prepared by James Grabert for the Meeting of the Working Group 'Statistics of the environment", sub-group "Integrated Emissions Statistics", Doc. IES/00/7.3.1, Eurostat (Luxembourg), 14-15 February 2000.

Vadmand Jensen H., Gravgård Pederesen O, *Danish NAMEA 1980-1992*, Statistics Denmark/Eurostat, København, January 1998, 98 p.

Vaze P., *Environmental Input-Output Tables for the United Kingdom*, Report to Eurostat, Directorate B, 1997, 67 p., (with contribution from N.D. Hughes, "How can this input-output framework be used to analyse policy?", Annex 3, pp. 23-30)

Vaze P., "A NAMEA for the UK", *Structural Change and Economic Dynamics*, vol. 10, n° 1, March 1999, pp. 99-121.

Vandille G., *The NAMEA Air for Belgium (1994-1998) – The NAMEA water for Belgium (1998)*, Report to Eurostat, Bureau Fédéral du Plan, Brussels, February 2002, 59 p.

Verduin H., *Integration of Energy Statistics in the National Accounts*, Final report to Eurostat concerning the project entitled "The Further development of the NAMEA and its Application in the Netherlands", Module 1, Statistics Netherlands (CBS), Voorburg, October 1999, 16 p. + appendices.

Westin J., Wadeskog A.,*The Environmental impact of Swedish Trade*, Report to Eurostat, Statistics Sweden, Stockholm, June 2002, 68 p.

Wolf .E., Hanauer J., Ahamer G., *NAMEA – Luftschadstoffe. Zeitreihen 1980-1997* (NAMEA – Air emissions. Time series 1980-1997), Statistik Austria (ÖSTAT) / Umweltbundesamt (UBA), Wien, March 2000, 42 p + tables.

Annexes

Annex 1 – List of abbreviations

CLRTAP: Convention on Long-range Transboundary air Pollution

CPA : Classification of Products by Activities in the European Community

CH_4: Methane

CORINE: CO-oRdination d'INformation Environmentale

CORINAIR: CORe INventory of AIR emissions

CO_2: Carbon dioxide

EA: Environmental Accounts

EMEP: Co-operative programme for monitoring and evaluation of the long-range transmission of air pollution in Europe

ESA: European System of Accounts

ETC/ACC: European Topic Centre on Air and Climate Change (previously the ETC on Air Emissions)

HFCs: Hydrofluorocarnons

IEA: International Energy Agency

IPCC: Intergovernmental Panel on Climate Change

NACE: Nomenclature générale des Activités économiques dans les Communautés Européennes (statistical classification of economic activities in the European Community)

NAM: National Accounting Matrix

NAMEA: National Accounting Matrix including Environmental Accounts

NAPFUE: Nomenclature of Air Pollution of FUEls

NMVOC: Non-Methane Volatile Organic Compounds

N_2O: Nitrous oxide

NO_x: Nitric oxides and nitrogen dioxide

NH_3: Ammonia

PFCs: Perfluorocarbons

PM: Particulate Matter

SEEA: System of Environmental and Economic Accounts

SNAP: Selected Nomenclature for sources of Air Pollution

SF_6: Sulphur hexafluoride

SO_2: Sulphur dioxide

UNECE: United Nations Economic Commission for Europe

UNFCCC: United Nations Framework Convention on Climate Change

UNFCCC CRF: UNFCCC Common Reporting Format

Annex 2 – NACE based classification for NAMEA-air

Proposed industry classification for NAMEA on air emissions

Industry classification based on NACE rev. 1			
A	**01-02**		**Agriculture, hunting and forestry**
	01		Agriculture, hunting and related service activities
	02		Forestry, logging and related service activities
B	**05**		**Fishing**
C	**10-14**		**Mining and quarrying**
	10		Mining of coal and lignite; extraction of peat
	11		Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying
	12		Mining of uranium and thorium ores
	13		Mining of metal ores
	14		Other mining and quarrying
D	**15-37**		**Manufacturing**
	15		Manufacture of food products and beverages
	16		Manufacture of tobacco products
	17		Manufacture of textiles
	18		Manufacture of wearing apparel; dressing and dyeing of fur
	19		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
	20		Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	21		Manufacture of pulp, paper and paper products
	22		Publishing, printing and reproduction of recorded media
	23		Manufacture of coke, refined petroleum products and nuclear fuel
	24		Manufacture of chemicals and chemical products
	25		Manufacture of rubber and plastic products
	26		Manufacture of other non-metallic mineral products
		26.1	*Manufacture of glass and glass products*
		26.2-8	*Manufacture of non-metallic mineral products n.e.c.*
	27		Manufacture of basic metals
		27.1-3	*Manufacture of basic iron and steel*
		27.4-5	*Other manufacture of basic metals*
	28		Manufacture of fabricated metal products, except machinery and equipment
	29		Manufacture of machinery and equipment n.e.c.
	30		Manufacture of office machinery and computers
	31		Manufacture of electrical machinery and apparatus n.e.c.
	32		Manufacture of radio, television and communication equipment and apparatus
	33		Manufacture of medical, precision and optical instruments, watches and clocks
	34		Manufacture of motor vehicles, trailers and semi-trailers
	35		Manufacture of other transport equipment
	36		Manufacture of furniture; manufacturing n.e.c.
	37		Recycling
E	**40-41**		**Electricity, gas and water supply**
	40		Electricity, gas, steam and hot water supply
		40.1	*Production and distribution of electricity*
		40.2	*Manufacture of gas; distribution of gaseous fuels through mains*
		40.3	*Steam and hot water supply*
	41		Collection, purification and distribution of water
F	**45**		**Construction**
G	**50-52**		**Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods**
H	**55**		**Hotels and restaurants**
I	**60-64**		**Transport, storage and communication**
	60		Land transport; transport via pipelines
		60.1	*Transport via railways*
		60.2	*Other land transport*
		60.3	*Transport via pipelines*
	61		Water transport
		61.1	*Sea and coastal water transport*
		61.2	*Inland water transport*
	62		Air transport
	63		Supporting and auxiliary transport activities; activities of travel agencies
	64		Post and telecommunications
J	**65-67**		**Financial intermediation**
K	**70-74**		**Real estate, renting and business activities**
L	**75**		**Public administration and defence; compulsory social security**
M	**80**		**Education**
N	**85**		**Health and social work**
O	**90-93**		**Other community, social and personal service activities**
	90		Sewage and refuse disposal, sanitation and similar activities
	91		Activities of membership organization n.e.c.
	92		Recreational, cultural and sporting activities
	93		Other service activities
P	**95**		**Private households with employed persons**
Q	**99**		**Extra-territorial organizations and bodies**
Classification of household consumption			
			Transport
			Heating
			Other
			Not allocated

