ISSN 1977-0375

eurostat
Methodologies and
Working papers

Manual for Air Emissions Accounts

2009 edition

eurostat
EUROPEAN COMMISSION

eurostat
Methodologies and
Working papers

Manual for Air Emissions Accounts

2009 edition

eurostat
EUROPEAN COMMISSION

How to obtain EU publications

Publications for sale:

- via EU Bookshop (http://bookshop.europa.eu);
- from your bookseller by quoting the title, publisher and/or ISBN number;
- by contacting one of our sales agents directly. You can obtain their contact details on the Internet (http://bookshop.europa.eu) or by sending a fax to +352 2929-42758.

Free publications:

- via EU Bookshop (http://bookshop.europa.eu);
- at the European Commission's representations or delegations. You can obtain their contact details on the Internet (http://ec.europa.eu) or by sending a fax to +352 2929-42758.

Europe Direct is a service to help you find answers to your questions about the European Union

Freephone number (*):

00 800 6 7 8 9 10 11

(*) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

More information on the European Union is available on the Internet (http://europa.eu).

Luxembourg: Office for Official Publications of the European Communities, 2009

ISBN 978-92-79-12205-7
ISSN 1977-0375
doi 10.2785/25501
Cat. No. KS-RA-09-004-EN-N

Theme: Environment and energy
Collection: Methodologies and working papers

Preface

The European Strategy for Environmental Accounting (ESEA) identifies Air Emissions Accounts as one core module of Environmental Accounts to be produced regularly and in a timely fashion in order to support policy making. By publishing this Manual for Air Emissions Accounts, Eurostat is laying the methodological foundation for harmonized Air Emissions Accounts across Europe.

Air Emissions Accounts record and present data on air emissions in a way that is compatible with traditional economic statistics. They record emissions to air in a breakdown by emitting industries as well as private households' activities as delineated in National Accounts. Air Emissions Accounts are linked to the framework of Supply, Use and Input-Output Tables enabling numerous analytical applications. Such kind of integrated environmental-economic analyses are increasingly demanded in the wider policy area of sustainable development (e.g. Lisbon Strategy, EU Sustainable Development Strategy, Global Climate Change, EU policies on Sustainable Consumption and Production etc.).

With the globalisation of economic activities production and consumption processes are increasingly geographically spread. The production system of a country specialised on services may emit comparably lower amounts of carbon dioxide on their territory since the country will tend to import major portions of their demand for basic material goods such as food, fuels, and metals. Hence, the carbon dioxide emissions on the territory only tell one side of the story (the production side) – whereas the consumption related emissions may be significant higher when the emissions from imports are considered. Input-Output models extended by Air Emissions Accounts help to quantify the embedded emissions of imported products.

The strategic objective of this Manual is to enhance the statistical basis in the area of Environmental Accounts. The Eurostat Manual intends to foster quality of statistical data and stimulate harmonisation of methods. The main emphasis of the Manual is to describe the methodologies and procedures for the compilation of Air Emissions Accounts in the European Statistical System.

The most important objective of the Manual is to provide guidance for compilers of Air Emissions Accounts. Therefore, the Manual needs to be detailed and comprehensive. Due to its clear focus on the practical implementation, the Eurostat Manual complements international references such as the UN System of Integrated Environmental and Economic Accounting (SEEA 2003). For national compilers the Eurostat Manual may serve as a practical compilation guide. Interested data users may also benefit from this publication as a source of background information and clarification.

Gilles DECAND
Head of Unit
Environmental Statistics and Accounts

Acknowledgements

This document is the result of a longstanding methodological development process which lasted more than 10 years. Eurostat's NAMEA Task Force – assembling experts from national statistical institutes (NSI), international organisations and science – was highly involved in this process of establishing the conventions for Air Emissions Accounts. Namely, we would like to thank the following members[1] of the Task Force for their valuable contributions to the methodological development process:

BUTINA Vida – Statistical Office of the Republic of Slovenia
FLACHMANN Christine – Federal Statistical Office Germany DESTATIS
GAZLEY Ian – Office for National Statistics (ONS) UK
GIE Gérard – PLANISTAT
GRAVGÅRD PEDERSEN Ole – Statistics Denmark
GREGOIRE Patrice – Institut français de l'environnement (I.F.E.N.)
HANSEN Dennis – Statistics Denmark
HARRIS Rocky – Office for National Statistics (ONS) UK
HASS Julie – Statistics Norway (SSB)
HEINZE Angela – Federal Statistical Office Germany DESTATIS
KOLSHUS Kristine E. – Statistics Norway (SSB)
MAYER Helmut – Federal Statistical Office Germany DESTATIS
MOLL Stephan – Wuppertal Institute for Climate, Environment, and Energy
OLSEN Thomas – Statistics Denmark
PASQUIER Jean–Louis – Institut français de l'environnement (I.F.E.N.)
PETERSEN Michael – Statistics Denmark
REITSCHULER Gerhard – Federal Environment Agency Austria
SEIBEL Steffen – Federal Statistical Office Germany DESTATIS
THOMAS Joachim – Federal Statistical Office Germany DESTATIS
TUDINI Angelica – ISTAT
WADESKOG Anders – Statistics Sweden (SCB)

Further, the involvement of the following Eurostat staff is also being gratefully acknowledged:
CABECA Julio, HANAUER Jörg-Alexander, HASS Julie L., MOLL Stephan, MØLLGAARD Elisabeth, MUTHMANN Rainer, NEWSON Brian, STEURER Anton

The final version of the Manual was written and edited by Stephan Moll, Angelica Tudini and Julie L. Hass.

[1] In alphabetical order

Furthermore, the authors and editors would like to thank many other experts who are not explicitly mentioned here for their positive feedback in the discussions.

Thanks to Thomas Olsen (Statistics Denmark) and Jean-Louis Pasquier (I.F.E.N.) for providing tables on the distribution of road transport emissions over NACE rev.1.1 divisions and private households.

Table of Content

Introduction

The overall objectives of Eurostat's Manual for Air Emissions Accounts are:

- Laying down most important principles and compilation rules for Eurostat's Air Emissions Accounts (Part A);
- Providing technical guidance for national statistical institutes (NSI) to compile Air Emissions Accounts (Part B);
- Illustrating how Air Emissions Accounts can be used in informing policy decisions (Part C).

In pursuing these objectives Eurostat aims at establishing harmonized compilation methodologies to improve data availability, coverage and quality of Air Emissions Accounts across Europe so as to enable the highest possible use for policy making.

The Manual is structured into three parts as following:

- Part A: Theory and Concepts

  This first part presents the overall conceptual framework for Environmental Accounts (UN SEEA) and places Air Emissions Accounts into this wider context.

- Part B: Compilation Guide

  The second part is a compilation guide that is aimed at compilers of Air Emissions Accounts and gives specific guidance on how to establish Air Emissions Accounts starting from air emission inventories or from energy accounts.

- Part C: Use of Air Emissions Accounts

  The third part describes some uses of the data derivable from Air Emissions Accounts. It shows examples from countries in terms of environmental profiles, decoupling, decomposition and other analyses. Detailed instructions for these analyses is not provided but helpful references are given to help guide readers to the more technical literature that can be used to make these types of analyses.

For more than a decade, Eurostat has been involved in developing and collecting Air Emissions Accounts from EU and EFTA countries. Currently, Eurostat collects and processes Air Emissions Accounts biannually on the basis of an electronic questionnaire comprising net-supply tables for 13 air emissions (see section 6.4 for further details).

Part A: Theory and Concepts

Introduction to Part A

Part A, 'Theory and Concepts', lays down the general conceptual foundations, definitions and delineations, and accounting principles and reporting formats for Eurostat's Air Emissions Accounts (AEA), thereby placing them into the wider contexts of Environmental Accounts and the UN System of Integrated Environmental and Economic Accounting (SEEA).

What are Air Emission Accounts – in brief?
Air Emission Accounts record and present data on air emissions in a way that is compatible with the National Accounts. They record national economies' emissions to air in a breakdown by emitting economic activities as delineated in National Accounts. Economic activities comprise production activities by industries as well as private households' activities.

The term *air emission* is used in this Manual to denote the physical flow of gaseous or particulate materials from the economic system (production or consumption processes) to the atmosphere which is part of the environmental system. Air emissions comprise emissions of greenhouse gases as well as emission of air pollutants such as e.g. SO_2, NOx, PM10 etc.

This Manual employs the term '*Air Emissions Accounts*' (instead of '*NAMEA-air*', as used formerly). The term '*Accounts*' is used here as it commonly expresses the fact that certain information is recorded and presented in a way compatible to National Accounts. Accordingly, the term '*Air Emissions Accounts*' means that air emission data are recorded and presented in a National Accounts compatible way.

The term '*Air Emissions Accounts*' clearly distinguishes from the term '*emission inventories*'. The latter is commonly used when referring to data on greenhouse gas emissions and emissions of air pollutants assembled following certain formats as agreed upon under international conventions (e.g. UNFCCC[2] and CLRTAP[3]).

Emission inventories are rather technology-oriented and may serve as the appropriate data basis for technology-oriented questions and analyses. Unlike, Air Emission Accounts which are economically oriented and assign air emissions to those economic entities that actually is carrying out the activity from which the air emissions are originating. Air Emissions Accounts are developed to answer more economically oriented questions and

[2] United Nation Framework Convention on Climate Change
[3] Convention on Long Range Transboundary Air Pollution

analyses. Both information systems – emission inventories and Air Emissions Accounts – complement each other.

One of the main purposes Eurostat is pursuing in promoting and collecting Air Emissions Accounts is to combine them with Eurostat's ESA95 Supply, Use and Input-Output Tables (SUIOT) in order to enable environmentally extended input-output analyses, allowing assessment of environmental pressures associated with European consumption and production patterns (see also Part C, chapter 10).

Air Emissions Accounts are part of Eurostat's work programme in the area of Environmental Accounts[4]. Eurostat's activities related to Air Emissions Accounts (formerly commonly termed "NAMEA-air") started already in 1995 with a series of workshops. Together with experts from national statistical institutes (NSI) and research, Eurostat developed basic compilation rules which were laid down in the form of standard tables which also helped to facilitate and structure compilation work of national statistical institutes.
Several rounds of data-collections took place between 1999 and 2004. Since 2006, Eurostat is conducting regularly bi-annual surveys for Air Emissions Accounts through electronic questionnaires.

A number of statistical offices in Europe, including Eurostat have established Environmental Accounts units. At the European level, the most advanced modules of Environmental Accounts are Air Emissions Accounts, Economy-wide Material Flow Accounts (EW-MFA), and environmental expenditure accounts.
In addition, Eurostat supports countries through so called grant-projects aiming at supporting the implementation of Environmental Accounts (amongst which Air Emissions Accounts) in their national statistical systems.

[4] see Eurostat's website on Environmental Accounts:
http://epp.eurostat.ec.europa.eu/portal/page/portal/environmental_accounts/introduction

1. Conceptual foundations

Air Emissions Accounts are part of Environmental Accounts. Conceptually, both – Environmental Accounts as well as its module Air Emissions Accounts – are founded on National Accounts. Environmental Accounts constitute satellite accounts to National Accounts for the analysis of the interaction between the environment and the economy (ESA95, paragraph 1.18.). An important feature of satellite accounts is that in principle all basic concepts and classifications of the standard National Accounts framework are retained (ESA95, paragraph 1.20.).

This chapter provides a brief overview on the conceptual foundations for National Accounts and Environmental Accounts and places Eurostat's Air Emissions Accounts into these overall frameworks.

1.1 National Accounts

National Accounts is a comprehensive mainly monetary bookkeeping framework portraying national economies. It follows mature and internationally harmonised and established methods for measuring macro-economic phenomena such as consumption and production so as to portray all economic activities and transactions of a national economy. Several economic indicators can be derived from the overall bookkeeping framework: Gross Domestic Product (GDP) is the most prominent indicator to monitor macro-economic development. Further prominent indicators derivable from National Accounts are national income, gross value added of industry branches, trade balance, net savings etc.

International statistical standards for National Accounts are the UN System of National Accounts – referred to SNA93 (United Nations 1993) – and its European version "European System of National and Regional Accounts in the Community"– referred to as ESA95[5]. They provide accounting principles and a systematic framework for the detailed assembling of economic data describing national economies. The SNA93 and the ESA95 are established statistical standards enabling international comparisons of basic economic data.

The ESA95 constitutes the main reference for Eurostat's Air Emissions Accounts as far as National Accounting principles are concerned[6].

[5] Council Regulation (EC) No 2223/96 of 25 June 1996 on the European system of national and regional accounts in the Community (OJ L 310, 30.11.1996, p. 1)

[6] Note that both, the SNA93 and the ESA95, are being revised but the revisions to these handbooks do not change the main principles used from these systems to which are needed to establish Air Emissions Accounts.

The ESA95 framework consists of two generic ways of representations of the national economy. It distinguishes two sets of tables (ESA95 paragraph 1.02):

(a) the sector accounts;

(b) the input-output framework and the accounts by industries.

The sector accounts (by institutional sectors) are a sequence of T-accounts systematically describing the different stages of the economic process: production, generation of income, distribution of income, redistribution of income, use of income and financial and non-financial accumulation. Although these are important in Environmental Accounts they are of less relevance for Air Emissions Accounts.

The input-output framework is the most relevant representation of the national economy with regards to Air Emissions Accounts. The input-output framework portrays in detail the production and consumption activities by showing in monetary values the flows of goods and services (output, imports, exports, final consumption, intermediate consumption and capital formation by product group). Within the input-output framework, two forms of representations are distinguished[7] (ESA95 paragraphs 9.01 ff, see also Eurostat 2008):

- supply and use tables;
- symmetric input-output tables.

1.2 Environmental Accounts

Environmental Accounts have been developed in connection to National Accounts and aim at providing information on the links between the environment and the economy. Environmental Accounts constitute a satellite accounting framework representing environmental data in a format compatible with economic National Accounts data, thus enabling integrated analyses.

Conventions, accounting methodologies, and classifications as laid down in National Accounts (SNA93, ESA95) form the point of departure for defining Environmental Accounts principles. Two accounting principles should be emphasised here: the residence principle and the balancing principle.

The *residence principle* is an important accounting convention in National Accounts which also needs to be retained in Environmental Accounts. The national economic system is defined by its residents' economic activities (see section 2.1) independent of where those activities take place geographically. This has particular important implications for Air Emissions Accounts (see section 6.1).

[7] Both constitute matrix representations which can be used as the NAM part of a NAMEA.

Another basic accounting principle in both, National Accounts and Environmental Accounts (particularly Physical Flow Accounts), is the *balancing principle*: each flow recorded needs to obtain a definite origin and a definite destination. The origin and the destination of a given flow characterises its direction. The sum of flows from all origins must equal the sum of flows to all destinations. In the case of Physical Flow Accounts this is also referred to as the material-balance and/or mass-balance principle (SEEA2003, paragraphs 3.6 – 3.10). Evolving from the balancing principle, each flow item may be recorded twice, at its origin and at its destination. This is also referred to as *double-entry principle* (ESA95; paragraph 1.50) which is another common feature to National Accounts.

Several methodological documents have been published laying down conceptual accounting principles for Environmental Accounts – most importantly the UN *System of Integrated Environmental and Economic Accounting* (SEEA):

- In 1993, the UN published first conceptual and methodological guidelines for a *System of Integrated Environmental and Economic Accounts* – referred to as SEEA93 (United Nations et al. 1993).
- In 2000, the UN Statistical Division and the UN Environment Programme published the *Handbook of National Accounting: Integrated Environmental and Economic Accounting -- An Operational Manual*. This handbook provides hands on guidance on the implementation of the more practical modules of the SEEA93 based on country experiences but focuses mostly on asset accounts for natural resources and not on physical flow accounts.
- In 2003, a revised draft version of the SEEA was issued: "*Handbook of National Accounting – Integrated Environmental and Economic Accounting 2003*" commonly referred to as SEEA2003 (United Nations et al. 2003). At this point of time, the SEEA2003 is the main reference for conceptual foundations of Environmental Accounts.
- Meanwhile, a further revision of the SEEA has been launched and is expected to be completed sometime during the period 2011-2013.

The SEEA has been developed by the so called "London Group"[8], which is also currently involved in the revision process.

So far, Environmental Accounts have no formal status of an international statistical standard. The UN has set up a Committee of Experts on Environmental-Economic Accounting[9] to begin the process of elevating a revised SEEA to a statistical standard.

The SEEA2003 comprises four categories of accounts:

- Physical and Hybrid Flow Accounts;
- Economic Accounts and Environmental Transactions;

[8] The London Group is an informal group of experts primarily from national statistical institutions but also international organisations including the United Nations, Eurostat, International Monetary Fund, OECD and the World Bank. See http://unstats.un.org/unsd/envaccounting/londongroup/

[9] see http://unstats.un.org/unsd/envaccounting/ceea/default.asp

- Asset Accounts in physical and monetary terms;
- Extending SNA aggregates to accounts for depletion, defensive expenditure and degradation.

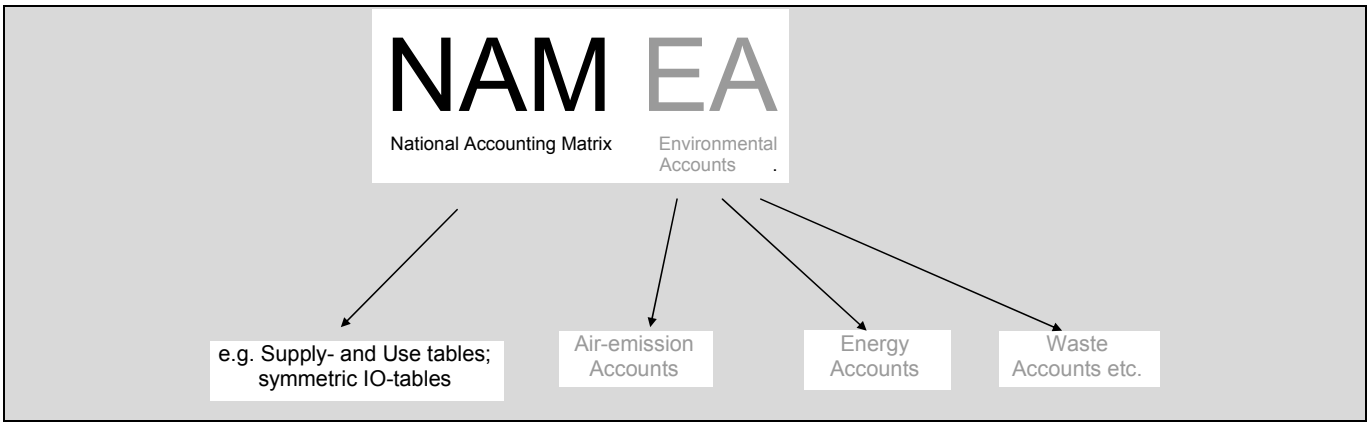
Air Emissions Accounts belong to the category of Physical Flow Accounts.

Physical Flow Accounts relate to recordings/bookkeeping of physical flows of materials and energy. These physical flows are assembled as far as possible according to the input-output-frameworks of National Accounts (see more details on Physical Flow Accounts in chapter 3).

Air Emissions Accounts – as also other potential modules of Environmental Accounts such as e.g. Energy Accounts, Land Use Accounts, or Waste Accounts – can be combined with National Accounting data in one framework. The combination of Physical Flow Accounts – such as Air Emissions Accounts – with monetary National Accounts data is termed Hybrid Flow Accounts in the SEEA2003 (see more details on Hybrid Flow Accounts in chapter 4).

The term NAMEA has come into widespread use for Hybrid Flow Account, i.e. the integration/combination of monetary National Accounting data and Environmental Accounts. NAMEA is the acronym for *National Accounting Matrix including Environmental Accounts*. It originates from work developed throughout the 1990s by Statistics Netherlands. It denotes a combination of National Accounts data, mainly in matrix format such as e.g. symmetric input-output tables and/or supply and use tables, and Environmental Accounts (see Figure 1).

Figure 1: Schematic of Hybrid Flow Accounts identifying the two main components, a National Accounting Matrix (NAM) and Environmental Accounts (EA)



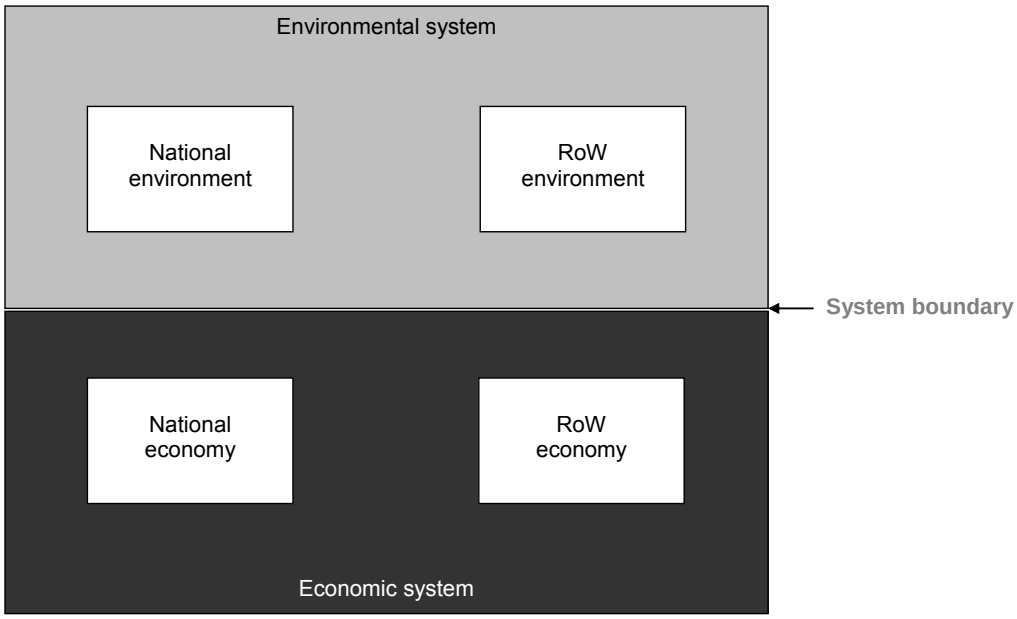
The revised SEEA will most likely have a more detailed accounting structure with regards to Physical Flow Accounts. And if the upcoming standard for physical flow accounting substantially changes, adaptations to this Manual for Air Emissions Accounts may be needed. However, at the time of writing this Manual no major changes are expected. Eurostat will carefully observe the methodological and conceptual developments in physical flow accounting and appropriately adopt its concepts for Air Emissions Accounts and revise this Manual if necessary at a later stage.

2. Definitions and delineations of the economic and the environmental system

In order to establish consistent accounting rules for Air Emissions Accounts, it is necessary to have clear definitions and delineations of the economic system and the environmental system.

This chapter introduces the economic system with its elements *national economy* and *Rest of the World* (RoW)-economy, as well as the environmental system with its elements national environment and RoW-environment. Figure 2 provides a schematic presentation of the different components discussed in this chapter.

Figure 2: Schematic presentation of the economic system and the environmental system and its national and Rest of the World (RoW) elements



2.1 Definition of the economic system (national economy and RoW economy)

The economic system is the totality of activities carried out by a large number of economic entities. Fundamental elements of the economic system are units carrying economic activities of all kinds for the purposes of production, consumption, accumulation etc. A basic unit of economic systems is referred to as institutional unit.

In National Accounts the national economy is defined in terms of institutional units (SNA93, paragraphs 2.19 and 2.22). It consists of all institutional units which are resident in the economic territory of a country – referred to as resident units (ESA95, paragraph 2.04). Thus, the national economy is defined as the total of all resident units. The National Accounts system records all flows and stocks related to the resident units of a national economy.

Residence principle

The concept of residence in National Accounts is not based on nationality or legal criteria. An institutional unit is said to be a resident unit of a country when it has a centre of economic interest in the economic territory of a country – that is, when it engages for an extended period (one year or more) in economic activities on this territory. (SNA93, paragraph 2.22)

Delimitation of the national economy and the rest of the world:

Resident units engage in transactions with non-residents (that is, units which are residents of other economies). These transactions are referred to as transactions between the national economy and the economy of the rest of the world.

Implications for Air Emissions Accounts:

The residence principle as employed by National Accounts has implications for Eurostat's Air Emissions Accounts.

Emissions accounted for must be those stemming from the resident-unit's economic activities 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, are fully included in the Air Emissions Accounts either under the economic activity earning the value added from these activities or under households (the case of tourists driving car abroad). Conversely, all emissions by non-resident entities on the national territory (foreign lorries and tourists, bunkering of foreign vessels) should be excluded. In short, Air Emissions Accounts record emissions arising from all resident units' activities, regardless from where these emissions actually occur geographically (see for details section 6.1).

Also, since the Air Emissions Accounts framework encompasses only emissions that can be traced to institutional units and economic activities, emissions from non-economic agents (e.g. nature) are not to be included.

2.2 Definition of the environmental system

The above National Accounts principles and accounting rules relate only to the economic system. They define what constitutes the economic system. Air Emissions Accounts – as part of Environmental Accounts – relate in addition to the environmental system and particularly to the economy-environment interface. This requires a clear definition of what constitutes the environmental system and a clear definition of the system boundary between the economic system and the environmental system.

What constitutes the environmental system?
The environmental system includes all natural assets and flows of the natural environment not belonging to the economic system. The environment is defined as the naturally produced physical surroundings on which humanity is entirely dependent in all its activities. In the SEEA2003 the environment is regarded as a type of asset, by referring to and by extending the asset concept of National Accounts.

Three basic functions of the environment can be distinguished: resource function, sink function, and service function. In Air Emissions Accounts the environment, more precisely the atmosphere, functions primarily as a sink (or destination) of residual flows arising from production and consumption activities.

Delineation of national environment opposed to the Rest of the World's environment
Corresponding to each national economy there is a national environmental sphere which is associated with the national territory including the surrounding sea area covered in an exclusive economic zone (EEZ) agreement and the airspace over the country.
Accordingly, other national economies are associated with their respective national environment.
Open oceans outside an EEZ and airspace outside a national territory are part of the environmental system but not part of any country's national environment (global commons).
The Rest of the World (RoW) environment encompasses all national environments of other countries as well as all the environmental parts outside of any national territory.

In summary, the following terminology is used regarding the environmental system:

national environment	national environmental sphere which is associated with the national territory including the surrounding sea area and sea floor covered in an exclusive economic zone (EEZ) agreement and the airspace over the country
RoW-environment	all national environments of other countries as well as all environmental parts outside of any national territory
environment (environmental system)	environmental sphere in total; i.e. national environment plus RoW-environment

3. General Representation of Physical Flows in SEEA2003's Physical Flow Accounts

Physical Flow Accounts form one category of accounts in the overall accounting structure of the SEEA2003 (see chapter 3 in SEEA2003). This chapter presents some general features of SEEA2003's Physical Flow Accounts which are of conceptual importance for Eurostat's Air Emissions Accounts.

3.1 General types of physical flows and their origin and destination (direction)

This section introduces the general types of physical flows and their direction as defined in the SEEA2003.

Physical flows are flows of materials and energy. SEEA2003's Physical Flow Accounts record physical flows within and between the economic and the environmental system (SEEA2003, paragraph 2.20). It broadly distinguishes:

- Flows within the economy (SEEA2003, paragraphs 2.22-2.24)
- Flows between the economy and the environment (SEEA2003, paragraphs 2.25-2.27)
- Flows within the environment (SEEA2003, paragraphs 2.28-2.30)

Further, the SEEA2003 distinguishes four different types of flows in its physical flow accounts (paragraphs 2.31-2.34):

1. *Products* are goods and services produced within the economic system and used within it, including flows of goods and services between the national economy and the rest of the world (RoW).

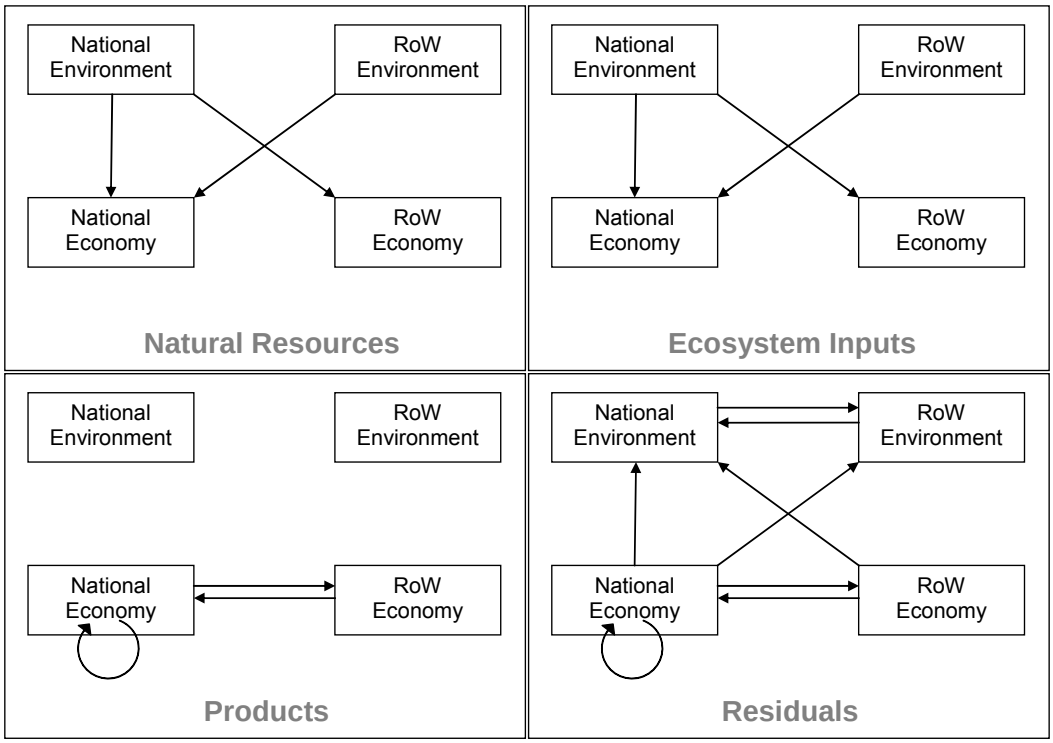
- *Natural resources* cover mineral and energy resources, water and biological resources originating in the environmental system and flowing into the economic system.
- *Ecosystem inputs* cover the water and other natural inputs (e.g. nutrients, carbon dioxide) required by plants and animals for growth, and the oxygen necessary for combustion.
- *Residuals* are the incidental and undesired outputs from the economy which generally have no economic value and may be recycled, stored within the economy or (more usually at present) discharged into the environment. "Residuals" is the single word used to cover solid, liquid and gaseous wastes.

Air emissions, as recorded in Eurostat's Air Emissions Accounts belong to the flow type category of *residuals*.
Figure 3 shows for each type of physical flow its principal origins and destinations.
Flows of natural resources and ecosystem inputs originate from the national environment as well as the RoW-

environment and flow into the national economy and the RoW-economy, respectively; thereby crossing the functional system boundary between environmental and economic system.
Flows of products originate in the economy and are used within the economy. They flow between single elements of the economy, e.g. from production to consumption. Further, they are traded between national economy and the RoW-economy.

Flows of residuals (including air emissions) originate in the economic system. They are emitted by the national economy and the RoW-economy, cross the system boundary, and flow into the environmental system (both, national environment and RoW-environment). However, it has to be noted, that some residual flows also remain within the economic system for further processing (see also section 5.1)
Flows of residuals may also occur within the environmental system, e.g. from the RoW-environment to the national environment (e.g. residuals transported by wind and water).

Figure 3: A picture of flows between the economy and the environment



Source: adapted from SEEA2003, Fig. 2.2, p. 31

3.2 Representation of physical flows in physical supply- and use tables

As seen before, the total supply (origin) of a given physical flow must equal the total use (destination) of a given physical flow. One way of representing this principle is by means of physical supply- and use tables. The SEEA2003 suggest this matrix representation (see SEEA2003, paragraphs 2.35 – 2.54; and 3.95 – 3.147).

A physical supply-table shows the origin of flows and a physical use-table shows the destination of flows. Figure 4 presents a numerical example for a physical supply and use tables.

The aforementioned material-balance principle becomes obvious when comparing the row-wise totals in the physical supply-table with the row-wise totals of the use-table in Figure 4. For instance, the total supply of natural resources amounts to 264 and equals the total use of natural resources.

One specific issue related to residuals shall be highlighted here. The total supply and use of residuals in the example (Figure 4) amount to 415 units which are not all released to the environmental system. As the numerical example for the physical use-table reveals, only 377 units are actually ending up in the environmental system (373 in the national environment; 4 in the RoW-environment) which is referred to as 'net-residuals' (see also section 5.1). A considerable amount of residuals is ending up on controlled landfills (being part of the economic system) in form of waste, some residuals are exported (e.g. shipment of waste) and some residuals are used by industries (e.g. for recycling).

Figure 4: Example for physical supply- and use tables

Physical Supply Table

origin / flow	National economy				RoW	Environment		
	Industries	Consumption	Capital formation	Controlled landfills	economy	national	RoW	Total
natural resources						258	6	264
eco-system inputs						143	4	147
products	551				150			701
residuals	280	48		73	6		8	415

Physical Use Table

destination / flow	National economy				RoW	Environment		
	Industries	Consumption	Capital formation	Controlled landfills	economy	national	RoW	Total
natural resources	261	2			1			264
eco-system inputs	121	24			2			147
products	442	39	119		101			701
residuals	7			26	5	373	4	415

not applicable

Eurostat's Air Emissions Accounts simplify from the full-fledged physical supply-use scheme as suggested by the SEEA2003. First, Eurostat's Air Emissions Accounts relate only to one particular sub-group of the flow type of residuals, i.e. air emissions. Secondly, Eurostat's Air Emissions Accounts apply only a kind of simplified physical supply-table; i.e. the double-entry accounting principle is not implemented. These specific deviations are further tackled in chapter 5.

4. General Representation of Hybrid Flow Accounts

Hybrid Flow Accounts form a further category of accounts in the overall accounting structure of the SEEA2003 (see chapter 4 in SEEA2003). This chapter presents some general features of SEEA2003's Hybrid Flow Accounts which are of conceptual importance for Eurostat's Air Emissions Accounts.

Although Eurostat's Air Emissions Accounts constitute purely physical flow accounts in a strict sense, they are supposed to be combined with monetary flow accounts. Eurostat combines Air Emissions Accounts with ESA95 Supply, Use, and Input-Output Tables (SUIOT). Such a combination of physical and monetary accounts belongs to the SEEA2003 category of Hybrid Flow Accounts.

The SEEA2003 employs the term "Hybrid Flow Accounts" to denote a single matrix presentation containing both economic accounts in monetary terms and physical flow accounts. The acronym NAMEA has come into widespread use for these types of tables. It stands for National Accounting Matrix with Environmental Accounts (see SEEA2003, paragraph 4.4).

Different forms of hybrid flow accounts are thinkable. The SEEA2003 distinguishes (see SEEA2003, paragraph 4.5):

- hybrid supply and use tables;
- hybrid input-output tables; and
- a more extensive hybrid flow account which includes all the distributive and redistributive monetary accounts of the SNA (full sequence of sector accounts, often referred to as so called NAM).

Further, a rather simple form of hybrid flow accounts is to present physical and monetary flows in one data table.

In the following sections, we present and discuss in more detail two forms of hybrid flow accounts: first, the simple representation of a data table with combined physical and monetary flow, and secondly, hybrid supply and use tables.

4.1 A data table with combined physical and monetary flows by industry

A data table combining physical and monetary flows is a rather simple means to publish annual results of Air Emissions Accounts together with selected economic flow data such as e.g. gross value added and/or production output.

Typically these data tables are developed annually by the national statistical institutes and are often published in tables putting the industries (using NACE classification) in the rows and economic flow data and the environmental data such as emissions data in the columns. An example of this type of data table is provided in the Figure 5.

Figure 5: Example of a data table with combined physical and monetary flows by industry

Year: xxxx	Total gross value added	Carbon dioxide CO_2	Methane CH_4	Nitrous oxide N_2O	Hydrofluor-carbons HFCs	Perfluoro-carbons PFCs	Sulphur-hexafluoride SF_6	*Greenhouse gase emissions* GHG	Nitrogen oxides NO_x	Ammonia NH_3	Sulphur dioxide SO_2	*Acidification pre-cursors*	Non-methane volatile organic carbons NMVOC	Carbon monoxide CO	*Ozone pre-cursors*
	constant basic prices	*1000 tonnes*	*tonnes*	*tonnes*	*Tonnes CO_2-equiv*	*Tonnes CO_2-equiv*	*Tonnes CO_2-equiv*	*Tonnes CO_2-equiv*	*tonnes*	*tonnes*	*tonnes*	*tonnes acid-equiv*	*tonnes*	*tonnes*	*tonnes NMVOC-equiv*
Total including households	Not applic-able														
Total for industries															
Agriculture, forestry and fishing															
Mining and extraction															
Manufacturing															
Electricity, gas & water supply															
etc															
.															
.															
Households	House-hold con-sumption														

4.2 Hybrid supply and use tables

Monetary supply and use tables are a common form to represent production and consumption activities in National Accounts. They are products by industry tables. The supply table presents the monetary value of products by producing industry. The use table shows the use of products by industries (intermediate use) and by several final use categories such as final consumption expenditure, gross capital formation, and exports. A pair of supply and use tables can be presented in one single matrix, whereby the supply table is transposed (rotated by 90º) and superimposed on the use table. For further details see Eurostat's SUIOT Manual (Eurostat 2008).

Figure 6 presents the schematic diagram of a pair of monetary supply and use tables merged into one single matrix presentation. The several sub-matrices of the monetary use table are represented in the product row (first row) and the value added row (sixth row). The sub-matrices of the transposed (rotated) monetary supply table are given in the product column (first column). The total use of products (sum over first row) equals the total

supply of products (sum over first column). The total industry output (sum over second row) equals the total industry input (sum over second column).

Figure 6: Schematic diagram of a pair of monetary supply and use tables merged into one single matrix presentation

	Products	*Industries*	*Consumption*	*Capital*	*Exports*	***Totals***
Products		Products used by industries (intermediate use)	Products used by households and governments	products converted to capital	products exported	**Total use of products**
Industries	Products made by industries					**Total industry output**
Imports	Products imported					**Total imports**
Margins	Trade/transport margins by products					
Product taxes	Taxes less subsidies by products					
Value added		Value added by industry and components				**Total value added**
Totals	**Total supply of products**	**Total industry inputs**	**Total final use by category**			

The single matrix presentation of a pair of monetary supply and use tables also stands at the core of a hybrid supply and use table. The latter is simply an extension of the former. Columns and rows for physical flows of natural resources, eco-system inputs and residuals are added to the monetary supply-use-scheme. And, the environment as an activity is added. Such a scheme of a hybrid supply and use tables is a logical extension of the National Accounts as it adds those pieces of information that are not represented/representable in monetary terms, i.e. the resource and ecosystem inputs into the economy and the residual outputs from the economy to the environment.

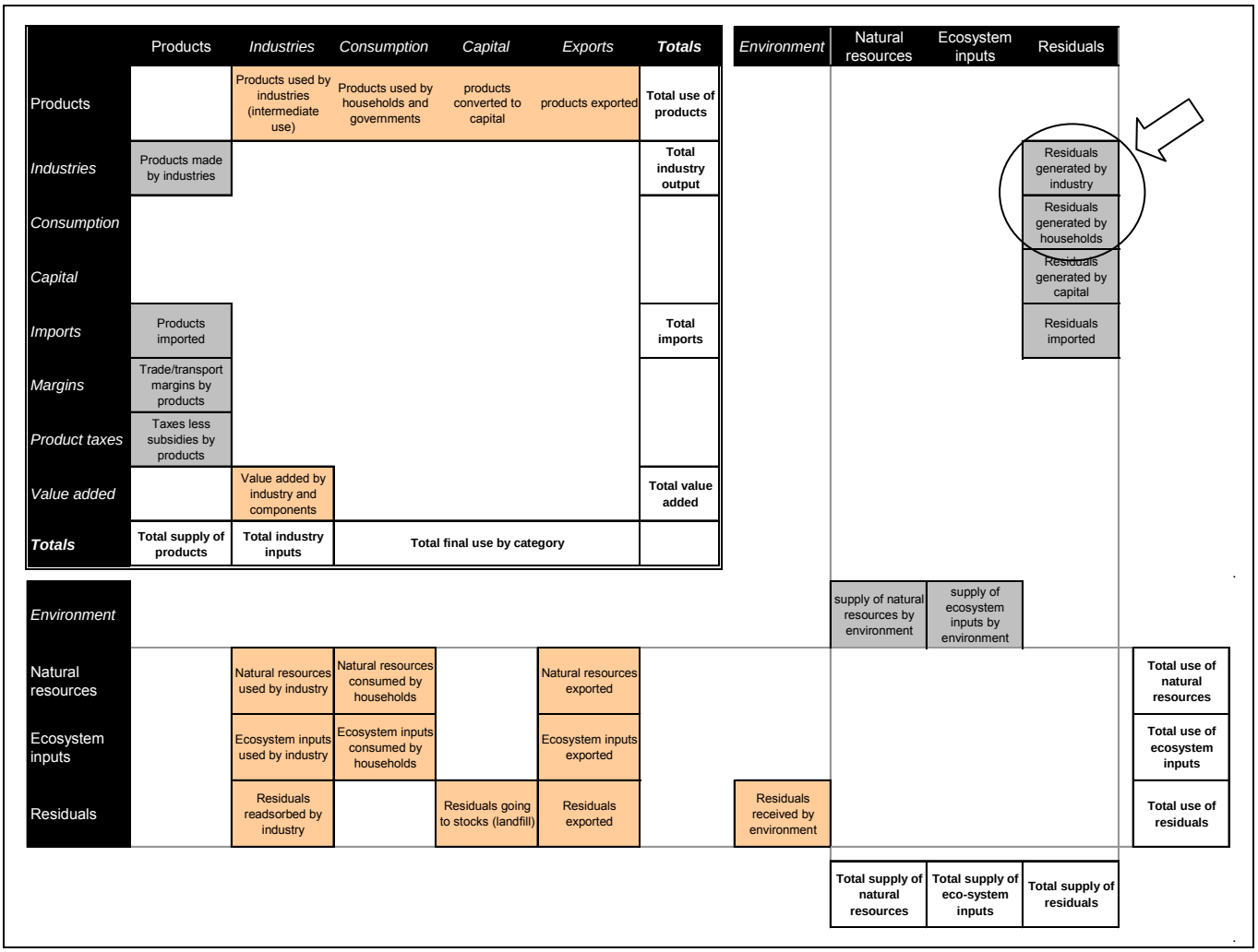
Figure 7 shows a schematic diagram of a hybrid supply and use table. The monetary elements remain the same as in Figure 6. The physical flows are added below and at the right hand of the monetary blocks. In such a hybrid supply-use scheme the product flows are shown in monetary units, whereas the natural resource, ecosystem input and residual flows are shown in physical units. There is no valuation issue in hybrid accounts and that is one reason that they can be established easier in the statistical system

Columns and rows for the three types of physical flows are added as well as a column and a row for the environment as an activity. The physical parts read as follows: At the right hand of the monetary block, the physical supply of residual flows by the several economic activities (industry, consumption, capital, and imports)

is shown. Further, the physical supply of natural resource and ecosystem input flows by the environment are presented. The use of physical flows (natural resources, ecosystem input, and residuals) by the several economic activities as well as by the environment is shown below the monetary block. The total supply of each of the physical flows (natural resource, ecosystem input, and residual) equals the total use of the respective type of physical flow.

Eurostat's Air Emissions Accounts belong to the blocks of physical supply of residuals which are placed in the right-last column of the scheme in Figure 7 showing residual supply by economic activities. However, air emissions – as one particular type of residual flows – only arise directly from production activities (industries) and consumption activities (private households) and not from capital stock and imports.

Figure 7: A schematic diagram of a full scheme of a hybrid supply and use table and placing of Eurostat's Air Emissions Accounts therein



Source: adapted from SEEA2003, Fig. 4.1, p. 137

5. Eurostat's Air Emissions Accounts: specific features

The previous chapters presented general accounting principles of Environmental Accounts and particularly of Physical Flow Accounts and Hybrid Flow Accounts. This chapter focuses on additional features which are specific for Eurostat's Air Emissions Accounts.
First, this chapter defines those physical residual flows which are covered by Eurostat's Air Emissions Accounts and introduces the concepts of gross versus net residual flows as the latter is an important feature of Eurostat's Air Emissions Accounts.
Secondly, this chapter introduces some conventions related to the definition of the system boundary between economic and environmental system as specifically applied in Eurostat's Air Emissions Accounts.

5.1 Definition and coverage of physical flows (i.e. air emissions) recorded in Eurostat's Air Emissions Accounts

As all residuals, air emissions are incidental and undesired outputs from elements of the economic system (production and consumption). Further, air emissions in Eurostat's Air Emissions Accounts relate to those physical flow of gaseous or particulate materials that origin in the economic system (production or consumption processes) and which are released into the atmosphere and remain suspended in the air for a substantial time period. Most of those residuals are in a gaseous state but small particulates ($PM_{2.5}$ and PM_{10}) and heavy metals are solids that are effectively suspended in the atmosphere for substantial times and have certain behaviours that are similar to gases.

The list of gaseous and particulate materials which could be recorded theoretically is huge. In Eurostat's Air Emissions Accounts only a selected number of environmentally most relevant residual materials is asked for; comprising greenhouse gases as well as emissions of air pollutants such as e.g. SO_2, NOx, PM10 etc. The list of gaseous and particulate materials (next to their measurement units) is provided in Part B (see section 6.4) which is the compilation section of this Manual.

Eurostat's Air Emissions Accounts record net flows of residual gaseous and particulate materials into the air that:

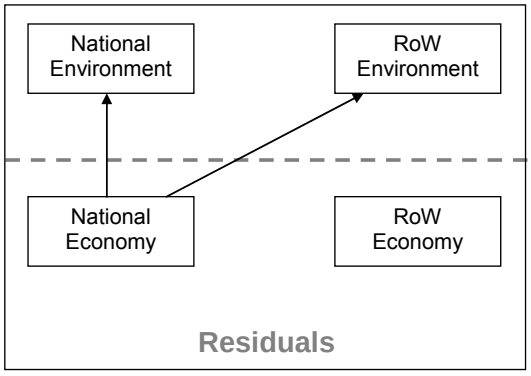
- originate from the national economy, i.e. production and consumption activities (as defined above in chapter 2; see also section 6.3);
- cross the functional economy-environment system boundary and hence ending up in either the national or RoW-environment.

Emissions of gaseous and particulate materials originating from economic activities do not necessarily end up in the environmental system. They can be captured by technical means and further processed within the economic system. For instance, methane from controlled landfill is captured in order to be combusted for energy recovery, thereby being transformed into CO_2 which is then emitted to the atmosphere. Hence, the total supply of air emissions from economic and household's activities does not equal the amount of air emissions actually crossing the system boundary, i.e. being released to the environmental system.