Annex 3 – Selected Nomenclature for sources of Air pollution (SNAP 97)

	01		**COMBUSTION IN ENERGY AND TRANSFORMATION INDUSTRIES**
01 01			Public Power
	01 01 01		*Combustion plants >= 300 MW (boilers)*
	01 01 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	01 01 03		*Combustion plants < 50 MW (boilers)*
	01 01 04		*Gas turbines*
	01 01 05		*Stationary engines*
01 02			District heating plants
	01 02 01		*Combustion plants >= 300 MW (boilers)*
	01 02 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	01 02 03		*Combustion plants < 50 MW (boilers)*
	01 02 04		*Gas turbines*
	01 02 05		*Stationary engines*
01 03			Petroleum refining plants
	01 03 01		*Combustion plants >= 300 MW (boilers)*
	01 03 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	01 03 03		*Combustion plants < 50 MW (boilers)*
	01 03 04		*Gas turbines*
	01 03 05		*Stationary engines*
	01 03 06		*Process furnaces*
01 04			Solid fuel transformation plants
	01 04 01		*Combustion plants >= 300 MW (boilers)*
	01 04 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	01 04 03		*Combustion plants < 50 MW (boilers)*
	01 04 04		*Gas turbines*
	01 04 05		*Stationary engines*
	01 04 06		*Coke oven furnaces*
	01 04 07		*Other (coal gasification, liquefaction, ...)*
01 05			Coal mining, oil/gas extraction, pipeline compressor
	01 05 01		*Combustion plants >= 300 MW (boilers)*
	01 05 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	01 05 03		*Combustion plants < 50 MW (boilers)*
	01 05 04		*Gas turbines*
	01 05 05		*Stationary engines*
	01 05 06		*Pipeline compressors*
	02		**NON-INDUSTRIAL COMBUSTION PLANTS**
02 01			Commercial and institutional plants
	02 01 01		*Combustion plants >= 300 MW (boilers)*
	02 01 02		*Combustion plants >= 50 and < 300 MW (boilers)*
	02 01 03		*Combustion plants < 50 MW (boilers)*
	02 01 04		*Stationary gas turbines*
	02 01 05		*Stationary engines*
	02 01 06		*Other stationary equipments (n)*
02 02			Residential plants
	02 02 01		*Combustion plants >= 50 MW (boilers)*
	02 02 02		*Combustion plants < 50 MW (boilers)*
	02 02 03		*Gas turbines*
	02 02 04		*Stationary engines*
	02 02 05		*Other equipments (stoves, fireplaces, cooking,...)*

02 03		Plants in agriculture, forestry and aquaculture
	02 03 01	*Combustion plants >= 50 MW (boilers)*
	02 03 02	*Combustion plants < 50 MW (boilers)*
	02 03 03	*Stationary gas turbines*
	02 03 04	*Stationary engines*
	02 03 05	*Other stationary equipments (n)*
	03	**COMBUSTION IN MANUFACTURING INDUSTRY**
03 01		Comb. in boilers, gas turbines and stationary engines
	03 01 01	*Combustion plants >= 300 MW (boilers)*
	03 01 02	*Combustion plants >= 50 and < 300 MW (boilers)*
	03 01 03	*Combustion plants < 50 MW (boilers)*
	03 01 04	*Gas turbines*
	03 01 05	*Stationary engines*
	03 01 06	*Other stationary equipments (n)*
03 02		Process furnaces without contact (a)
	03 02 03	*Blast furnace cowpers*
	03 02 04	*Plaster furnaces*
	03 02 05	*Other furnaces*
03 03		Processes with contact
	03 03 01	*Sinter and pelletizing plants*
	03 03 02	*Reheating furnaces steel and iron*
	03 03 03	*Gray iron foundries*
	03 03 04	*Primary lead production*
	03 03 05	*Primary zinc production*
	03 03 06	*Primary copper production*
	03 03 07	*Secondary lead production*
	03 03 08	*Secondary zinc production*
	03 03 09	*Secondary copper production*
	03 03 10	*Secondary aluminium production*
	03 03 11	*Cement (f)*
	03 03 12	*Lime (includ. iron and steel and paper pulp industr.)(f)*
	03 03 13	*Asphalt concrete plants*
	03 03 14	*Flat glass (f)*
	03 03 15	*Container glass (f)*
	03 03 16	*Glass wool (except binding) (f)*
	03 03 17	*Other glass (f)*
	03 03 18	*Mineral wool (except binding)*
	03 03 19	*Bricks and tiles*
	03 03 20	*Fine ceramic materials*
	03 03 21	*Paper-mill industry (drying processes)*
	03 03 22	*Alumina production*
	03 03 23	*Magnesium production (dolomite treatment)*
	03 03 24	*Nickel production (thermal process)*
	03 03 25	*Enamel production*
	03 03 26	*Other*
	04	**PRODUCTION PROCESSES**
04 01		Processes in petroleum industry
	04 01 01	*Petroleum products processing*
	04 01 02	*Fluid catalytic cracking - CO boiler*
	04 01 03	*Sulphur recovery plants*
	04 01 04	*Storage and handling of petroleum produc. in refinery*
	04 01 05	*Other*
04 02		Processes in iron and stell industries and colliries

	04 02 01	*Coke oven (door leakage and extinction)*
	04 02 02	*Blast furnace charging*
	04 02 03	*Pig iron tapping*
	04 02 04	*Solid smokeless fuel*
	04 02 05	*Open hearth furnace steel plant*
	04 02 06	*Basic oxygen furnace steel plant*
	04 02 07	*Electric furnace steel plant*
	04 02 08	*Rolling mills*
	04 02 09	*Sinter and pelletizing plant (except comb. 03.03.01)*
	04 02 10	*Other*
04 03		Processes in non-ferrous metal industries
04 04		Processes in inorganic chemical industries
	04 04 01	*Sulfuric acid*
	04 04 02	*Nitric acid*
	04 04 03	*Ammonia*
	04 04 04	*Ammonium sulphate*
	04 04 05	*Ammonium nitrate*
	04 04 06	*Ammonium phosphate*
	04 04 07	*NPK fertilisers*
	04 04 08	*Urea*
	04 04 09	*Carbon black*
	04 04 10	*Titanium dioxide*
	04 04 11	*Graphite*
	04 04 12	*Calcium carbide production*
	04 04 13	*Chlorine production*
	04 04 14	*Phosphate fertilizers*
	04 04 15	*Storage and handling of inorganic chemical prod. (o)*
	04 04 16	*Other*
04 05		Processes in organic chemical industries (bulk production)
	04 05 01	*Ethylene*
	04 05 02	*Propylene*
	04 05 03	*1,2 dichloroethane (except 04.05.05)*
	04 05 04	*Vinylchloride (except 04.05.05)*
	04 05 05	*1,2 dichloroethane + vinylchloride (balanced process)*
	04 05 06	*Polyethylene Low Density*
	04 05 07	*Polyethylene High Density*
	04 05 08	*Polyvinylchloride*
	04 05 09	*Polypropylene*
	04 05 10	*Styrene*
	04 05 11	*Polystyrene*
	04 05 12	*Styrene butadiene*
	04 05 13	*Styrene-butadiene latex*
	04 05 14	*Styrene-butadiene rubber (SBR)*
	04 05 15	*Acrylonitrile Butadiene Styrene (ABS) resins*
	04 05 16	*Ethylene oxide*
	04 05 17	*Formaldehyde*
	04 05 18	*Ethylbenzene*
	04 05 19	*Phtalic anhydride*
	04 05 20	*Acrylonitrile*
	04 05 21	*Adipic acid*
	04 05 22	*Storage and handling of organic chemical products (o)*
	04 05 23	*Glyoxylic acid*
	04 05 25	*Pesticide production*

	04 05 26	*Production of persistent organic compounds*
	04 05 27	*Other (phytosanitary,...)*
04 06		Processes in wood, paper pulp, food, drink and other industries
	04 06 01	*Chipboard*
	04 06 02	*Paper pulp (kraft process)*
	04 06 03	*Paper pulp (acid sulfite process)*
	04 06 04	*Paper pulp (Neutral Sulphite Semi-Chemical process)*
	04 06 05	*Bread*
	04 06 06	*Wine*
	04 06 07	*Beer*
	04 06 08	*Spirits*
	04 06 10	*Roof covering with asphalt materials*
	04 06 11	*Road paving with asphalt*
	04 06 12	*Cement (decarbonizing)*
	04 06 13	*Glass (decarbonizing)*
	04 06 14	*Lime (decarbonizing)*
	04 06 15	*Batteries manufacturing*
	04 06 16	*Extraction of mineral ores*
	04 06 17	*Other (including asbestos products manufacturing)*
	04 06 18	*Limestone and dolomite use*
	04 06 19	*Soda ash production and use*
04 08		Production of halocarbons and sulphur hexafluoride
	04 08 01	*Halogenated hydrocarbons production - By-products*
	04 08 02	*Halogenated hydrocarbons production - Fugitive*
	04 08 03	*Halogenated hydrocarbons production - Other*
	04 08 04	*Sulphur hexafluoride production - By-products*
	04 08 05	*Sulphur hexafluoride production - Fugitive*
	04 08 06	*Sulphur hexafluoride production - Other*
	05	**EXTRACTION AND DISTRIBUTION OF FOSSIL FUELS AND GEOTHERMAL ENERGY**
05 01		Extraction and first treatment of solid fossil fuels
	05 01 01	*Open cast mining*
	05 01 02	*Underground mining*
	05 01 03	*Storage of solid fuel*
05 02		Extraction, first treatment and loading of liquid
	05 02 01	*Land-based activities*
	05 02 02	*Off-shore activities*
05 03		Extraction, first treatment and loading of gaseous fossil fuels
	05 03 01	*Land-based desulfuration*
	05 03 02	*Land-based activities (other than desulfuration)*
	05 03 03	*Off-shore activities*
05 04		Liquid fuel distribution (except gasoline distribution)
	05 04 01	*Marine terminals (tankers, handling and storage)*
	05 04 02	*Other handling and storage (including pipeline) (q)*
05 05		Gasoline distribution
	05 05 01	*Refinery dispatch station*
	05 05 02	*Transport and depots (except 05.05.03)*
	05 05 03	*Service stations (including refuelling of cars)*
05 06		Gas distribution network
	05 06 01	*Pipelines (q)*
	05 06 03	*Distribution networks*
05 07		Geothermal energy extraction
	06	**SOLVENT AND OTHER PRODUCT USE**
06 01		Paint application