The SEEA2003 introduced the concept of gross and net residual flows (see e.g. SEEA2003, paragraphs 3.136-3.138). The total of residuals originating from economic activities is referred to as the gross amount. Part of it is captured and further processed and transformed by other economic activities. The amount of air emissions actually crossing the system boundary, i.e. ending up in the environmental system, is referred to as net residuals. Eurostat's Air Emissions Accounts only record net air emissions. This implies that not all – theoretically thinkable – air emissions are considered in Eurostat's Air Emissions Accounts. Air emissions remaining in the economic system, e.g. for further processing, are excluded as they are not released to the environmental system and hence not supposed to induce environmental impacts

Figure 8 shows the flows covered by Eurostat's Air Emissions Accounts (also compare with Figure 3).

Figure 8: Residual flows covered by Eurostat's Air Emissions Accounts



5.2 Definition of the functional system boundary between economy and environment in Eurostat's Air Emissions Accounts

This section discusses the system boundary between the economic system and the environmental system as applied in Eurostat's Air Emissions Accounts. This boundary is shown as a dotted grey line in Figure 8. Note, that this system boundary is defined functionally (economic versus environmental system) and not territorially (national versus RoW).

Air Emissions Accounts record the flows of residual gaseous and particulate materials originating from the national economy and flowing into the atmosphere. Here, the atmosphere is meant as a component of the environmental system. The destination can be the atmosphere of the national environment and/or the RoW-environment. The system boundary relates to the borderline between the national economy (as part of the economic system) and the atmosphere (as part of the environmental system). After having crossed this system boundary, the emitted substances are out of any human control and become part of natural materials cycles and may induce several environmental impacts.

In practice, drawing this functional system boundary is not always trivial. There are some “borderline” cases, where drawing this functional system boundary is not obviously clear and where certain conventions are needed, namely:

- Air emission from (and uptake by) cultivated plants and forests;
- Emission of gaseous substances from humans and domesticated animals;
- Air emission from agricultural soils (including sludge/manure spreading);
- Air emissions from landfills;
- Flaring and venting.

These cases have in common that they relate to air emissions from certain origins (agricultural soils, humans, cultivated plants and forests, animals, and landfills) for which the general question is to be answered, whether they are regarded as being part of the economic system or part of the environmental system? If they are part of the economic system, they should be recorded following the general rules of National Accounts. If they are part of the environmental system, they should not be recorded.

The first rule is to apply National Accounts principles as amended by the SEEA2003; this implies that any net emission (of residual gaseous and particulate materials into the air) activated by human/economic activity should be recorded and included in Eurostat's Air Emissions Accounts (e.g. theoretically including human breathing and evapotranspiration).
However, as a second rule – due to practical considerations – only those net air emissions are considered which are actually recorded in emission inventories and considered in deriving national totals. In other words, for practical reasons only those emissions are considered in Eurostat's Air Emissions Accounts for which data are available and used to derive national totals based on the emission inventories (e.g. human evapotranspiration is excluded for this reason).

The deviations from the first rule are mostly due to practical reasons, i.e. the difficulties in developing estimates for certain types of emissions not included in the official emission inventories. As figures are roughly estimated these estimates can introduce large sources of error in the Air Emissions Accounts.

In the following, the above mentioned “borderline” cases are further discussed in some more detail.

Emission (and uptake) of gaseous substances from cultivated plants and forests

The SEEA2003 states (paragraph 3.171): “According to the SNA production boundary, cultivated plants and cultivated animals are the result of production processes and have therefore to be regarded as products. An exception holds only for wild biota. They are considered to be raw materials extracted from the environment.” Consequently, cultivated plants and cultivated animals are part of the economic system and air emissions originating from these assets are to be recorded in Air Emissions Accounts. In principle, this would include the 'natural' emissions from cultivated forests and the absorption of gaseous substances by cultivated forests (i.e. carbon sequestration).

However, in Eurostat’s Air Emissions Accounts those flows are excluded due to difficulties in quantifying those in Europe. In other words, carbon sequestrations in forests are not to be subtracted from the total emissions to air by forestry. Similarly, 'natural' emissions from managed forests (e.g. NMVOC emissions from living trees) are not to be reported here.

Further exceptions are made with regards to water (evapotranspiration) and oxygen (photosynthesis). In general, water and oxygen are not accounted for in Eurostat’s Air Emissions Accounts and hence emissions of those substances from cultivated plants and forests are hence not considered. For more details see also section 7.2.10.

Emission of gaseous substances from humans and cultivated animals

Human bodies are the source of emissions of water (evapotranspiration) and carbon dioxide. Both are not accounted for in Eurostat’s Air Emissions Accounts due to the lack of data. Although in principle, these would belong to the flow of gaseous substances from the national economy to the environmental system.

Emissions of gaseous substances originating from domesticated animals comprise water (evapotranspiration), carbon dioxide and methane from enteric fermentation taking place in the digestive system of ruminant animals. Only methane emissions from ruminant animals are accounted for in Eurostat’s Air Emissions Accounts as data are available in emission inventories.

Emission of gaseous substances from agricultural soils (including sludge/manure spreading)

Air emissions of NH_3, N_2O, NMVOCs, and PM_{10} from agricultural soils – as a consequence of soil cultivation and harvest, fertilizer and manure application, and animal excreta – are considered in Eurostat’s Air Emissions Accounts as data are available. See for further details the UNEP/CORINAIR guidelines (European Environment Agency (2007)) and the IPCC guidelines (IPCC 1996) for emission inventories.

Air emissions from landfills

Emissions to air (i.e. atmosphere) of methane (CH_4) from controlled landfills are considered in Eurostat's Air Emissions Accounts as long as they are not captured (net emissions approach).

Flaring and venting

The flaring and venting of residual gaseous and particulate materials into the air is recorded in emission inventories and takes place in conjunction with certain economic activities, namely, in oil refineries (SNAP code 09 02 03 => NACE Rev.1.1 division 23), chemical industries (SNAP code 09 02 04 => NACE Rev.1.1 division 24), and oil extraction (SNAP code 09 02 06 => NACE Rev.1.1 division 11). Hence, flaring and venting is also recorded in Eurostat's Air Emissions Accounts.

Part B: Compilation Guide

Introduction to Part B

Part B presents practical guidance for the compilation of Air Emission Accounts and is hence primarily addressing compilers of Air Emissions Accounts in national statistical institutes (NSI).

The compilation of Air Emissions Accounts starts from existing data, namely data on air emissions, energy use and/or other parameters. These existing data need to be manipulated and re-arranged according to the accounting principles of National Accounts. Chapter 6 presents some general guidelines related to this transfer from existing data to Air Emissions Accounts.

For compiling Air Emissions Accounts, two main compilation approaches can be distinguished. The "inventory-first-approach" starts from existing national emission inventories and re-arranges those data to a format compatible with National Accounts. The "inventory-first-approach" is most often used by national statistical institutes and is presented in detail in chapter 7. As this approach is the most applied one across European NSIs, this chapter 7 is rather comprehensive and detailed. For each inventory source code (SNAP and CRF/NFR) it tries to give as precise as possible recommendations on how to re-assign air emissions to National Accounts categories of economic activities, i.e. industries (according to the NACE classification[10]) and private households.

The "energy-first-approach", described in chapter 8, starts from energy statistics/balances which are re-arranged to Energy Accounts from which air emissions are calculated using certain emission factors. This approach is applied in a smaller number of countries. Actually, it is less settled in methodological terms and each country more or less applies its individual methodological steps depending on the varying primary statistical sources employed. Hence, chapter 8 is more general in describing the compilation process.

The national economy totals of Air Emissions Accounts most likely differ from totals as presented in national emission inventories. These differences are recorded and presented in so-called bridge tables which are described in chapter 9.

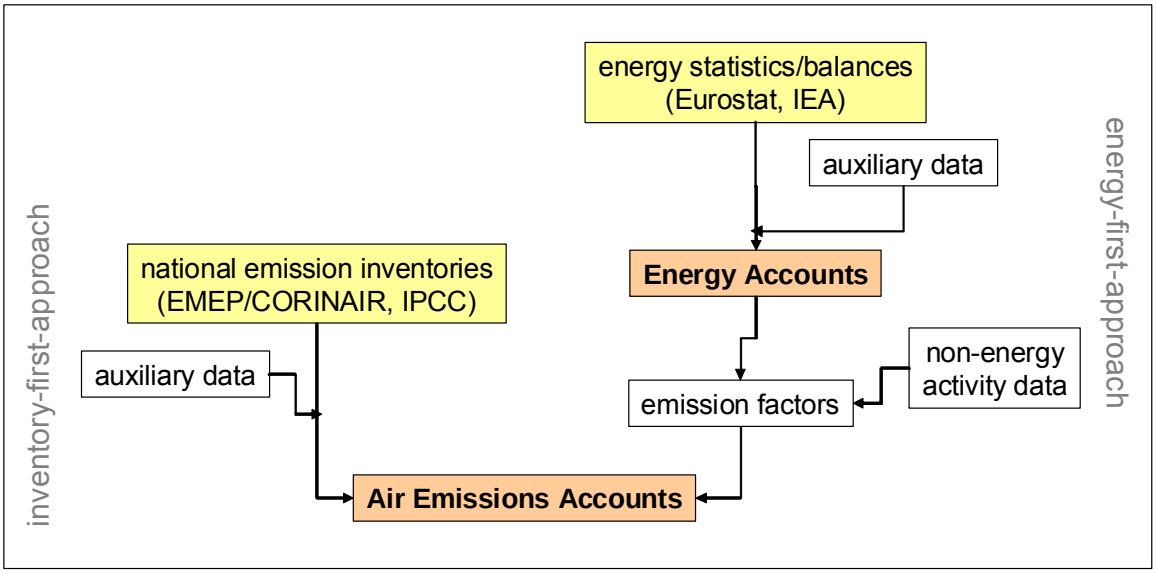
[10] Statistical Classification of Economic Activities in the European Community, NACE Rev. 1.1

6. General compilation guidelines

As most Environmental Accounts, Air Emissions Accounts are also developed from a variety of existing primary data (e.g. emission inventories, energy statistics) and compiled according to specific accounting rules, definitions and requirements. This conversion and re-arranging process requires that the existing data are made consistent with National Accounts principles and classifications; this includes reorganising the data according to economic activities (industries and households), removing any double counting, and adding/subtracting data so that the system boundaries correspond with the system boundaries of the National Accounts. When the system boundaries and the classification categories are the same, the economic accounts and environmental accounts can be combined with confidence. Relationships between environmental and economic variables can then be explored using analytical methodologies such as environmentally extended input-output analysis and decomposition analyses (see e.g. chapter 10).

In developing Air Emissions Accounts there are two main starting points as regards the main data sources: national emission inventories or energy statistics/balances (see Figure 9). Accordingly two generic compilation approaches are distinguishable: "inventory-first-approach" (see chapter 7) and "energy-first-approach" (see chapter 8). Deciding whether to start with energy or emissions data is typically determined by what data can be obtained and what type of cooperation with national experts can be established.

Figure 9: Schematic overview on two generic compilation approaches for Air Emissions Accounts



In the "energy-first-approach" energy data are the starting point (see chapter 8 for further details). First, emission-relevant energy use needs to be assigned to economic activities as defined by NACE and households and then emissions are calculated using emission factors. The adjustments for the residence principle also need to be made for energy use. If Energy Accounts are already available, then the energy use data have already been allocated to industries and households and system boundaries of the energy balances have been adjusted

according to the residence principle. Then industry specific emissions factors can be used to calculate emissions. The non-energy related emissions (industrial processes, solvent and other volatile organic products, agriculture and landfills) then need to be included as well.

In the “inventory-first-approach” national emission inventories form the starting point (see chapter 7 for further details). Then adjustments for the residence principle are typically made first and then the emissions are allocated to the economic activities (industries according NACE classification and private households).

But regardless of the starting point and compilation approach, there are two steps required when compiling Air Emissions Accounts on the basis of emissions inventories or energy statistics/balances. These two generic compilation steps are:

1. Adjusting the system boundaries to correspond with those of National Accounts (geographic versus economic system definition; see also section 2.1), and
2. Assigning the environmental data to economic activities (industries and households) actually inducing respective energy uses and/or air emissions.

And regardless of the starting point, allocating data to economic activities requires the use of auxiliary data to help distribute the figures from one classification system to another. Typically one tries to find a relationship – a distribution key – between the two categories that is as close as possible to the data to be distributed. If nothing specific can be found then employment or production output is sometimes used as a last resort.

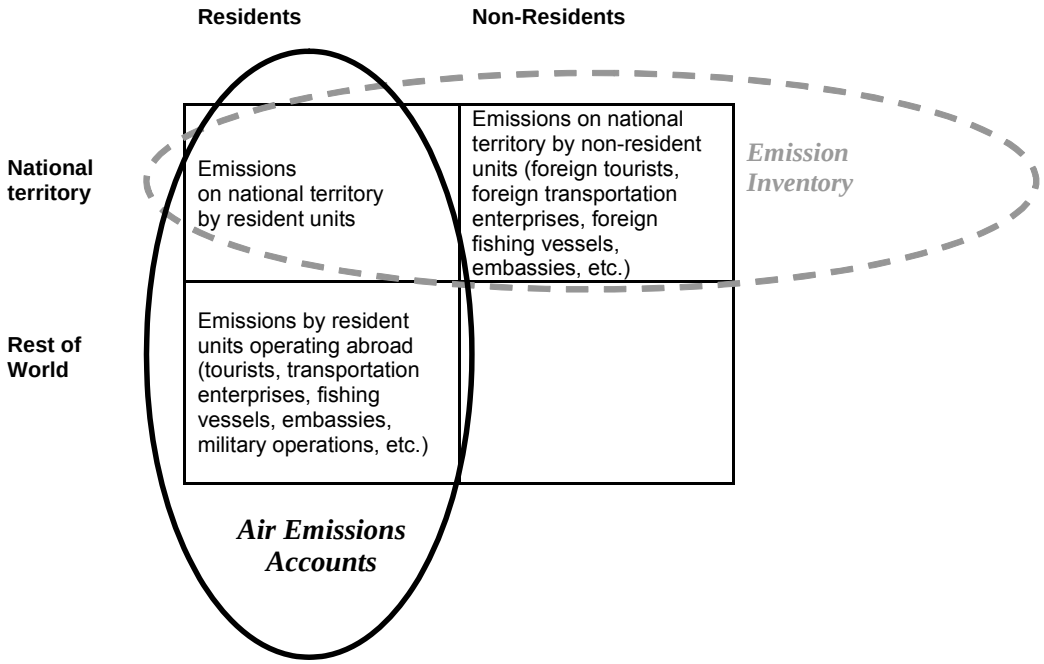
6.1 Adjusting the system boundaries to correspond with those of the National Accounts

One of the main differences between energy statistics/balances and emissions inventories, on the one hand, and National Accounts on the other hand, is related to the difference between a geographic definition and an economic definition of a country. Energy statistics/balances and emission inventories use a geographic or national territory definition of a country whereas National Accounts are based on the residence principle which is the basis for the economic definition of a country. To understand this difference we have to understand the meaning of a "resident unit" (see also section 2.1 in this Manual).

The following figure illustrates the differences between an economic and a geographic definition of a country and helps to show the residence principle. Basically, to convert from a geographically defined system (shown as a grey dashed area) to an economically defined system (the area shown with a solid black line) the air emissions of non-resident units operating on the national territory need to be removed and the air emissions from resident units operating in the rest of the world need to be added. Typically the biggest piece of these necessary adjustments relates to international transport – land, water, and air. In addition, some other, often more minor

adjustments are related to tourism and fishing vessels. However the relative importance of these activities depends on the structure of the countries' economies.

Figure 10: Differences between geographic and economic definitions of a country



Source: adapted from draft SEEA-Energy (UN 2008)

When making the conversion from one system definition to the other it is important to focus on adjusting for the quantitatively big items (“elephants”) and not to lose too much time and resources by tackling items that are theoretically correct but quantitatively of minor importance (“mice”). When establishing Air Emissions Accounts for the first time, the "mice" are good to identify. However, to quantify the “mice” generally requires a great deal of time and effort but only provide a marginal gain. Often they get a great deal of focus but usually they do not make that much difference unless there are allot of them. An “elephant” on the other hand is hard to ignore and needs to be included almost regardless of its difficulty to quantify.

Over time the theoretically correct but of minor importance issues (“mice”) can be addressed as a national compilation system for Air Emissions Accounts develops and is improved. Addressing these items systematically within the statistical systems of a country can lead to improvements of both the physical statistics and perhaps also improve the economic data thus leading to overall improvements in consistency in the National Accounts and Environmental Accounts.

It is important to find out from the national accountants exactly what is adjusted for in the National Accounts – private households' tourism and international transportation are good topics with which to begin. A good rule of thumb is: if the national accountants do not adjust for something, then neither should the Air Emissions Accounts. But always ask why the national accountants do not include these adjustments so you understand their

reasoning and to avoid surprises. It is also helpful to find out the quantitative order of magnitude of the economic adjustments because this provides an indication of the importance of the adjustment and can be used as guidance for setting priorities with regards to making adjustments in the Air Emissions Accounts.

How to evaluate whether an adjustment issue has the size of a “mouse” or an “elephant” is not always easy. Looking at the structure of the national economy, the taxation system, transportation, fishing and tourism statistics plus the geographic location of a country can often give good input into this evaluation.

By looking at the structure of the national economy evaluations regarding the size of certain industries can be important. Identifying the size and trends of the sea and coastal transport (NACE 61.1), land transport (NACE 60), air transport (NACE 62) and fishing (NACE 05.01) based on economic statistics can be helpful. If these industries are large and/or growing then a closer examination is warranted.

The national infrastructure and geographic location can also be important. For example, large airports with high numbers of international flights, large ports where ocean going vessels bunker fuels, large fishing fleets that bunker fuels in other countries are all important to examine in greater detail and decide if corrections are needed. The following list (Table 1) provides some additional examples of corrections that could be considered important to the countries listed, which then may choose to make adjustments when establishing their Air Emissions Accounts. This is *not* an exhaustive list and gives only examples.

Table 1: Overview of issues and countries where adjustments from geographic to economic system definition are likely to occur

Area needing adjustment:	Countries that may consider corrections for these areas
International water transport	Countries with large ocean transport fleets such as: Norway, Greece, Denmark, the Netherlands, United Kingdom, South Korea, Japan
International air transport	Most countries but especially those with airport "hubs": Netherlands, UK, Germany, Italy, France, Denmark
International road transport	Countries where companies operate transport services abroad (mostly lorries and coaches registered abroad)
Fishing vessels	Countries whose fishing vessels are active in areas far from national fishing areas such as: Portugal, Spain, Norway, Ireland, Iceland, Russia
Tourism (private car driving) (non-resident units on national territory)	Countries that are attractive destinations for relatively large numbers of foreign tourists such as: Malta, Cyprus, Spain, France, Italy, Switzerland, Austria, UK
Tourism (private car driving) (resident units operating abroad)	Countries whose resident often leave the national territory on holidays using their own vehicles: Belgium, Luxembourg, The Netherlands, Slovenia
Emissions from land transport that do not involve fuel purchases	Geographic location as a "transit country" – driven through without purchasing fuel: Switzerland, Slovenia, Belgium, Germany
Fuel "tourism" (often induced by differences in tax levels between adjacent countries)	Countries where non-resident travel across borders to purchase petrol and diesel: Luxembourg, Sweden and Denmark (from Norway)
Transportation in pipelines	When pipelines are located in international territories – such as the sea floor there may be some issues related to residence and how the energy use in the pipelines is recorded. The energy use in the non-resident pipelines should be coordinated with how this is treated in the National Accounts. Relevant for Norway, the Netherlands, and potentially Denmark and Iceland in the future
Embassies, consulates and other extraterritorial enclaves	Nearly all countries have embassies within the national boundaries. In the National Accounts the economic activities of these areas are considered as non-resident units on the national territory. For Air Emissions Accounts this activity is of minor importance and is not included in corrections although technically it should be included.
Military establishments and military "actions" on national territory	For countries that host large military bases for other countries, corrections for this activity as non-resident units on the national territory should be considered although often a lack of data often due to the confidentiality of the data do not allow for corrections to be made. The same applies to military actions/wars on national territories.

Publications such as Eurostat's *Panorama on Tourism*[11] can be helpful in making evaluations regarding adjusting for tourism activities especially since there is country specific information. The *Panorama on Transport*[12] can also be helpful to identify trends but there is not much country specific information. These summary publications only help to describe the overall picture and trends. It is necessary to find national detailed data helping to make the corrections needed in the Air Emissions Accounts.

The important thing in this evaluation process is to avoid "surprises" of things that are actually of significance but that have not been adjusted or accounted for.

6.2 Assigning the air emission data to economic activities

The environmental statistics that are used as primary source (i.e. energy statistics/balances and emission inventories) to create Air Emissions Accounts typically use their own classification systems. Those deviate from classification systems for economic activities (production and consumption) as applied in National and Environmental Accounts.

In Air Emissions Accounts, emissions are recorded by economic activity entities – i.e. sub-categories of the total economy – which actually emit the emissions in the course of their production and consumption activities. The economic activities are classified according to the classifications typically employed by National Accounts. This requires a re-assignment of air emissions (or energy use) from the classification system as used in emission inventories (or energy statistics/balances) to the classification system as employed in National Accounts. That is, compilers of Air Emissions Accounts need to devise a way to re-assign environmental statistics from their original groupings to economic activities according to the standard economic classifications (NACE[13] for production activities and COICOP[14] for household consumption activities).

The key to shifting from environmental to economic classifications is, first, to fully understand the relevant principles underlying the recordings of production and consumption activities in the framework of National Accounts (see section 6.3).

Transportation is one important example where the environmental classification and groupings significantly deviate from the standard economic ones. In energy statistics/balances and emission inventories transport is grouped according to several transport modes and technologies (e.g. road transport is classified into motor

[11] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-30-08-550/EN/KS-30-08-550-EN.PDF
[12] http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DA-07-001/EN/KS-DA-07-001-EN.PDF
[13] Statistical Classification of Economic Activities in the European Community, NACE Rev. 1.1
[14] Classification of Individual Consumption by Purpose

vehicle classes). In National Accounts transport is assigned to the entity undertaking transport in the course of its production or consumption activities. For instance, driving a car may be related to private households' leisure as well as to the provision of health services (ambulance car).

To convert from one classification system to another, some type of conversion key or correspondence table must be established that helps to re-assign the emission or energy data from the one to the other classification system. To establish this conversion key (correspondence tables) certain auxiliary information is used. The auxiliary information may comprise certain physical data, employment data and/or monetary data that provides additional information that helps make a link between the categories of the original data and the standard economic classifications. Specific recommendations for such a conversion table from national emission inventories to Air Emissions Accounts are provided in chapter 7.

In general, two cases of assignment can be distinguished in such conversion keys (correspondence tables):

1. a *one-to-one* correspondence between a original environmental category and a economic category;
2. a *one-to-several* correspondence between a original environmental category and a number of economic categories.

Evidently, any future change of the classifications (economic and/or emissions) will have major implications on the compilation process as the correspondences will have to be re-established. Particularly relevant in this respect are:

- The revision of the classification of economic activities from NACE rev 1.1 to NACE rev. 2 is currently ongoing. Eurostat's National and Environmental Accounts will introduce NACE rev.2 with the reporting year of 2008[15].
- The potential adoption of CRF/NFR as main classification instead of SNAP97 in some countries' compilation routines for emission inventories.[16]

6.3 Economic activities in Air Emissions Accounts – definition, groupings and classifications

This section introduces the relevant National Accounts (ESA95) concepts and principles for assigning air emissions to economic activities. In Air Emissions Accounts, the term *economic activity* is used to denote production and consumption activities. Broadly, production activities relate to industries and consumption activities relate to private households. The economic activities constitute the origins of air emissions; i.e. Air

[15] The survey of Air Emissions Accounts usually collects data for the year t-3; this implies that earliest in 2011 Air Emissions Accounts will be collected for the reference year 2008 using the NACE rev.2 classification.

[16] Note that the 2008 EMEP/CORINAIR Guidelines will no longer follow the SNAP structure but will adopt the CRF/NFR. However, it may be assumed that those countries who have established SNAP based compilation routines will keep those.

Emissions Accounts record air emissions by economic activities from which air emissions are directly originating.

Within the wider system of National Accounts, it is the input-output framework which constitutes an appropriate way of portraying in detail the production and consumption activities of a given national economy (see section 1.1; see also ESA95 paragraphs 1.02 and 9.01 ff). One of the main objectives of Eurostat's engagement in Air Emissions Accounts is to relate them to the input-output framework and to create simplified hybrid flow accounts as presented earlier in section 4.2 – Figure 6 and Figure 7. Therefore, it is important that the definitions, groupings and classifications of economic activities as employed in Eurostat's input output framework[17] are the same as in Air Emissions Accounts.

Economic activities in the context of Air Emissions Accounts comprise

- production activities by industries and
- consumption activities by private households

as those constitute the origins of air emissions in a national economy. As a general rule, Eurostat's Air Emissions Accounts record all net emissions arising from the economic activities of a national economy (see also section 5.2). The following sections present details on definition, delineation, and classifications of production and consumption activities as applied in Eurostat's Air Emissions Accounts.

6.3.1 Production activities by industries

Eurostat's Air Emissions Accounts record air emissions generated as unwanted output of the production processes by production activities[18], i.e. by sub-entities of the economic system that are engaged in producing goods and services.

To form hybrid accounts (see chapter 4), Eurostat's Air Emissions Accounts are linked to ESA95 Supply Tables which NSIs report annually to Eurostat. In ESA95 Supply Tables, *industry* is the unit employed to denote and delineate production activities. This unit is also to be applied in Eurostat's Air Emissions Accounts.

For compilers of Air Emissions Accounts it is important to understand how industries are defined and delineated in their national ESA95 Supply Tables reported to Eurostat.

The ESA95 Supply Table is a product by industry table with products in the row and industries in the columns. It shows the supply of goods and services by product and type of supplier. Products are classified according to the CPA classification and industries are classified according to the NACE classification. On the 2-digit level CPA

[17] The ESA input-output framework is laid down in: Eurostat (2008): Manual of Supply, Use and Input-Output Tables, 2008 edition, ISSN 1977-0375, Office for Official Publications of the European Communities: Luxembourg.
http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-RA-07-013

[18] Emissions directly caused by private households' activities are not dealt with in this but in the following section.

and NACE are identical (i.e. distinguishing 60 products and industries respectively). The supply of goods and services recorded in ESA95 Supply Tables comprises market output, output produced for own use, and other non-market output (SUIOT Manual, p. 72, p. 90, ESA95 paragraphs 3.16ff.).

The columns of the Supply Table present the production programme for each industry.

A producing unit (industry or local KAU; see below) may produce several products. The ESA95 distinguishes three main types of activities (see ESA95, paragraphs 3.10 ff.):

1) *principal activities*: the principal activity of a producing unit is the activity whose value added exceeds that of any other activity carried out within the same unit (ESA95 paragraph 3.10).

2) *secondary activities*: a secondary activity is an activity carried out within a producing unit in addition to the principal activity. The output of the secondary activity is a secondary product (ESA95 paragraph 3.11).

3) *ancillary activities*: an ancillary activity is not undertaken for its own sake but purely in order to provide supporting services for principal or secondary activities. The output of an ancillary activity is not intended for use outside the enterprise. Typical ancillary activities that may be carried out are transporting, storing, marketing, various kinds of financial and business services, computing, communications, training, security, maintenance, etc. Ancillary activities are not isolated to form distinct recording entities, i.e. they are recorded together with the associated principal and/or secondary activity (ESA95 paragraphs 3.12 – 3.13).

It follows that outputs produced by principal and secondary activities are recorded. Particular cases included are: (a) the goods and services which one local KAU (see below) provides to a different local KAU belonging to the same institutional unit; (b) the goods which are produced by a local KAU and remain in inventories at the end of the period in which they are produced, whatever their subsequent use. However, goods or services produced and consumed within the same accounting period and within the same local KAU are not separately identified. They are therefore not recorded as part of the output or intermediate consumption of that local KAU. When an institutional unit contains more than one local KAU, the output of the institutional unit is the sum of the outputs of its component local KAUs, including outputs delivered between the component local KAUs (ESA95 paragraphs 3.14 – 3.15).

The supply of primary products deriving from principal activities (including ancillary activities) is recorded on the main diagonal of the ESA95 Supply Table. That is, each industry produces its typical product. Actually, the output of the main product is characterizing the industry. The output of secondary products is recorded off the main diagonal.

For example, butter is a primary product of the dairy industry, as well as cream, yoghurt, cheese, and other dairy products. Production of those dairy products constitutes the principal activity in the dairy industry and would be

the primary output. The production of non-dairy products (such as e.g. electricity and heat, or restaurant services) would be the secondary output of the dairy industry. Similarly, the production of dairy products in other industries would be their secondary output.

The columns of the Supply Table present the supply of goods and services produced by the respective industry. An industry's column includes the output of primary products and may also include the output of secondary products. For each industry Air Emissions Accounts add the generation of air emissions related to the production programme of that industry as it is recorded in the Supply Table.

For example, assume that the waste management industry[19] – as a secondary activity – produces electricity and heat (e.g. from waste incinerators) and this secondary output is recorded in the waste management industry's column in the Supply Table. Then, the air emissions associated with the secondary activity, i.e. electricity and heat production, also have to be recorded under the waste management industry in the Air Emissions Accounts. Compilers of Air Emissions Accounts should be aware of this.

The share of secondary outputs varies from industry to industry. Some industries may only have primary outputs, while others will have a considerable amount of secondary outputs. Secondary outputs are usually smaller than primary outputs.

The size of secondary output also depends on the way how Supply Tables are compiled at your national statistical institute. The ESA95 and the SUIOT Manual recommend applying the so-called *local KAU* approach leading to rather homogenous industry units producing almost only their primary products (see e.g. SUIOT Manual, p. 19, p. 307; see also following Box).

Box 1: Use of local kind-of-activity units in ESA95 Supply Tables

The supply and use tables are based on the use of the local kind-of-activity units (local KAU) as unit of observation. The local KAU is designed to partition institutional units into smaller and more homogeneous units with regard to the kind of production.

In order to analyse flows occurring in the process of production and in the use of goods and services, it is necessary to choose units which emphasise relationships of a technical-economic kind. This requirement means that as a rule institutional units must be partitioned into smaller more homogeneous units with regard to the kind of production. Local kind-of-activity units are intended to meet this requirement as a first but practice-oriented operational approach. (ESA 1995, p. 2.105)

If an institutional unit consists of a principal activity and also one or several secondary activities, it should be subdivided into the same number of KAUs, and secondary activities should be re-classified under different headings from the principal

[19] Which is part of NACE Rev.1.1 division 90 " Sewage and refuse disposal, sanitation and similar activities"

activity. However, “KAUs falling within a particular heading of the classification system can produce products outside the homogeneous group on account of secondary activities connected with them which cannot be separately identified from available accounting documents. Thus a KAU may carry out one or more secondary activities.” (ESA 1995, p. 2.107)

These quotations from the ESA make clear that even if local KAUs are designed to describe production processes as homogeneously as possible; in practice it is impossible to observe the data necessary to describe each process separately. If observation were perfect, the local KAU would be a perfectly homogeneous unit without secondary production, apart from possible by- and joint products (see below for definitions).

Source: SUIOT manual page 307, section 11.2.3 "Statistical units underlying symmetric input-output tables and supply and use tables"

Local KAUs should be identified on the class level (4-digits) of the NACE Rev.1.1. That is, institutional units should be partitioned into smaller and homogenous units on a 4-digit level.

In ESA95 Supply Tables *local KAUs* are regrouped to *industries* at the NACE Rev.1.1 2-digit level. That is, all local KAUs engaged in the same, or similar, kind-of-activity are regrouped to the respective industry column in the Supply Table. In the ideal case, local KAUs are partitioned in an almost “pure” way, i.e. all secondary activities are separated and reclassified to the corresponding industry column. Then, also the industries, i.e. groupings of local KAUs, should be rather homogenous. In this ideal case, the monetary Supply Table would almost have no values off the main diagonal.

For compilers of Air Emissions Accounts, it is important to know how “pure”, i.e. homogenous, industries have been grouped in their national Supply Tables in order to make the correct assignment of air emissions to industries. A mean to do so is having a thorough look at the monetary Supply Table and to contact compilers of supply and use tables in your national statistical institution.

The current electronic questionnaire (version 2008) for Eurostat’s Air Emissions Accounts employs a hierarchical classification of *production activities by industries* based on NACE Rev.1.1. This hierarchical classification is fully compatible with Eurostat's National Accounts programme (ESA95) and comprises the following aggregation levels:

- A17 17 sections (1-letter code based on NACE Rev1.1)
- A31 31 subsections (2-letter code based on NACE Rev1.1)
- A60 60 divisions (2-digit code based on NACE Rev1.1)

The electronic questionnaire presents these three levels in a nested listing.

6.3.2 Consumption activities by private households

In addition, the *economic activities* as defined in Air Emissions Accounts comprise *consumption activities by private households*. Private households constitute significant origins of direct air emissions (e.g. emissions of CO_2 from central heating boilers).

Air emissions by households are to be accounted for in a way that indicates when household consumption is *directly* responsible for environmental pressures, avoiding double counting of air emission data from production activities by industries. Therefore, when households carry out polluting activities themselves, e.g. fuel consumption when heating homes or petrol use when driving which is associated with air emissions, the corresponding environmental data are to be reported under the relevant household consumption activity.

In Eurostat's Air Emissions Accounts, consumption activities by private households are sub-divided into three intuitive sub-classes, reflecting the relevance with regards to air emissions:

- Transport: This category includes all emissions related to the combustion of fuels used as propellant by resident households. Transport emissions are allocated to private households only when they arise from the use of private cars and motorbikes; emissions caused by public transport are to be assigned to the relevant transportation industry. Emissions from household's use of small leisure boats should also be classified here since this activity is usually related to a type of transportation activity.
- Heating (incl. cooking): This category covers emissions from the combustion of fuels for heating houses and flats by households, as well as from fuels used for cooking and producing hot water. Heating emissions are allocated to private households when they use the fuels themselves, e.g. gas for central heating boilers and cooking ovens. Emissions from the production of electricity purchased by households are not allocated to private households but to the electricity producers.
- Others: This category relates to direct air emissions by private household for other purposes than transport and heating. It includes e.g. solvent emissions from paints, aerosols from sprays and emissions from open fires (for leisure or burning garden refuse), lawn mowers, hedge clippers and other gardening equipment.

Air emissions directly induced by private households are closely linked to the consumption of certain products, most importantly fuels. Hence, direct air emissions by private households can also be related to economic classifications.

In ESA use tables, products purchased (final used) by households are classified using CPA, which is the standard statistical classification of products by activity in the European Economic Community.

In addition, private household's consumption activities can be categorised according to different purposes. Here the statistical system offers a classification called COICOP: Classification Of Individual COnsumption Purposes (UN, 2000).

Consumption activities by private households, in economic terms, can be cross classified using both classifications. The result is a product by purpose matrix, showing which products have been purchased by private households for which purposes.

In a matrix cross-classified this way, the three intuitive categories of household consumption applied in Eurostat's Air Emissions Accounts can be defined unmistakably:

- Transport emissions by private households relate to the purchase of '*refined petroleum products*' (CPA code 23.20) for the purpose of '*fuels and lubricants for personal transport equipment*' (COICOP code 07.2.2).
- Heating emissions by private households relate to the purchase of '*refined petroleum products*' (CPA code 23.20) and 'fuel wood' (CPA code 02.01.14) for the purpose of 'electricity, gas and other fuels' (COICOP code 04.5).
- Other emissions by private households relate to the purchase of all products for all kinds of purposes, except the ones mentioned above for transport and heating.

6.4 General representation of Eurostat's Air Emissions Accounts

This chapter introduces the general formats of representation of Eurostat's Air Emissions Accounts. As already outlined in Part A, chapter 3.2, the SEEA2003 recommends recording residuals (the broader group of physical flows to which air emissions belong to) in form of two types of representation:

- Supply (origin) tables (see SEEA2003, figure 3.8, p. 98), and
- Use (destination) tables (see SEEA2003, figure 3.9, p. 101).

The SEEA further recommends balancing out those residuals from the gross supply which are remaining within the economic system – arriving at a supply-table of net-residuals (see SEEA2003, figure 3.10, p. 102).

In this SEEA2003 logic, Eurostat's Air Emissions Accounts are physical supply tables of net residual flows. That is, they record net air emissions by originating economic activities. Eurostat's Air Emissions Accounts do not comprise physical use tables of air emissions (see also section 5.1). Further, Eurostat's Air Emissions Accounts can be regarded as simplified hybrid flow accounts in the case they include economic parameters in addition to the purely physical flows of air emissions (see also section 4.1).

Eurostat has been engaged in Air Emissions Accounts for more than a decade. During this period, two formats or ways of representing Eurostat's Air Emissions Accounts have been evolving:

- standard tables; and
- reporting tables (electronic questionnaire).

Standard tables were developed by several task forces over the period 1999 to 2003 in conjunction with a series of country pilot studies on NAMEA-Air. They have been developed to facilitate the establishment and practical compilation of Air Emissions Accounts at national statistical institutes (NSI). However, standard tables are not employed in all NSI; in particular new countries have hardly established standard tables for Air Emissions Accounts. In autumn 2008, the NAMEA Task Force recommended to Eurostat to abandon the standard tables and to focus on the reporting tables (electronic questionnaires) in future.

Reporting tables (electronic questionnaires) are used by Eurostat to collect Air Emissions Accounts data from national statistical institutes. Their format is much simpler compared to the standard tables. In its most recent version, Eurostat's electronic questionnaire includes only air emission data, i.e. no economic parameters[20]. In autumn 2008, the NAMEA Task Force recommended to add transport tables to the electronic questionnaire.

The following sections introduce the general representation format of standard tables and reporting tables (electronic questionnaire).

6.4.1 Eurostat's standard tables for Air Emissions Accounts

The first set of standard tables for Air Emissions Accounts[21] was adopted by the countries in 2000 and sent out to them for collecting all data available at that time – i.e. including a time series of data. The tables were revised in 2002. Many national statistical institutes use Eurostat's set of standard tables for setting up their national Air Emissions Accounts. Since 2006, Eurostat's survey employs a simplified electronic questionnaire (reporting tables) to collect Air Emissions Account data from national statistical institutes. Not all countries have established standard tables in their national system of compiling Air Emissions Accounts. Hence, the NAMEA Task Force recommended abandoning standard tables officially. Evidently, countries are free to use standard tables for compilation purposes also in future.

The 2002 version of the set of standard tables is composed of 6 tables plus accompanying information, either general or technical, presented on 5 additional work sheets in the electronic version (Excel format).

Each set of standard tables is for one year.

The introductory sheet (*Intro*) presents the tables of contents and gives some practical information. An overview of the set of tables (*Set of tables*, see also Figure 11) is given on the second electronic sheet in order to show the structure of the set of standards tables and to highlight the connection between the tables. The third and fourth sheets respectively remind the reader with the economic classification adopted for Eurostat's Air Emissions

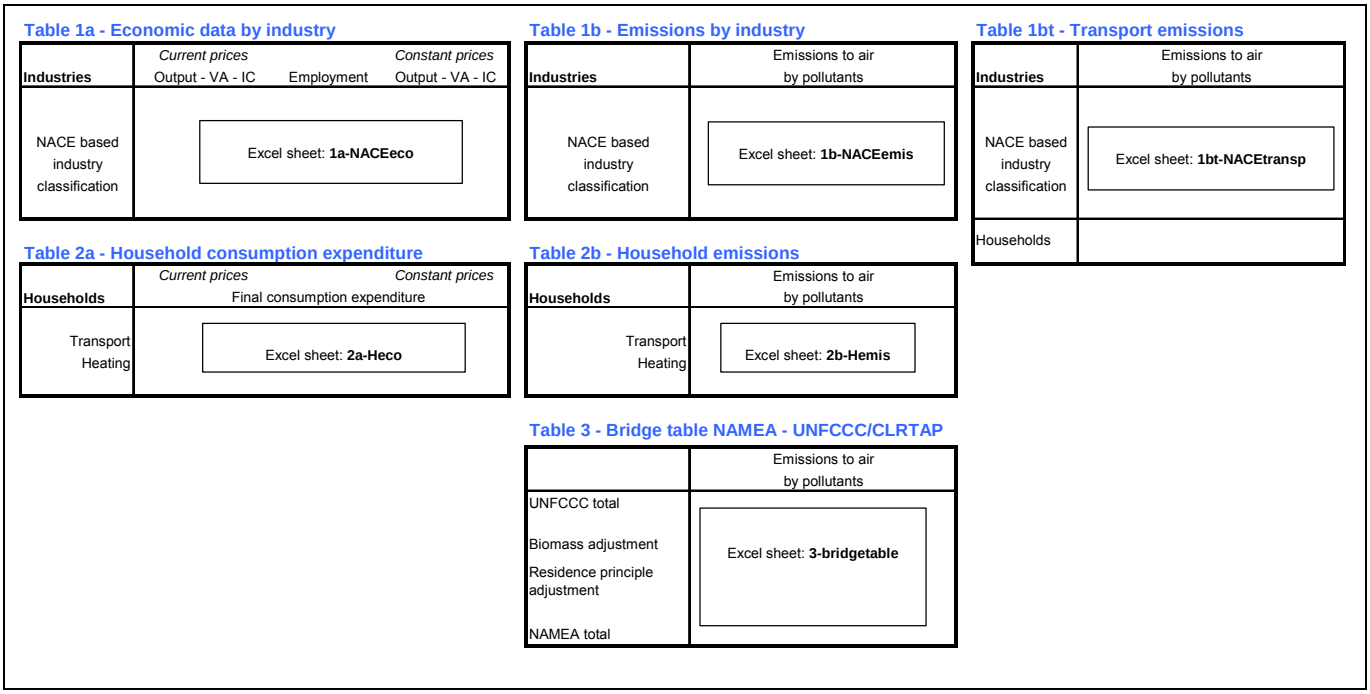
[20] Since standard industry classifications are used, the economic data is then also available from the standard reporting of national accounts data to Eurostat.

[21] formerly termed *NAMEA-air standard tables*

Accounts (*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*).

The 6 data tables are placed in separate sheets (see Figure 11), each being entitled in a way that combines the numbering of the tables (e.g. 1a, 1b, etc.) already used in the previous 2000-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*). A separate table is given for emissions from transport activities (*1bt-NACEtransp*). The *bridge table* is another separate sheet.

Figure 11: Overview on Eurostat's set of standard tables for Air Emissions Accounts (version 2002)



The 2002-version of Eurostat's set of standard tables comprise a long list of air emissions, differentiated by first, second and third priority (see Figure 12). Greenhouse gas emissions form the first priority and air pollutants the second priority. Emissions of heavy metals to air form the third priority.

Figure 12: List of air emissions foreseen in Eurostat's set of standard tables for Air Emissions Accounts (version 2002)

Name	Symbol	Evaluation	Unit
1st Priority			
Kyoto protocol greenhouse gases			
Carbon dioxide	CO_2	given as CO_2 equivalent	thousand tonnes
Nitrous oxide	N_2O	given as N_2O equivalent	tonnes
Methane	CH_4	given as CH_4 equivalent	tonnes
Hydrofluorocarbons	HFCs	given as CHF_3 equivalent*	tonnes
Perfluorocarbons	PFCs	given as C_2F_6 equivalent*	tonnes
Sulphur hexafluoride	SF_6	given as SF_6 equivalent	tonnes
2nd Priority			
Acidification			
Nitrogen oxides	NO_X (NO and NO_2)	given as NO_2 equivalent	tonnes
Sulphur oxides	SO_x	given as SO_2 equivalent	tonnes
Ammonia	NH_3	given as NH_3 equivalent	tonnes
Local air quality			
Non-Methane Volatile Organic Compounds	NMVOC	given as CH1.85 equivalent	tonnes
Carbon monoxide	CO	given as CO equivalent	tonnes
Particulate matter	PM	given as mass equivalent of filter measurements	tonnes
Ozone layer depletion			
Chlorofluorocarbons	CFCs	given as CFC-11 equivalent	tonnes
Hydrochlorofluorocarbons	HCFCs	given as HCFC-22 equivalent	tonnes
3rd Priority			tonnes
Heavy metals			
Arsenic	As	given as As equivalent	tonnes
Mercury	Hg	given as Hg equivalent	tonnes
Lead	Pb	given as Pb equivalent	tonnes
Zinc	Zn	given as Zn equivalent	tonnes
Cadmium	Cd	given as Cd equivalent	tonnes
Chromium	Cr	given as Cr equivalent	tonnes
Selenium	Se	given as Se equivalent	tonnes
Copper	Cu	given as Cu equivalent	tonnes
Nickel	Ni	given as Ni equivalent	tonnes

6.4.2 Eurostat's reporting tables for Air Emissions Accounts (electronic questionnaires)

Since 2006, Eurostat is conducting biannual surveys on Air Emissions Accounts. Eurostat uses an electronic questionnaire (reporting tables) to collect those data from NSIs. The most recent version (2008-survey) asks for 13 air emissions (greenhouse gases and air pollutants) by economic activities. The latter comprise – on the lowest level of disaggregation – 60 industries (NACE Rev.1.1 divisions; i.e. 2-digit level) and three categories of private household's consumption functions (see Annex 3). Further it asks for so called bridging items.

Eurostat's electronic questionnaire (2008-survey) is an MSEXCEL® workbook comprising 13 data sheets – one for each of the 13 air emissions. Table 2 shows these 13 gaseous and particulate materials next to their measurement units.

Table 2: List of air emissions currently collected via Eurostat's electronic questionnaire for Air Emissions Accounts (version 2008)

gaseous or particulate material	code	measurement unit
carbon dioxide without emissions from biomass)	CO_2	1000 metric tonnes
carbon dioxide from biomass	biomass CO_2	1000 metric tonnes
nitrous oxide	N_2O	metric tonnes
methane	CH_4	metric tonnes
hydrofluorocarbons	HFC	metric tonnes CO_2-equivalents
perfluorocarbons	PFC	metric tonnes CO_2-equivalents
sulphur hexafluorids	SF6	metric tonnes CO_2-equivalents
nitrogen oxides	NOx	metric tonnes NO_2-equivalents
sulphur dioxide	SO_2	metric tonnes SO_2-equivalents
ammonia	NH_3	metric tonnes
non-methane volatile organic compounds	NMVOC	metric tonnes
carbon monoxide	CO	metric tonnes
particulate matter	PM10	metric tonnes

Countries are requested to separately report emissions of CO_2 from biomass (wood and wood waste, charcoal, bio-alcohol, black liquor, landfill gas, household waste, etc.) used as fuel. The emissions of CO_2 from biomass are not included in the total CO_2 emissions in greenhouse gas emissions inventories reported to the UNFCCC, they are reported only as a memo item. For the purposes of air emissions accounts these emissions should be reported separately from non-biomass CO_2.