	06 01 01	*Paint application : manufacture of automobiles*
	06 01 02	*Paint application : car repairing*
	06 01 03	*Paint application : construction and buildings (except item 06.01.07)*
	06 01 04	*Paint application : domestic use (except 06.01.07)*
	06 01 05	*Paint application : coil coating*
	06 01 06	*Paint application : boat building*
	06 01 07	*Paint application : wood*
	06 01 08	*Other industrial paint application*
	06 01 09	*Other non industrial paint application*
06 02		Degreasing, dry cleaning and electronics
	06 02 01	*Metal degreasing*
	06 02 02	*Dry cleaning*
	06 02 03	*Electronic components manufacturing*
	06 02 04	*Other industrial cleaning*
06 03		Chemical proucts manufacturing or processing
	06 03 01	*Polyester processing*
	06 03 02	*Polyvinylchloride processing*
	06 03 03	*Polyurethane processing*
	06 03 04	*Polystyrene foam processing (c)*
	06 03 05	*Rubber processing*
	06 03 06	*Pharmaceutical products manufacturing*
	06 03 07	*Paints manufacturing*
	06 03 08	*Inks manufacturing*
	06 03 09	*Glues manufacturing*
	06 03 10	*Asphalt blowing*
	06 03 11	*Adhesive, magnetic tapes, films and photographs*
	06 03 12	*Textile finishing*
	06 03 13	*Leather tanning*
	06 03 14	*Other*
06 04		Other use of solvent and related activities
	06 04 01	*Glass wool enduction*
	06 04 02	*Mineral wool enduction*
	06 04 03	*Printing industry*
	06 04 04	*Fat, edible and non edible oil extraction*
	06 04 05	*Application of glues and adhesives*
	06 04 06	*Preservation of wood*
	06 04 07	*Underseal treatment and conservation of vehicles*
	06 04 08	*Domestic solvent use (other than paint application)(k)*
	06 04 09	*Vehicles dewaxing*
	06 04 11	*Domestic use of pharmaceutical products (k)*
	06 04 12	*Other (preservation of seeds,...)*
06 05		Use of HFC, N_2O, NH_3, PFC and SF_6
	06 05 01	*Anaesthesia*
	06 05 02	*Refrigeration and air conditioning equipments using halocarbons (e)*
	06 05 03	*Refrigeration and air conditioning equipments using other products than halocarbons (e)*
	06 05 04	*Foam blowing (except 060304)*
	06 05 05	*Fire extinguishers*
	06 05 06	*Aerosol cans*
	06 05 07	*Electrical equipments (except 060203)*
	06 05 08	*Other*
	07	**ROAD TRANSPORT**
07 01		Passenger cars (r)

	07 01 01		*Highway driving*
	07 01 02		*Rural driving*
	07 01 03		*Urban driving*
07 02			Light duty vehicles < 3.5 t (r)
	07 02 01		*Highway driving*
	07 02 02		*Rural driving*
	07 02 03		*Urban driving*
07 03			Heavy duty vehicles > 3.5 t and buses (r)
	07 03 01		*Highway driving*
	07 03 02		*Rural driving*
	07 03 03		*Urban driving*
07 04			Mopeds and Motorcycles < 50 cm3
07 05			Motorcycles > 50 cm3
	07 05 01		*Highway driving*
	07 05 02		*Rural driving*
	07 05 03		*Urban driving*
07 06			Gasoline evaporation from vehicles
07 07			Automobile tyre and brake wear
08			**OTHER MOBILE SOURCES AND MACHINERY**
08 01			Military
08 02			Railways
	08 02 01		*Shunting locs*
	08 02 02		*Rail-cars*
	08 02 03		*Locomotives*
08 03			Inland waterways
	08 03 01		*Sailing boats with auxilliary engines*
	08 03 02		*Motorboats / workboats*
	08 03 03		*Personal watercraft*
	08 03 04		*Inland goods carrying vessels*
08 04			Maritime activities
	08 04 02		*National sea traffic within EMEP area*
	08 04 03		*National fishing*
	08 04 04		*International sea traffic (international bunkers)(h)*
08 05			Air traffic
	08 05 01		*Domestic airport traffic (LTO cycles - <1000 m)*
	08 05 02		*International airport traffic (LTO cycles - <1000 m)*
	08 05 03		*Domestic cruise traffic (>1000 m)*
	08 05 04		*International cruise traffic (>1000 m)(i)*
08 06			Agriculture
08 07			Forestry
08 08			Industry
08 09			Household and gardening
08 10			Other off-road
	09		**WASTE TREATMENT AND DISPOSAL**
09 02			Waste incineration
	09 02 01		*Incineration of domestic or municipal wastes*
	09 02 02		*Incineration of industrial wastes (except flaring)*
	09 02 03		*Flaring in oil refinery*
	09 02 04		*Flaring in chemical industries*
	09 02 05		*Incineration of sludges from waste water treatment*
	09 02 06		*Flaring in gas and oil extraction*
	09 02 07		*Incineration of hospital wastes*
	09 02 08		*Incineration of waste oil*