Figure 13: General scheme of one data sheet in Eurostat's electronic questionnaire for Air Emissions Accounts (2008-survey)

air pollutant	years			
	1995	**1996**	**…**	**2006**
Industries NACE based industry classification	**Air emissions by industry**			
Household, total - transport - heating - other	**Air emissions by industry**			
Air Emissions Accounts (NAMEA) totals Less national residents Plus non-resident Less/plus other **Totals according UNFCCC or CLRTAP**	**Bridging items**			

Figure 13 shows the general scheme of the data sheet for one given air pollutant. The columns of such a data sheet represent the years, starting with 1995 and ranging to *n-2* (with *n* being the year of the survey). Row-wise, three data areas are distinguished:

- Air emissions by industries,
- Households' air emissions, and
- Bridging items.

The most recent electronic questionnaire (2008-survey) does not request reporting of any economic parameters for following reasons: Economic parameters are already reported to Eurostat's National Accounts programme. The 2006-survey on Air Emissions Accounts further revealed that most NSIs were not able to report economic parameters (gross value added, output). In cases where economic parameters were reported they often differed from those statistics reported under the reporting to Eurostat's National Accounts programme. In practical terms, Eurostat will link the Air Emissions Accounts as collected via electronic questionnaire to the ESA95 supply and use tables as those are annually collected by Eurostat's National Accounts unit in a European-wide harmonized way (ESA95[22]; Eurostat 2008[23]).

In autumn 2008, the NAMEA Task Force recommended to add transport related sub-tables to the electronic questionnaire. Most likely, the electronic questionnaire for the 2010-survey will include transport sub-tables for the most important gaseous and particulate materials with regards to transport[24] (see also sections 7.1.2 and 7.2.6 for further details).

[22] Council Regulation (EC) No 2223/96 of 25 June 1996 on the European system of national and regional accounts in the Community (OJ L 310, 30.11.1996, p. 1)

[23] Eurostat (2008): Eurostat Manual of Supply, Use, and Input-Output Tables – 2008 edition. Methodologies and Working Papers, Luxembourg: Office for Official Publications of the European Communities, 2008

[24] CO_2, NOx, SO_2, CO, NMVOC, and PM10.

7. Inventory-first-Approach: From national emission inventories to Air Emissions Accounts

In many countries national data bases for air emissions are available – so called *national emission inventories* – primarily serving the purpose of reporting to the main international agreements on emissions of air pollutants and greenhouse gases – namely the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) with reporting to UNECE/EMEP[25] and the United Nations Framework Convention on Climate Change (UNFCCC)[26].

Emission inventories for air pollutants are compiled following the methodology of the EMEP/CORINAIR guidebook[27]. Greenhouse gas emission inventories are compiled following the 1996 IPCC Guidelines for National Greenhouse Gas Inventories[28].

Subject of national emission inventory	International convention	Guidelines for compiling national emission inventories	Nomenclature and classification
Air pollutants	CLRTAP and UNECE/EMEP	EMEP/CORINAIR guidelines published by EEA	NFR* and SNAP97
Greenhouse gases	UNFCCC	IPCC guidelines	CRF*

* NFR and CRF are widely compatible

It is often the case that national emission inventories are also the primary data source for Air Emissions Accounts. This chapter focuses on this approach, referred to as “Inventory-first-Approach”, and gives practical compilation guidelines for it.

For the purpose of compiling Air Emissions Accounts, relevant features of national emission inventories are:

- emission data relate to the geographic territory of the reference country;
- emission data are broken down by means of technical process-oriented classifications[29];

By contrast, a basic feature of Air Emissions Accounts is that:

- they should relate to the domestic economic activities, i.e. the activities of resident economic units taking place as part of the national economy (residence principle);

[25] The UNECE/EMEP includes emissions of NO_x, CO, NMVOC and SO_2 plus NH_3 plus 9 heavy metals as well as 17 POPs (persistent organic pollutants)

[26] The UNFCCC reporting requirements, based on CRF (Common Reporting Format), covers emissions of the 6 greenhouse gases (CO_2, N_2O, CH_4, HFCs, PFCs and SF_6). Please note that HFCs and PFCs refer to a number of specific compounds of this type of chemical compound but are often referred to as "one" of the "6 greenhouse gases" although HFCs and PFCs are actually groups of gases and not a single gas.

[27] The 2007 version can be found on http://reports.eea.europa.eu/EMEPCORINAIR5/en/page002.html

[28] http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html

[29] Specifically, in EMEP/CORINAIR-oriented data bases air emissions are recorded following the SNAP-nomenclature (Selected Activities for Air Pollution), while international reports adopt the CRF/NFR (Common Reporting Format / Nomenclature For Reporting).

- the data breakdown needs to be consistent with the classifications adopted for economic activities (e.g. NACE rev. 1.1; see for further details section 6.4).

Hence, when compiling Air Emissions Accounts following the "Inventory-first-Approach" two main adjustments to the emissions inventory data are needed (see also sections 6.1 and 6.2):

1. The emissions caused by resident economic units have to be estimated starting from the emissions caused by all (economic and non-economic) emission sources on the geographic territory; this issue of adjusting totals is dealt with in section 7.1.
2. The inventory data following a process-oriented classification need to be assigned to economic activities (e.g. NACE); this issue is dealt with in section 7.2.

7.1 Adjusting totals: A requirement because of differing system boundaries

Emission totals in Air Emissions Accounts do not equal the sum of all process emissions included in the national emission inventories. In fact, in order for the emission data to be consistent with the National Accounts' residence principle, some adjustment of the basic data is needed. Section 7.1.1 provides an overview of the main issues involved when the emissions caused by resident economic units are calculated from basic data relating to all (economic and non-economic) emission sources on the geographic territory. The most important issues of adjustment are transport including fishing; section 7.1.2 addresses these specific topics.

7.1.1 Accounting for all emissions caused by resident economic units - overview

Accounting for emissions that stem from economic production as well as consumption activities means, first, that any possible emissions from non-economic agents (e.g. nature) possibly covered in the national emission inventory as well as nature's absorption of substances are excluded. When countries use the EMEP/CORINAIR air emission data as their main source of data, it needs to be understood that this system uses a classification according to the process-based SNAP97 classification, and that not covering nature's emissions/absorption implies the exclusion of all SNAP97 processes belonging to source category 11, as category 11 refers to emissions from non-economic agents and the absorption of emissions. If the CRF/NFR classification adopted in the international reports is the starting point, sector 5 'land use change and forestry' should be excluded instead.

On the other hand, since all of the emissions caused by economic activities are relevant for the Air Emissions Accounts, CO_2 emissions from biomass (wood and wood waste, charcoal, bio-alcohol, black liquor, landfill gas, household waste, etc.) used as fuel – which are reported only as a memorandum item for the international conventions but excluded from official calculation of total CO_2 emissions – should be included in the Air Emissions Accounts (see also section 6.4).

The other major source of likely discrepancy between the coverage of Air Emissions Accounts and emission inventories stems from the fact that economic accounts refer to *domestic* economic activities, i.e. the activities of *resident* economic units[30]; which means that they include the economic activities of resident units operating abroad and exclude the activities of non-resident units operating on the national territory. Similarly, Air Emissions Accounts should include emissions caused by the economic activities of resident units operating abroad and exclude those related to the activities of non-resident units operating on the national territory. By contrast, emission inventories usually cover emissions that broadly correspond to the (national) geographic territory; they include the activities of all units operating on the national territory without considering where the units are "resident" and exclude the activities of resident units operating abroad.

As far as stationary emission sources are concerned, the coverage of emission inventories is consistent with the resident principle as most units responsible for generating the emissions match the economic accounts definition of resident unit. By contrast, mobile emission sources reported by emission inventories, i.e. those stemming from transport – by road, water and air – fishing as well as tourism consumption, do not typically relate to resident units. In other words, the adjustments related to the territory-versus-residential principle are primarily related to transport emissions and in some cases also to fishing.

Table 3 provides a general overview of the types of adjustments that need to be made in order to adjust from a geographic definition to an economic definition, for the case of transport.

Table 3: General procedures for adjusting for transport emissions

Type of transport activity		General procedure for adjusting for transportation activities
Land transport	Road transport	1st step is to split between passenger and freight transport 2nd step: for each group one needs to adjust, hence need to identify: (a) Domestic journeys by resident units (b) Domestic journeys by non-resident units (c) International journeys by non-resident units (d) International journeys by resident units i. outbound ii. inbound and entirely abroad
	Railways	Relates only to industry and not households – some consideration should be made regarding the adjustment for the residence principle if there are substantial operations of domestic trains internationally or non-resident trains on the national territory
	Pipelines	Relates only to industry and not households – The amount of energy used in transporting petroleum, natural gas and water in pipelines is substantial. Although these are fixed installations there may be some unclear issues regarding residence when these are located in international waters as well as import or export issues regarding the energy used to move products in the pipeline.

[30] "An institutional unit is said to be resident within the economic territory of a country when it maintains the centre of economic interest in that territory – that is, when it engages, or intends to engage, in economic activities or transactions on a significant scale either indefinitely or over a long period of time, usually interpreted as one year." (SNA-1993)

Type of transport activity	General procedure for adjusting for transportation activities
Water transport	1st step is to split between private boats used by households from transport carried out as (principal, secondary or ancillary) economic activity. If household emissions can be estimated then if possible a split between transportation uses by households and recreational uses should be attempted. Usually this is not possible so the emissions from leisure boats used by households are simply assigned to households in the category "transport." Since most household uses of leisure boats are within the national territorial waters usually there is not a need to adjust for the residence principle for households – or the adjustment would be very minor. 2nd step: for water transport economic activity (shipping) the bunkering of fuels by the following units needs to be identified and the emissions from the bunkered fuels needs to be used to adjust the Air Emissions Accounts appropriately: (a) Journeys by resident units within the national territorial waters (b) Journeys by non-resident units within the national territorial waters (c) International journeys by non-resident units that have bunkered fuel in the national territory (d) International journeys by resident units i. Outbound ii. Inbound, and iii. Entirely abroad
Air transport	It is assumed that private use of aircraft is so minimal that is it is not worth adjusting for this activity. For air transport economic activity the bunkering of fuels by the following units needs to be identified and the emissions from the bunkered fuels needs to be used to adjust the Air Emissions Accounts appropriately: (a) Journeys by resident units within the national territory (b) Journeys by non-resident units within the national territory (c) International journeys by non-resident units that have bunkered fuel in the national territory (d) International journeys by resident units i. Outbound ii. Inbound, and iii. Entirely abroad

For transport and international fishing activities, in order to derive residents' emissions from territory-related emission statistics it is necessary:

- to add residents' emissions abroad, and
- to subtract non residents' air emissions on the national territory.

In symbols, for a given country *c*, the territory-related emission inventory data include the following components:

$$EMI^{R}(d) + EMI^{NR}(d) + EMI^{R}(I) + EMI^{NR}(I) \quad (1)$$

where,

EMI: emissions

R: resident units;

NR: non resident units

d: domestic journeys;

I: international journeys leaving from country '*c*' (outbound);

By contrast, Air Emissions Accounts will need to record the following transport emissions:

$$EMI^{R}(d) + EMI^{R}(I) + EMI^{R}(A) \quad (2)$$

where,

A: international journeys leaving from abroad (international journeys leaving from abroad with destination country 'c' and international journeys entirely abroad);

In order to derive (2) from (1), $EMI^{NR}(d) + EMI^{NR}(I)$ need to be subtracted and the component $EMI^{R}(A)$ should be added.

The following section deals with the implications of this general principle for the actual calculation of transport emissions in the context of Air Emissions Accounts.

7.1.2 Calculating transport emissions for resident units from air emission inventories[31]

As highlighted in previous section 7.1.1, in order to ensure consistency with the National Accounts' residence principle, Air Emissions Accounts data should include the emissions of resident units operating abroad for transport activities (driving, shipping or flying) and should exclude the emissions of non-resident units operating in the country for the same transport activities.

This same principle also applies to fishing vessels that purchase fuel (bunkering) in countries where they are not resident. The fuel purchases by the non-resident fishing vessels need to be corrected for in the same ways as non-resident ships, aircraft and vehicles.

Within the 'inventory first' approach, transport related emissions from the national emission inventory (classified by SNAP processes or CRF/NFR subcategories) are typically taken as a given and are the starting point for deriving a total consistent with the residence principle (as well as for the assignment to NACE industry codes). A general feature of this approach is that the calculation of resident units' transport-related emissions is likely to occur by estimating a proportion W^R of total air emission statistics for transport processes, EMI, i.e.:

$$\mathrm{EMI}^{\mathrm{R}}(\mathrm{d}) + \mathrm{EMI}^{\mathrm{R}}(\mathrm{I}) + \mathrm{EMI}^{\mathrm{R}}(\mathrm{A}) = W^{R} * EMI \qquad (3)$$

For the calculation of W^R suitable auxiliary data – mainly energy and transport statistics – are used. By contrast, as outlined in chapter 8, in the case of the 'energy use first' approach the adjustment needed in order to be consistent with National Accounts principles is more likely to be implemented at the stage of energy use data in order to directly estimate the emission components to be subtracted/added. In the inventory first approach the option of directly estimating the emissions components to be added or subtracted from the basic data by complementing the original activity data with proper energy use/transport statistics, is an option, particularly for the transport modes in which the emission estimates are obtained by multiplying activity data by emission factors. However for transport modes for which a complex model is required for the emission estimates this direct estimation method is not appropriate (as in the case of road transport emissions).

[31] This section is also relevant for countries in which the UNFCCC/CLRTAP reporting is the only available data source

All examples in this section relate to estimating residents' emissions as a proportion of inventory emissions as in equation (3). When applying this general principle to the actual calculation of Air Emissions Accounts on the basis of emission inventories, the actual adjustment to be made varies depending on the transport mode.

7.1.2.1 Road transport

This paragraph describes how the emissions of resident units due to road transport activities can be calculated for the purposes of Air Emissions Accounts on the basis of road transport emissions recorded in the air emissions inventories. In the EMEP/CORINAIR inventory the emissions due to road transport are included under SNAP category 07 *'Road Transport'*, specifically:

0701 - Passenger cars

0702 - Light duty vehicles <3.5t

0703 - Heavy duty vehicles >3.5t

0704 - Mopeds and motorcycles <50cm^3

0705 - Mopeds and motorcycles >50cm^3

Corresponding CRF/NFR codes are: 1 A 3 b

Road transport emissions relate to the combustion of propellant fuel purchased by users of road transport equipment (lorries, coaches, cars and motorcycles) on the national territory, regardless of the nationality of the user.

Hence, in principle, the EMEP/CORINAIR road transport emissions of a hypothetical country '*c*' include emissions of residents as well as non resident units due to domestic journeys and to international journeys leaving from country '*c*' as in equation (1) above:

$$EMI^{R}(d) + EMI^{NR}(d) + EMI^{R}(I) + EMI^{NR}(I)$$

For the Air Emissions Accounts purposes, and particularly in order to be consistent with the National Accounts residence principle, the emissions of resident units only, for domestic as well as international journeys regardless of the origin of the trip are needed, i.e. $EMI^{R}(d) + EMI^{R}(I) + EMI^{R}(A)$ (see equation 2 above).

In order to derive resident road transport emissions from emission inventory data the following steps are needed:

a) the emissions of foreign units driving on the national territory need to be excluded:
   $-[\, EMI^{NR}(d) + EMI^{NR}(I)]$,
b) the emissions caused by national residents operating transport services abroad (mostly lorries and coaches registered) and national residents driving their cars abroad e.g. for tourism, need to

be added:[32]

$$+ EMI^{R}(A)$$

Two methodological examples of estimating a) and b) based on auxiliary data, namely energy use and transport statistics, are given below. In general, it is recommended to contact the national emission experts in order to learn which variables are included in the emission estimates and whether they can be used to estimate residents' road transport emissions.[33]

Methodology A. Using energy-use as auxiliary data

If data on the total use of fuel *j* [34] for road transport on the national territory can be broken down by residents and non residents, the share of emissions due to non resident units driving in country 'c' (to be subtracted – see a. above), can be assumed to be equal to the share of non residents' consumption of energy product *j* on the national territory for passenger road transport (use_j^{NR}) out of total passenger consumption for the same energy product:

$$EMI_j^{NR}(d) + EMI_j^{NR}(I) = \frac{use_j^{NR}(d) + use_j^{NR}(I)}{\sum_i use_j^i}[EMI_j^R(d) + EMI_j^{NR}(d) + EMI_j^R(I) + EMI_j^{NR}(I)] \quad (4)$$

If fuel purchases for transport purposes abroad of residents of country 'c' are known the corresponding emissions could be estimated by a similar equation.

Methodology B. Using transport statistics as auxiliary data

Transport statistics could be used as well to estimate the components to be added/ subtracted as a proportion of the inventories' emissions. This approach is shown below with the example of statistics on transport of goods.

In order for this method to be applied to road transport emissions, the first step would be to split inventory data on road transport emissions into passenger transport and goods/freight transport.

Goods/freight transport emissions can be derived directly from the EMEP/CORINAIR inventory as follows:

- SNAP 97 process 070200 "light duty vehicles < 3.5 t",

[32] Compilers should also investigate if significant price differences exist/used to exist between their neighbouring countries, as this is likely to result in unbalanced emissions between residents and non-residents driving across the border. If the prices of fuel in foreign neighbouring countries were significantly lower than country 'c', the emissions of resident units on the territory could be related to fuel purchased abroad, when they fill in their tanks abroad just before re-entering in their home country; this component should be added to the inventory estimates when calculating Air Emissions Accounts. By contrast, if the prices of fuel in foreign neighbouring countries are significantly higher than country 'c', non-residents would fill in their tanks in country 'c' just before leaving; this component should be subtracted when calculating Air Emissions Accounts.

[33] In addition to the amount of fuel use, the actual emissions depend on a number of variables such as the type of vehicle, speed, driving mode (highway, rural, urban), all of which are taken into account in the data system and models set up by national air emission experts. Further details on the breakdown of SNAP processes within this category as well as on the methodology for emission estimates are given in subsection 7.2.6).

[34] It is likely that the most relevant energy product for the calculation will be gasoline and diesel (j = gasoline and diesel)

- SNAP 97 process 070300 “heavy duty vehicles > 3.5t and buses” only for the part “heavy duty vehicles”[35].

Eurostat statistics on goods/freight transport by road allow to calculate the following equation:

$$TG = G^{R}(d) + G^{NR}(d) + G^{R}(I) + G^{NR}(I) \quad (5)$$

where total goods/freight transport (*TG*) in country ‘*c*’ is given by the sum of transport of goods by resident as well as non resident units due to domestic journeys and to international journeys leaving from country ‘*c*’; the components into which total goods transport is split are the same component that make up the road transport emissions of country ‘*c*’ [see equation (1)].

Each component of the emissions can be assumed to be proportional to the corresponding Tkm (tonne kilometres) of goods/freight transport, namely:

$$EMI^{R}(d) : EMI = G^{R}(d) : TG \quad (6)$$
$$EMI^{NR}(d) : EMI = G^{NR}(d) : TG$$
$$EMI^{R}(I) : EMI = G^{R}(I) : TG$$
$$EMI^{NR}(I) : EMI = G^{NR}(I) : TG$$

Eurostat statistics on road transport in Tkm also allow to calculate the transport of goods by resident companies outside the country ‘c’, $G^{R}(A)$. Hence, the emissions of resident companies for transport of goods outside the territory, $EMI^{R}(A)$ (to be added to inventory data), are calculated by assuming that they can be related to goods transport by resident companies abroad, $G^{R}(A)$:

$$EMI^{R}(A) : EMI = G^{R}(A) : TG \quad (7)$$

Table 4 shows the list of Eurostat statistics on road transport in Tkm that can be used for equations (5) to (7). The first column lists the individual components of goods transport that appear in equations (5) to (7) and column 2 provides for each component, the name of the corresponding Table of the Eurostat online database that allows to quantify each component of column 1; all Tables are available in the Section Transport – Road transport – road freight transport measurement. Column 3 provides a numerical example for Italy.

[35] The remaining part would be passenger-related transport statistics: SNAP 97 processes 070100 “passenger cars”, 070300 “heavy duty vehicles > 3.5t and buses” only for the part “buses”, 070400 “mopeds and motorcycles < 50 cm^3”, 070500 “motorcycles > 50 cm^3”.

Table 4: Eurostat statistics on goods/freight transport suitable as auxiliary data for Air Emissions Accounts

Transport statistic	*Eurostat database Table*	*Example: Italy - 2005* *Variables selection*	*Mio Tkm*
G^R(d): transport of goods by residents within national territory	National annual road transport by group of goods and type of transport	Reporting country: Italy Group of goods: total Type of transport: total	171 568
G^{NR}(d): transport of goods by non residents within national territory	Road cabotage transport by country in which cabotage takes place	Partner: Italy	1 098
G^R(I): transport of goods by residents for international journeys leaving from country ‚c'	International annual road freight transport – goods loaded in reporting country by type of transport	Reporting country: Italy Type of transport: total Unload: all countries of the world	20 108
G^{NR}(I)): transport of goods by non residents for international journeys leaving from country ‚c'	International annual road freight transport by country of loading and unloading and by reporting country	Load: Italy Unload: all countries of the world Reporting country: all excluding Italy	32 792
G^R(A): *transport of goods by residents for international journeys leaving from a foreign country and bound to country ‚c' (1) or operating entirely abroad (2) and (3)*	1. International annual road freight transport – goods unloaded in reporting country by type of transport	Reporting country: Italy Type of transport: total Load: all countries of the world	17 763
	2. Road cabotage by hauliers from each reporting country	Reporting country: Italy	1 098
	3. Quarterly cross-trade road freight transport by type of transport	Reporting country: Italy Type of transport: total Load: all countries of the world Unload: all countries of the world	1 247

7.1.2.2 Water transport

This section describes how the emissions of resident units due to water transport activities can be calculated for the purposes of Air Emissions Accounts on the basis of water transport emissions recorded in emissions inventories. No reference is made to the extent to which the international component of water transport emissions is reported in the emission inventories, an issue that is dealt with in chapter 9 (bridge table).

In the EMEP/CORINAIR inventory the emissions due to water transport are included under SNAP category 08 '*Other mobile sources and machinery*', specifically:

080402 - National sea traffic

080403 - National fishing

080404 - International sea traffic (international bunkers)

Corresponding CRF/NFR codes are: 1.A.3.d.i, 1.A.3.d.ii, 1.A.4.c.iii

As specified in the EMEP/CORINAIR guidelines, data include all shipping activities – at sea, in port or on inland waterways – and they are recorded regardless of the nationality or flag of the carrier.

National Sea Traffic

In national emission inventories national sea traffic emissions for country '*c*' refer to the emissions from shipping vessels between ports in the same country, irrespective of flag or nationality. Also included are 'segments' of international journeys, in the following cases:

- shipping vessels that depart from one port in country '*c*', stop in another port in the same country and drop and pick up passengers or freight, then depart and leave the national territory, finally arriving in another country;
- shipping vessels that depart from one country other than '*c*', stop in one port in country '*c*' and drop and/or pick up more passengers or freight, then depart from the national port, finally arriving in a second port in the same country.

Compilers of Air Emissions Accounts should learn from the emission experts regarding the detailed methodology applied to estimate national sea traffic emissions consistently with the EMEP/CORINAIR guidelines. In principle, the EMEP/CORINAIR definition of national sea traffic emissions would include the emissions of resident as well as non-resident shipping vessels for domestic sea traffic, i.e. $EMI^{R}(d) + EMI^{NR}(d)$. In order to be consistent with the National Accounts' residence principle, only $EMI^{R}(d)$ should be included. In other words, only emissions from those shipping vessels operated by resident units should be considered

Statistics to look for in order to derive resident emissions are:

a) Fuel use statistics; if data on the total use of fuel *j* for national sea navigation can be broken down by residents and non residents, the emissions related to national sea navigation due to resident units can be calculated as a share of total national sea traffic emissions equal to the share of fuel *j* used by residents out of total fuel used for national sea traffic:

$$EMI_j^R(d) = \frac{use_j^R(d)}{use_j^R(d) + use_j^{NR}(d)}[EMI_j^R(d) + EMI_j^{NR}(d)] \qquad (8)$$

In some countries there are differentiated tax rates on maritime fuels so the tax revenues and tax rates can be used to distinguish the resident/non-resident fuel purchases.

b) Transport statistics; if statistics on national water transport include a break down by nationality of the operator, the emissions related to national sea navigation operated by resident units can be calculated as a share of total national sea traffic emissions equal to (for example) the share of total goods (in tonnes or Tkm) moved by national sea transport:

$$EMI^{R}(d): [EMI^{R}(d) + EMI^{NR}(d)] = G_S^R(d) : [G_S^{NR}(d) + G_S^R(d)] \qquad (9)$$

where $G_S^{NR}(d)$ and $G_S^{R}(d)$ are the weight of goods moved in national sea transport operated by resident units and non-resident units. In order for this method to be applied the consistency between the definition of resident units in the available (fuel or transport) statistics and the National Accounts definition should be checked.

National fishing

In emission inventories national fishing includes the emissions from all fuel supplied to commercial fishing activities in the reporting country. By contrast, for the Air Emissions Accounts purposes, emissions stemming from foreign fishing vessels, which purchase their fuel on national territory, should be excluded and the emissions of national fishing vessels purchasing fuel abroad need to be included. For countries in which international fishing is a significant activity of the resident fleet (Spain, Ireland, UK, Denmark, Norway, Russia, Iceland), it is likely that national fishing emissions need to be complemented by the estimated emissions related to overseas activities of resident units operating fishing vessels abroad. One possible source of auxiliary information to adjust these figures would be the proportion of total catches landed by non-resident/foreign fishing vessels (to be subtracted); a similar ratio could be used to estimate the emissions upwards for resident units operating abroad (to be added).

International sea traffic

In emission inventories, international sea traffic emissions cover the emissions caused by the combustion of fuel sold for international sea traffic purposes in the reporting country (so called bunkering); the following cases are included:

- shipping vessels that depart from one country and arrive in another,
- shipping vessels that depart from one country, make a 'technical' stop in the same country without dropping or picking up any passengers or freight, then depart again to arrive in another country;
- shipping vessels that depart from one country, stop in the same country and only pick up more passengers or freight and then finally depart from the national territory arriving in another country;
- shipping vessels that depart from one country with a destination in another country, and make an intermediate stop in the destination country where no passengers or cargo are loaded.

Compilers should learn from their national emission experts, the detailed methodology applied to estimate international sea traffic emissions. In principle, according to EMEP/CORINAIR guidelines, international sea traffic emissions would include the emissions of shipping vessels for international maritime journeys operated by resident units as well as by non-resident units (i.e. all shipping vessels bunkering fuel on the territory for international journeys), i.e. $EMI^{R}(I) + EMI^{NR}(I)$. In order to be consistent with the National Accounts' residence principle, residents' emissions $EMI^{R}(I)$ should be singled out

On the other hand, $EMI^{R}(A)$, i.e. the emissions caused by shipping vessels operated by resident units and bunkering fuel abroad for international journeys, should be added.

Statistics to look for in order to derive non-residents' emissions are:

a) Fuel use statistics: if data on the total use of bunker fuel *j* for international sea navigation can be broken down by residents and non residents, the emissions related to international sea navigation operated by resident units (departing from country '*c*') can be calculated as a share of total international sea traffic emissions equal to the share of bunker fuel *j* used by residents out of total bunker fuel used for international sea traffic:

$$EMI_j^R(I) = \frac{use_j^R(I)}{use_j^R(I) + use_j^{NR}(I)} [EMI_j^R(I) + EMI_j^{NR}(I)] \qquad (10)$$

In addition the emissions $EMI^R(A)$, i.e. emissions from shipping vessels operated by resident units bunkering fuel abroad for international sea traffic, could also be calculated on the basis of resident units' fuel bunkering abroad, if available.

b) Transport statistics: if statistics on international water transport include a break down by nationality of the operators, the emissions related to international sea navigation operated by resident units can be calculated as a share of total international sea traffic emissions equal to (for example) the share of goods (in tonnes or Tkm) moved by sea by resident shipping vessels (for outgoing international traffic) out of total goods moved by sea (outgoing international traffic):

$$EMI^R(I): [EMI^R(I) + EMI^{NR}(I)] = G_S^R(I): [G_S^{NR}(I) + G_S^R(I)] \qquad (11)$$

where $G_S^{NR}(I)$ and $G_S^R(I)$ are the weights of goods moved by sea (for international outgoing traffic) by resident operators as well as non-resident operators.

c) Detailed Balance of Payments (BoP) statistics: A third methodology for identifying resident units' activities outside the national territory is based on detailed balance of payments statistics where the bunkering by resident units operating vessels engaged in ocean transport activities should be separately identified as imported intermediate goods. This monetary data is then used together with estimates of average fuel prices to estimate energy use. Emissions factors are then applied to the fuel use data to obtain emissions estimates.

In order for any of these methods to be applied, the consistency between the definition of resident units in the available (fuel or transport) statistics and the National Accounts definition should be checked.

7.1.2.3 Air transport

This paragraph describes how the emissions related to resident units' air transport activities can be calculated for the purposes of Air Emissions Accounts on the basis of air transport emissions as recorded in emissions inventories. No reference is made to the extent to which the international component of air transport emissions is reported to the UNFCCC /CLRTAP conventions, an issue that is dealt with in chapter 9 (bridge table).

In the EMEP/CORINAIR inventory the emissions due to air transport are included under SNAP category 08 '*Other mobile sources and machinery*', specifically:

- 080501 - Domestic airport traffic (LTO cycles - <1000 m), where LTO is an abbreviation for the landing and take off stage of the flight, which includes all activities near the airport that take place below the altitude of 1000 m (3000 feet).
- 080502 - International airport traffic (LTO cycles - <1000 m), where cruise is defined as all activities that take place at altitudes above 1000 m (3000 feet), including climb from the end of climb-out in the LTO cycle to cruise altitude, cruise, and descent from cruise altitudes to the start of LTO operations of landing.
- 080503 - Domestic cruise traffic (>1000 m)
- 080504 - International cruise traffic (>1000 m)

As specified in the EMEP/CORINAIR guidebook, data include all use of aeroplanes consisting of scheduled and charter traffic of passengers and freight. This also includes taxiing, helicopter traffic and private aviation. Military aviation is included if it is possible to estimate. Emissions come from use of kerosene and aviation gasoline as fuel for the aircraft. Gasoline is used in small (piston engine) aircraft only.[36]

Domestic Air Traffic

(SNAP processes 080501 and 080503)

Under the EMEP/CORINAIR guidebook definition all traffic between two airports in one country is considered domestic no matter the nationality of the carrier. In addition, if an aircraft goes from one airport in one country to another in the same country and then leaves to a third airport in another country, the first part of the trip is considered a domestic trip.

In principle the EMEP/CORINAIR definition would cover the emissions from aircrafts operated by resident units as well as by non-resident units for national air traffic, i.e. the following two components:
$EMI^{R}(d) + EMI^{NR}(d)$.

Compilers should check if in fact (particularly for the first years of the emissions time series) domestic flights are run by resident companies only.

If EMEP/CORINAIR domestic air transport emissions can be regarded as being only due to aircrafts operated by resident units they match the component $EMI^{R}(d)$, and can be included as such in the AirEmissions Accounts; by

[36] The EMEP/CORINAIR guidebook also provides examples of aircraft-related emissions which are included under SNAP codes other than 0805: fuelling and fuel handling (SNAP 050402) in general; maintenance of aircraft engines (SNAP 060204); painting of aircraft (SNAP 060108); service vehicles for catering and other services (SNAP 0808); anti-icing and de-icing of aircraft (SNAP 060412).

contrast, if domestic flights can be operated both by resident as well as by non resident companies, the emissions due to domestic flights operated by resident units only need to be singled out.

Once again, it would be best to bring national territory-oriented emission inventory data to National Accounts residence basis using energy-based estimates. Alternatively, if transport statistics allow a distinction between flights operated by resident enterprises and flights operated by foreign/non resident enterprises, the share of emissions due to resident units out of total domestic air traffic emissions can be assumed to be equal to the share of domestic flights run by resident companies out of total flights:

$$EMI^{R}(d): [EMI^{R}(d) + EMI^{NR}(d)] = F^{R}(d) : [F^{NR}(d) + F^{R}(d)] \quad (12)$$

where $F^{R}(d)$ and $F^{NR}(d)$ are, respectively, the number of domestic flights run by resident enterprises of country '*c*' and non resident enterprises. In order to be consistent with the National Accounts residence principle it is also relevant to check with National Accounts whether or not foreign enterprises performing domestic flights are regarded as resident units.

International Air Traffic

(SNAP processes 080502 and 080504)

In emission inventories (according to the EMEP/CORINAIR guidebook) air traffic is considered international if it takes place between airports in two different countries. In addition if an aircraft goes from one airport in one country to another in the same country and then leaves to a third airport in another country, the second part of the trip is considered an international trip. Also included are technical refuelling stops, or domestic trips that only allow passenger or freight to board for an international trip or leave the aircraft after an international trip. EMEP/CORINAIR estimates are based on incoming international flights, regardless the nationality of the airlines. In principle, international air traffic emissions would include the emissions from international flights operated by resident as well as non resident companies arriving to country '*c*', i.e. $EMI^{R}(A) + EMI^{NR}(A)$.

Similarly to the case of domestic air transport, the share of emissions due to resident enterprises out of total international air traffic emissions can be assumed to be equal to the share of international flights run by resident companies out of total flights:

$$EMI^{R}(A): [EMI^{R}(A) + EMI^{NR}(A)] = F^{R}(A) : [F^{NR}(A) + F^{R}(A)] \quad (13)$$

Since the number of outgoing flights equals the number of incoming flights, $EMI^{R}(I)$, i.e. the amount of emissions due to departing flights run by resident companies (to be added to the emission inventory data), equals $EMI^{R}(A)$.

7.1.3 Summary of system boundary adjustments

Summing up, starting from the inventories' emissions, the calculation of resident units' emission data requires to:

a) exclude the emissions and the absorption of emissions by non-economic agents (nature);
b) include CO_2 emissions from biomass;
c) estimate and add the emissions of residents operating abroad for transport activities (driving, shipping or flying) as well as fishing;
d) estimate and deduct the emissions of non-residents operating in the country for transport activities (driving, shipping or flying) as well as fishing.

Estimates of c) and d) – to be preferably carried out for each specific transport mode – are most likely to be based on auxiliary data, particularly energy use and transport statistics. A prerequisite for the calculation, including the choice of the most appropriate auxiliary data, is the detailed knowledge of how the inventories' emission estimates are made by the responsible experts.

The described adjustments are likely to result, at least for some pollutants, in a significant difference between the total reported for the international conventions and the totals in the Air Emissions Accounts. Part of the compilation effort is specifically addressed at providing the data users with a tool, in the form of a Bridge Table, which itemizes the differences, for each air pollutant, between the two totals; guidelines for filling in the Bridge Table are provided in chapter 9 (bridge table).

Now that the system boundaries have been adjusted from a geographic definition to an economic definition, the next step is to assign the emissions to the different industries and to households depending on which entity is directly inducing the air emissions. This assigning to economic activity units is described in detail in the next section.

7.2 Assigning process based inventory emissions to economic activities – compilation steps

Emission inventories' data need to be connected to National Accounts' classification of economic activities. In national emission inventories air emissions are broken down according to the process-oriented SNAP-nomenclature (Selected Activities for Air Pollution), that do not match economically-oriented classifications/nomenclatures such as NACE, CPA and COICOP. The general procedure in the 'inventory-first approach', in order to have comparable economic and emission classification, is to assign national emission inventory data to economic activities (by NACE) and private households' consumption functions (by COICOP); see also section 6.3.

This section starts with an overview of the general compilation steps when assigning inventory emission data to economic activities and households in the inventory-first-approach (subsection 7.2.1). Then several specific chapters follow outlining in more detail the assignment procedure from SNAP categories to NACE Rev.1.1

industries for broad SNAP categories (subsections 7.2.2 to 7.2.10). Most important are subsection 7.2.2 (combustion) and subsection 7.2.6 (road transport). Annex 1 provides a "SNAP-NACE Rev.1.1-correspondence table" giving a detailed overview on how each single SNAP process relates (and may be assigned) to industries (NACE Rev.1.1 divisions) and household activities. This correspondence-table also includes the CRF/NFR codes.[37]

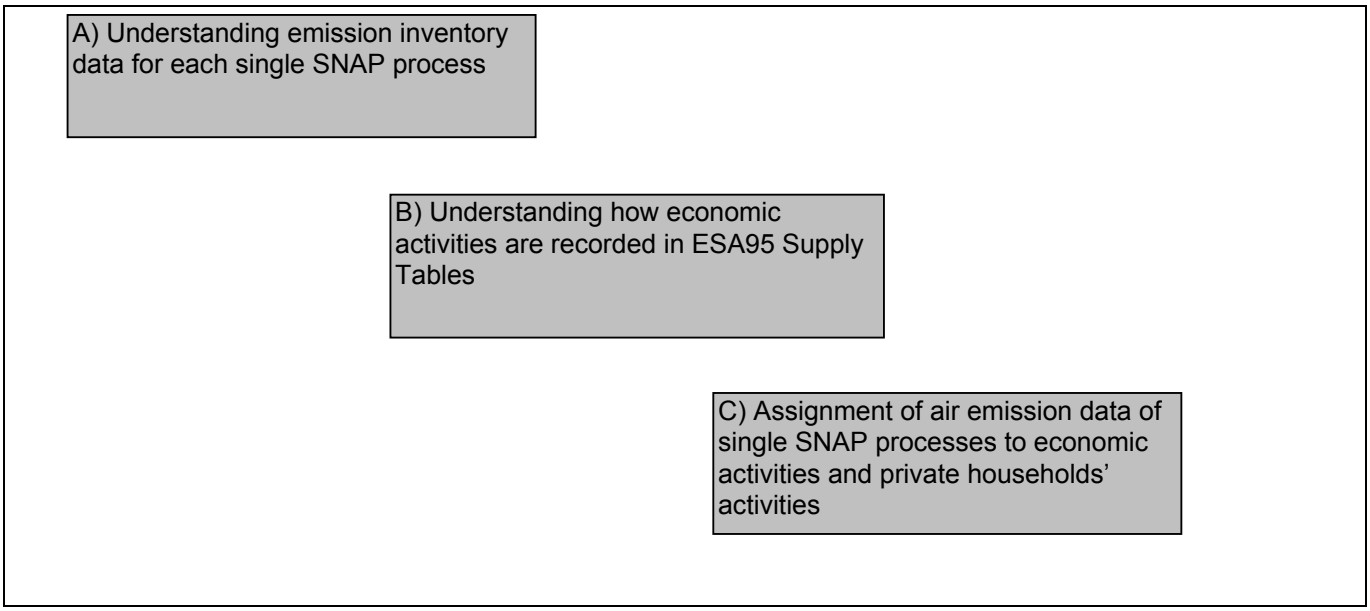
7.2.1 Overview

The general procedure in the 'inventory-first approach' is to assign national air emission inventory data to economic activities (NACE divisions) and private households' activities. As a general principle, the emissions of each SNAP97 process are to be assigned to the economic activity (i.e. industries in the ESA95 supply tables) and/or household activity producing these particular emissions.

In the "inventory-first" compilation process, three main compilation steps or stages can be identified (see also Figure 14):

A) Understanding emission inventory data for each single SNAP process
B) Understanding how economic activities are recorded in ESA95 Supply Tables
C) Assignment of air emission data of single SNAP processes to economic activities and private households' activities

Figure 14: Three main compilation steps in the "inventory-first" approach



These three compilation steps are now explained in general.

[37] Common Reporting Format / Nomenclature For Reporting (CRF/NFR) as employed in UNFCCC Greenhouse Gas Inventories and CLRTAP/EMEP Atmospheric Emission Inventories

A) Understanding emission inventory data for each single SNAP process

Before assignment, national emission inventory data for each SNAP code[38] need to be understood fully. The EMEP/CORINAIR Emissions Inventory Guidebook[39] is the principal source to look up how the single SNAP processes (6-digit level) are defined. In addition, it is highly recommended to consult the national experts who are responsible for compilation of national emission inventories. This consultation is necessary to fully understand how national emission inventory data are generated and what basic assumptions and data are behind the inventory data. This helps to achieve a proper understanding where air emissions of single SNAP processes are actually assumed to take place. In addition, national air emission experts may provide additional valuable information eventually being even more detailed than the 6-digit SNAP process level.

For a number of years, emission inventories have also employed another classification of sources/processes. This alternative classification is referred to as CRF/NFR.[40] It might be that particularly younger national emission inventories (e.g. in the newer EU Member States) employ only the CRF/NFR classification. The SNAP97 classification is fully compatible with the CRF/NFR classification (see Annex 2) and respective cross-references will be given throughout the following subsections.

Some countries may have set up their national emission inventories employing country-specific classifications of processes/sources. These country-specific classifications should be compatible at least with CRF/NFR – even though at aggregated levels – due to internationally harmonized reporting obligations.

B) Understanding how economic activities are recorded in ESA95 Supply Tables

The next challenge is to identify the correct economic activity to which the SNAP-coded emissions are to be assigned to. Towards this end, it is necessary to fully understand how economic activities are recorded in the input-output framework of the European System of Accounts (ESA 1995)[41] . The latter consists of three types of tables[42] of which the supply table is the most important one. Eurostat will assign air emissions as reported in Air Emissions Accounts to the economic data in the supply table which is reported separately by countries to Eurostat. At its core, the supply table shows the domestic production of products (rows) by industries (columns).[43]

[38] The SNAP97 classification comprises about 500 processes (6-digit code) which are clustered to groups (4-digits) and categories (2-digits).

[39] The 2007-version can be found on http://reports.eea.europa.eu/EMEPCORINAIR5/en/page002.html

[40] Common Reporting Format / Nomenclature for Reporting

[41] For details see the recently published "Eurostat Manual of Supply, Use and Input-Output Tables" (Eurostat 2008)

[42] supply tables, use tables, and symmetric input-output tables (SUIOTs)

[43] This part of the supply table – showing what is produced by whom – is termed 'production matrix'.

In principle, Eurostat will assign air emissions to the industries, i.e. columns in the supply table, which actually emit the emissions in the course of their production/provision of products which are shown in the respective cells of the given industry-column in the supply table (see also section 6.3.1).

The most important issue for the compilers of Air Emissions Accounts is to find out how the *industries*, i.e. column headings in the supply table, are delineated. In general, the ESA95 distinguishes three types of activities of industries:

- principal activity,
- secondary activity,
- ancillary activity.

The ESA95 defines industries as groupings of *local kind-of-activity units* (local KAUs) (see also subsection 6.3.1). Ideally, the local KAUs should be characterized by producing only one single product (on the 4-digit level of NACE Rev.1.1 and CPA respectively)[44]. In practice, however, this is not feasible and the local KAUs will have primary product outputs as well as secondary product outputs. Hence, most of the industry columns in the supply table will show several product outputs.

> *Local KAU groups all parts of an institutional unit […] which are located in a single or closely located sites and which contribute to the performance of an activity at the class level (4 digits) of the NACE Rev.1.1. In principle, as many local kind-of –activity units must be registered as there are secondary activities; however, if the accounting documents that would be necessary to describe such activities are not available, a local kind-of-activity unit may include one or several secondary activities. The group of local KAUs engaged on the same, or similar, kind-of-activity constitutes an industry. […] (ESA95 §1.29).*

The ESA95 definition of industries is hence different from institutional units (e.g. enterprises) which are usually subject to the statistical surveys, providing the basic data for the National Accounts. In a first step, the institutional unit (typically enterprises) surveyed is entirely assigned to the NACE Rev.1.1 industry code corresponding to its core business (i.e. the activity generating most of its value added), although this particular institutional unit most likely undertakes numerous secondary activities beside its principal activity.

For preparing and compiling data according to the ESA input-output framework, the national accountants have to decompose the surveyed units (e.g. enterprises) into sub-units which are as homogenous as possible, which are termed local KAUs. The partitioning of enterprises (as surveyed) into local KAUs should be done according to the type of production and should be as detailed as possible.

[44] This would lead to an ideal supply table (production matrix) where only the main diagonal is occupied and all cells off the diagonal would be zero.

In a next step, those local KAUs are re-grouped to *industries* as shown in the supply table's columns. In other words, certain secondary production outputs of enterprises are re-arranged in the supply table from the column where the original enterprise has been assigned to, to another industry column being the typical place for producing this specific secondary product.

For instance, assume a huge energy enterprise (assigned to NACE Rev.1.1 industry code 40 according to its core business in economic statistics) is also engaged in water supply (NACE Rev.1.1 industry code 41), waste management (NACE Rev.1.1 industry code 90) and even manufacturing of machinery (NACE Rev.1.1 industry code 29). Then this particular energy enterprise should be portioned by national accountants into four sub-units (40, 41, 90, 29) and the respective economic statistics (turnover, value added, employment etc.) are re-sorted in the ESA95 framework accordingly.

For the compilers of Air Emissions Accounts it is of utmost importance to understand exactly, how the national accountants have performed the above described procedure of partitioning enterprises into local KAUs and re-grouping the local KAUs to industries which are finally shown in the supply table (see sub-section 6.3.1).

It is highly recommended to contact and consult those national accountants in charge of compiling supply tables in your country to obtain the necessary information for the following step of assigning SNAP-based emission inventory data to NACE Rev.1.1 industries recorded in ESA95 supply tables. In addition, a good understanding of the supply table may also be helpful in critical allocation cases where emissions of one single SNAP process need to be distributed over a number of NACE Rev.1.1 industries.

C) Assignment of air emission data of single SNAP processes to economic activities and private households' activities

Once one has fully understood the emission inventory data and identified where relevant economic activities are recorded in the ESA95 supply tables, one can start assigning the SNAP-based air emission to the economic activity.

For many of the SNAP processes at the most detailed 6-digit level this assignment is straightforward (one-to-one correspondence). However, there are also cases where emissions from one single SNAP process need to be distributed over several economic activities. This "distribution" needs to be based on additional information (i.e. "helping" or auxiliary statistics). Depending on the availability of auxiliary information, several approaches are possible and the "best approach" will depend on the country specific availability of auxiliary information.

The following subsections provide detailed compilation guidance for SNAP groupings. Each subsection starts with an overview of the quantitative importance in terms of contribution to total air emissions of the respective SNAP group. Further, each section is structured along the three main steps (A, B, C; see above).

7.2.2 Combustion processes - SNAP 01, 02, and 03 (CRF/NFR 1.A.1, 1.A.2, 1.A.4, and 1.A.5)

These three SNAP categories 01, 02, and 03 related to all sorts of combustion are of very high importance (more than half) in terms of contribution to total national emissions for SO_2 and CO_2. They are also of high importance (more than 25%) for NOx and CO.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 01 01 and SNAP 01 02 (CRF/NFR 1.A.1.a)	SNAP 01 03 (CRF/NFR 1.A.1.b)	SNAP 01 04 and SNAP 01 05 (CRF/NFR 1.A.1.c)	SNAP 02 01 (CRF/NFR 1.A.4.a; 1.A.5.a)	SNAP 02 02 (CRF/NFR 1.A.4.b)	SNAP 02 03 (CRF/NFR 1.A.4.c)	SNAP 03 (CRF/NFR 1.A.2)
CO_2	29	4	2	5	12	2	16
N_2O	4	0	0	0	2	1	2
CH_4	0	0	0	0	2	0	2
SO_2	53	9	1	2	4	NE	15
NOx	17	2	1	2	5	NE	15
NH_3	0	0	0	0	0	0	0
NMVOC	1	0	0	0	9	NE	2
CO	2	0	0	1	23	NE	13

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP categories 01, 02 and 03

The 6-digit processes in SNAP categories 01, 02, and 03 comprise emissions from combustion plants to generate power and heat (or both), namely boilers[45], gas turbines[46], and stationary engines[47] (Note: process furnaces are recorded separately under SNAP group 04). Emissions considered in these three SNAP groups are released by controlled combustion processes (boiler emissions, emissions from the combustion chamber of gas turbines or stationary engines) taking into account primary reduction measures, such as furnace optimisation inside the boiler or the combustion chamber, and secondary reduction measures downstream the boiler or the combustion chamber. Solid, liquid or gaseous fuels are used, where solid fuels comprise coal, coke, biomass and waste (as far as waste is used to generate heat or power). (see EMEP/CORINAIR Emission Inventory Guidebook documents B111 and B112[48]).

The further subdivision into 4-digit SNAP groups and 6-digit SNAP processes takes into account two criteria:

a.) The economic sector (incl. households) concerning the use of energy (mainly concerning the 4-digit level)

[45] A *boiler* is a closed vessel in which water or other fluid is heated. The heated or vaporized fluid exits the boiler for use in various processes or heating applications.

[46] A gas turbine extracts energy from a flow of hot gas produced by combustion of gas or fuel oil in a stream of compressed air. It has an upstream air compressor (radial or axial flow) mechanically coupled to a downstream turbine and a combustion chamber in between. Energy is released when compressed air is mixed with fuel and ignited in the combustor. The resulting gases are directed over the turbine's blades, spinning the turbine, and mechanically powering the compressor. Finally, the gases are passed through a nozzle, generating additional thrust by accelerating the hot exhaust gases by expansion back to atmospheric pressure.

[47] A stationary engine is an engine whose framework does not move. It is normally used not to propel a vehicle but to drive a piece of immobile equipment such as a pump or power tool. E.g. a stationary diesel engine to co-generate heat and power.

[48] http://reports.eea.europa.eu/EMEPCORINAIR5/en/page002.html

- public power and co-generation,
- district heating,
- commercial and institutional combustion,
- industrial combustion in boilers,
- residential combustion,
- agriculture, forestry and fishing

b.) The technical characteristics (mainly concerning 6-digit level)

- with respect to boilers, the thermal capacity,
- other combustion technologies (gas turbines, stationary engines).

Table 5 (taken from EMEP/CORINAIR Guide) gives a good overview of how the SNAP processes in groups 01, 02, and 03 are delineated.

Table 5: Delineation of combustion processes (SNAP categories 01, 02, and 03)

NFR code	SNAP97 codes	Thermal capacity [MW_{th}]	Public power and cogeneration plants	District heating	Industrial combustion and specific sector	Commercial and institutional combustion	Residential combustion	Agriculture, forestry and fishing	Gas turbines	Stationary engines
1.A.1.a	01 01 01		X							
1.A.1.a	01 02 01			X						
1.A.1.b	01 03 01				X					
1.A.1.c	01 04 01	≥ 300			X					
1.A.1.c	01 05 01				X					
1.A.4.a	02 01 01					X				
1.A.2.a-f	03 01 01				X					
1.A.1.a	01 01 02		X							
1.A.1.a	01 02 02			X						
1.A.1.b	01 03 02				X					
1.A.1.c	01 04 02	≥ 50			X					
1.A.1.c	01 05 02	and			X					
1.A.4.a	02 01 02	< 300				X				
1.A.4.b.i	02 02 01						X			
1.A.4.c.i	02 03 01							X		
1.A.2.a-f	03 01 02				X					
1.A.1.a	01 01 03		X							
1.A.1.a	01 02 03			X						
1.A.1.b	01 03 03				X					
1.A.1.c	01 04 03				X					
1.A.1.c	01 05 03	< 50			X					
1.A.4.a	02 01 03					X				
1.A.4.b.i	02 02 02						X			

NFR code	SNAP97 codes	Thermal capacity [MW_{th}]	Public power and cogeneration plants	District heating	Industrial combustion and specific sector	Commercial and institutional combustion	Residential combustion	Agriculture, forestry and fishing	Gas turbines	Stationary engines
1.A.4.c.i	02 03 02							X		
1.A.2.a-f	03 01 03				X					
1.A.1.a	01 01 04	not relevant							X	
1.A.1.a	01 02 04								X	
1.A.1.b	01 03 04								X	
1.A.1.c	01 04 04								X	
1.A.1.c	01 05 04								X	
1.A.4.a	02 01 04								X	
1.A.4.b.i	02 02 03								X	
1.A.4.c.i	02 03 03								X	
1.A.2.a-f	03 01 04								X	
1.A.1.a	01 01 05	not relevant								X
1.A.1.a	01 02 05									X
1.A.1.b	01 03 05									X
1.A.1.c	01 04 05									X
1.A.1.c	01 05 05									X
1.A.4.a	02 01 05									X
1.A.4.b.i	02 02 04									X
1.A.4.c.i	02 03 04									X
1.A.2.a-f	03 01 05									X

Source: EEA: EMEP/CORINAIR Guidebook 2007

B) Understanding, where the relevant economic activities are recorded in National Accounts

In general, the SNAP codes 01, 02, and 03 concern combustion plants, i.e. facilities where power (electricity), heat or even both (CHP[49]) is generated. However, the SNAP codes in general give no or at least very little indication whether electricity and/or heat is generated. Rather, the SNAP codes (on the 4-digit level) seem to indicate in which characteristic types of industries the several combustion processes are taking place actually. However, the question arises regarding where those characteristic types of industries – as indicated by the titles of the SNAP codes – are actually recorded in the ESA95 supply tables?

As mentioned earlier, the national accountants do split institutional units (e.g. enterprises) into local KAUs and re-group those to rather homogenous industries of the same kind-of-activity, i.e. columns in the supply tables.

[49] Combined Heat and Power

Assume that a petroleum refinery enterprise is operating a combustion plant to produce electricity and heat for own use and for selling the surplus on the markets. Most likely, the related emissions are recorded under SNAP code 0103.

The national accountants, however might have identified this production activity as a secondary activity of the refinery enterprise and might have singled out the related economic statistics to a local KAU; which they then group to the industry-column with NACE Rev.1.1 industry code 40 ("electricity, gas, steam and hot water supply") in their ESA95 supply table. In this example, the emissions from SNAP 0103 are to be assigned to the industry with NACE Rev.1.1 industry code 40; although the title of the SNAP code 0103 suggest an assignment to the NACE Rev.1.1 industry code 23 ("manufacture of petroleum products").

Therefore, it is of utmost importance to know how the E SA95 supply tables are generated with respect to those economic activities that involve combustion as defined in SNAP categories 01, 02, and 03.

One may assume that in most countries national accountants have singled out local KAUs in most institutional units as far as they produce electricity as a secondary product. Indeed, this is obvious from a look at supply tables available at Eurostat. The product-row for CPA code 40 shows mainly a significant sized entry in the cell related to the industry-column with NACE Rev.1.1 industry code 40. If at all, there are only a few cells in the CPA-40-product-row off the NACE Rev.1.1-40-industry-column. This provides evidence for the assumption that in most cases electricity production has been identified as a secondary activity and local KAU in most enterprises and has been re-grouped to the industry-column with NACE Rev.1.1 industry code 40 in the ESA95 supply tables.

However, this might be mainly valid for electricity as it has been identified and singled out as a secondary product. Furthermore, combustion processes are also employed by enterprises to generate ancillary products/services, particularly for heating of own buildings and warming of tap-water. In ESA95 supply-tables, these ancillary activities are recorded together with the principal activity on the main diagonal; i.e. cannot be identified and separated as local KAUs.

Seemingly, combustion as an ancillary activity occurs in all industries and private households (dominantly for heating of buildings and warming of tap-water). Evidently, combustion emissions from such ancillary activities are to be assigned to the causing industry-column in the ESA95 supply table which then coincides with the industry suggested by the SNAP title.

C) Guidance for assignment of air emission data of SNAP categories 01, 02, and 03 to NACE Rev.1.1 industries

For assigning combustion-process-related emissions (as provided by SNAP categories 01, 02, and 03) to industries (as recorded in ESA95 supply tables' columns) it is of utmost importance to understand and know

what kind of functional services and product outputs are associated with the respective SNAP combustion process.

Five general groups of functional services and product outputs may be associated with SNAP combustion processes:

- electricity
- heat
- heating of buildings (space heating)
- warming of tap-water (water heating)
- (production) process-specific outputs (e.g. steel)

Unfortunately, many of the SNAP processes under SNAP categories 01, 02, and 03 are defined and delineated from a technical-physical viewpoint and do not reveal what kind of functional service and/or product output is actually associated with the respective SNAP process. For instance, SNAP group 02 01 (commercial and institutional plants) does not reveal whether the respective combustion processes are aimed at producing electricity or aimed at heating buildings and warming tap-water or even both (i.e. combined heat and power). This information however, is needed in order to find out the correct industry to which emissions from this SNAP group should be assigned. The national air emission experts should be contacted in order to obtain further information on the combustion-associated functional services and product outputs. In some countries, this information might be available in the data underpinning the SNAP-inventories.

If once the functional services and/or product outputs associated with SNAP combustion processes has been identified, the next questions arises: where in the ESA95 supply tables are the respective generations of functional services and product outputs recorded? It is recommended to contact the National Accounts experts in your country responsible for compiling the ESA95 supply tables. In general, the ESA95 may treat (and accordingly record) the five combustion-related functional services and product outputs as:

- principal activity,
- secondary activity,
- ancillary activity.

Table 6 provides an overview on how the five combustion-related functional services and product outputs (that can be associated with combustion processes) can be cross-tabled with the three ESA95 activity types; and gives some examples:

Table 6: Overview on how functional services and outputs of SNAP combustion processes can be cross-tables with three ESA95 activity types

		5 functional services and product outputs potentially associated with SNAP-combustion-processes (SNAP categories 01, 02, and 03)				
		Electricity	Heat	Heating buildings	Warming tap-water	Production process-specific outputs
Types of activities recorded in ESA95 supply tables	Principal activity	e.g. electricity production by public power plants i.e. NACE Rev.1.1 industry code 40	e.g. heat production by public heat-only boiler station for district heating i.e. NACE Rev.1.1 industry code 40			e.g. furnaces employed by respective industries (e.g. steel i.e. NACE Rev.1.1 industry code 27)
	Secondary activity	e.g. electricity production by refinery industry i.e. NACE Rev.1.1 industry code 23	e.g. heat production by waste incineration plant i.e. NACE Rev.1.1 industry code 90			respective industries (e.g. NACE Rev.1.1 industry code 23)
	Ancillary activity			assumingly by all NACE Rev.1.1 divisions	assumingly by all NACE Rev.1.1 divisions	

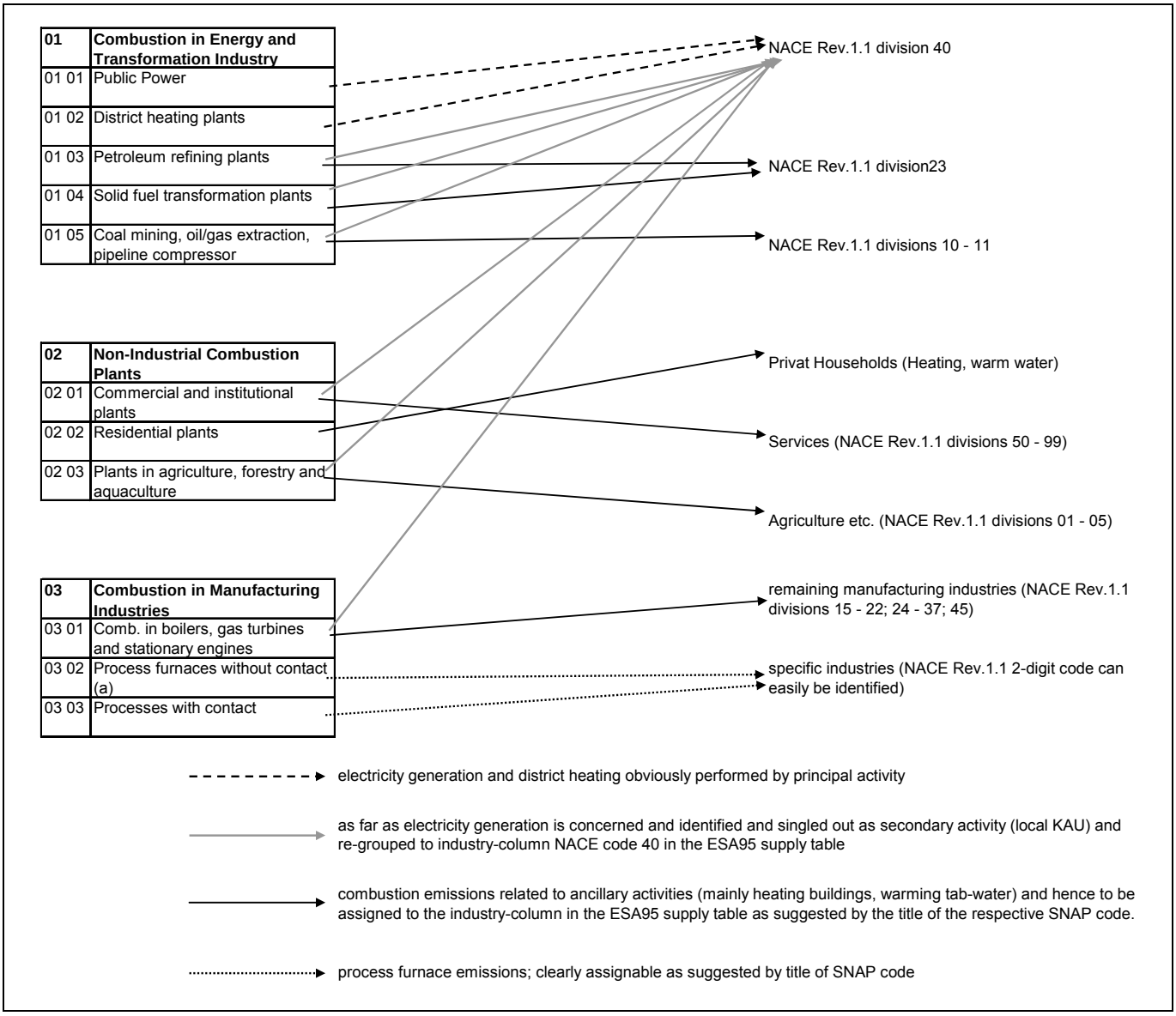
Figure 15 provides another presentation of possible assignments from SNAP combustion groups (4-digit level) to NACE Rev.1.1 divisions.

SNAP 01: includes combustion processes in the energy industry (NACE Rev.1.1 industry code 40) and – what energy and emission experts call – the energy transformation sector, which is mainly refinery (NACE Rev.1.1 industry code 23) and apparently also the coal mining and oil extracting industries (NACE Rev.1.1 industry codes 10-11).

Emissions from SNAP 01 01 ‘public power plants’ and 01 02 ‘district heating plants’ are clearly related to the principal activities of NACE Rev.1.1 industry 40 (dashed arrows).
One may assume that electricity production as secondary activities in the transformation sectors (SNAP 01 03 to 01 05, respectively NACE Rev.1.1 industry codes 23 and 10-11) has been re-grouped to industry-column with NACE Rev.1.1 industry code 40 in the ESA95 supply table. Hence, the electricity production related part of emissions in those SNAP codes 01 03 to 01 05 should be actually assigned to NACE Rev.1.1 industry code 40 (see grey arrows in Figure 15).

However, the emissions related to combustion processes in SNAP 01 03 to 01 05 aiming at heating buildings and/or providing warm tap-water are most likely ancillary activities in the ESA95 logic and have hence to be assigned to the industry columns NACE Rev.1.1 industry codes 23 and 10-11 respectively in the ESA95 supply table (see black arrows in Figure 15).

Figure 15: Assignments of 4-digit SNAP processes of groups 01, 02, and 03 to NACE Rev.1.1-based industries as recorded in ESA95 supply tables and private households



SNAP 02: includes "non-industrial" combustion processes (we do not know whether for electricity or heat). Most likely, this relates only to the service industries (NACE Rev.1.1 industry codes 50 to 99), the agriculture/forestry/fishery-industries (NACE Rev.1.1 industry codes 01 to 05) and the private households (residential). Most likely, combustion processes in manufacturing (i.e. NACE Rev.1.1 industry codes 10-45) are not concerned under this SNAP 02 group but under the following SNAP group.

Again, emissions related to electricity production as secondary activity in these SNAP processes needs to be separated and assigned to NACE Rev.1.1 industry 40 if National Accounts do so[50] (see grey arrows in Figure 15). All other emissions related to combustion processes aiming at heating of buildings and warming tap-water

[50] It is likely that the compiler of Air Emissions Accounts is able to get this information from the national accountants providing the supply- and use tables.

may be assumed as ancillary activity and hence be assigned to the industries with respective NACE Rev.1.1 industry codes (black arrows in Figure 15).

SNAP 03: includes "combustion in manufacturing". A general interpretation here is that all the manufacturing industries are concerned (generally ranging from NACE Rev.1.1 industry codes 10 to 45) excluding NACE Rev.1.1 industry code 40, NACE Rev.1.1 industry codes 10-11 and NACE Rev.1.1 industry code 23, as those are already covered under SNAP group 01 (see above).

SNAP 03 01 concerns 'combustion in boilers, gas turbines and stationary engines'. Here, one may assume again that several outputs are generated: electricity, heat or both. In the case of electricity, if this secondary activity has been identified as a local KAU in the ESA95 supply tables, the emissions from SNAP 03 01 related to electricity might have to be assigned to the industry column with NACE Rev.1.1 industry code 40 (grey arrow in Figure 15). As far as the combustion processes in 03 01 are related to heating of buildings and warming of tap-water, they may be regarded as ancillary activity of the respective NACE Rev.1.1 industry and related emissions are to be assigned to the very same industry (black arrow in Figure 15). Emissions from SNAP codes 03 02 and 03 03 are process specific and should be assigned to respective NACE Rev.1.1 industries as suggested by the name of the respective 6-digit SNAP-code (see dotted arrows in Figure 15). For instance, emissions from SNAP 03 03 02 'Reheating furnaces steel and iron' are obviously to be assigned to the industry-column with NACE Rev.1.1 industry code 27 ('manufacturing of basic metals').

However, deviations from these general rules are possible[51] and can only be detected if one

i. consults the national experts responsible for compilation of national emission inventories in order to find out exactly how the emissions related to SNAP groups 01, 02, and 03 are compiled in the respective country; and

ii. consults the ESA95 supply-table in order to identify and separate combustion emissions related to principal, secondary and ancillary activities.

In summary, the compilers of Air Emissions Accounts are challenged with two main problems related to SNAP groups 01, 02, and 03:

1) The distinctions between "grey" and "black" arrows in Figure 15). That is, sorting out what part of the SNAP emissions is due to electricity generation which might have been singled out as secondary activity (i.e. local KAU and hence showing up in industry column with NACE Rev.1.1 industry code 40 in the ESA95 supply table) and what part is non-electricity (i.e. related to heating of buildings, warm water etc.) which is most likely regarded as an ancillary activity and hence related emissions should be

[51] In Italy, for instance, emissions from power-related combustion in refinery industry, recorded under SNAP 01 03, were an integrated process of refineries (i.e. a secondary activity) up to the year 1999; afterwards, this part of refineries became in most cases a separate power producing unit, recorded as NACE 40; so the emissions from the year 1999 onwards need to be split among NACE 23 and 40 while they have to be placed entirely under NACE 23 before 1999.

assigned to, for example, NACE Rev.1.1 industry-column 23 in the example of SNAP codes in group 01 03.

2) The problem of splitting/distributing emissions from one single SNAP code to several NACE Rev.1.1 industries – such as the problem of how emissions from SNAP 02 01 need to be distributed over the service industries NACE Rev.1.1 industry codes 50 to 95 as shown by the black arrows in Figure 15.

Ad 1) Distinguishing between electricity related and non-electricity related emissions from combustion ("grey" versus "black" arrows in Figure 15) for SNAP groups 01 03, 01 04, 01 05, 02 01, 02 03, and 03 01:
The primary approach is to contact the national air-emission experts and talk with them about how they actually compile the emissions under these SNAP codes. Check with your national emission experts whether they have more detailed information on the combustion processes' purpose, i.e. electricity, district heating, space heating, water heating etc.[52]

Ad 2) Distributing single SNAP processes over a number of NACE Rev.1.1 industries
Yet, there are several SNAP processes (on the 6-digit level) that need to be distributed over a number of NACE Rev.1.1 divisions (with #-flag in Annex 1).
Quantitatively the most important cases are:

- combustion in commercial and institutional plants (SNAP 02 01 => NACE Rev.1.1 industry codes 50 to 99) and
- boiler etc. combustion in manufacturing industries (SNAP 03 01 => NACE Rev.1.1 industry codes 15-22 + 24 + 37 + 45).

For these cases, one needs to employ additional auxiliary information in order to perform this distribution. Data on energy use are a good statistic to be used as auxiliary information if available. Further possible approaches are presented in the following.

<u>SNAP 01 05 01-05 : distributions between NACE Rev.1.1 industry 10 and NACE Rev.1.1 industry 11</u>
Identify what kind of combustion processes could take place in the two industries:

- NACE Rev.1.1 industry code 10 'Mining of coal and lignite; extraction of peat'
- NACE Rev.1.1 industry code 11 'Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying'

If in your country these industries generate electricity as a secondary activity (such as on the oil platforms in the North Sea), this should be known by likely both, the national accountants in charge of compiling the ESA95 supply table (since they have most likely singled out this activity as a local KAU) and eventually the experts calculating the respective air emissions for these SNAP processes (since they might have used the electricity generated as an activity variable for their calculations). In both cases, knowledge might exist on how much

[52] E.g. in Germany air emission inventory data have specifications more detailed than the 6-digit level providing also the information of whether electricity, heat or combined heat and power are produced in a given combustion process.

electricity is produced by NACE Rev.1.1 industry 10 and how much by NACE Rev.1.1 industry 11 giving you an indication for the distribution of air emissions amongst those two mining industries.

Otherwise, a good assumption is:

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

are mainly used for electricity and is hence more likely assignable to NACE Rev.1.1 industry 40, and

01 05 05 Stationary engines

are mainly used for ancillary activities. If available, you may use the consumption of energy to split the emissions. Further, you may use production output (physical volume) or employment as auxiliary information to make the split between NACE Rev.1.1 industry 10 and NACE Rev.1.1 industry 11.

SNAP 02 01 01-06 distributions between NACE Rev.1.1 divisions 50 to 99

In the majority of cases, combustion in the service industries (NACE Rev.1.1 divisions 50 to 95) would be associated with heating of buildings and warming of tap water. However, it might be that electricity generation might be derived from secondary activities in these industries as well (e.g. from decentralised small combined heat and power plants). National accountants might help you to find out this information.

It might be assumed that bigger plants, i.e.

02 01 01 Combustion plants >= 300 MW (boilers)

02 01 02 Combustion plants >= 50 and < 300 MW (boilers)

and

02 01 04 Stationary gas turbines

are operated for larger scaled electricity and heat productions and should hence be identified by national accountants as local KAUs which might have been re-grouped to the industry column with NACE Rev.1.1 industry code 40 in the ESA95 supply tables.

For the remaining emissions, most likely stemming from

02 01 03 Combustion plants < 50 MW (boilers)

02 01 05 Stationary engines

02 01 06 Other stationary equipments (n)

employment is an appropriate auxiliary parameter to perform the distribution among the NACE Rev.1.1 industries.

SNAP 02 03 01-05 distributions between NACE Rev.1.1 divisions 01, 02 and 05

In a first step, the “grey” arrows in Figure 15 need to be identified (versus the “black” arrows in Figure 15). Presumably, agriculture (NACE Rev.1.1 industry code 01) is the industry bearing the highest likelihood of employing larger combustion plants for electricity production (e.g. biogas fuelled combined heat and power). But also forestry (NACE Rev.1.1 industry code 02) could potentially employ (combined) power plants. Again, the national accountants responsible for the compilation of ESA95 supply tables might provide some information with regards to secondary activities in generating electricity in these industries.

Otherwise, auxiliary data is needed to perform the distribution of SNAP 02 03 05 emissions among the three NACE Rev.1.1 industries: e.g. fuel use (if available) or employment.

SNAP 03 01 01-06 distributions between NACE Rev.1.1 divisions 15-22+24-37+45

In a first step, the “grey” arrows in Figure 15 need to be identified (versus the “black” arrows in Figure 15). After separating electricity-related emissions and assigning them eventually to NACE Rev.1.1 industry code 40, the remaining emissions need to be distributed over NACE Rev.1.1 industries 15-22, 24-37, and 45.

Most likely, emission data are also available following the CRF/NFR 4-digit codes which are in this particular case more detailed facilitating the assignments:

1.A.2.a = iron & steel (NACE Rev.1.1 industry codes 27-28)

1.A.2.b = non-ferrous metals (NACE Rev.1.1 industry codes 27-28)

1.A.2.c = chemicals (NACE Rev.1.1 industry codes 24-25)

1.A.2.d = pulp. Paper, print (NACE Rev.1.1 industry codes 21-22)

1.A.2.e = food, beverages, tobacco (NACE Rev.1.1 industry codes 15-16)

1.A.2.f = other manufacturing & construction (NACE Rev.1.1 industry codes 17-20; 26; 29-37; 45)

The NACE Rev.1.1 industry codes given in brackets already indicate the first step assignment. The further breakdown needs auxiliary information preferably energy use or some physical parameter characterising production volume.

SNAP 03 02 05 distribution between NACE Rev.1.1 divisions 26 and 27

Presumably, this is not of quantitative importance – you may use output (monetary or better physical output if available) or employment as auxiliary information to do the splitting.

SNAP 03 03 12 distribution between NACE Rev.1.1 divisions 15, 26 and 27

This assignment/distribution should be based on information revealing which industries are actual producing limes (if available). Otherwise, the default assignment should be to NACE Rev.1.1 industry code 26.

SNAP 03 03 13 distribution between NACE Rev.1.1 divisions 23 and 45

If information is available assign the emissions according to where asphalt concrete is produced; otherwise the default assignment should be NACE Rev.1.1 industry code 45.

SNAP 03 03 26 distribution between NACE Rev.1.1 divisions 15-22+24-37+45

If emission data are available at all for this SNAP code; then, the national emission experts should known where it comes from exactly.

7.2.3 Production processes - SNAP 04 (CRF/NFR 1.B.1.b, 1.B.2.a, 2.A, 2.B, 2.C, 2.D)

Emissions related to production processes are of significant importance (above 5% of national totals) in the cases of N_2O (in chemical industry), CH_4 (in refinery industry), NMVOC (refinery industry and others), and CO (metal industries).

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 04 01 (parts of CRF/NFR 1.B.2.a)	SNAP 04 02 and SNAP 04 03 (CRF/NFR 2.C)	SNAP 04 04 and SNAP 04 05 (CRF/NFR 2.B)	SNAP 04 06 (CRF/NFR 2.A and 2.D)
CO_2	1	2	1	3
N_2O	0	0	14	0
CH_4	12	0	0	0
SO_2	4	2	2	2
NOx	0	1	0	1
NH_3	NE	0	1	0
NMVOC	8	0	2	7
CO	0	9	0	0

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 04

This SNAP category 04 comprises emissions related to production processes in several industries (which can easily be derived from the names of the SNAP groups on the 4-digit level).

Production process related emissions occur in the following processes:

- *Refinery industry* (04 01): feed stock handling and storage; separation processes; petroleum conversion processes; petroleum treating processes; product storage and handling; auxiliary facilities.
- *Iron and steel industry* (04 02): coke ovens; blast furnace charging; pig iron tapping, oxygen furnace; electric furnace; rolling; sinter and pelletizing, etc.
- *Non-ferrous metal industry* (04 03): aluminium production; ferro-alloys production; silicium production; magnesium production; nickel production, etc.
- *Inorganic chemical industries* (04 04): production of acid, ammonia, chlorine, fertilizers etc.
- *Organic chemical industries* (04 05): production of ethylene, propylene, PVCs, formaldehyde, ethylbenzene etc.
- *Wood, paper pulp, food, drink and other industries* (04 06): production of paper pulp, bread, wine, beer, cement, glass, limes, soda ash, etc.
- *Production of halocarbons and sulphur hexafluoride* (04 08)

B) Understanding, where the relevant economic activities are recorded in National Accounts

Production process' emissions may be assumed to be closely tied to the principal activity of the industry is typically identified from the respective SNAP group name. Hence, in most cases the related economic output from this principal activity should be recorded in the appropriate column of the ESA95 supply table.

C) Guidance for assignment of air emission data of SNAP category 04 to NACE Rev.1.1 industries

The assignment of production process emissions to NACE Rev.1.1 industries is in most cases a straight forward one-to-one assignment which is obvious from the respective SNAP group name (see greenish rows in Annex 1). There are a few cases (indicated in yellowish cells in Annex 1) where the assignment is less clear:

- SNAP 04 02 01 "coke oven (door leakage and extinction)" is related to coke oven furnaces which might be operated by the iron and steel industry (NACE Rev.1.1 industry code 27) or might be recorded under solid fuel transformation, i.e. refinery industries (NACE Rev.1.1 industry code 23).
- SNAP 04 06 14 'lime (decarbonizing)' is typically assigned to NACE Rev.1.1 industry code 26 (default choice); however, lime may also be produced by the food industry (NACE Rev.1.1 industry code 15) and/or the steel industry (NACE Rev.1.1 industry code 27); not an "elephant," if you have data identifying this activity in the steel industry; otherwise assign emissions only to NACE Rev.1.1 industry code 26
- SNAP 04 06 16 'extraction of mineral ores' needs to be distributed over two NACE Rev.1.1 divisions, i.e. NACE Rev.1.1 industry code 13 and NACE Rev.1.1 industry code 14. This can be done by using the physical output (in tonnes) of both industries to calculate the distribution portions/weights.

7.2.4 Extraction and distribution of fossil fuels - SNAP 05 (mainly CRF/NFR 1.B)

Emissions related to the extraction and distribution of fossil fuels are of significant importance in the case of CH_4 and NMVOCs.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 05 (mainly CRF/NFR 1.B)
CO_2	1
N_2O	0
CH_4	12
SO_2	4
NOx	0
NH_3	NE
NMVOC	8
CO	0

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 05

This SNAP category comprises a variety of processes related to fossil fuel extraction, first treatment, storage and transportation/distribution.

B) Understanding, where the relevant economic activities are recorded in National Accounts

Emissions from fossil fuel extraction and distribution occur in a variety of NACE Rev.1.1 divisions. In most cases, the concerned industry's activity (which is identifiable from the SNAP process name) should be recorded in the appropriate industry-column of the ESA95 supply table.

C) Guidance for assignment of air emission data of SNAP category 05 to NACE Rev.1.1 industries

The assignment of emissions from this SNAP category to NACE Rev.1.1 divisions is in most cases a straight forward one-to-one assignment which is obvious from the respective SNAP process name (see greenish rows in Annex 1 correspondence-table).

There are a few cases (indicated in yellowish cells in Annex 1) where the assignment is less clear:

- SNAP 05 01 03 'storage of solid fuel': emissions may be distributed over the NACE Rev.1.1 divisions 23-24, 26, 27, and 40. Here, the plausible assumption is made that those industries using coal will have to store coal, i.e. will maintain major storage facilities. Most likely, coal power plants have by far the biggest storage.
- SNAP 05 04 02 'other handling and storage (including pipeline)' may occur in, and hence may need to be distributed over, three NACE Rev.1.1 divisions: 23, 60 and 63.
- SNAP 05 05 01 'refinery dispatch station': It seems likely that the dispatch activity that gives rise to the emissions is not a separate transport activity but rather an ancillary activity of the refinery company. Hence, assignment to NACE Rev.1.1 division 23.
- SNAP 05 05 02 'transport and depots (except 05.05.03)': It seems likely that the storage activity that gives rise to the emissions is not a secondary activity but rather an ancillary activity of the refinery company; hence assignment to NACE Rev.1.1 division 23.

7.2.5 Solvent and other product use - SNAP 06 (CRF/NFR 3.A, 3.B, 3.C, and 3.D)

Emissions from solvent and other product use are only relevant for the case of NMVOCs.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 06 01 (CRF/NFR 3.A)	SNAP 06 02 (CRF/NFR 3.B)	SNAP 06 03 (CRF/NFR 3.C)	SNAP 06 04 (CRF/NFR 3.D)
CO_2				
N_2O				
CH_4				
SO_2				
NOx				
NH_3				
NMVOC	16	2	4	18
CO				

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 06

This SNAP category comprises all activities in which organic solvents are used and are emitted. Most solvents are part of a final product, e.g. paint, and will sooner or later evaporate. This evaporation of solvent is a major source of NMVOC emission. Estimating emissions from solvent use can be done in two ways: either by estimating the amount of (pure) solvents consumed or by estimating the amount of solvent containing products consumed (taking account of their solvent content).

B) Understanding, where the relevant economic activities are recorded in National Accounts

In most cases, the names of the SNAP processes suggest where the respective activity (solvent use or any other relevant product use) is assumed to take place.

C) Guidance for assignment of air emission data of SNAP category 06 to NACE Rev.1.1 industries

In most cases, the assignment is straight forward (see greenish cells in Annex 1 correspondence table). There are a few cases where emissions from one single SNAP process need to be distributed over more than one NACE Rev.1.1 division (#-flags in Annex 1 correspondence table):

- SNAP 06 01 07 'paint application – wood' and SNAP 06 04 06 'preservation of wood': Potentially, painting and preservation of wood may occur in two industries: NACE Rev.1.1 industry code 20 and NACE Rev.1.1 industry code 36. Compilers may use employment data to distribute between the two industries.
- SNAP 06 01 08 'other industrial paint application': This is a kind of residual item. It concerns paint applications in all remaining industries which are not covered by previous items. Potentially, emissions from this SNAP process need to be distributed over the following industries (NACE Rev.1.1 divisions): 21-22; 24-27; 29-35.

  However, emissions may derive only from a limited number of industries. You have to contact your national air emission experts to find out which ones.
- SNAP 06 02 01 'metal degreasing': In principle, there are two NACE Rev.1.1 divisions concerned: NACE Rev.1.1 industry code 27 and NACE Rev.1.1 industry code 28.
- SNAP 06 04 07 'underseal treatment and conservation of vehicles': This activity may occur in three NACE Rev.1.1 divisions: 34, 35 and 50. Most likely, it will occur in the manufacturing of vehicles, i.e. NACE Rev.1.1 industry codes 34 and 35, and less likely in repair of vehicles (NACE Rev.1.1 division 50). Contact your national emission experts as they may have used production statistics (i.e. industry classified data which may be confidential data) to calculate emissions under this SNAP process.

Assignment is assumingly difficult in the case of SNAP group 06 05 'use of HFC, N_2O, NH_3, PFC and SF_6'. Here, it is highly recommended to contact the national emission experts in order to find out what kind of activities they have considered. In the case of the fluorinated gases, refrigeration and air conditioning activities can be important.

7.2.6 Road transport - SNAP 07 (CRF/NFR 1.A.3.b)

Emissions from road transport are of extraordinarily high importance typically accounting for one fifth of total NMVOC-emissions, nearly one quarter of total CO_2 emissions, and around 40% of total NOx- and CO-emissions. Hence, a careful assignment to NACE Rev.1.1 divisions and private households is required – although the auxiliary information to do the assignments is unfortunately rather sparse.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 07 (CRF/NFR 1.A.3.b)
CO_2	23
N_2O	7
CH_4	1
SO_2	1
NOx	40
NH_3	2
NMVOC	20
CO	41

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 07

Emissions from road transport cover emissions produced by the exhaust systems of road vehicles (SNAP groups 07 01 to 07 05) and non-exhaust emissions such as fuel evaporation from vehicles (SNAP group 07 06) and component attrition/wear (SNAP group 07 07).

The exhaust emissions are broken down into five vehicle categories (SNAP 4 digit level):

- Passenger cars (SNAP 09 01)
- Light duty vehicles <3.5t (SNAP 09 02)
- Heavy duty vehicles >3.5t (SNAP 09 03)
- Mopeds and motorcycles <50cm3 (SNAP 09 04)
- Mopeds and motorcycles >50cm3 (SNAP 09 05)

The further breakdown to the 6-digit level takes into account the different modes of driving (highway, rural, urban) which relates particularly to the different specific fuel consumption rates for the different modes.

The level of detail given by this SNAP classification of road transport is however not sufficient for actually calculating related emissions. The EMEP/CORINAIR Guide proposes a more detailed vehicle category split as presented in Table 7.

National air emission experts most likely maintain more detailed data for representing road transport emissions. Your national air emission experts have set up a detailed data system and model to calculate emissions from road transport for the specific case of your country. Hence, it is recommended to contact your national air emission experts in order to get a full overview of the emission calculations for road transport in your country.

Table 7: Vehicle category split as suggested in EMEP/CORINAIR Guidebook

SNAP-like code	Activity	Driving Mode		
		Highway	Rural	Urban
07 01	PASSENGER CARS			
07 01 01	Gasoline <1.4 l	07 01 01 01	07 01 01 02	07 01 01 03
07 01 02	Gasoline 1.4 l – 2.0 l	07 01 02 01	07 01 02 02	07 01 02 03
07 01 03	Gasoline > 2.0 l	07 01 03 01	07 01 03 02	07 01 03 03
07 01 04	Diesel < 2.0 l	07 01 04 01	07 01 04 02	07 01 04 03
07 01 05	Diesel > 2.0 l	07 01 05 01	07 01 05 02	07 01 05 03
07 01 06	LPG	07 01 06 01	07 01 06 02	07 01 06 03
07 01 07	Two Stroke Gasoline	07 01 07 01	07 01 07 02	07 01 07 03
07 01 08	Hybrids	07 01 08 01	07 01 08 02	07 01 08 03
07 02	LIGHT DUTY VEHICLE < 3.5 l			
07 02 01	Gasoline	07 02 01 01	07 02 01 02	07 02 01 03
07 02 02	Diesel	07 02 02 01	07 02 02 02	07 02 02 03
07 03	HEAVY DUTY VEHICLES			
07 03 01	Gasoline	07 03 01 01	07 03 01 02	07 03 01 03
07 03 02	Diesel < 7.5 t	07 03 02 01	07 03 02 02	07 03 02 03
07 03 03	Diesel 7.5 – 16 t	07 03 03 01	07 03 03 02	07 03 03 03
07 03 04	Diesel 16 – 32 t	07 03 04 01	07 03 04 02	07 03 04 03
07 03 05	Diesel > 32 t	07 03 05 01	07 03 05 02	07 03 05 03
07 03 06	Urban Busses	-	-	07 03 06 03
07 03 07	Coaches	07 03 07 01	07 03 07 02	07 03 07 03
07 04	MOPEDS & MOTORCYCLES < 50 cm^3	-	-	07 04 01 00
07 05	MOTORCYCLES			
07 05 01	Two Stroke > 50 cm^3	07 05 01 01	07 05 01 02	07 05 01 03
07 05 02	Four Stroke > 50 cm^3	07 05 02 01	07 05 02 02	07 05 02 03
07 05 03	Four Stroke 50 – 250 cm^3	07 05 03 01	07 05 03 02	07 05 03 03
07 05 04	Four Stroke 250 – 750 cm^3	07 05 04 01	07 05 04 02	07 05 04 03
07 05 05	Four Stroke > 750 cm^3	07 05 05 01	07 05 05 02	07 05 05 03

Source. EMEP/CORINAIR technical document B710

There are joint European efforts to harmonize data gathering and modelling related to road transport emissions. The EMEP/CORINAIR Guide describes a certain methodology for calculating emissions from road transport[53]. This specific methodology has been implemented into the software tool COPERT 4 which is available at http://lat.eng.auth.gr/copert/. It may be that your national air emission experts are using the COPERT model. However, it is also likely that in your country specific data systems and models exist.

Data systems and models for calculating emissions from road transport require a number of underpinning data and information, such as:

[53] EMEP/CORINAIR Guidebook; technical document B710

- Composition of national car fleet by several cohorts including vehicle category, age, engine (and fuel) type, norm concerning emission standards etc. and eventually also by operator/holder (i.e. private households, public authorities, commercial – eventually even by industry, etc.);
- Transport distances actually driven by aforementioned cohorts;
- Specific emission coefficients, broken down by aforementioned cohorts and degree of implementation of abatement technologies (e.g. additional particle filters).

B) Understanding, where the relevant economic activities are recorded in National Accounts

In the ESA95 supply tables, road transport maybe treated as principal, secondary or ancillary activity.

Road transport as a principal activity is given if the transport of passengers and freight is the actual service which constitutes the core business of an industry. This is obviously the case for the land transport industry (NACE Rev.1.1 division 60) including for example, taxi operations, bus transport companies, freight transport agencies etc. In the ESA95 supply table, road transport as a principal activity output is recorded in the industry-column of NACE Rev.1.1 industry code 60.

Road transport (mainly freight) may be treated as a secondary activity in industries which by nature of their core business need to transport things, such as construction (NACE Rev.1.1 division 45), postal services (NACE Rev.1.1 division 64) or wholesale services (NACE Rev.1.1 division 51). In the ESA95 supply table this might be recorded in the industry-column undertaking this secondary activity (i.e. the postal or wholesale service industries' columns) and the product-row with CPA code 60. Or, it might have been identified as local KAUs, singled out and re-grouped to the industry-column with NACE Rev.1.1 industry code 60 in the ESA95 supply table (and again product-row with CPA code 60). In order to find out, you should discuss this with your national accountants.

Road transport as ancillary activity may occur in all industries – from NACE division 01 to 99. It includes road vehicles operated by the respective industry, such as e.g. ambulances (NACE Rev.1.1 division 85) or lorries such as in the construction industry.

Finally, road transport is undertaken by private households, i.e. private car driving.

C) Guidance for assignment of air emission data of SNAP category 07 to NACE Rev.1.1 industries

The assignment of road transport emissions is a difficult one. The assignment can only be done with the help of auxiliary data. The availability of the latter depends on your specific country situation. Hence, it is difficult to provide practical guidance so unfortunately, the following description remains rather abstract.

Note: For road transport emissions adjustment from territory system boundaries to the residence principle is required[54].

As a minimum point of departure for the assignment of road transport emissions is the SNAP 4-digit level, i.e. 5 categories of road vehicles. A further breakdown of vehicles by engine size and fuel (as given in Table 7) would be ideal. In any case, auxiliary information is needed to split emissions from the five SNAP groups to industries (NACE).

In general, it is recommended to first conduct the split – for each of the five vehicle categories – between:

- private households, and
- industries (all NACE Rev.1.1 divisions)

Subsequently, the industry related road transport emissions needs to be further divided into:

- land transport industry (NACE Rev.1.1 industry code 60)
- other industries (NACE Rev.1.1 industry codes 01 to 99, excl. 60)

In general, one can think of several solutions/approaches, depending on the auxiliary information available in your country. In the following, two approaches and a "fall-back option" are introduced. One may also combine two or all three approaches as appropriate.

1) Specific (national) emission model for road transport ("best choice solution"):
You may have at hand a national road transport data system or model that allows you to make all splits required. I.e. your national transport statistics system contains information on the owner of the road transport vehicle and respective quantities of kilometres driven. This enables you to broadly split between private and commercial transport, i.e. between private households and industries.

2) Detailed data on energy use from your National Accounts:
It might be that Energy Accounts (NAMEA-energy) are available in your country. Those show the use of different energy commodities by NACE Rev.1.1 industries. The use of diesel and gasoline may be used to distribute road transport emissions over industries.

In any case, contact your national accountants. They may maintain some type of energy use monetary data. Often, national accountants maintain for internal use only comprehensive use tables – typically the use of 1000+ commodities broken down by industries. For each industry (NACE Rev.1.1 division and private households), the fuel use (differentiated by fuel type, i.e. diesel, gasoline, LPG, etc.) could be assigned to the five vehicle categories by employing certain auxiliary information such as e.g. mileages as shown in Table 8 or other nationally available information. The resulting percentage shares could be used to distribute emissions from SNAP groups (4-digits) accordingly.

[54] Practical guidelines to bridge from territory to residence approach is presented in section 7.1.

Table 8: Mileage driven bye each vehicle category, EU15 2002

Country	Gasoline PC	Diesel PC	Gasoline LDV	Diesel LDV	Diesel HDV	Buses & Coaches	Two Wheelers
Austria	16 641	18 156	25 000	25 000	67 891	41 573	4 881
Belgium	14 319	22 774	20 000	35 000	63 275	23 210	7 800
Denmark	20 410	21 413	18 253	15 000	38 714	60 040	3 846
Finland	19 256	31 165	8 500	16 000	55 000	70 000	3 260
France	9 950	15 059	16 500	25 000	59 719	39 550	4 359
Germany	11 596	15 353	17 500	22 000	70 340	47 000	2 420
Greece	16 689	16 054	13 000	20 000	40 225	16 904	5 975
Ireland	20 388	14 977	25 000	27 000	35 989	48 136	11 955
Italy	9 273	15 760	20 000	17 000	38 742	41 000	5 088
Luxembourg	13 920	20 174	40 000	40 000	40 000	47 730	2 189
Netherlands	10 841	15 087	35 000	n.a.	26 180	35 000	3 980
Portugal	12 267	12 267	n.a.	15 000	26 683	30 220	477
Spain	9 578	14 362	22 500	30 000	60 281	28 000	2 428
Sweden	15 005	20 579	20 000	35 000	56 930	60 000	5 995
UK	13 729	15 644	17 000	16 500	60 000	60 000	3 815

Source. EMEP/CORINAIR Guidebook 2007, technical document B710

3) Using the split of a similarly structured country ("fall-back option"):
If none of the above information is available in your country, you may use the percentages from a country with similar economic structures as your country.

The following Table 9 shows an example of how road transport emissions have been distributed across the NACE rev.1.1 industries and private households in the French Air Emissions Accounts in the year 2005. These data result from a model combining information on the fleet of vehicles and annual distances covered. Note that, for each SNAP code, the percentages apply for all pollutants concerned in road transport (i.e. CO_2, CH_4, NOx, SO_2, CO, NMVOC, and PM10).