09 04		Solid Waste Disposal on Land
	09 04 01	*Managed Waste Disposal on Land*
	09 04 02	*Unmanaged Waste Disposal Sites*
	09 04 03	*Other*
09 07		Open burning of agricultural wastes (except 10.03)
09 09		Cremation
	09 09 01	*Incineration of corpses*
	09 09 02	*Incineration of carcasses*
09 10		Other waste treatment
	09 10 01	*Waste water treatment in industry*
	09 10 02	*Waste water treatment in residential/commercial sect.*
	09 10 03	*Sludge spreading*
	09 10 05	*Compost production*
	09 10 06	*Biogas production*
	09 10 07	*Latrines*
	09 10 08	*Other production of fuel (refuse derived fuel,...)*
	10	**AGRICULTURE**
10 01		Cultures with fertilizers
10 02		Cultures without fertilizers
10 03		On-field burning of stubble, straw,...
10 04		Enteric fermentation
10 05		Manure management regarding organic compounds
10 06		Use of pesticides and limestone
10 09		Manure management regarding nitrogen compounds
	11	**OTHER SOURCES AND SINKS**
11 01		Non-managed broadleaf forests
11 02		Non-managed coniferous forests
11 03		Forest and other vegetation fires
1104		Natural grassland and other vegetation
11 05		Wetlands (marshes - swamps)
11 06		Waters
11 07		Animals
11 08		Volcanoes
11 09		Gas seeps
11 10		Lightning
11 11		Managed broadleaf forests
11 12		Managed coniferous forests
11 21		Changes in forest and other woody biomass stocks
	11 21 01	*Tropical forests*
	11 21 02	*Temperate forests*
	11 21 03	*Boreal forests*
	11 21 04	*Grassland/tundra*
	11 21 05	*Other*
11 22		Forest and grassland conversion
11 23		Abandonment of managed lands
11 24		CO_2 emiss. from/or removals into soils (except 10.06)
11 25		Other

Annex 4 – Nomenclature for Air pollution of fuels (NAPFUE)

CODE	FUEL IDENTIFICATION
	solid fuels
101	COKING COAL (GHV > 23 865 kJ/kg)
102	STEAM COAL (GHV > 23 865 kJ/kg)
103	SUB-BITUMINOUS (17 435 kJ/kg < GHV < 23 865 kJ/kg)
104	PATENT FUELS (from hard/sub-bituminous coal)
105	BROWN COAL / LIGNITE (GHV < 17 435 kJ/kg)
106	BROWN COAL BRIQUETTES
107	COKE OVEN COKE FROM HARD COAL
108	COKE OVEN COKE FROM BROWN COAL
109	GAS COKE
110	PETROLEUM COKE
111	WOOD AND SIMILAR WOOD WASTES
112	CHARCOAL
113	PEAT
114	MUNICIPAL WASTES
115	INDUSTRIAL SOLID WASTES
116	WOOD WASTES (except wastes similar to wood)
117	AGRICULTURAL WASTES (corncobs, straw, etc.)
118	SEWAGE SLUDGE
119	REFUSE DERIVED FUELS
120	OIL-SHALE
121	OTHER SOLID FUELS (tar, benzol, pitch, etc.)
	liquid fuels
201	CRUDE OIL
202	Item not used
203	RESIDUAL OIL
204	GAS OIL
205	DIESEL OIL FOR ROAD TRANSPORT
206	KEROSENE
207	JET FUEL
208	MOTOR GASOLINE
209	AVIATION GASOLINE
210	NAPHTA
211	SHALE-OIL
212	GASOLINE ENGINE WASTE OIL
213	DIESEL ENGINE WASTE OIL
214	WASTE SOLVENTS
215	BLACK LIQUOR
216	MIXTURE OF FUEL OIL AND COAL
217	REFINERY FEEDSTOCKS AND ADDITIVES
218	OTHER LIQUID WASTES
219	LUBRICANTS
220	WHITE SPIRIT
221	PARAFFIN WAXES
222	BITUMEN
223	BIO-ALCOHOL
224	OTHER PETROLEUM PRODUCTS (grease, aromatics, etc.)
225	OTHER LIQUID FUELS

	gaseous fuels
301	NATURAL GAS (except liquefied natural gas)
302	NATURAL GAS LIQUIDS
303	LIQUEFIED PETROLEUM GASES (LPG)
304	COKE OVEN GAS
305	BLAST FURNACE GAS
306	MIXTURE OF COKE OVEN AND BLAST FURNACE GASES
307	WASTE GAS (especially chemical industry)
308	REFINERY AND PETROCHEMICAL GAS (not condensable)
309	BIOGAS
310	GAS FROM WASTE TIPS
311	GAS WORKS GAS
312	STEEL PLANT FURNACE GAS
313	HYDROGEN
314	OTHER GASEOUS FUEL

Annex 5 – Eurostat's NAMEA for air emissions standard tables

Table 1a - Economic data by industry from the National Accounts according to NACE rev. 1 and ESA 95