Table 9: Distribution of road transport related air emissions over NACE rev.1.1 divisions and private households (in percent of respective SNAP group column total)

country: FR air pollutant: all year: 2006	SNAP group (vehicle category)							
	07 01	07 02	07 03	07 04	07 05	07 06	07 07	07 08
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3	Gasoline evaporation from vehicles	Automobile tyre and brake wear	Automobile road abraision
NACE 01	0.65%	2.90%	0.00%			0.77%	1.55%	1.55%
NACE 02	0.00%	2.66%	0.00%			0.31%	0.38%	0.38%
NACE 05	0.00%	2.66%	0.00%			0.31%	0.38%	0.38%
NACE 10	0.00%	0.37%	0.02%			0.05%	0.06%	0.06%
NACE 11	0.00%	0.37%	0.02%			0.05%	0.06%	0.06%
NACE 12	0.00%	0.37%	0.53%			0.05%	0.11%	0.11%
NACE 13	0.00%	0.22%	0.53%			0.02%	0.08%	0.08%
NACE 14	0.01%	0.27%	0.53%			0.03%	0.10%	0.10%
NACE 15	0.12%	2.26%	2.51%			0.33%	0.81%	0.81%
NACE 16	0.00%	0.09%	0.00%			0.01%	0.03%	0.03%
NACE 17	0.02%	0.27%	0.04%			0.03%	0.06%	0.06%
NACE 18	0.02%	0.16%	0.01%			0.02%	0.05%	0.05%
NACE 19	0.00%	0.16%	0.01%			0.01%	0.05%	0.05%
NACE 20	0.02%	0.27%	0.03%			0.03%	0.06%	0.06%
NACE 21	0.02%	0.29%	0.08%			0.04%	0.07%	0.07%
NACE 22	0.05%	0.16%	0.06%			0.04%	0.08%	0.08%
NACE 23	0.00%	0.37%	0.46%			0.05%	0.12%	0.12%
NACE 24	0.10%	0.27%	0.41%			0.09%	0.16%	0.16%
NACE 25	0.05%	0.27%	0.14%			0.06%	0.10%	0.10%
NACE 26	0.04%	0.27%	1.01%			0.05%	0.16%	0.16%
NACE 27	0.01%	0.27%	0.24%			0.03%	0.09%	0.09%
NACE 28	0.10%	0.27%	0.23%			0.09%	0.14%	0.14%
NACE 29	0.09%	0.61%	0.20%			0.10%	0.22%	0.22%
NACE 30	0.01%	0.55%	0.07%			0.03%	0.15%	0.15%
NACE 31	0.04%	0.55%	0.10%			0.05%	0.17%	0.17%
NACE 32	0.02%	0.16%	0.20%			0.02%	0.08%	0.08%
NACE 33	0.04%	0.61%	0.07%			0.06%	0.16%	0.16%
NACE 34	0.21%	0.15%	0.48%			0.16%	0.24%	0.24%
NACE 35	0.01%	0.72%	0.22%			0.02%	0.13%	0.13%
NACE 36	3.36%	2.61%	0.57%			2.51%	3.28%	3.28%
NACE 37	0.01%	1.38%	0.54%			0.15%	0.21%	0.21%
NACE 40	0.02%	0.37%	0.26%			0.06%	0.11%	0.11%
NACE 41	0.01%	1.38%	0.04%			0.15%	0.17%	0.17%
NACE 45	0.35%	13.85%	0.00%			1.08%	2.79%	2.79%
NACE 50	1.33%	4.88%	0.00%			1.27%	1.95%	1.95%
NACE 51	0.44%	2.44%	0.00%			0.48%	0.79%	0.79%
NACE 52	0.16%	2.44%	0.00%			0.29%	0.59%	0.59%
NACE 55	0.07%	0.73%	0.00%			0.14%	0.18%	0.18%
NACE 60	0.48%	2.75%	90.42%			0.79%	6.41%	6.41%
NACE 61	0.00%	0.72%	0.00%			0.02%	0.09%	0.09%
NACE 62	0.01%	0.72%	0.00%			0.02%	0.10%	0.10%
NACE 63	0.24%	2.10%	0.00%			0.33%	0.42%	0.42%
NACE 64								
NACE 65	0.11%	0.30%	0.00%			0.12%	0.10%	0.10%
NACE 66	0.02%	1.01%	0.00%			0.19%	0.16%	0.16%
NACE 67	0.04%	0.30%	0.00%			0.07%	0.07%	0.07%
NACE 70	0.14%	0.84%	0.00%			0.17%	0.21%	0.21%
NACE 71	3.62%	1.38%	0.00%			2.65%	2.68%	2.68%
NACE 72	0.06%	1.38%	0.00%			0.19%	0.21%	0.21%
NACE 73	0.01%	1.38%	0.00%			0.15%	0.17%	0.17%
NACE 74	0.41%	1.38%	0.00%			0.43%	0.43%	0.43%
NACE 75	0.13%	1.01%	0.00%			0.26%	0.22%	0.22%
NACE 80	0.14%	0.78%	0.00%			0.21%	0.25%	0.25%
NACE 85	0.22%	0.78%	0.00%			0.27%	0.30%	0.30%
NACE 90	0.02%	1.38%	0.00%			0.16%	0.17%	0.17%
NACE 91	0.03%	1.01%	0.00%			0.19%	0.17%	0.17%
NACE 92	0.04%	0.73%	0.00%			0.12%	0.16%	0.16%
NACE 93	0.02%	0.73%	0.00%			0.11%	0.15%	0.15%
NACE 95								
NACE 99	0.00%	1.01%	0.00%			0.17%	0.15%	0.15%
all industries	13.15%	70.24%	100.00%	0.00%	0.00%	15.65%	28.54%	28.54%
private households	86.85%	29.76%	0.00%	100.00%	100.00%	84.35%	71.46%	71.46%
total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: personal communication with Jean-Louis Pasquier (Commissariat général au développement durable - Service de l'observation et des statistiques)

In the French example, emissions recorded under SNAP 07 04 (Mopeds and Motorcycles < 50 cm^3) and 07 05 (Motorcycles > 50 cm^3) are entirely allocated to private households. Concerning SNAP 0703 (Heavy duty

vehicles > 3.5 t and buses) only own account transport of employees is taken into consideration, i.e. all emissions resulting from transport of goods are attributed to the road transport industry (NACE rev.1.1 60.2). These two issues will be further investigated further for the next data set to be prepared by the French authorities.

Further examples for the distribution of road transport emissions over NACE rev.1.1 divisions and private households are given in Annex 4.

7.2.7 Other mobile sources and machinery - SNAP 08 (CRF/NFR 1.A.3.a, 1.A.3.c, and 1.A.3.d; and others)

Emissions from mobile sources and other machinery are of importance in the case of NOx and SO2.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 08 02 (CRF/NFR 1.A.3.c)	SNAP 08 03 and SNAP 08 04 (CRF/NFR 1.A.3.d)	SNAP 08 05 (CRF/NFR 1.A.3.a)
CO_2	0	1	1
N_2O	0	0	0
CH_4	0	0	0
SO_2	0	4	0
NOx	1	4	1
NH_3	0	0	0
NMVOC	0	2	0
CO	0	2	0

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 08

This SNAP category comprises emissions from internal combustion engines other than 'on-road' vehicles (treated in previous subsection) such as railways, air and water vehicles and ‘off-road’ machinery as used in several industries.

Particularly in the case of ‘off-road’ vehicles or machinery, there is a risk of overlap with ‘on-road’ vehicles as covered under SNAP 07, e.g. fire trucks, refuse collectors, sewage trucks, road tankers, etc. because it is not always clear whether or not these utility vehicles are part of national on-road vehicle inventories. The EMEP/CORINAIR Guide proposes “to count these as on-road vehicles. In addition, some of the vehicles have a second combustion engine in order to operate their special equipment. These additional machines should fall under 'Off-Road' machinery. In some other cases, machinery is mobile in principle, but actually stays at the same site for long periods, or only is mobile within a small radius, e.g., some excavators and cranes. In this case, it is proposed to consider these machines here as 'Other Mobile Sources and Machinery'. Moreover, there are large mobile generator sets, e.g. above 1 MW, which are mobile but quite often not moved in reality. With regard to this equipment, there is a real risk of misallocation, because in many inventories such generator sets most likely fall into the categories of SNAP sectors 1, 2 or 3 under the item 'Stationary Engines'. A further risk of misallocation occurs in the sector 'Airports', because many of the ground activities covered there are carried out

by 'off-road' machines and equipment, which fall into the category 0801. Therefore, there is a risk of double counting" (EEA 2007).

It is recommended to contact your national experts for air emission inventories in order to fully understand, which processes are covered.

Table 10: Proposal for a Reference List of 'Off-road' machinery, which should be, covered under SNAP codes 0801 to 0803 and 0806 to 0809

SNAP code	Name		Machinery included
080100	Military		
080200	Railways	01	Shunting locs
		02	Rail-cars
		03	Locomotives
080300	Inland Waterways:	01	Sailing Boats with auxiliary engines
		02	Motorboats / Workboats
		03	Personal Watercraft
		04	Inland Goods Carrying Vessels
080600	Agriculture:	01	2-wheel tractors
		02	Agricultural tractors
		03	Harvesters / Combines
		04	Others (sprayers, manure distributors, agriculture mowers, balers, tillers, swatchers)
080700	Forestry:	01	Professional Chain Saws / Clearing Saws
		02	Forest tractors / harvesters / skidders
		03	Others (tree processors, haulers, forestry cultivators, fellers/bunchers, shredders, log loaders, pilling machines)
080800	Industry:	01	Asphalt / Concrete Pavers
		02	Plate compactors / Tampers / Rammers
		03	Rollers
		04	Trenchers / Mini Excavators
		05	Excavators (wheel/crawler type)
		06	Cement and Mortar Mixers
		07	Cranes
		08	Graders / Scrapers
		09	Off-Highway Trucks
		10	Bull Dozers (wheel/crawler type)
		11	Tractors / Loaders / Backhoes
		12	Skid Steer Tractors
		13	Dumper / Tenders
		14	Aerial Lifts
		15	Forklifts
		16	Generator Sets
		17	Pumps
		18	Air / Gas Compressors
		19	Welders
		20	Refrigerating Units
		21	Other general industrial equipment (broomers, sweepers / scrubbers, Slope and brush cutters, pressure washers, pist machines, ice rink machines, scrapers, blowers, vacuums)
		22	Other material handling equipment (conveyors, tunnel locs, snow clearing machines, industrial tractors, pushing tractors)
		23	Other construction work equipment (paving/surfacing equipment, bore/drill rigs, crushing equipment, concrete breakers/saws, peat breaking machines, pipe layers, rod benchers/cutters
080900	Household & Gardening:	01	Trimmers / Edgers / Brush Cutters
		02	Lawn Mowers
		03	Hobby Chain Saws
		04	Snowmobiles / Skidoos
		05	Other household and gardening equipment (wood splitters, snow blowers, chippers/stump grinders, gardening tillers, leaf blowers/vacuums)
		06	Other household and gardening vehicles (lawn and garden tractors, all terrain vehicles, minibikes, off-road motorcycles, golfcarts)

Source: EMEP CORINAIR Guidebook 2007, technical document B810

B) Understanding, where the relevant economic activities are recorded in National Accounts

In ESA95 supply tables, the employment of mobile sources as covered under SNAP category 08 maybe treated as principal, secondary or ancillary activity.

The running of railway, water and air vehicles may be regarded as principal activities of the respective transport service industries NACE Rev.1.1 industry code 60.1 'Transport via railways', NACE Rev.1.1 industry code 61 'Water transport', and NACE Rev.1.1 industry code 62 'Air transport', and in the case of fishing vessels NACE Rev.1.1 industry code 05 'Fishing'.

Railway vehicles may also be employed by other industries as a secondary activity. Contact your national accountants to find out whether this is the case in your country and whether these secondary activities have been singled out as local KAUs and accordingly have been re-grouped in your national supply table.

The employment of 'off-road' machinery (SNAP groups 08 01, 08 06, 08 07, 08 08, and 08 09) should fall under ancillary activities of the respective industries which can be derived/identified from the titles of the respective SNAP processes.

C) Guidance for assignment of air emission data of SNAP category 08 to NACE Rev.1.1 industries

The assignment of emissions from other mobile sources to NACE Rev.1.1 industries is rather straightforward. In most cases single SNAP processes of this SNAP category can be assigned to one clear NACE Rev.1.1 industry or households (see Annex 1 correspondence table).

It is only SNAP group 08 08 'Industry' where the associated emissions need to be distributed over a number of NACE Rev.1.1 industries. Contact your national air emission expert in order to find out more about the processes recorded here. The construction industry may operate a significant share of that mobile 'off-road' machinery.

You may also use auxiliary data, such as e.g. employment and/or economic output, to do the distribution.

Note: For other mobile source emissions adjustments from territory approach to residence principle is required, particularly for air and water transport.[55]

7.2.8 Waste (SNAP 09)

Emissions from waste management are of high importance in the case of CH_4.

[55] Practical guidelines to bridge from territory to residence approach are presented in section 7.1.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 09 02 SNAP 09 07 SNAP 09 09 (CRF/NFR 6.C)	SNAP 09 04 (CRF/NFR 6.A)	SNAP 09 10 (CRF/NFR 6.B and 6.D)
CO_2	0	0	0
N_2O	0	0	3
CH_4	0	27	3
SO_2			
NOx			
NH_3			
NMVOC			
CO			

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 09

This SNAP category comprises emissions from several waste treatments (incineration, landfilling, other), burning of agricultural wastes and cremation. Table 11 provides some more detailed information on the single SNAP processes.

Table 11: Detailed information related to SNAP category 09 (Waste)

code	SNAP process	Descriptions from EMEP/CORINAIR Guidebook 2007
09 02 01	Incineration of domestic or municipal wastes	Relates to the incineration of domestic or municipal wastes, often referred to as municipal solid waste (MSW). MSW is defined as a mix of unwanted waste material from households and commercial organisations.
09 02 02	Incineration of industrial wastes (except flaring)	Relates to the combustion of industrial waste (including hazardous or chemical waste). The definition of industrial waste varies, but the EMEP/CORINAIR Guidebook assumes it to include all non-domestic chemical, hazardous and difficult wastes, and other industrial wastes. The composition of industrial waste varies considerably. Industrial waste includes any unwanted hazardous/chemical waste such as: acids and alkalis; halogenated and other potentially-toxic compounds; fuels, oils and greases; used filter materials, animal and food wastes. Industrial waste sources include chemical plant, refineries, light and heavy manufacturing etc. The number of large merchant incinerators of hazardous waste, operated by waste disposal contractors to receive a wide variety of wastes from different sources, is relatively small. Many industries have smaller hazardous/chemical waste incinerators constructed within their own site and intended for their use only. A large proportion of these handle only single streams of waste. There is little information on emissions from these smaller plants.
09 02 03	Flaring in oil refinery	Flares are commonly used during petroleum refining for the safe disposal of waste gases during process upsets (e.g., start-up, shut-down, system blow-down) and emergencies to combust the organic content of waste emission streams without recovering/using the associated energy. Blowdown systems are used at petroleum refineries (see SNAP Code 0401) to collect and separate both liquid and vapour discharges from various refinery process units and equipment. The gaseous fraction, that may represent a planned or unplanned hydrocarbon discharge, may be either recycled or flared. Flaring provides a widely-used safety mechanism and emission control option for blowdown systems when the heating value of the emission stream cannot be recovered due to uncertain or intermittent releases during process upsets/emergencies.
09 02 04	Flaring in chemical industries	n.a.
09 02 05	Incineration of sludges from waste water treatment	Volume reduction, by combustion, of sludge resulting from municipal waste water treatment (sewage).
09 02 06	Flaring in gas and oil extraction	Flaring is gas combusted without utilisation of the energy. SNAP 090206 include all flaring for extraction and first treatment of gaseous and liquid fossil fuels. Flaring in oil refineries and other industry is described in SNAP 09 02 03 and 09 02 04, respectively. Emissions to air from incineration after a well testing should be reported in SNAP 09 02 06 as well. This section also includes flaring in gas terminals. Gas is flared on oil and gas production installations for safety. The main reasons are lack of process or transport capacity for gas, a continuous surplus gas flow, start up, maintenance and emergency (need for pressure relief). The gas is led through a pipeline to a flare tip located high above and away from the platform. Well testing is performed as a part of the exploration activity. After a discovery the well is tested to check the production capacity and the composition of the reservoir fluid. Due to lack of treatment, storage and transport facilities the oil or gas extracted may be disposed by burning.

code	SNAP process	Descriptions from EMEP/CORINAIR Guidebook 2007
09 02 07	Incineration of hospital wastes	Volume reduction, by combustion, of hospital wastes In some cases hospital waste is combusted in municipal waste incinerators, or in 'hazardous waste incinerators' along with hazardous/ chemical wastes from industrial processes. Users of this chapter should be aware of the potential for double counting of activity data with this chapter and the chapters on SNAP 090201 and SNAP 090202.
09 02 08	Incineration of waste oil	n.a.
09 04 01 09 04 02 09 04 03	Solid waste disposal on land	n.a.
09 07	Open burning of agricultural wastes	Covers the volume reduction, by open burning, of agricultural wastes. It does not include stubble burning, which is covered under SNAP code 100300, or forest fires, which is covered under SNAP code 110300. The open burning of rubber tyres or waste oil on farms has also not been included. Examples of agricultural wastes that might be burned are crop residues (e.g. cereal crops, peas, beans, soya, sugarbeet, oil seed rape etc.) wood, leaves, animal carcasses, plastics and other general wastes. Straw and wood are often used as the fuel for the open burning of agricultural wastes. Poultry and animal excreta are difficult to burn except under controlled conditions.
09 09 01	Incineration of Corpses	This chapter covers the atmospheric emissions from the incineration of human bodies in a crematorium. The emissions associated with the combustion of support fuels during the cremation process are also included
09 09 02	Incineration of Carcasses	
09 10 01 09 10 02	Waste Water Treatment in Industry / in Residential/Commercial Sectors	The installations described are biological treatment plants. During the treatment process carbon dioxide, methane, and nitrous oxide can be produced.
09 10 03	Sludge Spreading	Emissions from the spreading of sewage sludge can be considered as a part of a wastewater treatment plant. The sludge produced in a wastewater treatment plant is either burned, mechanically dried or dried by spreading in the open air. Information on emissions from the latter process is scarce. Emissions to air include odours. Recent measurements indicate that some ammonia is also produced.
09 10 05	Compost production	In many areas organic domestic waste is gathered separately. Composting the organic waste produces a reusable product. The main emissions to be expected have to do with odour and abatement methods are directed at reducing the odour. Also a small amount of ammonia is produced.
09 10 06	Biogas production	n.a.
09 10 07	Latrines	Considers ammonia emissions from latrines which are storage tanks of human excreta, located under naturally ventilated wooden shelters. A latrine is a simple "dry" toilet built outside the house, usually in a backyard. A storage tank under the latrine can be a hole dug in the ground, or a concrete reservoir
09 10 08	Other production of fuel (refuse derived fuel,...)	n.a.

B) Understanding, where the relevant economic activities are recorded in National Accounts

In ESA95, the several waste treatments covered in SNAP category 09 may occur as principal, secondary and/or ancillary activity. Waste treatment as a principal activity is undertaken by the industry with NACE Rev.1.1 industry code 90 ("Sewage and refuse disposal, sanitation and similar activities"). This industry also covers waste water management. Waste treatments may also be carried out by public authorities (e.g. NACE division 75) as a secondary activity.

Incineration of particular waste streams (e.g. industrial, hazardous, clinical etc.) and waste water treatment of specific industrial waste waters may occur as secondary activity in certain industries. Have a look at your ESA95 supply table. Check whether the commodity row with CPA code 90 has entries off the diagonal.

Cremation is a principal activity of industry with NACE Rev.1.1 industry code 93.03 ("Funeral and related activities").

In any case, it is recommended to contact your national accountants in order to identify exactly where the different waste treatment activities are recorded economically in your ESA95 supply tables.

C) Guidance for assignment of air emission data of SNAP category 09 to NACE Rev.1.1 industries

As regards waste incineration processes (SNAP 0902) and cremation (SNAP 0909) the related emissions are assigned to who owns the incinerator – can be municipalities, hospitals, industries and crematoriums (NACE 93) in the case of cremation; the specific NACE can in some cases be determined from the detailed calculations on which CORINAIR data are based; another possible source of information are the pollution permits that these types of facilities are typically required to obtain from the pollution control regulatory agencies.

Emissions from flaring are mostly caused by industry-specific processes such as 'flaring in oil refinery' (to be assigned to NACE 23), 'flaring in chemical industries' (24) flaring in gas and oil extraction (NACE 11).

Concerning solid waste disposal on land (SNAP 0904), emissions from landfills need to be distributed among those who own the landfills – can be municipalities or specific industries, the possible source of information being waste statistics). In both cases the actual NACE code of the industry owning the landfill is likely to be NACE 90 but could in principle be a different one.

Finally, the main possible sources of NACE-related information when assigning emissions arising from waste water treatment facilities (SNAP 0910) are similar to the case of waste incineration, i.e. the detailed calculations on which CORINAIR data are based, or the pollution permits that these types of facilities are typically required to obtain from the pollution control regulatory agencies.

7.2.9 Agriculture - SNAP 10 (CRF/NFR 4)

Emissions from agriculture are of extraordinarily high importance with almost two thirds of total N_2O-emissions, more than half of total CH_4-emissions and even 95% of total NH_3-emissions arising from agriculture activities.

Quantitative importance EU15, 2005 (in % of emission inventory totals):

	SNAP 10 01 SNAP 10 02 (CRF/NFR 4.D)	SNAP 10 03 (CRF/NFR 4.F)	SNAP 10 04 (CRF/NFR 4.A)	SNAP 10 05 SNAP 10 09 (CRF/NFR 4.B)	SNAP 10 06 (CRF/NFR 4.G)
CO_2	-	-	-	-	-
N_2O	59	-	-	7	-
CH_4	-	-	39	14	-
SO_2	-	-	-	-	-
NOx	-	-	-	-	-

NH_3	15	-	-	80	-
NMVOC	2	-	-	2	-
CO	0	-	-	0	-

Source: EEA greenhouse gas data viewer and air pollutant emissions data viewer

A) Understanding the emission data of SNAP category 10

SNAP groups 10 01 and 10 02 comprise emissions from agricultural soils. SNAP group 10 03 relates to the emissions of ammonia from stubble burning, including the burning of crop residues and wastes from crops in situ. Most important are methane emissions from animal husbandry which originate from enteric fermentation (SNAP 10 04). Methane emissions from manure management are considered under SNAP group 10 05 whereas emissions of ammonia (NH_3) and nitrous oxide (N_2O) from manure management are covered by SNAP 10 09. SNAP 10 06 considers the emission of carbon species resulting from the application of pesticides and limestone to agricultural soils and plants.

B) Understanding, where the relevant economic activities are recorded in National Accounts

All activities related to SNAP 10 should be recorded under agriculture (NACE Rev.1.1 division 01).

C) Guidance for assignment of air emission data of SNAP category 10 to NACE Rev.1.1 industries

The assignment of emissions is straightforward to NACE Rev.1.1 division 01 “agriculture”.

7.2.10 Other sources (SNAP 11)

All SNAP97 processes belonging to source category 11 'other sources and sinks' are excluded from Air Emissions Accounts as they refer to emissions from non economic agents and the absorption of emissions. If the CRF/NFR classification adopted in the international reports is the starting point, category 5 ‘land use change and forestry’ should be excluded instead.

SNAP code	SNAP label	CRF/NFR code and label	Description
SNAP 11 01	Non-managed broadleaf forests	not applicable	According to the EMEP/CORINAIR guidelines for air pollutants, these four SNAP items comprise all types of foliar forest emissions, non-managed and managed, deciduous and coniferous. Forest foliage is primarily a source of emissions of VOC. Also foliar emissions of CH_4, N_2O and – to a minor extent – NH_3 arise from forests, managed and un-managed. Emissions from forest soils – managed and un-managed – are covered in the SNAP codes 11 01 17, 11 02 16, 11 11 17, and 11 12 16. According to the 1996 IPPC guideline, emissions of NMVOC from the trees in managed forests and N_2O or CH_4 emissions/removals from the soil of managed forests are reported under CRF 5E. Here, managed forests include all trees planted or managed by man. In a strict sense applying National Accounts, managed forests belong to the economy. As a convention, foliar forest emissions from managed forests are however excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in estimating those.
SNAP 11 02	Non-managed coniferous forests		
SNAP 11 11	Managed broadleaf forests	CRF/NFR code 5E 'Land Use Change and Forestry – Other'	
SNAP 11 12	Managed coniferous forests		
SNAP 11 03	Forest and other vegetation fires	not applicable	According to EMEP/CORINAIR guidelines, this item includes emissions (CO_2, NOx, NMVOC, CH_4, CO, N_2O, NH_3) from burning (naturally or man-induced) of non-managed and managed forests and other vegetation, excluding agricultural burning of stubble, etc. In a strict sense applying National Accounts, emissions from man-induced forest fires belong to the economy. As a convention, however, they are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in estimating those.
SNAP 11 04	Natural grassland and other vegetation	n.a.	According to EMEP/CORINAIR guidelines, this item includes NMVOC emissions from all types of grasslands and other types of vegetation (natural, semi-natural and

SNAP code	SNAP label	CRF/NFR code and label	Description
			in some cases cultivated) which do not fit easily into the forest classification. This includes especially the Mediterranean maquis/garrique and other low scrub-type vegetation, heathland, Tundra, etc. Not mentioned in 1996 IPCC guidelines. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 05	Wetlands (marshes - swamps)	n.a.	According to EMEP/CORINAIR guidelines, this item covers emissions of methane (CH_4) and to a lesser extent sulphur produced in naturally saturated soils, in areas either permanently or seasonally flooded with fresh water. Note that this chapter covers shallow lakes (110601), typically defined by depths of less than 2 m, as well as the wetland (1105) SNAP-codes. Lakes of greater than 2m depth should not generally be treated as wetlands. The chapter does not cover agricultural wetlands such as rice fields, though the biogeochemical processes are the same. The main emission, CH_4, is produced by anaerobic bacteria (methanogens) in the soil, diffused through soil water and transported to the atmosphere by plants, ebullition, or diffusion. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 06	Waters	n.a.	According to EMEP/CORINAIR guidelines, this item comprises natural emissions from waters. No methodologies included yet in the EMEP/CORINAIR guidelines. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 07	Animals	n.a.	According to EMEP/CORINAIR guidelines, this item covers the emissions from wild-living animals. Both the emissions from the intestines and from excreta are included. Not covered are emissions from animal husbandry (SNAP 10.4: Enteric fermentation) or from pets, which are partly similar, but may be considered influenced by human behaviour in many respects. Still included here however are emissions from humans (breath, sweat, etc.; excreta are dealt with in SNAP 9.1.7, latrines, or 9.10.2, waste water treatment), as they do not appear anywhere else and should be perceived differently to other anthropogenic emissions. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 08	Volcanoes	n.a.	According to EMEP/CORINAIR guidelines, this item includes emissions from geothermal activities, both eruptive and noneruptive. Sources include volcanoes, but also fumaroles, geysers, metamorphic degassing or other activities related to molten magma in the earth's crust. Heated magma under pressure contains gases like sulfur dioxide, carbon dioxide, hydrogen sulfide, mercury, and chlorine. These gases may be released when magma gets close to the surface and the pressure may be discharged. With respect to the different sources, non-eruptive volcanoes that outgas at relatively constant rates seem to be more important than those from sporadic eruptions, both for CO_2 [and SO_2. Some of the emissions may also be considered anthropogenic, when produced at geothermal power plants where artificial holes are drilled to obtain hot water from the earth's interior. These emissions however are treated in SNAP 0507 and are assumed to be rather small. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 09	Gas seeps (Geological seepage)	n.a. ?	According to EMEP/CORINAIR guidelines, this item comprises geologic emissions of methane which are an important global greenhouse-gas source. Significant amounts of methane, produced within the Earth crust, are released naturally into the atmosphere through faults and fractured rocks. Major emissions are related to hydrocarbon production in sedimentary basins (biogenic and thermogenic methane), through continuous exhalation and eruptions from more than 1200 onshore and offshore mud volcanoes, more than onshore 10000 seeps and through diffuse soil microseepage, and thousands of shallow marine seeps. Global emission estimates range from 40 to 60 Tg y-1, more than 8% of the total CH_4 emission, representing the second most important natural methane source behind wetlands. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 10	Lightning	n.a.	According to EMEP/CORINAIR guidelines, lightning and corona discharge during thunderstorm events cause atmospheric chemical reactions to take place at high voltages and high temperatures. These reactions cause the production of NOx in the atmosphere. Such production processes are, strictly speaking, not real emissions as the compounds involved (primarily N2 and O2) are not injected into the atmosphere but are present anyway. However as these processes can not adequately be described by conventional atmospheric models on one hand, and their impact is eventually identical to those from (anthropogenic) emissions on the other hand, they are easy to be compared on the emission level and thus are frequently treated as such. By convention, emissions under this item are excluded from Air Emissions Accounts as they are emitted by nature.
SNAP 11 21	Changes in forest and other woody biomass stock	CRF 5A	No methodologies included yet in the EMEP/CORINAIR guidelines. According to 1996 IPPC guidelines, this item covers emissions and removals of CO_2

SNAP code	SNAP label	CRF/NFR code and label	Description
			from decreases or increases in biomass stocks due to forest management, logging, fuelwood collection, etc. The category is either a net source if biomass harvest/destruction exceeds regrowth in the inventory year, or a net sink if regrowth exceeds harvest/destruction. Include afforestation under CRF 5A5. By convention, emissions under this item are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in calculating those.
SNAP 11 22	Forest and grassland conversion	CRF/NFR 5B	No methodologies included yet in the EMEP/CORINAIR guidelines. According to the 1996 IPCC guidelines, this category includes conversion of existing forests and natural grasslands to other land uses. Emissions of CO2, CH4, CO, N2O, NOx and NMVOCs from the burning and decay of biomass Forest and grassland conversion to permanent cropland or pasture is primarily an activity of the tropics. Tropical forest clearing is usually accomplished by cutting undergrowth and felling trees followed by burning biomass on-site or as fuelwood. Where conversion of forest and grassland to permanent cropland and pasture occurs outside the tropics, the basic calculations should still be the same. Carbon is also lost from the soils after conversion, particularly when the land is cultivated. Conversion of grasslands into cultivated lands also results in CO_2 emissions, mainly from soils. By convention, emissions under this item are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in calculating those.
SNAP 11 23	Abandonment of Managed Land	CRF 5C	No methodologies included yet in the EMEP/CORINAIR guidelines. According to the 1996 IPCC guidelines, this item deals with net-CO_2 removals in biomass accumulation resulting from the abandonment of managed lands. Managed lands include: · Cultivated lands (arable land used for the cultivation of crops) · Pasture (land used for grazing animals) Carbon accumulation on abandoned lands is sensitive to the type of natural ecosystem (forest type or grasslands) which is regrowing. Therefore abandoned lands regrowing should be entered by type. For grasslands the default assumption is that net accumulation aboveground is zero. Because regrowth rates become slower after a time, the periods considered are: · Land abandoned during the 20 years prior to the Inventory Year (i.e., 1990) · Land abandoned between 20 and 100 years ago (i.e., before 1970 and after 1870) When managed lands are abandoned, carbon may or may not reaccumulate on the land. Abandoned areas are therefore split into those which reaccumulate carbon and those which do not regrowth or which continue to degrade. Only natural lands which are regrowing towards a natural state should be included. Lands which do not regrow or degrade should be ignored in this calculation. By convention, emissions under this item are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in calculating those.
SNAP 11 24	CO_2 Emissions and removals from soil (except SNAP 10.06)	CRF 5D	No methodologies included yet in the EMEP/CORINAIR guidelines. According to the 1996 IPCC guidelines, this item relates to estimates of net CO_2 emissions (sinks and sources) from three processes: 1) changes in carbon stored in soil and litter of mineral soils due to changes in land-use practices, 2) CO_2 emissions from organic soils converted to agriculture or plantation forestry, and 3) CO_2 emissions from liming of agricultural soils. At present, CO_2 emissions or uptake associated with naturally ocurring carbonate minerals in soils are not included. By convention, emissions under this item are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in calculating those.
SNAP 11 25	Other	CRF/NFR 5E	No methodologies included yet in the EMEP/CORINAIR guidelines. According to the 1996 IPCC guidelines, this item relates to emissions and removals (sources and sinks) of CO_2 from land use or land-use change activities which can not be included under the categories provided above. Emissions of NMVOC from the living trees in managed forests and N_2O or CH_4 emissions/removals from the soil of managed forests are reported here. Managed forests include all trees planted or managed by man for profit, pleasure, wind or water-erosion protection etc By convention, emissions under this item are excluded from Air Emissions Accounts (see section 5.2) due to the difficulties in calculating those.

8. Energy-first-Approach: Energy Statistics/Balances over Energy Accounts to Air Emissions Accounts

8.1 Introduction

This Manual is focused on the development of Air Emissions Accounts and not Energy Accounts however since some countries use energy statistics/balances as the starting point for their Air Emissions Accounts some brief guidelines regarding the conversion from energy statistics/balances to Energy Accounts and then to Air Emissions Accounts will be provided[56].

When starting with energy statistics/balances the system boundaries need to be adjusted from geographic/territorial boundaries to economic system boundaries based on the residence principle. And the energy use needs to be assigned to industries and households according to the standard industry classification (NACE). After the energy use (both combustion and non-combustion uses, i.e. catalysts) has been adjusted and assigned, then emissions are calculated on an industry-by-industry and household basis often using industry-specific and technology specific emission factors for each energy carrier.

In addition to energy related emissions, emissions from other sources need to be added in order to develop comprehensive air emission inventories and Air Emissions Accounts. The following list identifies the major components that need to be added to the emissions that are calculated from the energy information.

- Industrial processes (typically already identified by NACE since the local KAU often must report these point emissions to Pollution Control Authorities. The industry classification must somehow be associated with the reporting unit through a business register number or other identification).
- Solvent and other volatile organic product use need to be assigned to NACE – sales of these products gives amounts, and information to assign to industry/households typically comes from the use of surveys of industries or from sales data obtained by producers. National Accounts detailed supply and use tables may also be helpful in this process.
- Agriculture has its own NACE classification so what is needed is usually information regarding the number and types of animals and manure management information.
- Waste: Emissions from landfills are estimated based on the type of waste, landfill construction and other factors. These emissions are assigned to those who own the waste disposal sites, primarily municipalities although some privately owned landfills are assigned to the NACE of the owners. Emissions from waste water treatment and waste incineration also need to be included.

[56] Specific guidance for developing energy accounts is being developed by the United Nations Statistical Division in a document known as SEEA-Energy. Energy accounts will also be a focus in upcoming work at Eurostat and in work being led by the Oslo Group on energy statistics.

The following steps are needed to develop Air Emissions Accounts when using energy statistics/balances as the starting point:

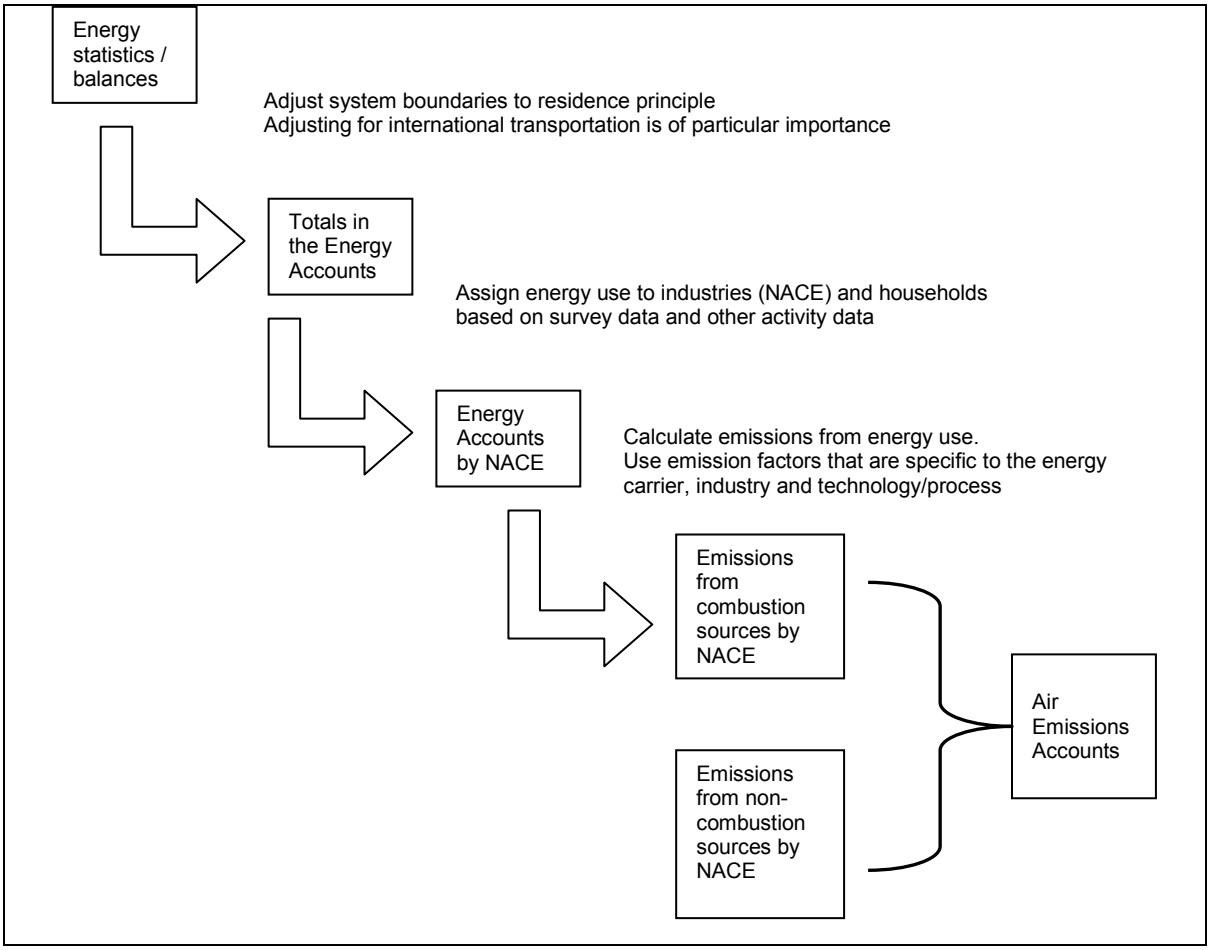
1. Adjust energy statistics/balances from geographic system boundaries to energy "accounts" with system boundaries defined by the residence principle.
2. Assign energy use to industry NACE categories and households to arrive at Energy Accounts that are according to NACE categories and households.
3. Calculate emissions from energy use industry-by-industry (and households) with the help of energy carrier, industry and technology specific emissions factors.
4. Calculate emissions from non-energy sources and add to emissions from energy sources.

These steps may not necessarily follow directly after each other, for instance it may be the case that the energy use is assigned to industries first and then adjustments for system boundaries are made on an industry-by-industry level. The steps in the process are the important part – the order can vary.

Some countries have developed multi-purpose energy data systems where the data needed for different purposes is in a coordinated system (see section 8.2.3 and figure 17 for a brief description). In this case the emission accounts will not differ from the emissions inventory figures.

More likely, countries will have two different systems one leading to air emission inventories and the other to air emission accounts. If there are two systems then it is very important to compare the air emission accounts results with the air emission inventory results and make appropriate adjustments and balancing so that the only differences can be explained as the adjustments need for the different system boundaries. The balancing is needed because differences will arise due to the different ways the emissions factors are used in the calculations yielding accounts vs. the calculations resulting in the inventory systems. Finding and using the most relevant emission factors is a major task when developing the air emission accounts which should not be under estimated.

Figure 16: Schematic showing the steps for establishing Air Emissions Accounts when starting with energy statistics/balances



8.2 Energy Statistics/Balances to Energy Accounts

8.2.1 Adjusting system boundaries

The system boundaries for energy statistics/balances use a geographical definition of a country. This needs to be adjusted to an economic definition, i.e. non-resident units operating on the national territory need to be removed and the resident units operating in the rest of the world need to be added. Most of these adjustments are related to international transportation, including land (including rail), water and air. See sections 6.1 and 7.1 for a discussion of this topic and how to approach adjusting system boundaries in more detail.

8.2.2 Assigning to industries according to NACE and households

Energy use also needs to be reallocated to the industries/households that use the energy. In order to do this we need to know, or at least estimate in some way, the energy used by the different industries. Typically there is a

combination of various methods and information sources that are used to develop the different energy statistics that are then used to create energy balances. In some countries there are specific energy use surveys to different industries and in the household budget surveys. Sometimes energy used measured in physical units is requested and sometimes purchases of energy in monetary units are requested. If monetary units are surveyed then this information is combined with pricing data to calculate energy use in physical units.

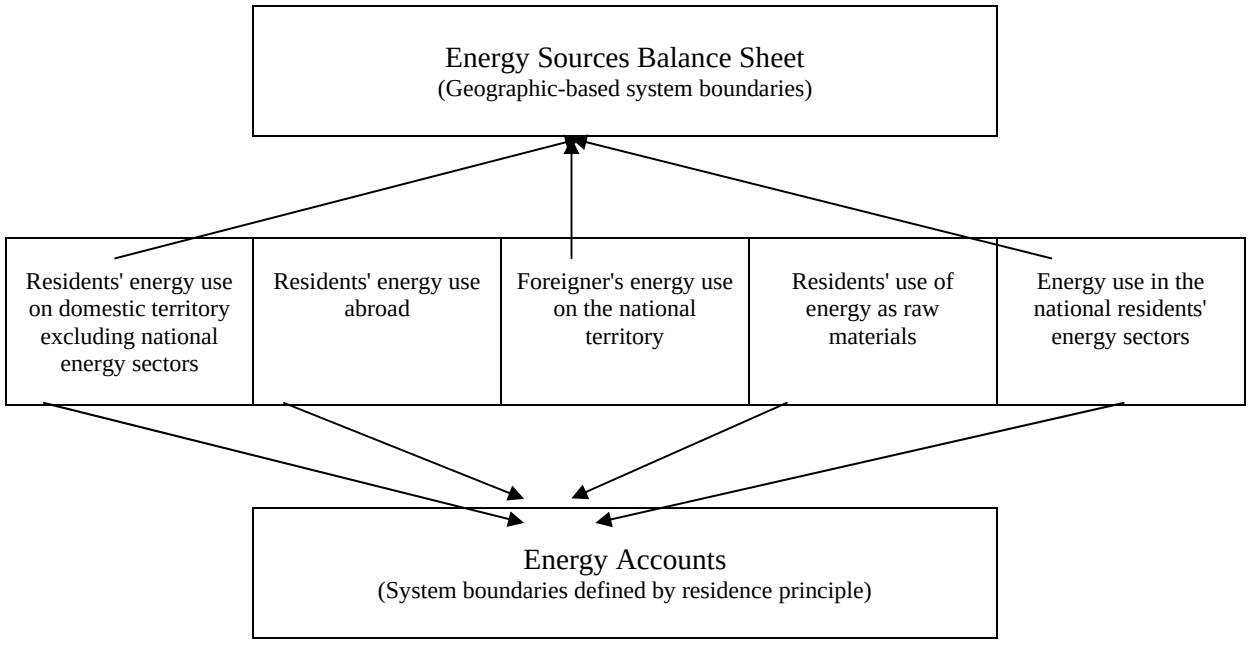
When surveys are used it can be possible to connect energy use to the industries (by NACE) and households especially if the industry classification of the unit being surveyed is known. It may be necessary to increase the sample size if energy use by detailed industry group (such as 2-digit NACE) is to be estimated and not just total energy use. Often total energy use is better known than industry-level consumption. So it is important to have a close cooperation with the persons responsible for energy statistics so that the energy data can be collected in a way that multiple uses of the data can be made.

When assigning energy use to industries and households it is important to do it in the same way that the economic activities are assigned to these categories since the point of Air Emissions Accounts is to have them correspond to the economic information from the National Accounts (heterogeneous or homogeneous industries).

8.2.3 Multi-purpose energy data system

One approach to developing a multi-purpose energy data system that can be used to develop both energy balances and Energy Accounts is schematically shown in Figure 17:

Figure 17: Schematic of multi-purpose energy data system for developing energy balances and energy accounts



Source: adapted from Hass and Kolshus (2007)

By organising the energy data in this way the different portions of the data base can be combined depending on whether a geographic-based system boundary definition is used or whether the system boundaries are defined by the economic-based criteria of residence. This type of organisation also means that no double counting will occur when the different portions of the data are combined.

If each of the entries in the data system is also identified by energy carrier and by NACE industry classification (or households) then the process of developing energy accounts according to standard NACE industrial groups can be relatively straight forward.

8.3 Calculating Emissions - general emission model for both combustion and non-combustion emissions

A general emission model using Energy Accounts as the starting point can be expressed as:

$$\text{Emissions (E)} = \text{Activity level (A)} \times \text{Emission Factor (EF)}$$

There are two major types of input needed: combustion and non-combustion emissions. The combustion related emissions use the Energy Accounts whereas the non-combustion emissions typically need to be obtained from the national emission inventories. Special attention must be given to the use of energy carriers for non-combustion industrial processes – such as their use as catalysts.

8.3.1 Emissions from combustion

For emissions from *combustion,* the activity data concerns energy use. When starting with Energy Accounts the use of different forms of energy have already been allocated to industries and households. In order to calculate emissions to air, energy use must also be allocated to technical sources (e.g. equipment). After energy use has been allocated in this way, the Energy Accounts may be viewed as a cube in which the three axes are fuels, industries, and technical sources. The energy use data are then combined with a corresponding matrix of emission factors for each of the different types of pollutant.

In principle, there should be one emission factor for each combination of fuel, industry (and households), technical source, and pollutant. However it is often the case that an emission factor is used in more than one combination. Although there will be many empty cells in the matrix (due to no consumption in this combination) this organisation of the energy data and emissions factors allow for clearly defined data base to be developed. By organizing the data in this systematic way it is possible to make emission calculations in a variety of different ways depending how the data are to be presented or reported.

The following Figure 18 shows the combinations of fuels and technical sources in the 2007 Norwegian Air Emissions Model. As mentioned, the majority of the cells are empty (indicated by "..") but this way of organizing the data helps to keep a structured database.

Figure 18: Combinations of fuels and technical sources in the Norwegian Air emissions Model

	Direct fired furnaces	Gas turbines	Boilers	Small stoves	Flaring	Passenger car	Light duty vehicles	Heavy duty vehicles	Motorcycle	Moped	Snowscooter	Railway	Aviation jet/turboprop	Aviation helicopter	Aviation small craft	Ships	Small boats 2 stroke	Small boats 4 stroke	Equipment 2 stroke	Equipment 4 stroke, tractor
Coal	x	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coke	x	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Petrol coke	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fuel wood	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wood waste	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Black liquor	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wood pellets	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wood briquettes	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Charcoal	..	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Natural gas	x	x	x	..	x	x	..	x	..	..	..	..	..	..	..	x	..	..	..	..
Refinery gas	x	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blast furnace gas	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Landfill gas	..	..	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fuel gas	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
LPG	..	..	x	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Motor gasoline	..	..	..	..	..	x	x	x	x	x	x	..	..	..	..	..	x	x	x	x
Aviation gasoline	..	..	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..	..
Kerosene (heating)	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jet kerosene	..	..	..	..	..	..	..	..	..	..	..	..	x	x	..	..	..	..	..	..
Auto diesel	..	..	x	..	..	x	x	x	..	..	..	x	..	..	..	..	..	x	..	x
Marine gas oil/diesel	x	x	x	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..
Light fuel oils	..	..	x	x	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	x
Heavy distillate	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..
Heavy fuel oil	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	x	..	..	..	..
Municipal waste	..	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Special waste	x	..	x	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Source: Aasestad (editor) 2007, Statistics Norway

The Energy Accounts provide much of the activity data (amount of energy combusted) needed to calculate the emissions from combustion. To calculate emissions, specific emission factors are needed. Although there is default emission factors provided in the IPCC and EMEP/CORINAIR guidelines, most countries have developed their own country-specific emission factors. Some emissions factors are given in mass (tonnes or kilograms or grams) of the pollutant per tonne (or Sm^3 natural gas) of fuel. This means that the energy accounts need to be in mass units (tonnes) (or in Sm^3 for natural gas) or need to be converted from energy units to mass units.

The emission factors need to be obtained from the air emissions inventory experts in your country so that the Air Emissions Accounts calculations are based on the same factors. If different emission factors are used this will bring a systematic source of error into the accounts. When trying to account for or "bridge" the differences between the inventory and accounts the difference arising from the different calculation method will need to be entered in the line for "other adjustments and statistical discrepancies" in the Bridge Table (see chapter 9 describing the Bridge Table).

Compilers should make sure that proper emission factors are available for the estimation of CO_2 from biomass (wood and wood waste, charcoal, bio-alcohol, black liquor, landfill gas, household waste, etc.) used as fuel, which is to be included in Air Emissions Accounts (see subsections 6.4.1 and 7.1.1).

Some countries only distribute energy use to industries and not to technical sources as well. Although some fuel and industry combinations have only one technical source this can cause some difficulties determining which emission factor to use when more than one technical source is used in the industry. Again this may introduce a difference between the figures from the national emissions inventory and the Air Emissions Accounts which should be identified as such in the Bridge Table.

In the United Kingdom, the Air Emissions Accounts compilers start with the energy data used in the National Atmospheric Emission Inventory (NAEI) which are allocated to technical sources and re-allocate the data into National Accounts categories – before estimating the corresponding emissions by applying the relevant emission factors. 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 more 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"[57] registered in the NAEI. The result gives a sort of Energy Accounts by economic category and energy product. Then, for each of the pollutants taken into consideration, the relevant emission factor enables the corresponding air emissions to be calculated.

Generally speaking emissions from combustion contribute about 80 per cent of a country's total greenhouse gas emissions. The other approximately 20 per cent arises from non-combustion sources.

8.3.2 Non-combustion emissions

Non-combustion emissions are generally calculated in the same way as combustion emissions, i.e., by combining appropriate activity data with emission factors. Some non-combustion emissions are obtained from estimations and some are measured directly. The calculated or reported non-combustion emissions can then be fitted into the general data set using the parameters industry, source, and pollutant. Note that the fuel parameter is not relevant here.

[57] 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.

In addition to energy related emissions, emissions from other sources need to be added in order to develop comprehensive air emission inventories and Air Emissions Accounts. The following list identifies the major components that need to be added to the emissions that are calculated from the energy information. Please note that this is NOT an exhaustive list.

Some of the non-combustion emissions arise from the following activities:

- Industrial processes:
  There are a large number of industrial processes that need to be included but often there is a one-to-one correspondence between the emissions producing activity and the NACE classification. Therefore, a close cooperation with the emissions inventory experts is necessary to ensure that all of these different areas are covered and included.
  Some of the activities to be included are (some of the CFR codes are included in parentheses but many of these categories contain more than one process):
  - Cement production (CFR 2.A.1)
  - Lime production (CFR 2.A.2)
  - Limestone and dolomite use (CFR 2.A.3)
  - Rock wool production (CFR 3.D.3)
  - Glass and glass fibre production (CFR 2.A.7.d)
  - Ore mines (CFR 2.A.7.a)
  - Mining and extraction of stones and minerals
  - Construction and repairing of vessels (including sandblasting)
  - Production of inorganic and organic chemicals including for example, ammonia (CFR 2.B.1), nitric acid (CFR 2.B.2), other fertilizers (CFR 2.B.5.a), sulphuric acid (CFR 2.B.5.a), plastics, explosives, pigments, soap, paints and varnishes (CFR 3.A.1 and 3.A.2)
  - Metal production, such as, iron and steel, ferroalloys (CFR 2.C.2), aluminium (CFR 2.C.3), magnesium (CFR 2.C.5.e), nickel (CFR 2.C.5.c), and electroplating (CFR 2.C.5.e).
  - Emissions related to other products such as pulp and paper (CFR 2.D.1) beer, wine, spirits and bread (CFR 2.D.2) and cigarettes also need to be included

- Solvent and other volatile organic product use (such as in dry cleaning CFR 3.B.2 and domestic solvent use CFR 3.D.2) need to be assigned to NACE – sales of these products gives amounts, and information to assign to industry/households typically comes from the use of surveys of industries or from sales data obtained by producers. In any event, solvent use needs to be distributed using some type of distribution key – information about these products may be available from the supply and use tables or input-output tables of the National Accounts. See the description for SNAP 06 in the inventory-first methodology section 7.2.5 for additional guidance.

- Agriculture has its own NACE classification so assigning to NACE is no problem usually. The additional information needed is usually regarding the number and types of animals. This provides the "activity" data. Information about manure management is needed in addition in order to estimate emissions from soils. This information can potentially be taken directly from the emissions inventory since it will be primarily assigned to the agricultural industry (CRF 4).
  The only exception may be when households have substantial own-use production. Then the activity data would need to be divided between the agriculture industry (NACE 01) and households. Households may also differ in their manure management so emissions calculations for this may also differ. But again if households have substantial own-use production then the air emissions inventory experts will probably have the necessary knowledge for calculating and assigning this correctly.

- Waste: Emissions from landfills are estimated based on the type of waste, landfill construction and other factors. These emissions are assigned to those who own the waste disposal sites, often primarily municipalities although some privately owned landfills are assigned to the NACE of the owners if auxiliary production. Emissions from wastewater treatment and waste incineration also need to be included. See the description for SNAP 09 in the inventory-first methodology section 7.2.8 for additional guidance.

As this list shows, there are many non-energy related emissions that need to be added to the combustion emissions. This must be done in a systematic way and in cooperation with national emission inventory experts. Many of the emissions can be obtained directly from the emission inventories however some of these emissions will then need to be assigned to industries (NACE) and households using additional information – physical or monetary information.

In Denmark the non-combustion emissions are taken directly from the CORINAIR database (Jensen / Olsen, 2003) and would need to be distributed in the way described in the "inventory first" methodology described in section 7.2 for the non-combustion SNAP categories.

8.4 Summary of Energy Accounts to Air Emissions Accounts

To summarize, the main steps needed to develop Air Emissions Accounts when using energy statistics as the starting point are:

- Adjust energy statistics from geographic system boundaries to system boundaries defined by the residence principle as used in the National Accounts;
- Assign energy use to industry NACE categories and households (taking into consideration if the industries are homogeneous or heterogeneous) using auxiliary information to re-assign energy use;

- Calculate emissions from energy use industry-by-industry (and households) with the help of emissions factors that are specific for the combination of energy carrier, industry and technological sources;
- Calculate emissions from non-energy sources;
- Systematically aggregate the emissions from combustion and non-combustion sources for each industry and households for each pollutant.
- Check that the differences between the accounts and inventories and known and only due to adjustments in system boundaries. If this is not the case, balance the accounts appropriately.

Assistance from the emission inventory national experts and the energy statistics national experts are vital for implementing this approach to developing Air Emissions Accounts.

9. Bridge Table

9.1 Introduction

Since air emission inventories are the figures for a country to avoid confusion one needs to be able to account for the differences between the national emission inventory data and the Air Emissions Accounts – this is called "bridging" between the two systems and a table has been developed as part of the formats for Eurostat's Air Emissions Accounts (see 6.4) to help countries account for the adjustments that have been made. This information also helps in making international comparisons because from examining the items included in this table it becomes fairly evident what is included and excluded in a country's reporting.

9.2 Bridge Table

Emission totals in Air Emissions Accounts for a given country and pollutant are typically not equal to total emissions for the same country and pollutant reported to the main international agreements on air emissions. The observed difference mainly stems from the fact that Air Emissions Accounts, consistently with National Accounts, are based on the residence principle which is the basis for the economic definition of a country, whereas international agreements on air emissions use a geographic or national territory definition of a country (see also section 6.1).

As discussed in previous parts of the manual, converting from a geographically defined system to an economically defined system is one of the fundamental steps of building up Air Emissions Accounts. It mainly requires to remove from basic air emission statistics the air emissions due to non-resident units operating on the national territory and to add the air emissions due to resident units operating in the rest of the world. Typically these necessary adjustments relate to international transport – land, water and air - as well as to tourism and fishing vessels, the relative importance of these activities in the overall adjustment depending on the structure of the countries' economies.

The last section of the Eurostat's electronic questionnaire, called 'bridging items', requires compilers to report, for a given country and for each pollutant, the link (or 'bridge') between total emissions in Air Emissions Accounts and total emissions reported by the country to the main international agreements on emissions of air pollutants and greenhouse gases. Making this quantitative bridge available is especially important for users as it helps help to understand the causes and the magnitude of existing gap between two official statistics on air emissions.

Table 12 shows the detailed components of the bridging items section for a given pollutant 'x' as it appears in the Eurostat's electronic questionnaire.

Table 12: Bridging items for pollutant x

Row	Item
1	**Total NAMEA air emissions (industry + households) of pollutant X**
2	less National residents abroad
2.1	- National fishing vessels operating abroad
2.2	- Land transport
2.3	- Water transport
2.4	- Air transport
3	Plus Non-residents on the territory
3.1	+ Land transport
3.2	+ Water transport
3.3	+ Air transport
4	(+ or -) Other adjustments and statistical discrepancy
5	**= 'Total emissions of pollutant X as reported to UNFCCC/CLRTAP**
6	Year of submission to UNFCCC/CLRTAP

Row 1, the starting point, relates to the 'NAMEA total', i.e. the Air Emissions Accounts total including emissions from production activities as well as households' emissions. By definition, for each pollutant, the total covers the emissions of resident economic units, i.e.:

- included are the emissions caused by resident economic activities operating abroad for international transport activities – by road, water and air – and fishing as well as by resident households' (mainly due to) driving abroad for tourism purposes;
- excluded are the emissions caused by non-resident economic activities operating in the country as well as by non-resident households' emissions (mainly due to) driving in the country for tourism purposes.

Row 5, relates to total air emissions of pollutant 'x' reported to the main international agreements on emissions of air pollutants and greenhouse gases subject to IPCC guidelines – CLRTAP (Convention on Long-Range Transboundary Air Pollution) with reporting to UNECE/EMEP and UNFCCC (United Nations Framework Convention on Climate Change). Row 6 identifies the specific reporting year to which data in row 5 refer to, generally the same year 't' in which the questionnaire is compiled.

The UNFCC/CLRTAP emissions total for pollutant 'x' broadly complies with a national territory definition of a country. According to the IPCC guidelines totals do not include:

- emissions from international sea traffic (associated with SNAP code 080404 for countries using CORINAIR inventories as main input data)
- emissions from international aviation (associated with SNAP codes 080502 and 080504 for countries using CORINAIR inventories as main input data)

Rows 2 to 4 show in detail the items that explain the difference between the Air Emissions Accounts total (row 1) and international agreements' total (row 5); they mostly relate to international transport/tourism emissions and fishing (rows 2 and 3); if additional corrections have been made then can be reported under "other adjustments and statistical discrepancy" (row 4).

As regards rows 2.1 to 2.4, compilers should report all emissions included in the Air Emissions Account total due to residents travelling abroad (both economic activities – international transport, fishing – and households – tourism), to be subtracted in order to derive the international agreements' total as they do not fit into a geographic definition of a country.

As regards rows 3.1 to 3.3, compilers should report all emissions - not included in the Air Emissions Account total - due to non-residents travelling on the territory (both economic activities and households). However, in order to correctly bridge the gap between row 1 and 5, non-residents emissions on the territory should only be reported in rows 3.1 to 3.3 if they are accounted for in the UNFCCC/CLRTAP totals. Since, according to the IPCC guidelines emissions from international air and see traffic are not part of national totals, rows 3.1 – 3.3 should include:

- emissions from *national* sea traffic due to non residents operating on the territory.
- emissions from *national* air traffic due to non residents operating on the territory
- emissions from *national and international* road traffic due to non residents operating on the territory

Table 13 summarises for each transport mode the differences in coverage between Air Emissions Accounts and IPCC Guidelines providing practical indications on compilers on what should be included in the bridging items rows.

Table 13: Differences in the coverage of air emissions between the IPCC guidelines and Air Emissions Accounts

	Air Emissions Accounts	IPCC	Comment	Implication for bridging item section
Land transport (all emission types)				
- resident units on the territory	yes	yes		Not relevant for bridging items
- 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.	Row 3.1 - include land transport emissions due to non-residents travelling on the territory (both economic activities and households – tourism)
- resident units abroad	yes	no		Row 2.2 – include NAMEA land transport emissions due to residents travelling abroad (both economic

	Air Emissions Accounts	IPCC	Comment	Implication for bridging item section
				activities – international land transport and households – tourism)
Water transport (all emission types)				
- resident units on the territory	yes	(yes) partial	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.	Not relevant for bridging items
- non-resident units on the territory	no	(yes) partial	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.	Row 3.2 – include national sea traffic emissions from shipping vessels operated by non resident units
- 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).	Row 2.3 - include NAMEA international sea traffic emissions from shipping vessels operated by resident units
Air transport (all emission types)				
- resident units on the territory	yes	(yes) partial	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).	Not relevant for bridging items
- non-resident units on the territory	no	(yes) partial	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).	Row 3.3 – include national air traffic emissions from aircrafts operated by non resident units
- 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*).	Row 2.4 - include NAMEA international air traffic emissions from aircrafts operated by resident units

Emissions caused by non-economic agents, i.e. nature, are not covered by bridging items since they are excluded both from Air Emissions Accounts' totals and from national totals for the UNFCC/CLRTAP.

Part C: Use of Air Emissions Accounts

10. Use of Air Emissions Accounts

The main objective of this Part C is to provide an overview on possible uses of Air Emissions Accounts as support for policy making in the broader area of Sustainable Consumption and Production.

Air Emissions Accounts can be used and analysed to help inform a wide range of issues. In particular, they can be used to analyse environmental implications – in terms of air emissions – of European production and consumption patterns. The general analytical added value of Air Emissions Accounts is its compatibility with National Accounts enabling integrated environmental and economic analyses. Emission inventories, on the other hand, are more tailored to investigate specific issues in the environmental policy areas of climate change and air pollution.

With regards to the analytical range of Air Emissions Accounts a general distinction can be made between a *production perspective* and a *consumption perspective*. The first considers all the direct air emissions arising from national production and distinguishes and compares the environmental performance of different industries. The second considers the direct and indirect air emissions arising along the international production chains of all products consumed nationally, and compares the air emissions caused by the final use of different product groups or broadly compares across the different categories of final use such as consumption, investments and exports.

The *production perspective* can be investigated directly using Air Emissions Accounts in their basic form as these provide a picture of where exactly in the national economy air emissions are generated directly. Total direct air emissions within a national economy can be obtained simply by summing contributions from each economic branch and from households. The production-related direct air emissions provide a picture of the environmental 'hot spots' in production patterns. In addition, due to the compatibility to economic data the Air Emissions Accounts framework offers the possibility of linking air emissions to economic output allowing the comparison of different industries' environmental performance. The air emission intensities of individual industries can be derived simply from Air Emissions Accounts by dividing the total pressures they are responsible for by their economic output. This cannot be done directly using national emissions inventories for example.

Considerably more effort is required to shift to the *consumption perspective*. Complex matrix transformations developed by Leontief (1970) and others are applied. These mathematical procedures are termed

environmentally extended input-output analyses (EE-IOA). Through the transformations, air emissions directly emitted by a given industry are re-allocated to the flows of goods and services it sells to other branches and eventually to the final user. The pressures are allocated in accordance with the monetary value of these flows. At the end of this process, the air emissions allocated to a finally consumed product group are equivalent to the sum of all direct and indirect air emissions accumulated along the full global production-cycles of those goods. For the final use product group food and beverages it includes for instance all pressures emitted in the production of food from the farm through to the supermarket shelf, including all inputs made along this journey (e.g. air emissions activated by the production and application of fertilisers, by the production and combustion of fuels in agricultural machinery, by the production of electricity consumed in food processing plants etc.). To perform these calculations, one needs monetary input-output tables combined with the Air Emissions Accounts.

The different analytical potentials of Air Emissions Accounts can further be grouped along the associated data requirements. In general, one can state that data requirements for production related questions are less ambitious than data requirements for consumption related questions. The latter require comprehensive input-output tables and certain modelling. Whereas the production related questions can often be met on the basis of the primary Air Emissions Accounts data.

Table 14 provides an overview on the different application fields of Air Emissions Accounts as they are introduced in the following sections of this Part C.

Table 14: Overview on possible uses of Air Emissions Accounts

Section	(Policy) Question	Perspective	Data requirements	Time coverage (minimum)	Comparisons of…	Presentation (e.g.)
10.1 10.2	How much do economic activities (incl. private households) contribute to total direct national air emissions? Ranking and comparison of industries	"production"	AEA (Air Emissions Accounts)	single year	all industries (incl. HH) within one economy; one industry (HH) across economies	pie charts, stacked bar charts; bar charts
10.3	Environmental-economic profiles of industries: How much do single industries contribute to total air emissions and total economic parameters? (relative or percentage share)	"production"	AEA + single economic parameters (e.g. output, gross value added, employment etc.)	single year	one industry within one economy	horizontal bar charts
10.4	Decoupling of production-related air emissions from output and/or value added generation in industries: Do single industries manage to de-couple environmental pressures from economic growth?	"production"	AEA + single economic parameters in constant prices (e.g. output, gross value added)	time series	one industry within one economy	line charts
10.5	Air emission intensities of industries: Which industries are most (less) intensive in emitting air emissions per unit output (or gross value added)?	"production"	AEA + single economic parameters	single year	all industries (incl. HH) within one economy; one industry across economies	bar charts

Section	(Policy) Question	Perspective	Data requirements	Time coverage (minimum)	Comparisons of…	Presentation (e.g.)
10.6	Determining the role of economic structural change, eco-efficiency and overall economic growth on the temporal development of total production-related air emissions	"production"	AEA + single economic parameters in constant prices + Structural Decomposition Analysis (SDA)	two year points, or time series	one economy; across economies	bar charts; mountain charts
10.7	How much indirect air emissions are activated by final use of product groups?	"consumption"	AEA + SIOT + environmentally extended Input-Output analysis (EE-IOA)	single year	all product groups in one economy; one product group across economies	pie charts, stacked bar charts
10.8	How much indirect air emissions are activated by the various categories of final use (private household consumption, government consumption, investments, exports)?	"consumption"	AEA + SIOT + EE-IOA	single year	all final use categories in one economy; one final use category across economies	pie charts, stacked bar charts
10.9	How much total (direct and indirect) air emissions, activated by domestic final use, are emitted domestically and how much abroad in the rest of the world? (problem shifting)	"consumption"	AEA + SIOT + EE-IOA	single year	one economy; across economies (in addition, domestic versus foreign share can be broken down by product groups and/or final use categories)	pie charts, stacked bar charts
10.10	Production-cycle wide air emission intensities of product groups: How much air emissions are emitted along the entire production chain per € final use of a given product group?	"consumption"	AEA + SIOT + calculations (EE-IOA)	single year	all product groups in one economy; one product group across economies	bar charts
10.11	Determining the role of national consumption mix, eco-efficiency along production chain, and overall economic growth on the temporal development of consumption-related air emissions	"consumption"	AEA + SIOT in constant prices + calculations (EE-IOA) + SDA	two year points, or time series	one economy; across economies	bar charts; mountain charts

AEA: Air Emissions Accounts; SIOT: symmetric Input-Output tables; HH: private households; SDA: Structural Decomposition Analysis; EE-IOA: environmentally extended Input-Output analysis

Aggregation of air emissions to environmental themes:

In order to assess the aggregated impact potential of a number of different air emissions on the same environmental theme it is possible to aggregate several air emissions to aggregated numbers introducing conversion factors (see SEEA2003, paragraphs 4.94 ff.).

Three environmental impact categories are derivable from 8 air emissions of Eurostat's Air Emissions Accounts:

- Global Warming Potentials (CO_2, N_2O, CH_4)
- Acidification (SO_2, NOx, NH_3)
- Tropospheric Ozone Formation Potential (NOx, NMVOC, CO, CH_4)

The impact categories are derived through aggregating several air emissions to one number applying internationally agreed upon weighing factors. Table 15 presents the weighing factors applied.

Table 15: Weighting factors applied for aggregating emissions to environmental themes

impact category	*unit*	*Air emission*	*weighing factor*
Global Warming Potential (GWP) after 100 years	CO_2-equivalents	CO_2	1.0
		N_2O	310
		CH_4	21
Acidification (ACID)	SO_2-equivalents	SO_2	1.0
		NOx	0.7
		NH_3	1.9
Tropospheric Ozone Forming Potential (TOFP)	NMVOC-equivalents	NOx	1.22
		NMVOC	1.0
		CO	0.11
		CH_4	0.014

Sources: GWP: IPPC (2007 Table 2.14); ACID: based on Adriaanse 1993 and EEA 2002, p. 83; TOFP: EEA 2002, p. 84

Chained volume measures for economic time series:

There are several measurement concepts applicable for economic variables such as production output and gross value added. As those economic parameters are to be compared over time it is of utmost importance to apply the appropriate measurement concept.

In the System of National Accounts, particularly in the IO framework, the flows of goods and services are recorded in monetary measurement units. It is the (monetary) value of goods and services which is actually measured[58]. The value (v) is a product of two elements: unit price (p) multiplied with the quantity unit (q):

$$v = p \cdot q$$

The values of goods and services as recorded in the System of National Accounts bear a volume dimension and a price dimension, which – if needed – has to be decomposed. For analyses of time series, it is recommended to use volume measures only, i.e. measurement units where the price dimension (inflation, changes in relative prices) has been deducted.

As of 2005, the ESA has introduced *chained volume measures* to report economic aggregates in volume terms in their annual and quarterly accounts. Chained volume measures are replacing former *'constant prices'* that were used to express development in volume terms. Eurostat offers four forms of chained volume measures:

- growth rates,
- (chain) index (year 2000 = 100),
- chained level series (reference year 2000), and
- levels at prices of the previous year.

[58] for more details see SNA93 chapter XVI, ESA95 chapter 10, and Eurostat 2008 SUIOT Manual chapter 9

Growth rates: For annual series year-on-year growth rates are shown. For quarterly series, the growth rate compared to the previous quarter as well as the growth rate compared to the same quarter of the previous year is given.

Index: Chained volume measure series will be expressed as index numbers in which the series is scaled to a value of 100 in one year, which is called the reference year. In 2008, Eurostat uses the year 2000 as reference year for the chain indices. The choice of the reference year has no impact on the movements in the series.

Chained level series: Chained volume measure series will also be shown and referenced onto the year 2000. These level series are obtained by multiplying the chain index by the current price figures in the reference year 2000.

Level at prices of the previous year: These figures are intended as input for advanced users to allow them building their own aggregations and derived measures. It must be noted that, as the price base changes every year, the figures do not constitute a homogeneous time series, so in particular growth rates cannot be derived directly from them.

Users who want to work with the chained level series must be aware that chain-linking results in the loss of additivity of volume data (except for the data relating to the reference year and the one following the reference year): The chained level of an aggregate is not equal to the sum of the chained components. This means, for example, that in the chained level series the components of GDP do not add up to GDP. This loss of additivity also applies to geographical aggregations (such as euro zone, EU15, EU25 and EU27). Non-additivity arises for purely mathematical reasons; the discrepancies cannot and should not be interpreted as indications of quality. Additivity however remains in data expressed at previous year's prices and in the data expressed at current prices. Hence it is also given in the chained level series for the reference year and the year following the reference year.

10.1 Comparing and ranking production-related air emissions by industries (incl. private households) within one economy for one year

For a given country and a given time period, the original Air Emissions Accounts data comprise several types of air emissions broken down by direct emitters (i.e. industries and private households). Thereof, the direct emissions by industries, i.e. excluding direct air emissions by private households, relate to the production system of the given country's national economy and characterises the latter with regards to directly induced environmental pressures.

This allows investigating the question “How much do economic production activities (industries incl. private households) contribute to total national air emissions?” This requires a simple ranking of the Air Emissions Accounts original data.

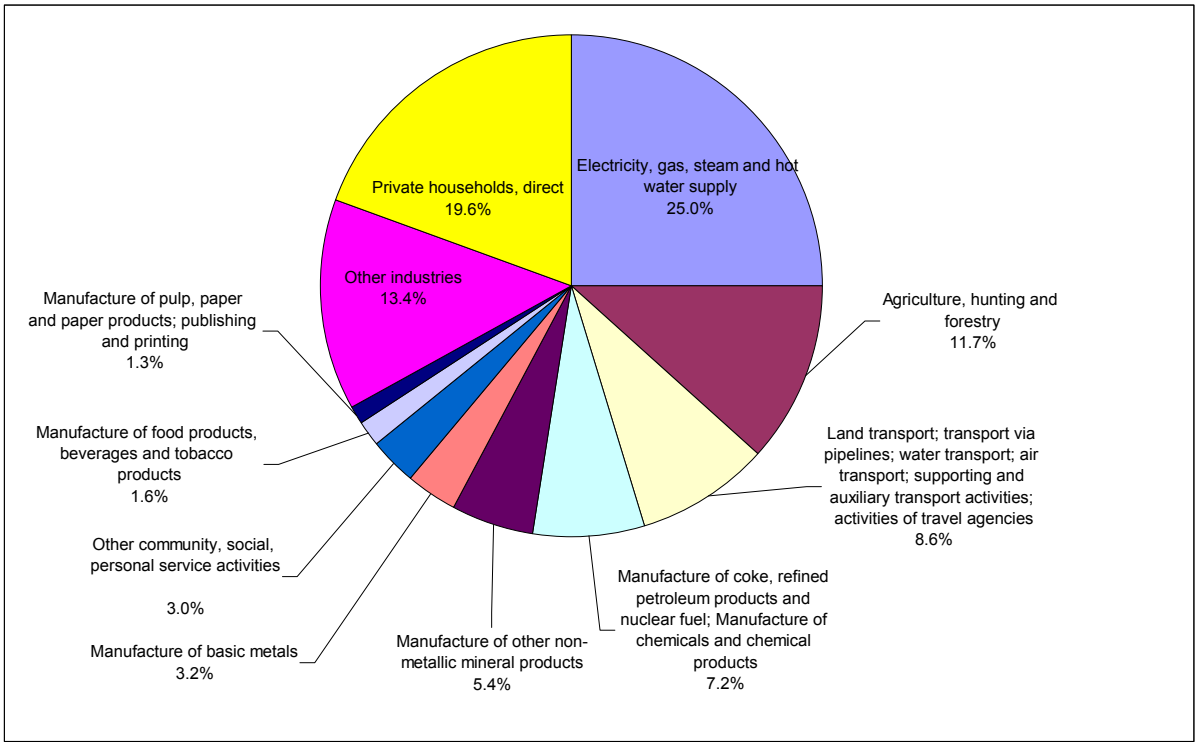
The original AEA can be represented in *industry by year* tables, whereby the industry breakdown constitutes one dimension (rows) and the different years constitute the second dimension (columns). Evidently, such a table exists for each single air pollutant. This data can be sorted/ranked and visualised. The industries (incl. private households) can be ranked according to the amount of air emissions they directly emit. As a result, one obtains a resorted list of air emissions directly emitted by industries where the industry with the highest amount of air emissions comes first, followed by the industry with the second highest amount of air emissions and so on. The last industry on this resorted list emits the smallest amount of air emissions. See Table 16 as an example of this process using EU25 data reported in 2004.

In addition, one may calculate the single industry’s percentage share in total national air emissions; i.e. the total of all air emissions of a certain type emitted by national resident units.

The resorted list is best visualised with a pie chart in order to enable a quick comprehension of which industries are most important emitters of air emissions of a given type in a given country and year. However the number of industries (plus private household activities) amounts to more than 60 items which are too many elements for a usual pie chart. Hence, it is recommended to group the less important industries (with shares less than 1.5%) into one group of “other industries”.

Figure 19 shows as an example the direct emissions of aggregated greenhouse gases (GHGs) (CO_2, N_2O, CH_4) for the EU25 in 2004. Almost one fifth (19.6%) of the greenhouse gas emissions emitted in the national economy of the EU25 are emitted directly by private households, mainly for private transport and heating. This means that around four fifths of GHGs are emitted directly by the production system of the EU25 economy. The most important direct industrial emitter is the electricity supply industry (NACE division code 40) responsible for exactly one quarter of all EU25’s greenhouse gas emissions. The second most important industry is agriculture, hunting and forestry (NACE division codes 01 to 05, or A to B) with around 11.7% of total greenhouse gas emissions of the EU25 economy. Transport services (NACE division codes 60 to 61) are the third most important direct emitter of greenhouse gases with some 8.6%.

Figure 19: Pie chart: direct emissions of aggregated greenhouse gases (CO_2, N_2O, CH_4) by industries and private households. EU25, 2004.



Source: Eurostat (NAMEA-Air survey 2006)

The re-sorted table associated to Figure 19 is given in Table 16. The grey shaded area mark those industries which have been grouped together to the category “other industries”, representing around 13.4% of total direct greenhouse gas emissions in the EU25 and the year 2004

Table 16: Direct emissions of aggregated greenhouse gases (CO_2, N_2O, CH_4) by resorted (ranked) industries and private households. EU25, 2004.

		Emissions of greenhouse gases		
Code	Name	1000 tonnes CO_2-equiv.	percentage of totals	rank
TOT_ECON	Total Economy (industries + private households)	5,147,702	100.0	
SUB_TOT	Total Industry	4,127,000	80.2	
E40	Electricity, gas, steam and hot water supply	1,301,454	25.3	1
A	Agriculture, hunting and forestry	608,312	11.8	3
I60_TO_I63	Land transport; transport via pipelines; water transport; air transport; supporting and auxiliary transport activities; activities of travel agencies	448,866	8.7	4
DF23_DG24	Manufacture of coke, refined petroleum products and nuclear fuel; Manufacture of chemicals and chemical products	375,520	7.3	5
DI26	Manufacture of other non-metallic mineral products	283,848	5.5	6
DJ27	Manufacture of basic metals	164,445	3.2	7
O	Other community, social, personal service activities	157,992	3.1	8
DA	Manufacture of food products, beverages and tobacco products	85,688	1.7	9
DE	Manufacture of pulp, paper and paper products; publishing and printing	68,685	1.3	10
F	Construction	59,746	1.2	11
K	Real estate, renting and business activities	48,215	0.9	12
CA11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying	44,216	0.9	13
G52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	43,413	0.8	14
G51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	43,179	0.8	15
N	Health and social work	41,629	0.8	16
L	Public administration and defence; compulsory social security	38,156	0.7	17
DB17_DB18_DC19	Manufacture of textiles; manufacture of wearing apparel; dressing; dyeing of fur; tanning, dressing of leather; manufacture of luggage	29,864	0.6	18
M	Education	29,202	0.6	19
CA10	Mining of coal and lignite; extraction of peat	25,910	0.5	20
H	Hotels and restaurants	21,646	0.4	21
DM	Manufacture of motor vehicles and other transport equipment	20,634	0.4	22
J	Financial intermediation	20,633	0.4	23
DH25	Manufacture of rubber and plastic products	20,090	0.4	24
CA12_CB13_CB14	Mining of uranium and thorium ores; Mining of metal ores; Other mining and quarrying	18,909	0.4	25
DK29	Manufacture of machinery and equipment n.e.c.	18,256	0.4	26
DN36	Manufacture of furniture; manufacturing n.e.c.	18,221	0.4	27
DJ28	Manufacture of fabricated metal products, except machinery and equipment	16,972	0.3	28
G50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	15,401	0.3	29
DL	Manufacture of electrical and optical equipment	11,222	0.2	30
DD20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	11,192	0.2	31
B	Fishing, fish farming and related service activities	11,158	0.2	32
DN37	Recycling	9,238	0.2	33
I64	Post and telecommunications	9,186	0.2	34
E41	Collection, purification and distribution of water	2,239	0.0	35
Q	Extra-territorial organizations and bodies	56	0.0	36
P95	Activities of households as employers of domestic staff	0	0.0	37
EP_HOUS	Private households, total	1,019,741	19.8	2

Source: Eurostat (NAMEA-Air survey 2006)

10.2 Comparing production-related air emissions of one particular industry across economies for one or several years

The direct emissions by industries – as presented by the original AEA data – can also be used to compare a particular industry's air emissions across countries. Several questions can be answered with regards cross-country comparisons of single industry's direct air emissions.

First, one may be interested in how much a single industry is contributing to national totals and compare these shares across countries. For instance, in most EU countries the industry supplying electricity is among the largest

contributors of direct greenhouse gas emissions. It might be of interest to know which countries' electricity industry is contributing higher shares to national totals and which countries' electricity industry is contributing lower shares to respective national totals.

Secondly, one may be interested in how the EU-wide direct air emissions of a particular industry is composed by single EU countries contributions, e.g. which countries' electricity industries contribute most to total EU emissions by electricity industry?

Table 17 shows emissions of greenhouse gases by the electricity industry (NACE Rev 1.1 industry code 40) for a number of single countries[59] and the EU25 as an aggregate. The first column gives the numbers in 1000 tonnes CO_2-equivalents. The second column shows the share of the electricity industry in respective national totals. For instance, in Estonia almost two thirds of all direct greenhouse gas emissions are stemming from the electricity industry. Also Germany's electricity industry contributes a significantly large share of national industry totals. Evidently, policies to reduce greenhouse gas emissions in those countries will have to focus on the electricity supply system. On the other side, countries such as France, Sweden and Austria will have to foster policies addressing other sources of greenhouse gas emissions. The third column shows the contribution of the respective country's electricity industry in total EU25 emissions from the electricity industry. It reveals that the Estonian electricity industry only contributes marginally to EU25 totals whereas Germany's electricity industry plays a dominant role contributing to almost 30% of EU25's total emissions from electricity industry.

Table 17: Direct emissions of greenhouse gases (CO_2, N_2O, CH_4) by the electricity industry, by selected EU countries and the aggregated EU25 for the year 2003

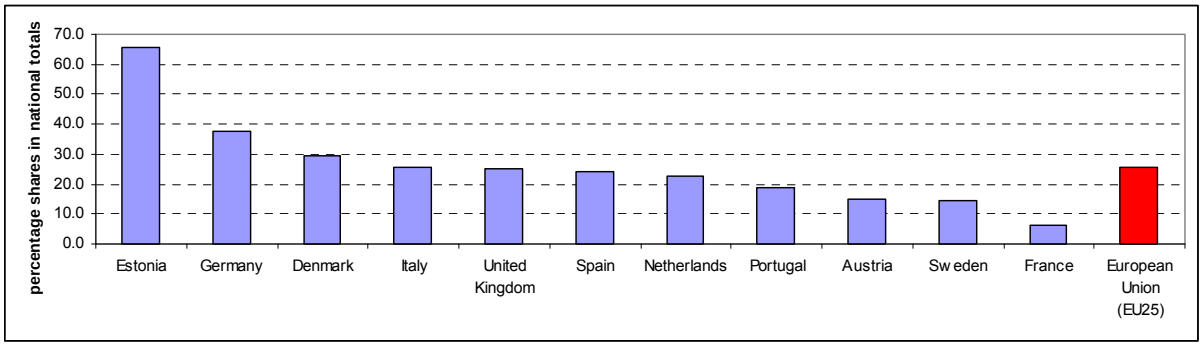
Emissions of aggregated greenhouse gases (CO_2, N_2O, CH_4)				
country		1000 t CO_2-equivalents	percentage of national industry totals	percentage in EU25 totals
EE	Estonia	14,316	65.8	1.1
DE	Germany	378,513	37.7	29.1
DK	Denmark	29,412	29.6	2.3
IT	Italy	144,923	25.5	11.1
UK	United Kingdom	178,308	25.3	13.7
ES	Spain	93,545	24.1	7.2
NL	Netherlands	54,921	22.7	4.2
PT	Portugal	16,698	18.9	1.3
AT	Austria	13,724	15.2	1.1
SE	Sweden	10,794	14.3	0.8
FR	France	40,535	6.3	3.1
EU25	European Union (EU25)	1,300,894	25.3	100.0

Source: Eurostat (NAMEA-Air survey 2006)

Either column of the Table 17 can be presented in form of a bar chart. Figure 20 shows the percentages of the electricity industry in national totals for emissions of greenhouse gases in a number of EU countries in the year 2004.

[59] Those EU countries have been selected and presented here, for which data are available.

Figure 20: Percentage shares of the electricity industry in national totals for emissions of greenhouse gases in a number of EU countries in the year 2004



Source: Eurostat (NAMEA-Air survey 2006)

10.3 Environmental-economic profiles of industries

Air Emissions Accounts present air emissions by industries which are the same industries as are shown in the National Accounts. This offers the possibility to compare – for one single industry – several air emissions together with economic parameters. Most interesting economic parameters – commonly reported by National Accounts – are gross value added, production output in monetary terms, and number of engaged people (employed persons).

In so called environmental-economic profiles (see also SEEA2003, paragraphs 4.101 ff.) both – environmental and economic – parameters can be presented jointly for selected single industries. Those profiles present the particular industry's shares of industries' totals for a number of parameters such as greenhouse gas emissions, emissions of acidifying substances, emissions of ground level ozone precursors, gross value added, production output, and number of engaged persons.

Please note that emissions from households are excluded in these comparisons since households do not contribute to value added or production output. The "total emissions" that are compared to value added or production output figures should only include emissions from the economic activities included in the economic statistics. Household emissions are excluded in the calculations of total industry totals and the percentage totals.

Such environmental-economic profiles show e.g. that most service industries contribute much higher shares to economic parameters (e.g. total gross value added) than they contribute to total air emissions. On the other hand, most of those industries contributing the highest shares in total air emissions (e.g. agriculture, electricity supply,

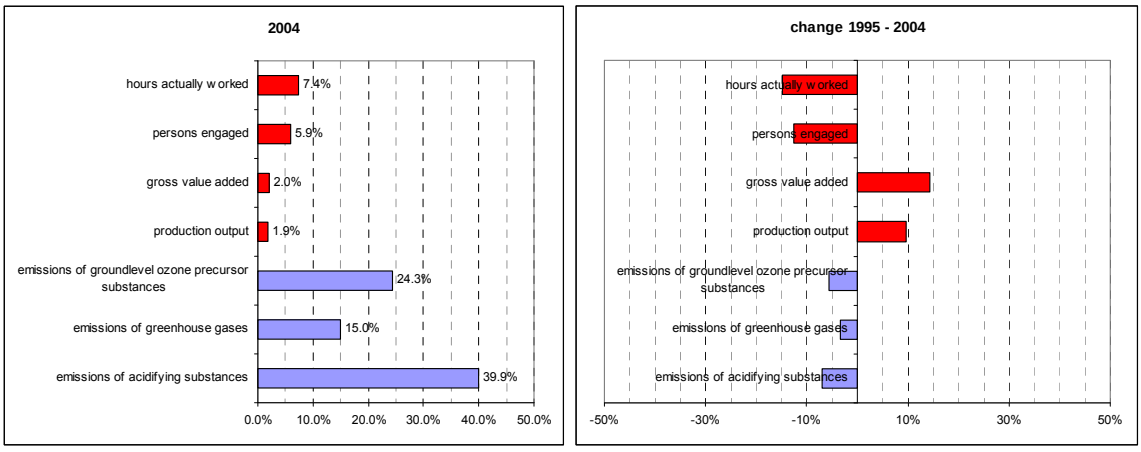
and certain heavy industries such as chemicals and basic metals) usually contribute lower shares to the national totals of economic parameter such as gross value added and employment.

Figure 21 shows the environmental-economic profile for the EU25 agriculture, hunting, forestry, and fishing industry (NACE A and B). The left hand bar chart shows the profile for the year 2004. The upper bars represent agriculture's role in total EU25 economy with regards to several economic parameters. In terms of gross value added, the EU agriculture industry plays a minor role: only 2% of total gross value added of the EU25 economy was generated by this industry in 2004. There is a similar picture for the production output (1.9%). In terms of employment, the role of the agriculture industry is much more important with about 5.9% of total persons engaged in this industry and even 7.4% of total hours are actually worked in the agriculture industry.

The environmental performance of the agriculture industry is represented by the lower bars. This industry is responsible for almost 40% of total emissions of acidifying substances in the EU. This is mainly due to high ammonia (NH_3) emissions. In addition, agriculture contributes 15% of industries' total greenhouse gas emissions (mainly through methane, CH_4, and nitrous oxide, N_2O). Finally, agriculture also significantly contributes to the emissions of ground level ozone precursor substances with 24.3% of industries' totals. In conclusion, agriculture contributes much more to environmental pressures than it contributes to the economic performance of the EU25.

The right bar chart of Figure 21 shows the changes between 1995 and 2004 of agriculture's environmental-economic profile. All three environmental pressures have decreased since 1995 in relative terms. So did employment related figures. The number of persons engaged in agriculture out of total economy employee decreased as well as the hours worked. On the other hand, the industry's shares of production output and gross value added have increased.

Figure 21: Environmental-economic profile of the agriculture, hunting, forestry and fishing industry, EU25 for the year 2004 (left) and changes between 1995 and 2004 (right)



Source: Eurostat (NAMEA-Air survey 2006); EU KLEMS

For households one of the most common ways of presenting the data is to break down household's direct air emissions into the three functional sub-categories as applied in Eurostat's Air Emissions Accounts: transport, heating, and other purposes. The corresponding economic parameters can be derived from the *Classification Of Individual COnsumption Purposes* (COICOP) and are shown in Table 18.

Table 18: Relation between functional classes of private household's direct air emissions (as applied in Eurostat's Air Emissions Accounts) and COICOP purposes of consumption expenditures

Direct air emissions by private households, as applied in Eurostat Air Emissions Accounts (physical)	COICOP classes of consumption purposes (monetary)
Total direct air emissions by households *thereof:*	Total final consumption expenditure by households
– Transport	– 07.2.2 Fuels and lubricants for personal transport equipment
– Heating	– 04.5 Electricity, gas and other fuels
– Other	– all other COICOP classes

10.4 Decoupling of production-related air emissions on industry level

Decoupling of environmental pressures from economic growth is a policy issue of increasing importance, e.g. in the 6th Environmental Action Programme. It denotes that – whilst economic growth is continuing – environmental pressures are declining (absolute decoupling) or at least growing at a lower rate than the economic parameter (relative decoupling).

Box 2: The concept of decoupling

The term decoupling refers to breaking the link between "*environmental bads*" and "*economic goods*." It refers to the relative growth rates of a direct pressure on the environment and of an economically relevant variable to which it is causally linked. Decoupling occurs when the growth rate of the environmental pressure (EP) is less than that of its economic driving force (DF) over a given period. One distinguishes between *absolute and relative decoupling*. Decoupling is said to be absolute when the environmental variable is stable or decreasing while the economic variable is growing. Decoupling is said to be relative when environmental variable is increasing, but at a lower rate than the economic variable.
The decoupling concept has however *no automatic link* to the environment's capacity to sustain, absorb or resist pressures of various kinds (deposition, discharges, harvests). A meaningful *interpretation* of the relationship of EP to economic DF will require additional information. Also, the relationship between economic DF and EP, more often than not, is *complex*. Most DF have multiple environmental effects, and most EP are generated by multiple DF, which, in turn, are affected by societal responses. Changes in decoupling may thus be *decomposed* in a number of intermediate steps. These may include changes in the scale of the economy, in consumption patterns, and in economic structure — including the extent to which demand is satisfied by domestic production or by imports. Other mechanisms in the causal chain include the adoption of cleaner technology, the use of higher-quality inputs, and the post-facto clean-up of pollution and treatment of waste.

Source: OECD 2003, p. 13

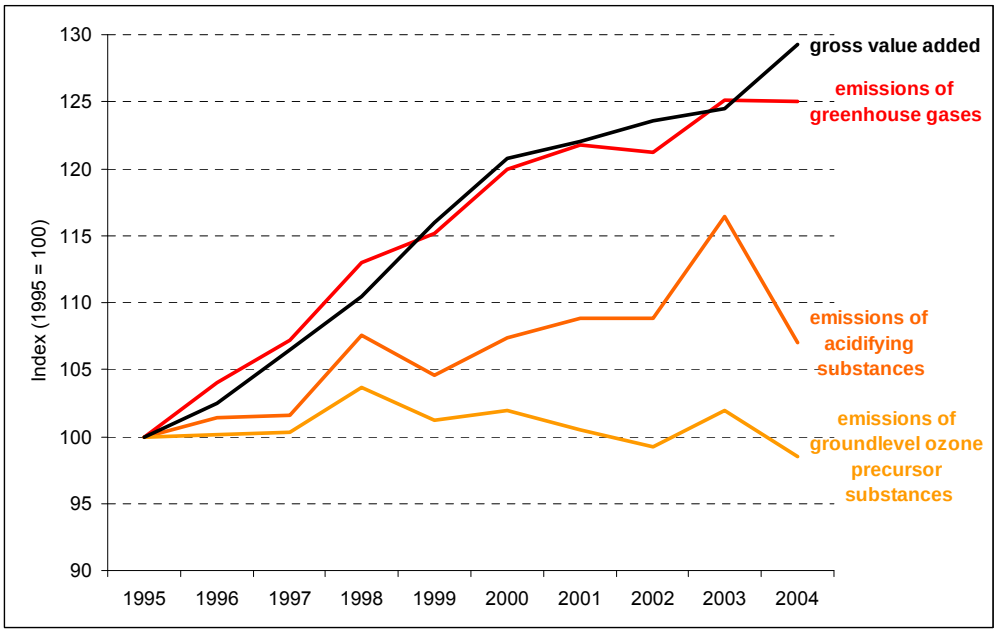
Data from Air Emissions Accounts together with National Accounts data can be used to illustrate decoupling developments on the level of single industries. In addition, they can be used to analyse in depth macro-economic decoupling trends (see section 10.6 on Structural Decomposition Analyses).

Time series of economic data have to be in constant prices or chained volume measures respectively (see introductory part of chapter 10).

The typical visual presentation of decoupling is to show indexed time series (e.g. 1990=100) of an economic variable in comparison to one or more environmental pressure variables. Before calculating the index, the economic variables need to be converted into a unit allowing reasonable comparisons over time; this is preferably chain linked values. From such a decoupling-graph, it is immediately obvious whether the economic variable is growing or shrinking, and whether environmental pressure variables are decoupling absolutely or relatively (see OECD 2002, p.19-20). It is also possible to present the decoupling between an economic and an environmental pressure variable as a single line (decoupling indicator = ratio of environmental pressure to economic variable). For country comparison, the OECD (OECD 2002, p. 19-20) further proposes to calculate the ratio of the decoupling indicator at the end and at the start of the observation period. If this ratio is less than 1, decoupling has occurred during the period – although it does not indicate whether decoupling was relative or absolute. The OECD further proposes to calculate a decoupling factor (= 1 – decoupling ratio). The decoupling factor is zero or negative in the absence of decoupling and has a maximum level of 1 when the environmental pressure variable reaches zero.