YYYY CCC Country name	Notes	*Current prices*						*Constant prices*			Industry specific comments
		Output	Value added	Intermediate consumption	Employment			Output	Value added	Intermediate consumption	
		In national currency			'000 manhours	full-time jobs	'000 persons	In national currency			
		1a.2	1a.3	1a.4	1a.5	1a.6	1a.7	1a.8	1a.9	1a.10	1a.11
Total industries											
Industry clas	1a.1										
A-B 01-05											
A 01-02											
01											
02											
B 05											
C 10-14											
10											
11											
12-14											
12											
13											
14											
D 15-37											
15-16											
15											
16											
17-19											
17											
18											
19											
20											
21-22											
21											
22											
23-24											
23											
of which	*23.1*										
	23.2										
	23.3										
24											
of which	*24.14*										
	24.15										
25											
26											
of which	*26.1*										
	26.2										
	26.3										
	26.4										
	26.5										
	26.6										
	26.7										
	26.8										
27											
of which	*27.1-3*										
	27.4										
	27.5										
28											
29											
30-33											
30											
31											
32											
33											
34-35											
34											
35											
36											
37											
E 40-41											
40											
of which	*40.1*										
	40.2										
	40.3										
41											
F 45											
G 50-52											
H 55											
I 60-64											
60-63											
60											
of which	*60.1*										
	60.2										
of which	*60.24*										
	60.3										
61											
of which	*61.1*										
	61.2										
62											
63											
64											
J 65-67											
K-Q 70-99											
K 70-74											
L 75											
of which	*75.22*										
M 80											
N 85											
O 90-93											
90											
91											
92											
93											
P 95											
Q 99											
Not allocated	1a.12										
FISIM	1a.13										

Table 1b - Air emissions by industry according to NACE rev. 1 and NAMEA definitions

YYYY	CCC	Country name	Notes	1st Priority							2nd Priority											3rd Priority						Industry specific comments
				CO_2	of which CO_2 from biomass as fuel	N_2O	CH_4	HFCs	PFCs	SF_6	NO_x	SO_x	NH_3	NMVOC	CO	PM_{10}	CFCs	HCFCs	Hg	Pb	Cd	As	Zn	Cr	Se	Cu	Ni	
				1000 tonnes		tonnes																						
																												1b.1
Total industrie			1b.2																									
Industry classif			1b.3																									
A-B	01-05																											
A	01-02																											
		01																										
		02	1b.4																									
B	05		1b.5																									
C	10-14																											
		10																										
		11	1b.6																									
	12-14																											
		12																										
		13																										
		14																										
D	15-37																											
	15-16																											
		15																										
		16																										
	17-19																											
		17																										
		18																										
		19																										
		20																										
	21-22																											
		21																										
		22																										
	23-24																											
		23	1b.7																									
of which		*23.1*																										
		23.2																										
		23.3																										
		24																										
of which		*24.14*																										
		24.15																										
		25																										
		26																										
of which		*26.1*																										
		26.2																										
		26.3																										
		26.4																										
		26.5																										
		26.6																										
		26.7																										
		26.8																										
		27																										
of which		*27.1-3*																										
		27.4																										
		27.5																										
		28																										
		29																										
	30-33																											
		30																										
		31																										
		32																										
		33																										
	34-35																											
		34																										
		35																										
		36																										
		37																										

Table 1b - Air emissions by industry according to NACE rev. 1 and NAMEA definitions

YYYY CCC Country name		1st Priority							2nd Priority											3rd Priority						Industry specific comments
		CO_2	of which CO_2 from biomass as fuel	N_2O	CH_4	HFCs	PFCs	SF_6	NO_x	SO_x	NH_3	NMVOC	CO	PM_{10}	CFCs	HCFCs	Hg	Pb	Cd	As	Zn	Cr	Se	Cu	Ni	
		1000 tonnes		tonnes																						
	Notes																									1b.1
Total industrie	1b.2																									
Industry classif	1b.3																									
E 40-41																										
40	1b.8																									
of which	*40.1*																									
	40.2																									
	40.3																									
41																										
F 45																										
G 50-52																										
H 55																										
I 60-64																										
60-63	1b.9																									
60																										
of which	*60.1*																									
	60.2																									
of which	*60.24*																									
	60.3																									
61																										
of which	*61.1*																									
	61.2																									
62																										
63																										
64																										
J 65-67																										
K-Q 70-99																										
K 70-74																										
L 75																										
of which	*75.22*																									
M 80																										
N 85																										
O 90-93																										
90	1b.10																									
91																										
92																										
93																										
P 95																										
Q 99																										
Not allocated	1b.11																									

Note:

As decided at the June 2003 NAMEA-air Task Force meeting, Mercury (Hg), lead (Pb) and cadmium (Cd) have been moved from the 3rd to the 2nd priority. The same applies for table 2b on households' emissions.

Also, form now on, the possibility is offered to report emissions of HFCs, PFCs, SF_6, CFCs and HCFCs in tonnes of CO_2 equivalent. The same applies for table 2b on households' emissions as well as for the bridge table (table 3).

Table 1bt - Air emissions from transport activities

YYYY / Country name	CCC	CO_2	N_2O	NO_x	SO_2	NMVOC	CO	PM_{10}	Pb	Comments
		1000 tonnes	tonnes							
Grand total	Notes	0	0	0	0	0	0	0	0	1bt.1
Total industries	1bt.2									
Industry classification	1bt.3									
A-B 01-05										
A 01-02										
01										
02										
B 05	1bt.4									
C 10-14										
10										
11										
12-14										
12										
13										
14										
D 15-37										
15-16										
15										
16										
17-19										
17										
18										
19										
20										
21-22										
21										
22										
23-24										
23										
of which	*23.1*									
	23.2									
	23.3									
24										
of which	*24.14*									
	24.15									
25										
26										
of which	*26.1*									
	26.2									
	26.3									
	26.4									
	26.5									
	26.6									
	26.7									
	26.8									
27										
of which	*27.1-3*									
	27.4									
	27.5									
28										
29										
30-33										
30										
31										
32										
33										
34-35										
34										
35										
36										
37										
E 40-41										
40										
of which	*40.1*									
	40.2									
	40.3									
41										
F 45										
G 50-52										
H 55										
I 60-64										
60-63	1bt.5									
60										
of which	*60.1*									
	60.2									
of which	*60.24*									
	60.3									
61										
of which	*61.1*									
	61.2									
62										
63										
64										
J 65-67										
K-Q 70-99										
K 70-74										
L 75										
of which	*75.22*									
M 80										
N 85										
O 90-93										
90										
91										
92										
93										
P 95										
Q 99										
Not allocated	1bt.6									
Households	1bt.7									

Table 2a - Household consumption expenditure data from the National Accounts					
YYYY	CCC		Final consumption		Comments
Country name			*Current prices*	*Constant prices*	
			In national currency	In national currency	
	Notes		2a.3	2a.2	2a.1
Households, total					
		By COICOP categories			
	2a.4				
Transport 07		**Transport**			
07.1		Purchase of vehicles			
07.2		Operation of personal transport equipment			
of which	07.2.1	Spare parts and accessories for personal transport equipment			
	07.2.2	Fuels and lubricants for personal transport equipment			
	07.2.3	Maintenance and repair of personal transport equipment			
	07.2.4	Other services in respect of personal transport equipment			
07.3		Transport services			
Heating 04.5	2a.5	Electricity, gas and other fuels			
04.5.1		Electricity			
04.5.2		Gas			
04.5.3		Liquid fuels			
04.5.4		Solid fuels			
04.5.5		Heat energy			
Other		all other COICOP categories			
Not allocated					

Table 2b - Household air emissions according to NAMEA definitions																												
YYYY	CCC	*1st Priority*							*2nd Priority*												*3rd Priority*							
Country name	2b.2	CO_2	of which CO_2 from biomass as fuel	N_2O	CH_4	HFCs	PFCs	SF_6	NO_x	SO_x	NH_3	NMVOC	CO	PM_{10}	CFCs	HCFCs	Hg	Pb	Cd	As	Zn	Cr	Se	Cu	Ni	Comments		
		1000 tonnes		tonnes																								
	Notes																									2b.1		
Households, total																												
Transport	2b.3																											
of which leisure-gardening equipment																												
Heating	2b.4																											
Other	2b.5																											
Not allocated	2b.6																											

Note:

As decided at the June 2003 NAMEA-air Task Force meeting, Mercury (Hg), lead (Pb) and cadmium (Cd) have been moved from the 3rd to the 2nd priority. The same applies for table 1b on emissions of industries.

Also, from now on, the possibility is offered to report emissions of HFCs, PFCs, SF_6, CFCs and HCFCs in tonnes of CO_2 equivalent. The same applies for table 1b on emissions of industries as well as for the bridge table (table 3 below).

Table 3 - Bridge table between total air emissions in NAMEA and total according to UNFCCC and CLRTAP																												
Country name	3.3	CO_2	N_2O	CH_4	HFCs	PFCs	SF_6	NOx	SOx	NH_3	NMVOC	CO	PM_{10}	CFCs	HCFCs	As	Hg	Pb	Zn	Cd	Cr	Se	Cu	Ni	Comments			
CCC	Unit	1000 tonnes	tonnes																									
YYYY	Notes					3.2																			3.1			
Total UNFCCC or CLRTAP air emissions	3.4																											
plus CO_2 emissions from biomass	3.5																											
plus CO_2 net removal accounted for in UNFCCC total	3.6																											
plus National residents abroad	3.7																											
National fishing vessels operating abroad	3.8																											
Land transport																												
of which - industries																												
- households (tourism...)																												
Water transport																												
Air transport																												
less Non-residents on the territory	3.9																											
Land transport																												
of which - industries																												
- households (tourism...)																												
Water transport																												
Air transport																												
Other adjustments	3.10																											
Statistical discrepancy																												
Total NAMEA air emissions	3.11																											

Annex 6 – Difference in the coverage of air emissions between the IPCC guidelines and NAMEA