Figure 22 presents an example for a decoupling graph of a single industry – here the transport services (NACE 60 to 63) in the EU25 over the period 1995 to 2004. Gross value added of EU's transport services grew almost 30% over this period. At the same time, emissions of ground level ozone precursor substances remained rather stable, they even decreased slightly below 1995 levels in 2004, hence showing a slight absolute decoupling. Emissions of acidifying substances also de-coupled relatively from economic growth in the transport service sector. This means, it grew at a lower rate than the gross value added, although it grew by around 5%. Direct emissions of greenhouse gases by transport services did not de-couple at all, as they developed more or less parallel along the economic growth path of this industry. Only recently, between 2003 and 2004, a slight decoupling of greenhouse gas emissions from economic growth occurred.

Figure 22: Transport services (NACE 60 to 63) – Decoupling of air emissions from value added, EU25 1995-2004



Source: Eurostat (NAMEA-Air survey 2006); EU KLEMS

10.5 Air emission intensities of industries

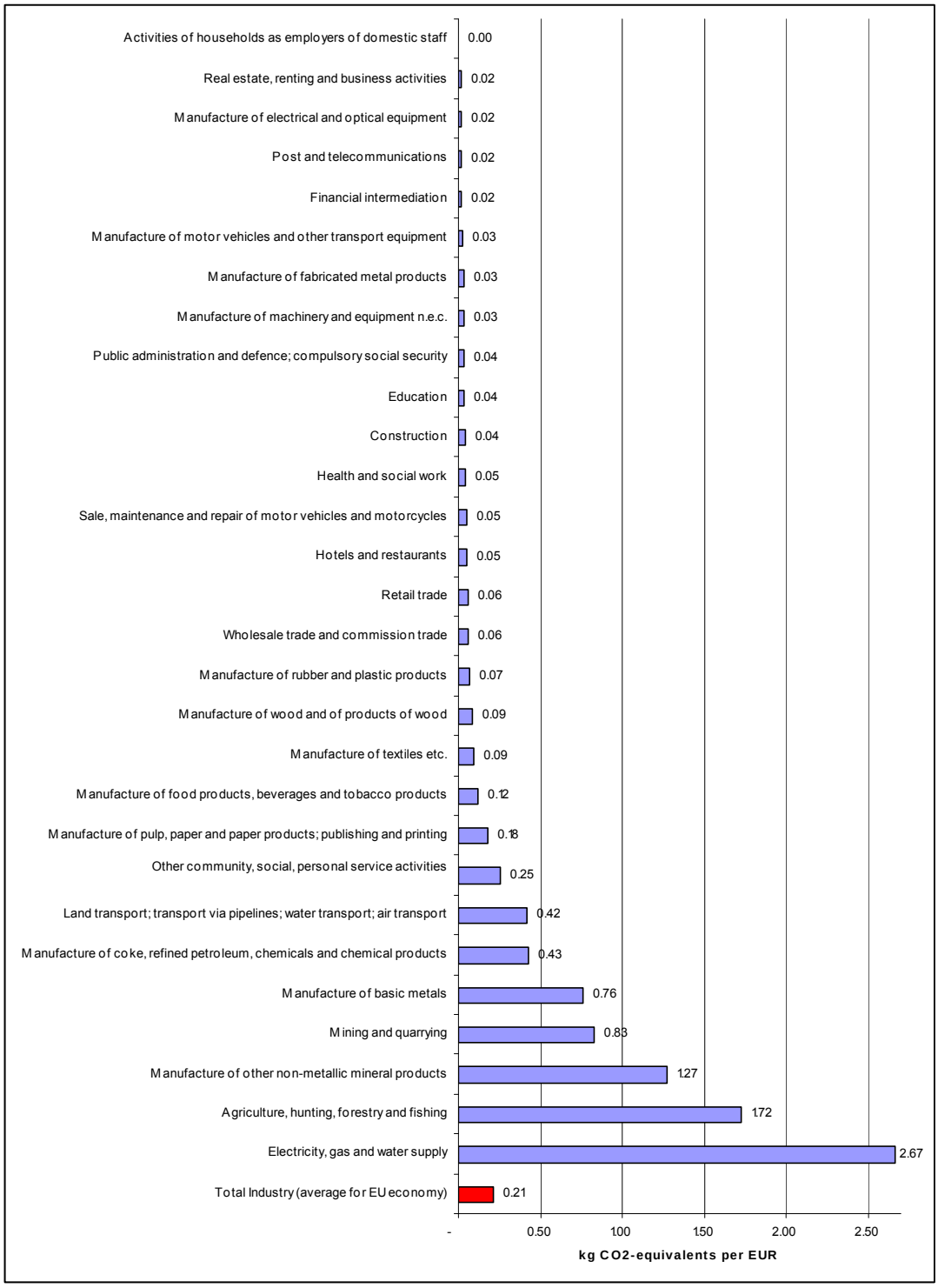
Eco-efficiency is a prominent concept in environmental policies (see e.g. EEA 1999). There are several means to monitor eco-efficiency depending on the subject and level of aggregation. Air Emissions Accounts in combination with economic parameters (preferably production output) can be used to calculate production related air emission intensities of industries; these are the amount of air emissions directly emitted per unit output.

Such production related and industry specific air emission intensities can be used to

a) compare industries within one national economy in order to identify most eco-efficient ones;
b) compare across countries (for a given industry) in order to identify best performers; and
c) monitor development over time in order to assess improvements in eco-efficiency, i.e. – for an enterprise, industry or even whole national economy – the generation of one unit of economic output with lower levels of environmental pressures and less use of natural resources.

Air emission intensities are calculated by dividing the amount of direct air emissions of a given industry by the output of the respective industry. The unit is e.g. grams per EUR, or tonnes per million EUR. If air emission intensities are calculated for time series, it is required to convert the economic variable, i.e. output, into a chain linked unit. If air emission intensities are calculated for country comparison, it is required to convert the economic variables of the various countries into a common currency.

Figure 23: Greenhouse gas emission intensities for industries, EU25 2004



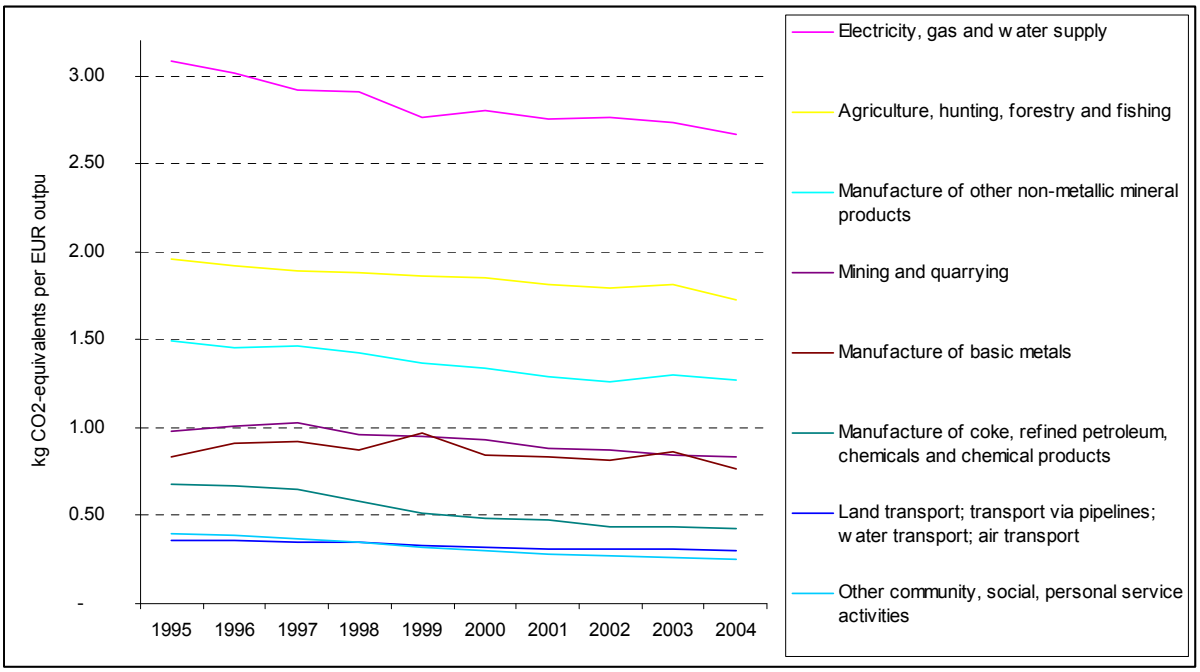
Source: Eurostat (NAMEA-Air survey 2006); EU KLEMS

Figure 23 shows the greenhouse gas emission intensities by industries for the EU25 and for the year 2004. On average, that is for the total EU economy, greenhouse gas emission intensity amounts to 0.21 kg CO_2-equivalents per EUR output. There are a number of industries above this average. The highest greenhouse gas emission intensity can be found for the electricity supply industry with 2.67 kg CO_2-equivalents per EUR output. Other highly intensive industries include agriculture (1.72 kg/EUR), manufacture of mineral products (1.27 kg/EUR), mining (0.83 kg/EUR), manufacture of basic metals (0.76 kg/EUR), manufacture of refinery and

chemical products (0.43 kg/EUR), transport services (0.42 kg/EUR), and other community services incl. waste management (0.25 kg/EUR). Industries with low intensities include several services such as real estate and business services (0.02 kg/EUR), post and telecommunication services (0.02 kg/EUR), and financial services (0.2 kg/EUR) – but also certain manufacturing industries such as manufacture of electrical and optical equipment (0.02 kg/EUR), manufacture of vehicles (0.03 kg/EUR), manufacture of machinery (0.03 kg/EUR) and manufacture of fabricated metal products (0.03 kg/EUR).

It might be of interest to monitor the air emission intensities of most important industries over time in order to assess whether eco-efficiency has been improving or not. Figure 24 shows an example for this. It presents the development of greenhouse gas emission intensities of the 8 most intensive industries in the EU. All industries managed to decrease their greenhouse gas intensities over the period 1995-2004, although to different degrees.

Figure 24: Greenhouse gas emission intensities for most intensive industries, EU25 1995 - 2004



Source: Eurostat (NAMEA-Air survey 2006); EU KLEMS

These decreasing trends indicate an increase in eco-efficiency.

10.6 Structural Decomposition Analysis of production related air emissions

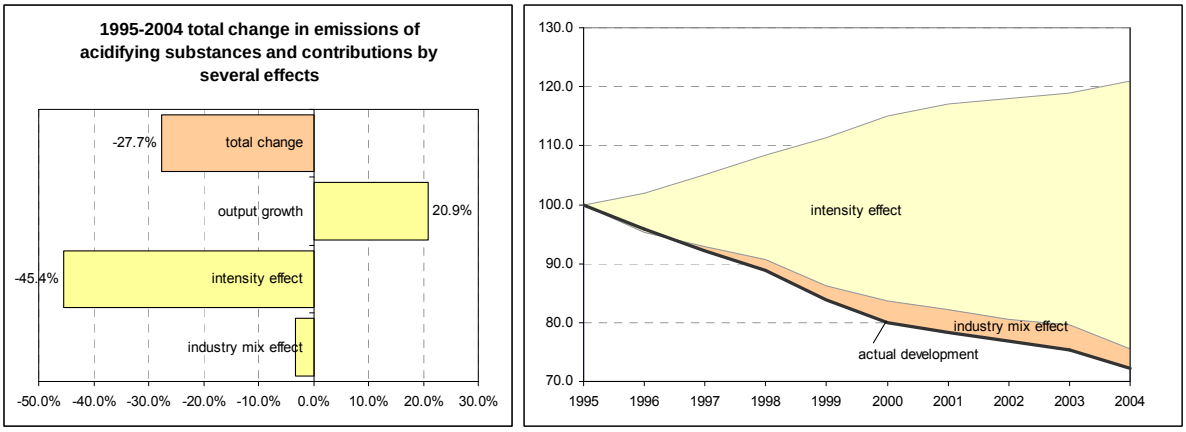
Over time, the development of total production related air emissions can have several causes. A decrease of total national air emissions can be due to eco efficiency improvements in the single industries. Or, an increase of air emissions can be due to overall economic growth. Economic structural change can be another reason for

decreasing national air emissions if air emission intensive industries lose relative weight in the total economy due to the increasing importance of lower emissions intensive industries.

Those different effects on the overall development of total national production related air emissions can be investigated and quantified with the help of *Structural Decomposition Analyses* (SDA) (see SEEA2003, paragraphs 4.136 ff. and 11.21 ff.; de Haan 2001, Jensen/Olsen 2003). SDA is a specific technique to investigate time series. Applied to air emissions, it shows how much of a change in total air emissions is due to a specific number of causes. Data requirements are AEA for several years (at least two time points) and associated economic statistics (i.e. gross value added broken down by industries).

With regards to data requirements, SDA requires – in addition to the Air Emissions Accounts data – time series of economic data (in constant prices).

Figure 25: Decomposition of total production related emissions of acidifying substances, EU25 1995-2004



Source: Eurostat (NAMEA-Air survey 2006); EU KLEMS

Figure 25 shows the results of a SDA of the total production related emissions of acidifying substances in the EU25 between 1995 and 2004. The left bar chart shows the overall results for the change between 1995 and 2004. During this period, production related emissions of acidifying substances decreased by 27.7%. This overall decrease is determined by three cumulative effects. The first effect is related to the overall output growth of the EU25 economy. Output growth has had an increasing effect. In absence of the other effects, emissions would have increased by 20.9% if emissions would have been determined only by this growth effect. The second effect relates to the emission intensities of the single industries. This intensity effect has had a decreasing effect, i.e. in absence of the other effects, emissions would have decreased by 45.4% due to improvements in emission intensity in all industries of the EU25 economy. The third effect relates to economic structural change. The industry mix of the EU25 economy has changed between 1995 and 2004. Apparently, certain intensive industries lost importance in the total economy whereas less intensive industries gained importance. Therefore the industry mix effect is a decreasing effect, i.e. due to changes in the industry mix emissions decreased – although only by 3.3%. In other words, the industry mix changed only little in favour of emissions of acidifying substances. The

three effects are cumulative as they sum up to the total change
[20.9 + (-45.4) + (-3.3) = -27.7].[60]

The right chart in Figure 25 presents the results of the SDA in a time series. This is a special presentation showing the influence of the different effects over time. It reads as follows: The bold bottom line shows the actual development of EU25's production related emissions of acidifying substances which decreased by 27.7%. The orange part above denotes the contribution of the industry mix effect; i.e. avoided emissions due to economic structural changes. The upper yellow area denotes the contribution of the intensity effect, i.e. avoidances of emissions due to eco efficiency improvements in the single industries. The upper line denotes the hypothetical development of emissions of acidifying substances as if they would have been determined only by economic output growth.

It is important to note that the results of such SDA depend on the number of industries, i.e. on the resolution of the industry breakdown underlying the basic data. The above example is calculated for an industry breakdown differentiating some 30 to 40 industries. Results would be different if the number of industries increase; particularly the industry mix effect can gain importance when the number of industries is increased.

10.7 Indirect air emissions activated by domestic final use of product groups

So far, only examples of investigations of production related air emissions have been presented. Now, the perspective is switched to the consumption side of the national economy. This perspective is possible through employing the technique of *environmentally extended input-output analyses* (EE-IOA)[61] which combines Air Emissions Accounts data with symmetric input-output tables (monetary data). With this technique it is possible to calculate indirect air emissions activated by final use.

In the ESA input-output framework, final use is represented by a matrix: *product groups* by categories of *final use*. The products are grouped into 60 CPA[62]-divisions. The final use categories comprise the following items (see Eurostat SUIOT Manual[63], p. 122) :

- *final consumption expenditure:*
  - *final consumption expenditure by households,*
  - *final consumption expenditure by non-profit institutions serving households (NPISH) and*

[60] Note the rounding error of 0.1

[61] see e.g. Moll et al. 2007 pp. 66ff.; Miller/Blair 1985 chapter 7 pp. 236ff.; ten Raa 2005 chapter 11 pp. 139ff.

[62] Statistical Classification of Products by Activity in the European Economic Community. A product classification structured according to the criterion of economic origin being based on NACE. This recourse to NACE Rev.1.1 with respect to the definitions of economic activity means that the CPA's structure corresponds at
all levels to that of NACE Rev.1.1.

[63] Eurostat (2008): Eurostat Manual of Supply, Use and Input-Output Tables. Luxembourg: Office for Official Publications of the European Communities

    - *final consumption expenditure by government*
- *gross capital formation:*
    - *gross fixed capital formation,*
    - *changes in valuables and*
    - *changes in inventories*
- *exports:*
    - *intra EU exports and*
    - *extra EU exports*

Final consumption expenditure and gross capital formation together form *domestic* final use. That is the final use of products by resident units.

Policy makers may be interested in air emissions activated by domestic final use. This includes all air emissions arising along the entire production chain of products used by resident units. These comprise both, air emissions arising in the domestic production system and those arising in production systems of the rest of the world economy through imports.

These indirect air emissions activated by domestic final use can be broken down and presented by product groups. As an illustrative example, Table 19 presents for Germany and the year 2000 the indirect emissions of greenhouse gases activated by domestic final use, broken down by 60 product groups.

One can identify those product groups the domestic use of which bear the highest “embodied” air emissions. Therefore, the product groups are to be ranked according to their “embodied” air emissions. The most important product groups can be presented e.g. in form of a pie chart. As an example, Figure 26 presents the 10 most important product groups for Germany and the year 2000. Those 10 products “embody” more than two thirds of all indirect emissions of greenhouse gases activated by the domestic final use.

In most cases these calculations of indirect air emissions with the help of *environmentally extended input-output analyses* (EE-IOA) employ national input-output tables. In those cases, assumptions are made with regards to the embodied air emissions associated with imported goods: the so called *domestic-technology-assumption*: This assumes that the rest of the world production systems apply the same production technologies as the domestic production system.

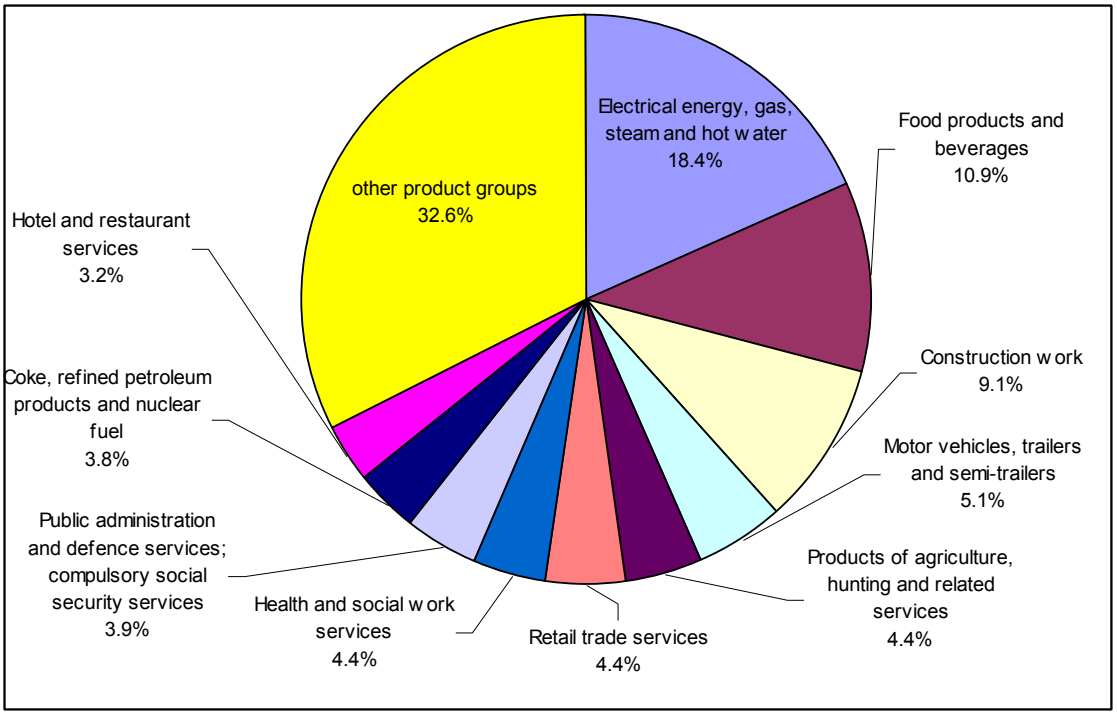
Table 19: Indirect emissions of greenhouse gases activated globally by domestic final use by 60 product groups, Germany 2000

CPA code	product groups	1000 tonnes **CO2**	tonnes **N2O**	tonnes **CH4**	1000 tonnes CO2-equivalents **GHG**
40	Electrical energy, gas, steam and hot water	141,499	5,169	306,691	149,542
15	Food products and beverages	42,614	86,796	900,189	88,424
45	Construction work	68,793	4,515	176,877	73,907
34	Motor vehicles, trailers and semi-trailers	38,360	2,805	97,208	41,271
01	Products of agriculture, hunting and related services	8,295	53,477	511,641	35,617
52	Retail trade services	31,976	2,248	131,622	35,437
85	Health and social work services	28,293	13,453	140,209	35,408
75	Public administration and defence services; compulsory social security services	28,074	4,100	129,195	32,058
23	Coke, refined petroleum products and nuclear fuel	22,502	570	372,357	30,498
55	Hotel and restaurant services	17,766	14,084	177,317	25,856
29	Machinery and equipment n.e.c.	21,983	1,476	55,186	23,600
60	Land transport and transport via pipeline services	19,540	1,311	49,588	20,988
24	Chemicals, chemical products and man-made fibres	16,617	5,948	77,793	20,095
80	Education services	13,309	1,163	46,188	14,640
62	Air transport services	12,900	476	34,693	13,776
70	Real estate services	10,662	2,286	58,355	12,596
50	Trade, maintenance and repair services of motor vehicles and motorcycles; retail trade services of automotive fuel	10,844	752	37,309	11,860
36	Furniture; other manufactured goods n.e.c.	10,209	981	27,714	11,095
28	Fabricated metal products, except machinery and equipment	10,385	489	23,820	11,037
51	Wholesale trade and commission trade services, except of motor vehicles and motorcycles	9,530	759	25,615	10,303
18	Wearing apparel; furs	8,582	2,019	37,015	9,985
32	Radio, television and communication equipment and apparatus	8,584	624	20,803	9,215
90	Sewage and refuse disposal services, sanitation and similar services	2,594	742	254,376	8,166
27	Basic metals	- 7,637	- 255	- 13,743	- 8,005
35	Other transport equipment	6,898	399	16,349	7,365
11	Crude petroleum and natural gas; services incidental to oil and gas extraction, excluding surveying	3,951	89	153,837	7,209
65	Financial intermediation services, except insurance and pension funding services	6,172	481	20,559	6,753
17	Textiles	4,849	1,618	25,151	5,879
33	Medical, precision and optical instruments; watches and clocks	5,416	350	13,515	5,808
30	Office machinery and computers	5,331	372	14,093	5,742
26	Other non metallic mineral products	5,213	144	9,068	5,448
22	Printed matter and recorded media	4,859	432	15,088	5,310
31	Electrical machinery and apparatus n.e.c.	4,765	288	11,556	5,097
92	Recreational, cultural and sporting services	4,184	564	20,731	4,795
66	Insurance and pension funding services, except compulsory social security services	3,951	338	13,674	4,343
63	Supporting and auxiliary transport services; travel agency services	3,860	290	10,360	4,167
64	Post and telecommunication services	3,347	215	10,755	3,639
93	Other services	2,636	208	8,191	2,873
19	Leather and leather products	2,328	385	9,100	2,639
21	Pulp, paper and paper products	2,057	152	7,369	2,259
16	Tobacco products	1,098	1,857	19,638	2,086
74	Other business services	1,831	181	7,217	2,039
25	Rubber and plastic products	1,738	414	6,988	2,013
91	Membership organization services n.e.c.	1,650	196	6,031	1,837
41	Collected and purified water; distribution services of water	1,598	81	3,576	1,698
73	Research and development services	1,546	114	4,945	1,685
20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials	1,315	122	3,875	1,434
10	Coal and lignite; peat	419	22	43,559	1,340
72	Computer and related services	1,162	95	3,855	1,273
14	Other mining and quarrying products	343	10	407	355
02	Products of forestry, logging and related services	293	48	1,079	331
71	Renting services of machinery and equipment without operator and of personal and household goods	179	16	607	197
61	Water transport services	150	14	685	168
67	Services auxiliary to financial intermediation	53	4	159	57
05	Fish and other fishing products; services incidental to fishing	49	5	166	54
12	Uranium and thorium ores	-	-	-	-
13	Metal ores	-	-	-	-
37	Secondary raw materials	-	-	-	-
95	Private households with employed persons	-	-	-	-
99	Services provided by extra-territorial organizations and bodies	-	-	-	-
total	all product groups - Total	659,514	215,492	4,140,197	813,261

Source: ETC/RWM calculations[64]: based on Federal Statistical Office Germany and Eurostat

[64] see Moll et al. 2007

Figure 26: Indirect emissions of greenhouse gases activated globally by domestic final use of products – 10 most important product groups, Germany 2000



Source: ETC/RWM calculations[65]: based on Federal Statistical Office Germany and Eurostat

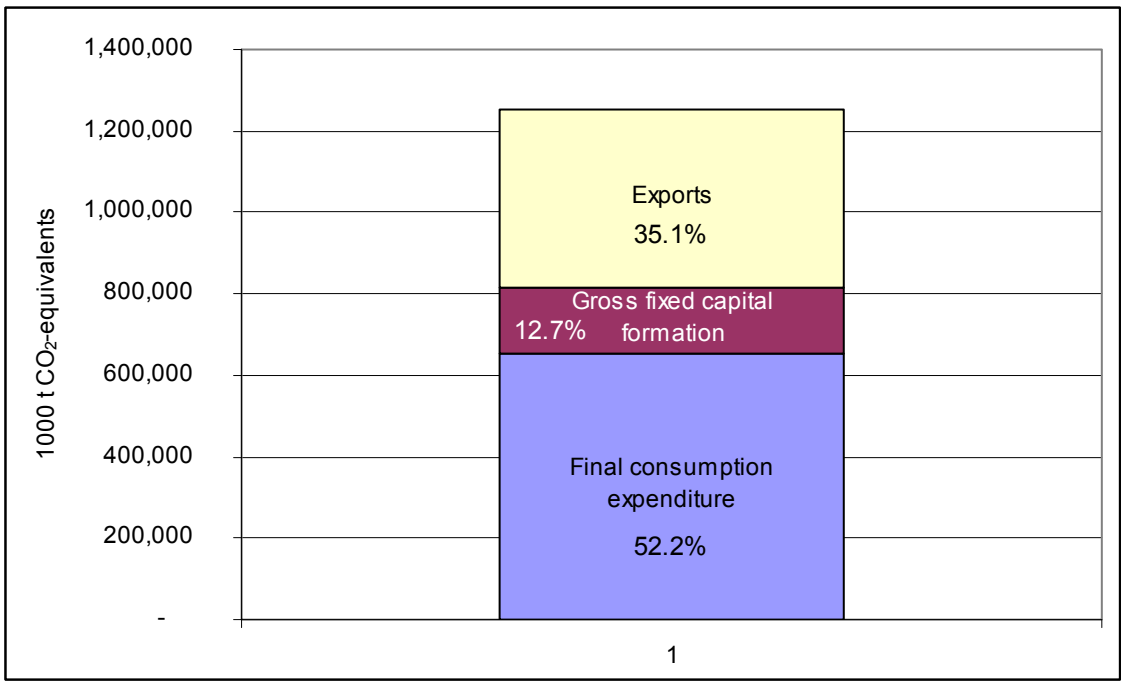
10.8 Indirect air emissions activated by categories of final use

Yet another interesting question is to analyse how much of indirect air emissions are activated by the different categories of final use, namely final consumption expenditure, gross capital formation and particularly exports.

Figure 27 presents results for German greenhouse gas emissions in 2000. More than one third (35.1%) of greenhouse gas emissions activated by German final use are due to export products, i.e. products produced mainly by the German production system but used by consumers and investors in the rest of the world. About two thirds of the indirect greenhouse gas emissions (813 million tonnes CO_2-equivalents) are activated by domestic final use. Thereof, final consumption expenditure dominates with 52% of total indirect greenhouse gas emissions. The final use of investment goods, i.e. gross capital formation amounts to about 160 million tonnes CO_2-equivalents of "embodied" greenhouse gas emissions which represent 12.7% of total indirect greenhouse gas emissions.

[65] see Moll et al. 2007

Figure 27: Indirect greenhouse gas emissions activated by different categories of final use, Germany 2000



Source: ETC/RWM calculations[66]: based on Federal Statistical Office Germany and Eurostat

10.9 Splitting indirect air emissions activated by final use into domestic and foreign origins

Policy makers may be interested in the origin of the indirect air emissions activated by final use. Indirect air emissions allocated to final used products arise along the entire production chain of the given product. Those production chains are increasingly international. A good portion of the indirect air emissions are actually not derived from the domestic production system but are associated with imports of intermediate goods and hence originate in the production systems of the rest of the world's economies. In other words, the final use in a national economy is inducing indirect air emissions outside its boundaries. In times of increasingly globalised economic activities, this portion is assumed to increase steadily.

The technique of EE-IOA allows distinguishing between indirect air emissions originating from the national economy opposed to those originating in the rest of the world. However, there are some methodological shortcomings to be noted. First, the indirect air emissions originating in the rest of the world are estimated based on the *domestic-technology-assumption* as mentioned earlier. In other words, based on this assumption what is estimated is how much air emissions have been avoided domestically through the import of intermediate and final goods. Secondly, and as a consequence of the domestic-technology-assumption, the rest of the world

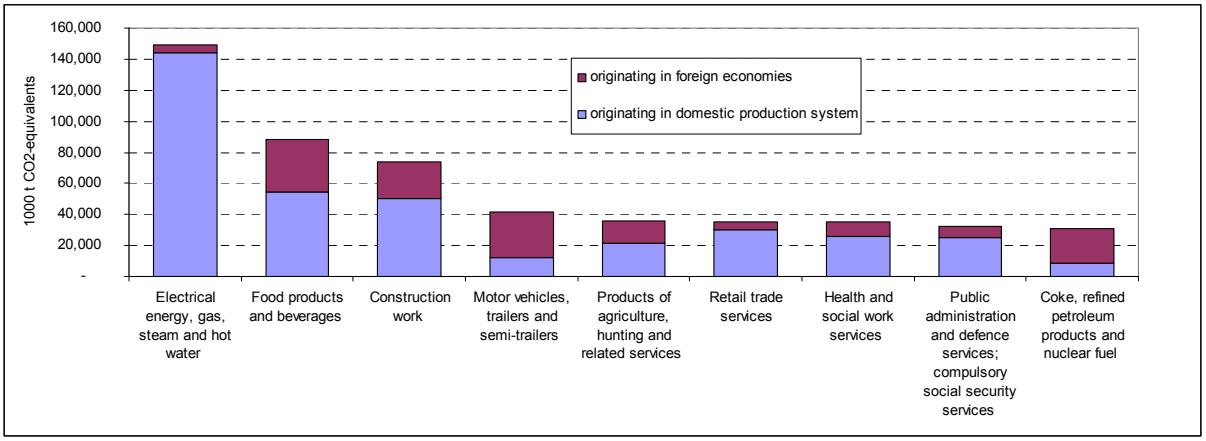
[66] see Moll et al. 2007

economies cannot be specified with regards to single countries, i.e. it cannot be stated whether foreign indirect air emissions are originating in Japan or China.[67]

The splitting of indirect air emissions into domestic and foreign origins can be done for both, products which are domestically final used (see also section 10.7) and categories of final use (see also section 10.8). From a policy perspective, the domestic-foreign split is most interesting for products.

Figure 28 presents an example for the 10 most important products groups used in Germany in the year 2000. It shows the product specific indirect emissions of greenhouse gases broken down into its domestic and foreign shares. The foreign shares vary significantly across the different product groups. The indirect emissions activated by the domestic final use of electricity are mainly originating in the German production system; only around 3% are originating in production systems abroad. On the other hand, a majority of indirect emissions activated by the German final use of motor vehicles etc. and use of petroleum products are originating outside Germany.

Figure 28: Indirect emissions of greenhouse gases activated by domestic final use of product groups - domestic and foreign shares, Germany 2000



Source: ETC/RWM calculations[68]: based on Federal Statistical Office Germany and Eurostat

10.10 Production-cycle wide air emission intensities of product groups

Section 10.5 presented intensities for production related air emissions – relating air emissions by industry to the respective industry's production output. In a similar way, air emission intensities can be calculated from a consumption perspective, i.e. for products final used. Here, all air emissions arising along the production chain

[67] There are possibilities to overcome the *domestic-technology-assumption* by refining the estimation of emissions associated to imports, especially when NAMEA-type data are available from the exporting countries of origin.

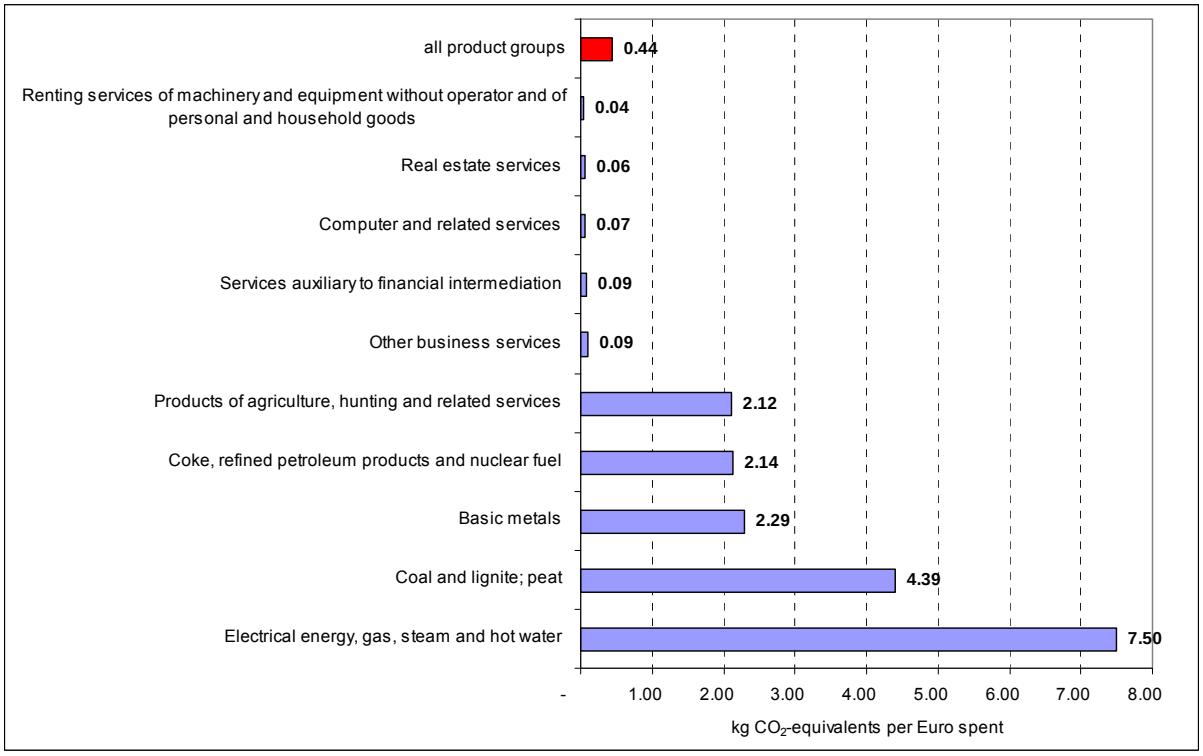
[68] see Moll et al. 2007

of a given final used product are related to the value of the respective product. It is an expression of the eco-efficiency of the entire production chain of the given product. Policy makers may be interested in comparing the production-cycle wide air emission intensities across products. Usually, the final use of services implies much less indirect environmental pressures per Euro spent compared to certain material products. A shift of consumption patterns towards those services and products with low chain-wide environmental intensities – on the account of less spending for very intensive products – bears an opportunity to reduce overall consumption related environmental pressures whilst total monetary expenditure for final use remains constant or even increases.

The nominator is the indirect air emissions activated by the domestic final use of a given product, as it can be calculated by environmentally extended input-output analysis. The denominator is the monetary value of the domestic final use of the respective product which can be derived directly from the final use matrix of the input-output table.

Figure 29 shows the production-cycle wide greenhouse gas intensities of a selected number of product groups which were finally used (i.e. consumption expenditures by households and governments, gross capital formation and exports) in Germany in the year 2000. The five most intensive product groups are compared to the five less intensive product groups. The average greenhouse gas intensity of all products final used in Germany amounts to 0.44 kg CO_2-equivalents per Euro spent. Electricity (7.50 kg CO_2-equivalents per Euro) and petroleum products (4.39 kg CO_2-equivalents per Euro) show very high intensities. On the other hand, services such as rental services, real estate services, computer services and other business services show very low intensities of production-cycle wide greenhouse gas emissions per Euro spent. Changing consumption patterns towards increased Euros spent for services – on the account of less spending for intensive goods – could help reduce overall consumption related greenhouse gas emissions. Yet another conclusion is to focus on potentials to reduce indirect emissions of greenhouse gases along the production chain of those product groups showing the highest intensities.

Figure 29: Production-cycle wide greenhouse gas emission intensities of products final used, Germany 2000



Source: ETC/RWM calculations[69]: based on Federal Statistical Office Germany and Eurostat

10.11 Structural Decomposition Analysis of consumption related air emissions

The consumption related air emissions (i.e. indirect air emissions activated by domestic final use of product groups) as discussed in the previous section (particularly section 10.7) can also be analysed over time. The total of indirect air emissions activated worldwide along the production chain of consumed products may increase or decrease over time.

With the help of Structural Decomposition Analysis, these changes can be decomposed into several effects:

- *Consumption scale or growth*: This effect relates to the changes of total domestic final use and how this development influences the worldwide indirect air emissions associated with domestic final use; usually, total consumption increases more or less at the same pace as gross domestic product.
- *Consumption mix*: This effect relates to the change of composition of products consumed in a given economy and how it influences the worldwide indirect air emissions associated with domestic final use. For instance, one may assume that a shift from material goods towards a greater portion of services consumed should have a decreasing effect on the worldwide associated indirect air emissions.

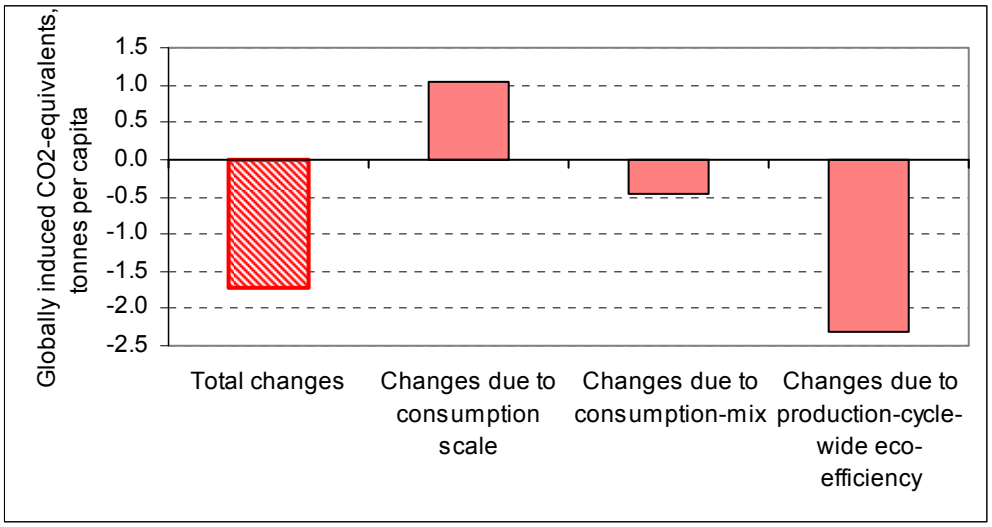
[69] see Moll et al. 2007

- *Production-cycle wide air emission intensities*: This effect relates to changes in the eco-efficiency of product chains (see section 10.10). If the intensities of air emissions along the worldwide production chain is improving, this should have a decreasing effect on total air emissions associated with consumption.

Structural Decomposition Analyses enables the quantification of the three effects. Figure 30 shows the respective results for Denmark between 1995 and 2000. The indirect (worldwide) greenhouse gas emissions activated by Danish final use of products decreased by some 1.6 t CO_2-equivalnts per capita between 1995 and 2000 (see most left bar in Figure 30). This overall change can be decomposed into the three aforementioned effects:

- Over the period 1995 to 2000 consumption (.e. domestic final use) in Denmark grew. This consumption growth would have led to an increase of greenhouse gas emissions by ca. 1 t CO_2-equivalents per capita if no other effects would have been in place (see second bar from left in Figure 30).
- The consumption-mix, i.e. the composition of products consumed, in Denmark has changed slightly in favour of less greenhouse gas emissions. In absence of any further effect, the changed consumption-mix would have led to a decrease by 0.4 to 0.5 1 t CO_2-equivalents per capita (see third bar from left in Figure 30). In other words, the more favourable consumption-mix compensated already something of the consumption growth effect.
- The most important impact derives however from improved production-cycle wide greenhouse gas intensities. This effect amounted to ca. 2.3 t CO_2-equivalents per capita (see last bar from left in Figure 30).

Figure 30: Structural decomposition of change in per capita greenhouse gas emissions activated by consumption, Denmark 1995-2000



Source: ETC/RWM calculations[70]: based on Statistics Denmark and Eurostat

[70] see Moll et al. 2007

The methodology of decomposition is unfortunately very sensitive to aggregation levels used in the analysis. The aggregation level influences the results of the analysis – sometimes to the point where opposite results are obtained depending purely on the aggregation level of the industries in the data used in the analysis. Typically the strength of the factor relating to the composition of the economy is determined largely by the aggregation level of the industry groupings used for the analysis – showing an inverse relationship. This means that the more highly aggregated the industry groupings used in the analysis, the weaker is the factor relating to the composition of the economy.

Another consideration when making these analyses is the choice of economic variable to be included. The choice is usually between production value and value added. The results will be different – i.e. different weights to the factors will result – depending on which economic variable is used.

With the aggregation level and the influence of the economic variable chosen being so high, it could be asked if this is a reliable methodology for analysis. These methodologies are useful but using the exact results – making statements such as, the changes in the economic structure of a country account for precisely "x" per cent of the changes in the levels of emissions should perhaps be avoided. This methodology is only appropriate for making more general observations and statements about the underlying reasons for the observed changes in the emissions levels.

References

Aasestad (editor) (2007): *The Norwegian Emission Inventory 2007: Documentation of methodologies for estimating emissions of greenhouse gases and long-range transboundary air pollutants*, Report 2007/38 Oslo: Statistics Norway.

Adriaanse, A. (1993): *Environmental Performance Indicators*, The Hague: Ministry of Housing, Spatial Planning and the Environment, VROM.

de Haan, Mark and Steven J. Keuning (1996): *Taking the Environment into Account: The NAMEA Approach*. Review of Income and Wealth, Series 42, Number 2, 131-148.

de Haan, M. (2001): *A Structural Decomposition Analysis of Pollution in the Netherlands*. In Economics Systems Research, Vol. 13, No2.

European Environment Agency, EEA (1999): *Making sustainability accountable: Eco-efficiency, resource productivity and innovation*. EEA Topic report No 11/1999, EEA: Copenhagen http://reports.eea.europa.eu/Topic_report_No_111999/en

European Environment Agency, EEA (2002): *Environmental Signals 2002 – Benchmarking the Millenium*. Environmental Assessment Report No. 9, European Environment Agency: Copenhagen

European Environment Agency, EEA (2007): *EMEP/CORINAIR Emission Inventory Guidebook – 2007*, Technical report no 16/2007. European Environment Agency: Copenhagen.

Eurostat (1996): *Council Regulation (EC) No 2223/96 of 25 June 1996 on the European system of national and regional accounts in the Community (OJ L 310, 30.11.1996, p. 1)*

Eurostat (2008): *Manual of Supply, Use and Input-Output Tables*, 2008 edition, ISSN 1977-0375, Office for Official Publications of the European Communities: Luxembourg. http://epp.eurostat.ec.europa.eu/portal/page/portal/product_details/publication?p_product_code=KS-RA-07-013

Hass, J. (ed.) and V. Skarborg (2000): *Nordic Environment-Economic Indicators: Nordic Natural and Environment Accounts - Part III*. TemaNord 2000:515. Copenhagen: Nordic Council of Ministers.

Hass, Julie L. and Knut Ø. Sørensen (1998): *Environmental profiles and benchmarking of Norwegian industries. Results from the Norwegian economic and environmental accounts (NOREEA) project*. Statistics Norway: *Economic Survey* 1/98.

Hass, Julie L. and Kristine E. Kolshus (2007): *Requirements for energy statistics in linked environmental-economic data sets*. Paper presented at the Second meeting of the Oslo group on Energy statistics, New Delhi, India, 5-7 February 2007. http://www.ssb.no/ocg/hass_namea_energy.pdf

IPPC (1996): *Revised 1996 Guidelines for National Greenhouse Gas Inventories*. The Intergovernmental Panel on Climate Change (IPCC): Hayama, Kanagawa (http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html)

IPPC (2006): *IPCC Guidelines for National Greenhouse Gas Inventories*, The Intergovernmental Panel on Climate Change (IPCC): Hayama, Kanagawa (http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html)

IPCC (2007): *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

Jensen, P.R., Olsen, T. (2003): *Analysis of Changes in Air Emissions in Denmark 1980 – 2001- Time series • Bridge tables • Decomposition analysis*. Statistics Denmark: Copenhagen

Keuning, S., J. van Dalen and M. de Haan (1999). *The Netherlands' NAMEA: Presentation, Usage and Future Extensions*, In Structural Change and Economic Dynamics, Vol. 10 No. 1, pp. 15-37.

Keuning, Steven J. and Albert E. Steenge (1999): *Introduction to the special issue on 'Environmental extensions of national accounts: the NAMEA framework*.' Structural Change and Economic Dynamics, 10, 1-13.

Keuning, Steven J. and Mark de Haan (1998): *Netherlands: What's in a NAMEA? Recent results* in K. Uno and P. Bartelmus (eds), Environmental Accounting in Theory and Practice. Kluwer Academic Publishers, Great Britain, 143-156.