	NAMEA	IPCC	Comment
CO_2 emissions from biomass used as fuel	yes	no	IPCC: CO_2 emissions from biomass (wood and wood waste, charcoal, bio-alcohol, black liquor, as well as landfill and sludge gas) is excluded from national total, but they should reported separately for information (*Memo Items*).
CO_2 net removal (absorption by biomass and effects of land-use changes)	no	yes	IPCC:*Land-use change & forestry* (5) take both CO_2 emissions from biomass decrease and CO storage into biomass (increase of biomass). Also effects of land use changes and changes of carbon storage in soil are taken into account. This category is therefore either a **net source** or a **net sink**.
Land transport (all emission types)			
- resident units on the territory	yes	yes	
- non-resident units on the territory	no	yes	IPCC: no reference is made to international transport (lorries) and tourists (private cars) on the territory. All emissions stemming from road transport on the national territory are therefore included, whoever are the cars and lorries' owners.
- resident units abroad	yes	no	
Water transport (all emission types)			
- resident units on the territory	yes	(yes)	Only 'national' journeys (from one national harbour to another national harbour) of resident ship operators. This may include journeys of considerable length - e.g. between main territory and far overseas territory.
- non-resident units on the territory	no	(yes)	Only 'national' journeys (from one national harbour to another national harbour) of foreign ship operators. This may include journeys of considerable length - e.g. between main territory and far overseas territory.
- resident units abroad	yes	no	IPCC: vessels engaged in international transport should as far as possible be excluded from national total (but are to be reported separately for information in *Memo items*), **except emissions related to fishing** that are to be reported in the category *Other sectors* (1A4iii).
Air transport (all emission types)			
- resident units on the territory	yes	(yes)	IPCC: national companies' emissions related to national flights only; emissions from fuel used for international flights by resident companies are not included, since emissions related to all international flights are excluded from national total (reported separately).
- non-resident units on the territory	no	(yes)	IPCC: foreign companies' emissions related to national flights only; emissions from fuel used for international flights by foreign companies are not included, since emissions related to all international flights are excluded from national total (reported separately).
- resident units abroad	yes	no	IPCC: emissions stemming from international civil aviation should as far as possible be excluded from national total, but they are to be reported separately for information (*Memo Items*).

Annex 7 – Table on energy use for the NAMEA-air standard tables

Table 1be - Energy use by industries and households

CCC / YYYY / Country name	Notes	Primary energy forms combusted							Secondary energy forms combusted									Air emission free energy forms and net balance						Total by industry	Comments
		Lignite	Coal	Natural gas	Biofuels		Peat and other	Waste	Coal coke	Coke gas and other gases	Petroleum products							Primary electricity produced	Other	(-) Electricity sold	(+) Electricity purchased	(-) Heat+hot water sold	(+) Heat+hot water purchased		
					Wood	Other bio-fuels					Total	Fuel oil	Diesel oil	Motor gasoline	LPG	Jet fuel and kerosene	Other petrolum products								
				1be.10		1be.11	1be.12	1be.13		1be.14	1be.15						1be.16	1be.17	1be.18	1be.19				1be.20	
		Tera Joules							Tera Joules									Tera Joules		Tera Joules				Tera Joules	
Grand total		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	
Total Industries																								0	
Industry clas	1be.2																								1be.1
A-B 01-05																								0	
A 01-02																								0	
01																								0	
02																								0	
B 05	1be.3																							0	
C 10-14																								0	
10																								0	
11	1be.4																							0	
12-14																								0	
12																								0	
13																								0	
14																								0	
D 15-37																								0	
15-16																								0	
15																								0	
16																								0	
17-19																								0	
17																								0	
18																								0	
19																								0	
20																								0	
21-22																								0	
21																								0	
22																								0	
23-24																								0	
23																								0	
of which	*23.1*																							0	
	23.2																							0	
	23.3																							0	
24																								0	
of which	*24.14*																							0	
	24.15																							0	
25																								0	
26																								0	
of which	*26.1*																							0	
	26.2																							0	
	26.3																							0	
	26.4																							0	
	26.5																							0	
	26.6																							0	
	26.7																							0	
	26.8																							0	
27																								0	
of which	*27.1-3*																							0	
	27.4																							0	
	27.5																							0	
28																								0	
29																								0	
30-33																								0	
30																								0	
31																								0	
32																								0	
33																								0	
34-35																								0	
34																								0	
35																								0	
36																								0	
37																								0	

Table 1be - Energy use by industries and households

CCC / YYYY / Country name	Notes	Primary energy forms combusted							Secondary energy forms combusted									Air emission free energy forms and net balance						Total by industry	Comments
		Lignite	Coal	Natural gas	Biofuels		Peat and other	Waste	Coal coke	Coke gas and other gases	Petroleum products							Primary electricity produced	Other	(-) Electricity sold	(+) Electricity purchased	(-) Heat+hot water sold	(+) Heat+hot water purchased		
					Wood	Other bio-fuels					Total	Fuel oil	Diesel oil	Motor gasoline	LPG	Jet fuel and kerosene	Other petrolum products								
				1be.10		1be.11	1be.12	1be.13		1be.14	1be.15						1be.16	1be.17	1be.18	1be.19				1be.20	
		Tera Joules							Tera Joules									Tera Joules		Tera Joules				Tera Joules	
E 40-41																								0	
40																								0	
of which	*40.1*																							0	
	40.2																							0	
	40.3																							0	
41																								0	
F 45																								0	
G 50-52																								0	
H 55																								0	
I 60-64																								0	
60-63	1be.5																							0	
60																								0	
of which	*60.1*																							0	
	60.2																							0	
of which	*60.24*																							0	
	60.3																							0	
61																								0	
of which	*61.1*																							0	
	61.2																							0	
62																								0	
63																								0	
64																								0	
J 65-67																								0	
K-Q 70-99																								0	
K 70-74																								0	
L 75																								0	
of which	*75.22*																							0	
M 80																								0	
N 85																								0	
O 90-93																								0	
90																								0	
91																								0	
92																								0	
93																								0	
P 95																								0	
Q 99																								0	
Not allocated	1be.6																							0	
Households, total																								0	
Transport	1be.7																							0	
of which leisure-gardening equipment																								0	
Heating	1be.8																							0	
Other																								0	
Not allocated	1be.9																							0	