Leontief, W. (1970): *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

Miller, R.E., Blair, P.D. (1985): *Input-Output Analysis: Foundations and Extensions*. Prentice-Hall Inc., Englewood Cliffs, New Jersey

Moll, S., Vrgoc, M., Watson, D., Femia, A., Gravgård Pedersen, O. (2007): *Environmental Input-Output Analyses based on NAMEA data – A comparative European study on environmental pressures arising from consumption and production patterns*. ETC/RWM working paper 2007/2, European Topic Centre on Resource and Waste Management, Copenhagen http://scp.eionet.europa.eu/publications/wp2007_2

OECD (2002): *Indicators to measure decoupling of environmental pressures from economic growth*. SG/SD(2002)1/FINAL, OECD: Paris, http://www.olis.oecd.org/olis/2002doc.nsf/LinkTo/sg-sd(2002)1-final

OECD (2003): OECD *Environmental Indicators – Development, Measurement and Use*. Reference Paper, OECD: Paris http://www.oecd.org/dataoecd/7/47/24993546.pdf

Ten Raa, T. (2005): *The Economics of Input-Output Analysis*. Cambridge University Press, Cambridge

United Nations (1993). *SNA Handbook on Integrated Environmental and Economic Accounting*, Series F, No. 61, Statistical Office of the United Nations: New York.

United Nations (1999a). *Handbook of Input-output Tables - Compilation and Analysis*, Handbook of National Accounting, Studies in Methods, No.74, United Nations: New York.

United Nations (2008). *System of Environmental and Economic Accounts for Energy: SEEA-E*. Draft Chapters 1-4. May 2008 version. United Nations Statistical Division document.

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank (1993): *Handbook of National Accounting – Integrated Environment and Economic Accounting*, United Nations: New York.

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, World Bank (2003): *Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003 (SEEA2003)*, United Nations et al.: New York.

Annex 1: Correspondence between SNAP97 (CRF/NFR) and NACE rev.1.1

Source: EMEP/CORINAIR Emission Inventory Guidebook 2007 (EEA website)

http://reports.eea.europa.eu/EMEPCORINAIR5/en/page002.html

The correspondence table on the following pages presents the allocation of SNAP-based EMEP/CORINAIR emission data to NACE Rev.1.1 divisions (2-digits) for Eurostat's Environmental Accounts.
See also chapter 7 making specific references to this correspondence table.

Legend:

level of complexity:		**Flaggs**
easy		# one single SNAP process needs to be distributed over several NACE divisions
medium		(#) distribution is eventually required
very complex		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	***Label***	***code***	***label***	***NACE Rev.1.1 codes***	***flag***	***notes***
1	**COMBUSTION IN ENERGY AND TRANSFORMATION INDUSTRIES**					
01 01	Public Power	1.A.1.a	Public electricity and heat production			
01 01 01	*Combustion plants >= 300 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 01 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 01 03	*Combustion plants < 50 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 01 04	*Gas turbines*	*1.A.1.a*	Public electricity and heat production	40		
01 01 05	*Stationary engines*	*1.A.1.a*	Public electricity and heat production	40		
01 02	District heating plants	1.A.1.a	Public electricity and heat production			
01 02 01	*Combustion plants >= 300 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 02 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 02 03	*Combustion plants < 50 MW (boilers)*	*1.A.1.a*	Public electricity and heat production	40		
01 02 04	*Gas turbines*	*1.A.1.a*	Public electricity and heat production	40		
01 02 05	*Stationary engines*	*1.A.1.a*	Public electricity and heat production	40		
01 03	Petroleum refining plants	1.A.1.b	Petroleum refining			
01 03 01	*Combustion plants >= 300 MW (boilers)*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	Power plants operated by refinery industry (NACE Rev.1.1 code 23) generating electricity may be identified as a secondary activity and hence re-grouped to the industry column with NACE Rev.1.1 code 40 in your ESA95 supply table In other words, power plants operated by refinery industry may become independent power plants over time (NACE Rev.1.1 code 40) while the emissions are still recorded under this SNAP category; check with your emissions expert if this is the case and NA experts (alternatively Supply table) where they record electricity produced in refinery industry. Emissions from combustion plants for heating purposess (particularly space and water heating) should be recorded under NACE Rev.1.1 code 23 (ancillary activity).
01 03 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	
01 03 03	*Combustion plants < 50 MW (boilers)*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
01 03 04	*Gas turbines*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	
01 03 05	*Stationary engines*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	
01 03 06	*Process furnaces*	*1.A.1.b*	Petroleum refining	23 and/or 40	(#)	
01 04	Solid fuel transformation plants	1.A.1.c	Manufacture of solid fuels and other energy industries			
01 04 01	*Combustion plants >= 300 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	
01 04 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	
01 04 03	*Combustion plants < 50 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	
01 04 04	*Gas turbines*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	
01 04 05	*Stationary engines*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	
01 04 06	*Coke oven furnaces*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	27 or 23	(#)	Coke oven furNACE Rev.1.1 codes are mainly operated by steel industry (NACE Rev.1.1 code 27) but this activity could be outsourced to NACE Rev.1.1 code 23 (check with your National Accounts experts where they record the coke production in steel industry)
01 04 07	*Other (coal gasification, liquefaction, ...)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	23 and/or 40	(#)	see above cells 01 03 01 ff.
01 05	Coal mining, oil/gas extraction, pipeline compressor					
01 05 01	*Combustion plants >= 300 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	10 - 11 and/or 40	(#)	Power plants operated by coal mining and oil extraction industries (NACE Rev.1.1 code 10 and 11) generating electricity may be identified as secondary activity and hence re-grouped to the industry column with NACE Rev.1.1 code code 40 in your ESA95 supply table. In other words, they may become independent power plants over time (NACE Rev.1.1 code 40) while the emissions are still recorded under this SNAP category; check with your emissions expert if this is the case and NA experts (alternatively Supply table) where they record electricity produced in mining industry. Combustion plants for heating purposess (particularly buildings) should be recorded under NACE Rev.1.1 code 10 and 11 according to where they actually take place.
01 05 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	10 - 11 and/or 40	(#)	
01 05 03	*Combustion plants < 50 MW (boilers)*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	10 - 11 and/or 40	(#)	

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	***Label***	***code***	***label***	***NACE Rev.1.1 codes***	***flag***	***notes***
01 05 04	*Gas turbines*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	10 - 11 and/or 40	(#)	
01 05 05	*Stationary engines*	*1.A.1.c*	Manufacture of solid fuels and other energy industries	10 - 11 and/or 40	(#)	
01 05 06	*Pipeline compressors*	*1.A.3.e.i*	Pipeline compressors	60		
2	**NON-INDUSTRIAL COMBUSTION PLANTS**					
02 01	Commercial and institutional plants	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary			
02 01 01	*Combustion plants >= 300 MW (boilers)*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	Check with your emissions expert, what kind of combustions plants are actually recorded under this SNAP codes (e.g. electricity and heat; or only heat) and where (in all industries or only the service industries as suggested by the name of the SNAP code?) Power plants operated by service industries (NACE Rev.1.1 divisions 50 to 99) generating electricity may be identified as secondary activity and hence re-grouped to the industry column with NACE code 40 in your ESA95 supply table. In other words, they may become independent power plants over time (NACE Rev.1.1 code 40) while the emissions are still recorded under this SNAP category; check with your emissions expert if this is the case and NA experts (alternatively Supply table) where they record electricity produced in service industry. Emissions from combustion plants for heating purposess (particularly space and water heating) are associated with ancilliary activities and should be recorded under NACE Rev.1.1 divisions 50 to 99 according to where they a
02 01 02	*Combustion plants >= 50 and < 300 MW (boilers)*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	
02 01 03	*Combustion plants < 50 MW (boilers)*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	
02 01 04	*Stationary gas turbines*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	
02 01 05	*Stationary engines*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	
02 01 06	*Other stationary equipments (n)*	1.A.4.a.i ; 1.A.5.a	Commercial / institutional: stationary	(10) 50 - 99 and/or 40	#	
02 02	Residential plants	1.A.4.b.i	Residential plants			
02 02 01	*Combustion plants >= 50 MW (boilers)*	*1.A.4.b.i*	Residential plants	H. heating		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	***Label***	***code***	***label***	***NACE Rev.1.1 codes***	***flag***	***notes***
02 02 02	*Combustion plants < 50 MW (boilers)*	*1.A.4.b.i*	Residential plants	H. heating		
02 02 03	*Gas turbines*	*1.A.4.b.i*	Residential plants	H. heating		
02 02 04	*Stationary engines*	*1.A.4.b.i*	Residential plants	H. heating		
02 02 05	*Other equipments (stoves, fireplaces, cooking,...)*	*1.A.4.b.i*	Residential plants	H. others		
02 03	Plants in agriculture, forestry and aquaculture	1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary			
02 03 01	*Combustion plants >= 50 MW (boilers)*	*1.A.4.c.i*	Agriculture / Forestry / Fishing - Stationary	01 - 05	(#)	Power plants operated by agriculture, forestry, fisheries (NACE Rev.1.1 codes 01, 02, and 05) generating electricity may be identified as secondary activity and hence re-grouped to the industry column with NACE Rev.1.1 code 40 in your ESA95 supply table. In other words, they may become independent power plants over time (NACE Rev.1.1 division 40) while the emissions are still recorded under this SNAP category; check with your emissions expert if this is the case and NA experts (alternatively Supply table) where they record electricity produced in agriculture, forestry, fisheries. Emissions from combustion plants for heating purposess (particularly space and water heating) are associated with ancilliary activities and should be recorded under NACE Rev.1.1 divisions 01, 02 and 03 according to where they actually take place.
02 03 02	*Combustion plants < 50 MW (boilers)*	*1.A.4.c.i*	Agriculture / Forestry / Fishing - Stationary	01 - 05	(#)	
02 03 03	*Stationary gas turbines*	*1.A.4.c.i*	Agriculture / Forestry / Fishing - Stationary	01 - 05	(#)	
02 03 04	*Stationary engines*	*1.A.4.c.i*	Agriculture / Forestry / Fishing - Stationary	01 - 05	(#)	
02 03 05	*Other stationary equipments (n)*	*1.A.4.c.i*	Agriculture / Forestry / Fishing - Stationary	01 - 05	(#)	
3	**COMBUSTION IN MANUFACTURING INDUSTRY**					
03 01	Comb. in boilers, gas turbines and stationary engines	1.A.2.a - 1.A.2.f				
03 01 01	*Combustion plants >= 300 MW (boilers)*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	Power plants generating electricity operated by these industries (NACE Rev.1.1 divisions 15-22; 24-37; 45) may be identified as secondary activites and hence re-grouped to the industry column with NACE Rev.1.1 code 40 in your ESA95 supply table. In other words, they may become independent power plants over

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
						time (NACE Rev.1.1 code 40) while the emissions are still recorded under this SNAP category; check with your emissions expert if this is the case and NA experts (alternatively Supply table) where they record electricity produced in these industries. Emissions from combustion plants for heating purposess (particularly space and water heating) are associated with ancilliary activities and should be recorded under these industries (NACE Rev.1.1 divisions 15-22; 24-37; 45) according to where they actually take place. If 4-digit NFR/CRF code is available, this gives some indication on how to distribute: 1.A.2.a = iron & steel (NACE Rev.1.1 codes 27-28) 1.A.2.b = non-ferrous metals (NACE Rev.1.1 codes 27-28) 1.
03 01 02	*Combustion plants >= 50 and < 300 MW (boilers)*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	
03 01 03	*Combustion plants < 50 MW (boilers)*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	
03 01 04	*Gas turbines*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	
03 01 05	*Stationary engines*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	
03 01 06	*Other stationary equipments (n)*	*1.A.2.a - 1.A.2.f*		15 - 22; 24 - 37; 45	#	
03 02	Process furnaces without contact (a)					
03 02 03	*Blast furnace cowpers*	*1.A.2.a*	Iron and steel	27		
03 02 04	*Plaster furnaces*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 02 05	*Other furnaces*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26 - 27	#	
03 03	Processes with contact					
03 03 01	*Sinter and pelletizing plants*	*1.A.2.a*	Iron and steel	27		
03 03 02	*Reheating furnaces steel and iron*	*1.A.2.a*	Iron and steel	27		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
03 03 03	*Gray iron foundries*	*1.A.2.a*	Iron and steel	27		
03 03 04	*Primary lead production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 05	*Primary zinc production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 06	*Primary copper production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 07	*Secondary lead production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 08	*Secondary zinc production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 09	*Secondary copper production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 10	*Secondary aluminium production*	*1.A.2.b*	Non-ferrous metals	27		
03 03 11	*Cement (f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 12	*Lime (includ. iron and steel and paper pulp industr.)(f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	15; 26; 27	#	Note: lime might also be produced in food and steel industry; not an elephant, if you have data ok
03 03 13	*Asphalt concrete plants*	*1.A.2.f.i - 1.A.2.f.ii*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	23; 45	#	
03 03 14	*Flat glass (f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 15	*Container glass (f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 16	*Glass wool (except binding) (f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 17	*Other glass (f)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and	26		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
			construction: Other (Please specify in your IIR)			
03 03 18	*Mineral wool (except binding)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 19	*Bricks and tiles*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 20	*Fine ceramic materials*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 21	*Paper-mill industry (drying processes)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	21		
03 03 22	*Alumina production*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	27		
03 03 23	*Magnesium production (dolomite treatment)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	27		
03 03 24	*Nickel production (thermal process)*	*1.A.2.f.i*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	27		
03 03 25	*Enamel production*	*1.A.2.f.i - 1.A.2.f.ii*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	26		
03 03 26	*Other*	*1.A.2.f.i - 1.A.2.f.ii*	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	15 - 22; 24 - 37; 45	#	Note: NACE Rev.1.1 division 23 is already covered in SNAP 0103 and 0104; mining is covered in SNAP 0105 If emission data are available for this SNAP code; then, the national emission experts should known where it comes from?
4	**PRODUCTION PROCESSES**					
04 01	Processes in petroleum industries	1.B.2.a.iv	Refining / storage			
04 01	*Petroleum products processing*	*1.B.2.a.iv*	Refining / storage	23		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
01						
04 01 02	Fluid catalytic cracking - CO boiler	1.B.2.a.iv	Refining / storage	23		
04 01 03	Sulphur recovery plants	1.B.2.a.iv	Refining / storage	23		
04 01 04	Storage and handling of petroleum produc. in refinery	1.B.2.a.iv	Refining / storage	23		
04 01 05	Other	1.B.2.a.iv	Refining / storage	23		
04 02	Processes in iron and stell industries and colliries					
04 02 01	Coke oven (door leakage and extinction)	1.B.1.b	Solid fuel transformation	23; 27	#	see comment related to SNAP 01 04 06 'coke oven furnaces'
04 02 02	Blast furnace charging	2.C.1	Iron and steel production	27		
04 02 03	Pig iron tapping	2.C.1	Iron and steel production	27		
04 02 04	Solid smokeless fuel	1.B.1.b	Solid fuel transformation	27		
04 02 05	Open hearth furnace steel plant	2.C.1	Iron and steel production	27		
04 02 06	Basic oxygen furnace steel plant	2.C.1	Iron and steel production	27		
04 02 07	Electric furnace steel plant	2.C.1	Iron and steel production	27		
04 02 08	Rolling mills	2.C.1	Iron and steel production	27		
04 02 09	Sinter and pelletizing plant (except comb. 03.03.01)	2.C.1	Iron and steel production	27		
04 02 10	Other	2.C.1	Iron and steel production	27		
04 03	Processes in non-ferrous metal industries					
04 03 01	Aluminium production (electrolysis)	2.C.3	Aluminium production	27		
04 03 02	Ferro alloys	2.C.2	Ferroalloys production	27		
04 03 03	Silicium production	2.C.5.e	Other metal production (Please specify the sources included/excluded in the notes	27		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
			column to the right)			
04 03 04	*Magnesium production (except 03.03.23)*	*2.C.5.e*	Other metal production (Please specify the sources included/excluded in the notes column to the right)	27		
04 03 05	*Nickel production (except 03.03.24)*	*2.C.5.c*	Nickel production	27		
04 03 06	*Allied metal manufacturing*	*2.C.5.e*	Other metal production (Please specify the sources included/excluded in the notes column to the right)	27		
04 03 07	*Galvanizing*	*2.C.5.e*	Other metal production (Please specify the sources included/excluded in the notes column to the right)	27		
04 03 08	*Electroplating*	*2.C.5.e*	Other metal production (Please specify the sources included/excluded in the notes column to the right)	27		
04 03 09	*Other*	*2.C.5.e*	Other metal production (Please specify the sources included/excluded in the notes column to the right)	27		
04 04	Processes in inorganic chemical industries					
04 04 01	*Sulfuric acid*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 02	*Nitric acid*	*2.B.2*	Nitric acid production	24		
04 04 03	*Ammonia*	*2.B.1*	Ammonia production	24		
04 04 04	*Ammonium sulphate*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 05	*Ammonium nitrate*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04	*Ammonium phosphate*	*2.B.5.a*	Other chemical industry (Please	24		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
06			specify the sources included/excluded in the notes column to the right)			
04 04 07	NPK fertilisers	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 08	Urea	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 09	Carbon black	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 10	Titanium dioxide	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 11	Graphite	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 12	Calcium carbide production	2.B.4	Carbide production	24		
04 04 13	Chlorine production	2.B.5	Carbide production	24		
04 04 14	Phosphate fertilizers	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 15	Storage and handling of inorganic chemical prod. (o)	2.B.5.b	Storage, handling and transport of chemical products (Please specify the sources included/excluded in the notes column to the right)	24		
04 04 16	Other	2.B.5.a-b	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05	Processes in organic chemical industries (bulk production)					
04 05	Ethylene	2.B.5.a	Other chemical industry (Please	24		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
01			specify the sources included/excluded in the notes column to the right)			
04 05 02	Propylene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 03	1,2 dichloroethane (except 04.05.05)	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 04	Vinylchloride (except 04.05.05)	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 05	1,2 dichloroethane + vinylchloride (balanced process)	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 06	Polyethylene Low Density	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 07	Polyethylene High Density	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 08	Polyvinylchloride	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 09	Polypropylene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 10	Styrene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 11	Polystyrene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
04 05 12	Styrene butadiene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 13	Styrene-butadiene latex	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 14	Styrene-butadiene rubber (SBR)	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 15	Acrylonitrile Butadiene Styrene (ABS) resins	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 16	Ethylene oxide	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 17	Formaldehyde	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 18	Ethylbenzene	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 19	Phtalic anhydride	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 20	Acrylonitrile	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 21	Adipic acid	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 22	Storage and handling of organic chemical products (o)	2.B.5.a	Other chemical industry (Please specify the sources included/excluded in the notes	24		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
			column to the right)			
04 05 23	*Glyoxylic acid*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 25	*Pesticide production*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 26	*Production of persistent organic compounds*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 05 27	*Other (phytosanitary,...)*	*2.B.5.a*	Other chemical industry (Please specify the sources included/excluded in the notes column to the right)	24		
04 06	Processes in wood, paper pulp, food, drink and other industries					
04 06 01	*Chipboard*	*2.D.1*	Pulp and paper	20		
04 06 02	*Paper pulp (kraft process)*	*2.D.1*	Pulp and paper	21		
04 06 03	*Paper pulp (acid sulfite process)*	*2.D.1*	Pulp and paper	21		
04 06 04	*Paper pulp (Neutral Sulphite Semi-Chemical process)*	*2.D.1*	Pulp and paper	21		
04 06 05	*Bread*	*2.D.2*	Food and drink	15		
04 06 06	*Wine*	*2.D.2*	Food and drink	15		
04 06 07	*Beer*	*2.D.2*	Food and drink	15		
04 06 08	*Spirits*	*2.D.2*	Food and drink	15		
04 06 10	*Roof covering with asphalt materials*	*2.A.5*	Asphalt roofing	45		Allocation to NACE Rev.1.1 division 45 is based on the following sentence from the Inventory Guidebook: "The asphalt roofing industry manufactures saturated felt, roofing and siding shingles, and roll…Our interpretation is that these products are produced by the industry that uses them (asphalt roofing industry = NACE Rev.1.1 code 45) rather than by a separate producer.

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
04 06 11	*Road paving with asphalt*	*2.A.6*	Road paving with asphalt	45		
04 06 12	*Cement (decarbonizing)*	*2.A.1*	Cement production	26		
04 06 13	*Glass (decarbonizing)*	*2.A.7.d*	Other mineral products (Please specify the sources included/excluded in the notes column to the right)	26		
04 06 14	*Lime (decarbonizing)*	*2.A.2*	Lime production	15; 26; 27	#	Note: lime might also be produced in food and steel industry; not an elephant, if you have data ok; otherwise only NACE Rev.1.1 division 26
04 06 15	*Batteries manufacturing*	*2.A.7.d*	Other mineral products (Please specify the sources included/excluded in the notes column to the right)	31		
04 06 16	*Extraction of mineral ores*	*2.A.7.a*	Quarrying and mining of minerals other than coal	13 - 14	#	
04 06 17	*Other (including asbestos products manufacturing)*	*2.A.7.d*	Other mineral products (Please specify the sources included/excluded in the notes column to the right)	15 - 45	#	Note: only what is not include elsewhere
04 06 18	*Limestone and dolomite use*	*2.A.3*	Limestone and dolomite use	26		
04 06 19	*Soda ash production and use*	*2.A.4*	Soda ash production and use	24		Na_2CO_3 is produced in NACE Rev.1.1 division 24; main use in: glass industry, chemical industry, steel industry, paper/pulp industry (but also textile, food, water supply, flue gas desulphurisation) Actually, emissions occur during production, i.e. in NACE Rev.1.1 division 24.
04 08	Production of halocarbons and sulphur hexafluoride					
04 08 01	*Halogenated hydrocarbons production - By-products*	*n.a.*		24		
04 08 02	*Halogenated hydrocarbons production - Fugitive*	*n.a.*		24		
04 08 03	*Halogenated hydrocarbons production - Other*	*n.a.*		24		
04 08 04	*Sulphur hexafluoride production - By-products*	*n.a.*		24		
04 08 05	*Sulphur hexafluoride production - Fugitive*	*n.a.*		24		
04 08 06	*Sulphur hexafluoride production - Other*	*n.a.*		24		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	*Label*	*code*	*label*	*NACE Rev.1.1 codes*	*flag*	*notes*
5	**EXTRACTION AND DISTRIBUTION OF FOSSIL FUELS AND GEOTHERMAL ENERGY**					
05 01	Extraction and first treatment of solid fossil fuels	1.B.1.a	Coal mining and handling			
05 01 01	*Open cast mining*	*1.B.1.a*	Coal mining and handling	10		
05 01 02	*Underground mining*	*1.B.1.a*	Coal mining and handling	10		
05 01 03	*Storage of solid fuel*	*1.B.1.a*	Coal mining and handling	23-24; 26; 27; 40	#	Plausible assumption: those industries using coal will have to store coal, i.e. will maintain majority of storage facilities. Mostlikely, coal power plant have by far the biggest storage. Italy splits the emissions among the relevant NACE Rev.1.1 divisions on the basis of their relative use of coal, lignite and peat. Over the period 1990 - 2005 NACE Rev.1.1 division 40 accounts for more than 50% of the uses while NACE Rev.1.1 division 23 is second (around 20%) up to 2003 and is replaced by NACE Ref.1.1 division 27 in the last two years.
05 02	Extraction, first treatment and loading of liquid	1.B.2.a	Other (please specify)			
05 02 01	*Land-based activities*	*1.B.2.a.i*	Exploration production, transport	11		
05 02 02	*Off-shore activities*	*1.B.2.a.i*	Exploration production, transport	11		
05 03	Extraction, first treatment and loading of gaseous fossil fuels	1.B.2.b	Natural gas			
05 03 01	*Land-based desulfuration*	*1.B.2.b*	Natural gas	11		
05 03 02	*Land-based activities (other than desulfuration)*	*1.B.2.b*	Natural gas	11		
05 03 03	*Off-shore activities*	*1.B.2.b*	Natural gas	11		
05 04	Liquid fuel distribution (except gasoline distribution)	1.B.2.a.v	Distribution of oil products			
05 04 01	*Marine terminals (tankers, handling and storage)*	*1.B.2.a.iv*	Refining / storage	23		
05 04 02	*Other handling and storage (including pipeline) (q)*	*1.B.2.a.iv*	Refining / storage	23; 60; 63	#	
05 05	Gasoline distribution	1.B.2.a.v	Distribution of oil products			
05 05 01	*Refinery dispatch station*	*1.B.2.a.v*	Distribution of oil products	23		It seems likely that the dispatch activity that gives rise to the emissions is not a separate transport activity but rather an ancillary activity of the refinery company.

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
05 05 02	*Transport and depots (except 05.05.03)*	*1.B.2.a.v*	Distribution of oil products	23		It seems likely that the storage activity that gives rise to the emissions is not a secondary activity but rather an ancillary activity of the refinery company. ITALY: As concerns transport, it could be a separate activity but our data do not allow us to split the emissions, so we introduced a simplyfing assumption
05 05 03	*Service stations (including refuelling of cars)*	*1.B.2.a.v*	Distribution of oil products	50		
05 06	Gas distribution network	1.B.2.b	Natural gas			
05 06 01	*Pipelines (q)*	*1.B.2.b*	Natural gas	40		
05 06 03	*Distribution networks*	*1.B.2.b*	Natural gas	40		
05 07	Geothermal energy extraction	1.B.2.a.vi	Geothermal energy extraction	40		ITALY: If there were emissions accounted for in the emission inventory, they would be placed under Nace 40. However, our Inventory does not include any emissions under this item as nature and not the process of geothermal energy extraction per se is considered to be the cause of emissions. I do not understand how households' acitvities can have a role in this process?
6	**SOLVENT AND OTHER PRODUCT USE**					
06 01	Paint application					
06 01 01	*Paint application : manufacture of automobiles*	*3.A.2*	Industrial coating application	34		
06 01 02	*Paint application : car repairing*	*3.A.2*	Industrial coating application	50		
06 01 03	*Paint application : construction and buildings **(except item 06.01.07)***	*3.A.1*	Decorative coating application	45		
06 01 04	*Paint application : domestic use (except 06.01.07)*	*3.A.1*	Decorative coating application	H. other		
06 01 05	*Paint application : coil coating*	*3.A.2*	Industrial coating application	28		
06 01 06	*Paint application : boat building*	*3.A.2*	Industrial coating application	35		
06 01 07	*Paint application : wood*	*3.A.2*	Industrial coating application	20 ; 36	#	NACE Rev.1.1 division 20 is included here as painting is part of the manufacture of wood products as well.
06 01 08	*Other industrial paint application*	*3.A.2*	Industrial coating application	21-22; 24-27; 29-35	#	This is one example of country-specific links: in principle all industrial sectors not mentioned before could be included but in practice in the Italian case the emissions arise from a limited number of sectors only.

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
06 01 09	*Other non industrial paint application*	*3.A.3*	Other coating application (Please specify the sources included/excluded in the notes column to the right)	--		
06 02	Degreasing, dry cleaning and electronics					
06 02 01	*Metal degreasing*	*3.B.1*	Degreasing	27, 28	#	
06 02 02	*Dry cleaning*	*3.B.2*	Dry cleaning	93		
06 02 03	*Electronic components manufacturing*	*3.B.1*	Degreasing	32		
06 02 04	*Other industrial cleaning*	*3.B.1*	Degreasing	--		
06 03	Chemical proucts manufacturing or processing	3.C	Chemical products, manufacture and processing			
06 03 01	*Polyester processing*	*3.C*	Chemical products, manufacture and processing	25		
06 03 02	*Polyvinylchloride processing*	*3.C*	Chemical products, manufacture and processing	25		
06 03 03	*Polyurethane processing*	*3.C*	Chemical products, manufacture and processing	25		
06 03 04	*Polystyrene foam processing (c)*	*3.C*	Chemical products, manufacture and processing	25		
06 03 05	*Rubber processing*	*3.C*	Chemical products, manufacture and processing	25		
06 03 06	*Pharmaceutical products manufacturing*	*3.C*	Chemical products, manufacture and processing	24		
06 03 07	*Paints manufacturing*	*3.C*	Chemical products, manufacture and processing	24		
06 03 08	*Inks manufacturing*	*3.C*	Chemical products, manufacture and processing	24		
06 03 09	*Glues manufacturing*	*3.C*	Chemical products, manufacture and processing	24		
06 03 10	*Asphalt blowing*	*3.C*	Chemical products, manufacture and processing	45		for the same reason applying to SNAP process 040610: asphalt production seems to be undertaken by construction industries and we found no evidence in economic data that is recorded under a different nace
06 03 11	*Adhesive, magnetic tapes, films and photographs*	*3.C*	Chemical products, manufacture and processing	24		
06 03	*Textile finishing*	*3.C*	Chemical products, manufacture	17		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
12			and processing			
06 03 13	*Leather tanning*	*3.C*	Chemical products, manufacture and processing	19		
06 03 14	*Other*	*3.C*	Chemical products, manufacture and processing	--		
06 04	Other use of solvent and related activities					
06 04 01	*Glass wool enduction*	*3.D.3*	Other product use	26		
06 04 02	*Mineral wool enduction*	*3.D.3*	Other product use	26		
06 04 03	*Printing industry*	*3.D.1*	Printing	22		
06 04 04	*Fat, edible and non edible oil extraction*	*3.D.3*	Other product use	15		
06 04 05	*Application of glues and adhesives*	*3.D.3*	Other product use	? --		This is a case in which it is advisable to know in detail how the emissions are estimated; hence contact emission experts
06 04 06	*Preservation of wood*	*3.D.3*	Other product use	20 + 36	#	Similar to SNAP 06 01 07
06 04 07	*Underseal treatment and conservation of vehicles*	*3.D.3*	Other product use	34; 35 + 50	#	Most likely NACE Rev.1.1 divisions 34 and 35 (both in production) and 50 (reparing)
06 04 08	*Domestic solvent use (other than paint application)(k)*	*3.D.2*	Domestic solvent use including fungicides	H. other		
06 04 09	*Vehicles dewaxing*	*3.D.3*	Other product use	50		case dewaxing is done by NACE Rev.1.1 code 50.2 - maintenance and repair
06 04 10	*Pharmaceutical product manufacturing (SNAP 94)*	*3.D.3*	Other product use			not included in SNAP97
06 04 11	*Domestic use of pharmaceutical products (k)*	*3.D.2*	Domestic solvent use including fungicides	H. other		
06 04 12	*Other (preservation of seeds,...)*	*3.D.3*	Other product use	? --		depends on the actual data source for this process in a specific country
06 05	Use of HFC, N_2O, NH_3, PFC and SF_6					
06 05 01	*Anaesthesia*	*3.D.3*	Other product use	85		
06 05 02	*Refrigeration and air conditioning equipments using halocarbons (e)*	*2.G*	Other (please specify in a covering note)	? --		potentially all NACE Rev.1.1 divisions, depends on the actual data source for this process in a specific country

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
06 05 03	*Refrigeration and air conditioning equipments using other products than halocarbons (e)*	*2.G*	Other (please specify in a covering note)	? --		potentially all NACE Rev.1.1 divisions, depends on the actual data source for this process in a specific country
06 05 04	*Foam blowing (except 06 03 04)*	*2.F.2*	Consumption of POPs and HMs	? --		potentially all NACE Rev.1.1 divisions, depends on the actual data source for this process in a specific country
06 05 05	*Fire extinguishers*	*2.F.2*	Consumption of POPs and HMs	? --		potentially all NACE Rev.1.1 divisions, depends on the actual data source for this process in a specific country
06 05 06	*Aerosol cans*	*2.G*	Other (please specify in a covering note)	? --		ITALY: in our case it is aerosol use in food products only
06 05 07	*Electrical equipments (except 060203)*	*2.F.6*	Consumption of POPs and HMs	? --		
06 05 08	*Other*	*2.F.6*	Consumption of POPs and HMs	? --		
7	**ROAD TRANSPORT**					
07 01	Passenger cars (r)	1.A.3.b.i	Road transport, passenger cars	H. transp + 01-99	#	
07 01 01	*Highway driving*	*1.A.3.b.i*	Road transport, passenger cars			
07 01 02	*Rural driving*	*1.A.3.b.i*	Road transport, passenger cars			
07 01 03	*Urban driving*	*1.A.3.b.i*	Road transport, passenger cars			
07 02	Light duty vehicles < 3.5 t (r)	1.A.3.b.ii	Road transport, light duty vehicles	H. transp + 01-99	#	
07 02 01	*Highway driving*	*1.A.3.b.ii*	Road transport, light duty vehicles			
07 02 02	*Rural driving*	*1.A.3.b.ii*	Road transport, light duty vehicles			
07 02 03	*Urban driving*	*1.A.3.b.ii*	Road transport, light duty vehicles			
07 03	Heavy duty vehicles > 3.5 t and buses (r)	1.A.3.b.iii	Road transport, heavy duty vehicles	H. transp + 01-99	#	
07 03 01	*Highway driving*	*1.A.3.b.iii*	Road transport, heavy duty vehicles			
07 03 02	*Rural driving*	*1.A.3.b.iii*	Road transport, heavy duty vehicles			

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	***Label***	***code***	***label***	***NACE Rev.1.1 codes***	***flag***	***notes***
07 03 03	*Urban driving*	*1.A.3.b.iii*	Road transport, heavy duty vehicles			
07 04	Mopeds and Motorcycles < 50 cm3	1.A.3.b.iv	Road transport, mopeds & motorcycles	H. transp + 01-99	#	
07 05	Motorcycles > 50 cm3	1.A.3.b.iv	Road transport, mopeds & motorcycles	H. transp + 01-99	#	
07 05 01	*Highway driving*	*1.A.3.b.iv*	Road transport, mopeds & motorcycles			
07 05 02	*Rural driving*	*1.A.3.b.iv*	Road transport, mopeds & motorcycles			
07 05 03	*Urban driving*	*1.A.3.b.iv*	Road transport, mopeds & motorcycles			
07 06	Gasoline evaporation from vehicles	1.A.3.b.v	Road transport, gasoline evaporation	H. transp + 01-99	#	
07 07	Automobile tyre and brake wear	1.A.3.b.vi	Road transport, automobile tyre and brake wear	H. transp + 01-99	#	
07 08	Automobile road abraision	1.A.3.b.vii	Road transport, automobile road abrasion	H. transp + 01-99	#	
8	**OTHER MOBILE SOURCES AND MACHINERY**					
08 01	Military	1.A.5.b	Other, mobile (including military, land based and recreational boats)	75		
08 02	Railways	1.A.3.c	Railways			
08 02 01	*Shunting locs*	*1.A.3.c*	Railways	60		It may happen, that railway vehicles are operated by other (manufacturing) industries
08 02 02	*Rail-cars*	*1.A.3.c*	Railways	60		
08 02 03	*Locomotives*	*1.A.3.c*	Railways	60		
08 03	Inland waterways	1.A.3.d.ii	National navigation			
08 03 01	*Sailing boats with auxilliary engines*	*1.A.3.d.ii*	National navigation	61		
08 03 02	*Motorboats / workboats*	*1.A.3.d.ii*	National navigation	61		
08 03 03	*Personal watercraft*	*1.A.3.d.ii*	National navigation			
08 03	*Inland goods carrying vessels*	*1.A.3.d.ii*	National navigation			

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	*Label*	*code*	*label*	*NACE Rev.1.1 codes*	*flag*	*notes*
04						
08 04	Maritime activities					
08 04 02	*National sea traffic within EMEP area*	*1.A.3.d.ii*	National navigation	61		
08 04 03	*National fishing*	*1.A.3.d.ii*	National navigation	05		
08 04 04	*International sea traffic (international bunkers)(h)*	*1.A.3.d.ii*	National navigation	61		
08 05	Air traffic					
08 05 01	*Domestic airport traffic (LTO cycles - <1000 m)*	*1.A.3.a.ii.(i) - (ii)*	Civil aviation (domestic, LTO)	62		
08 05 02	*International airport traffic (LTO cycles - <1000 m)*	*1.A.3.a.i.(i) - (ii)*	International aviation (LTO)	62		
08 05 03	*Domestic cruise traffic (>1000 m)*	*1.A.3.a.ii.(i) - (ii)*	Civil aviation (domestic, LTO)	62		
08 05 04	*International cruise traffic (>1000 m)(i)*	*1.A.3.a.i.(i) - (ii)*	International aviation (LTO)	62		
08 06	Agriculture	1.A.4.c.ii	Agriculture / Forestry / Fishing - Off-road vehicles and other machinery	01		
08 07	Forestry	1.A.4.c.ii	Agriculture / Forestry / Fishing - Off-road vehicles and other machinery	02		
08 08	Industry	*1.A.2.a - 1.A.2.f*		10-37 + 45	#	many construction related sources
08 09	Household and gardening	1.A.4.b.ii	Household and gardening (mobile)	H.transport		H. transport. The rationale for putting gardening under households' transport emissions the consistency with economic data - see 'old' compilation guide: "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) also includes 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.
08 10	Other off-road	1.A.4.c.ii	Agriculture / Forestry / Fishing - Off-road vehicles and other	? --		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	Label	code	label	NACE Rev.1.1 codes	flag	notes
			machinery			
9	WASTE TREATMENT AND DISPOSAL					
09 02	Waste incineration					
09 02 01	*Incineration of domestic or municipal wastes*	6.C.c	Municipal waste incineration (d)	90, 75	#	mainly NACE Rev.1.1 division 90! It might be that waste treatment activities are operated by municalplities (recorded under NACE Rev.1.1 division 75)
09 02 02	*Incineration of industrial wastes (except flaring)*	6.C.b	Industrial waste incineration (d)	90; 10 - 37	#	The number of large merchant incinerators of hazardous waste, operated by waste disposal contractors (NACE Rev.1.1 code 90) to receive a wide variety of wastes from different sources, is relatively small. Many industries (NACE Rev.1.1 divisions 10 to 37) have smaller hazardous/chemical waste incinerators constructed within their own site and intended for their use only. A large proportion of these handle only single streams of waste. There is little information on emissions from these smaller plants.
09 02 03	*Flaring in oil refinery*	1.B.2.c	Venting and flaring	23		
09 02 04	*Flaring in chemical industries*	6.C.b	Industrial waste incineration (d)	24		
09 02 05	*Incineration of sludges from waste water treatment*	6.C		90; 24	#	mainly NACE Rev.1.1 division 90! Maybe, chemical industry (NACE Rev.1.1 code 24 operates its own incineration plants for combusting their own waste water sludges. ITALY: possibly others (in our case data for NACE Rev.1.1 division 62 are limited to a few years only)
09 02 06	*Flaring in gas and oil extraction*	1.B.2.c		11		
09 02 07	*Incineration of hospital wastes*	6.C.a	Clinical waste incineration (d)	90; 85	#	It might be, that hospitals (NACE Rev.1.1 division 85) operate their own incineration plants
09 02 08	*Incineration of waste oil*	6.C.b	Industrial waste incineration (d)	90; 26	#	mainly NACE Rev.1.1 division 90! possibly others, e.g. cement indsutry
09 04	Solid Waste Disposal on Land					
09 04 01	*Managed Waste Disposal on Land*	6.A.1	Solid waste disposal on land	90, 75	#	mainly NACE Rev.1.1 division 90! It might be that waste treatment activities are operated by municalplities (recorded under NACE Rev.1.1 division 75)
09 04 02	*Unmanaged Waste Disposal Sites*	6.A.2	Solid waste disposal on land	90		
09 04 03	*Other*	6.A.3	Solid waste disposal on land	90, 75	#	mainly NACE Rev.1.1 division 90! It might be that waste treatment activities are are operated by municalplities (recorded under NACE Rev.1.1 division 75)
09 07	Open burning of agricultural wastes (except 10.03)	6.C.b	Industrial waste incineration (d)	01		
09 09	Cremation	6.C.d	Cremation			

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
09 09 01	*Incineration of corpses*	6.C.d	Cremation	93		
09 09 02	*Incineration of carcasses*	6.C.d	Cremation	93		
09 10	Other waste treatment					
09 10 01	*Waste water treatment in industry*	*6.B.1*	Waste-water handling	10-45; 90	#	In principle all industrial activities; ITALY: in our case a limited number of them as we know where the data come from
09 10 02	*Waste water treatment in residential/commercial sect.*	*6.B.2*	Waste-water handling	90		
09 10 03	*Sludge spreading*	*6.D*	Other waste	90 ; 01	#	ITALY: We also wondered whether Agriculture could be involved but concluded on the basis of information from some enterprises that sludge spreading is likely to be undertaken by the industry generating sludges, i.e. NACE Rev.1.1 division 90
09 10 05	*Compost production*	*6.D*	Other waste	90 ; 01	#	
09 10 06	*Biogas production*	*6.D*	Other waste	90 ; 01	#	mainly NACE Rev.1.1 division 90
09 10 07	*Latrines*	*6.B.2*	Waste-water handling	90		
09 10 08	*Other production of fuel (refuse derived fuel,...)*	*6.D*	Other waste	90		
10	**AGRICULTURE**					
10 01	Cultures with fertilizers					
10 01 01	*Permanent crops*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 01 02	*Arable land crops*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 01 03	*Rice field*	*4.C*	Rice Cultivation -	01		
10 01 04	*Market gardening*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 01 05	*Grassland*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 01 06	*Fallows*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 02	Cultures without fertilizers					

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	**Label**	**code**	**label**	**NACE Rev.1.1 codes**	**flag**	**notes**
10 02 01	*Permanent crops*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 02 02	*Arable land crops*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 02 03	*Rice field*	*4.C*	Rice Cultivation -	01		
10 02 04	*Market gardening*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 02 05	*Grassland*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 02 06	*Fallows*	*4.D.1*	Agriculture Soils - Synthetic N-fertilizers	01		
10 03	On-field burning of stubble, straw,...					
10 03 01	*Cereals*	*4.F.1*	Field burning of agricultural wastes	01		
10 03 02	*Pulse*	*4.F.2*	Field burning of agricultural wastes	01		
10 03 03	*Tuber and Root*	*4.F.3*	Field burning of agricultural wastes	01		
10 03 04	*Sugar Cane*	*4.F.4*	Field burning of agricultural wastes	01		
10 03 05	*Other*	*4.F.5*	Field burning of agricultural wastes	01		
10 04	Enteric fermentation					
10 04 01	*Dairy cows*	*4.A.1.a*	Enteric fermentation - Cattle - Dairy	01		
10 04 02	*Other cattle*	*4.A.1.b*	Enteric fermentation - Cattle - Non-Dairy	01		
10 04 03	*Ovines*	*4.A.3*	Enteric fermentation - Sheep	01		
10 04 04	*Fattening pigs*	*4.A.8*	Enteric fermentation - Swine	01		
10 04 05	*Horses*	*4.A.6*	Enteric fermentation - Horses	01		
10 04 06	*Mules and asses*	*4.A.7*	Enteric fermentation - Mules and Asses	01		
10 04 07	*Goats*	*4.A.4*	Enteric fermentation - Goats	01		
10 04	*Laying hens*	*4.A.9*	Enteric fermentation - Poultry	01		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	Label	code	label	NACE Rev.1.1 codes	flag	notes
08						
10 04 09	Broilers	4.A.9	Enteric fermentation - Poultry	01		
10 04 10	Other poultry (ducks,gooses,etc.)	4.A.9	Enteric fermentation - Poultry	01		
10 04 11	Fur animals	4.A.10	Enteric fermentation - Cattle - Non-Dairy	01		
10 04 12	Sows	4.A.8	Enteric fermentation - Swine	01		
10 04 13	Camels	4.A.5	Enteric fermentation - Camels and Llamas	01		
10 04 14	Buffalo	4.A.2	Enteric fermentation - Buffalo	01		
10 04 15	Other	4.A.10	Enteric fermentation - Cattle - Non-Dairy	01		
10 05	Manure management regarding organic compounds					
10 05 01	Dairy cows	4.B.1.a	Manure Management - Dairy cattle	01		
10 05 02	Other cattle	4.B.1.b	Manure Management - Non-dairy cattle	01		
10 05 03	Fattening pigs	4.B.8	Manure Management - Swine	01		
10 05 04	Sows	4.B.8	Manure Management - Swine	01		
10 05 05	Ovines	4.B.3	Manure Management - Sheep	01		
10 05 06	Horses	4.B.6	Manure Management - Horses	01		
10 05 07	Laying hens	4.B.9.a	Manure Management - Laying hens	01		
10 05 08	Broilers	4.B.9.b	Manure Management - Broilers	01		
10 05 09	Other poultry (ducks,gooses,etc.)	4.B.9.d	Manure Management - Other poultry	01		
10 05 10	Fur animals	4.B.13	Manure Management - Other	01		
10 05 11	Goats	4.B.4	Manure Management - Goats	01		
10 05	Mules and asses	4.B.7	Manure Management - Mules and	01		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	Label	code	label	NACE Rev.1.1 codes	flag	notes
12			asses			
10 05 13	Camels	4.B.5	Manure Management -	01		
10 05 14	Buffalo	4.B.2	Manure Management - Buffalo	01		
10 05 15	Other	4.B.13	Manure Management - Other	01		
10 06	Use of pesticides and limestone					
10 06 01	Agriculture	4.G	Agriculture - Other	01		
10 06 02	Forestry	4.G	Agriculture - Other	05		
10 06 03	Market gardening	4.G	Agriculture - Other	01		
10 06 04	Lakes	4.G	Agriculture - Other	01		
10 09	Manure management regarding nitrogen compounds					
10 09 01	Dairy cows	4.B.1.a	Manure Management - Dairy cattle	01		
10 09 02	Other cattle	4.B.1.b	Manure Management - Non-dairy cattle	01		
10 09 03	Fattening pigs	4.B.8	Manure Management - Swine	01		
10 09 04	Sows	4.B.8	Manure Management - Swine	01		
10 09 05	Sheep	4.B.3	Manure Management - Sheep	01		
10 09 06	Horses	4.B.6	Manure Management - Horses	01		
10 09 07	Laying hens	4.B.9	Manure Management - Swine	01		
10 09 08	Broilers	4.B.9	Manure Management - Swine	01		
10 09 09	Other poultry (ducks,gooses,etc.)	4.B.10	Manure Management - xxx	01		
10 09 10	Fur animals	4.B.13	Manure Management - Other	01		
10 09 11	Goats	4.B.4	Manure Management - Goats	01		

SNAP		NFR/CRF		correspondance to NACE Rev.1.1 divisions (2-digit level)		
Code	***Label***	***code***	***label***	***NACE Rev.1.1 codes***	***flag***	***notes***
10 09 12	*Mules and asses*	*4.B.7*	Manure Management - Mules and asses	01		
10 09 13	*Camels*	*4.B.5*	Manure Management -	01		
10 09 14	*Buffalo*	*4.B.2*	Manure Management - Buffalo	01		
10 09 15	*Other*	*4.B.13*	Manure Management - Other	01		
10 10	Fugitive PM sources					
10 10 01	*Particle emissions from animal husbandry*	*n.a.*		01		

Annex 2: Correspondence between 1996 IPCC source categories (CRF/NFR) and SNAP97

Source: Emission Inventory Guidebook 1 September, 1999

This correspondence table provides the allocation of 1996 IPCC source categories to SNAP 97 items.

All codes used in this correspondence table refer to :

- CORINAIR / SNAP 97 version 1.0 dated 20/03/1998
- IPCC / Greenhouse Gas Inventory / Reporting Instructions / Revised 1996 Guidelines for National Greenhouse Gas Inventories (Volume 1)

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
1	**ENERGY**		
1.A	**FUEL COMBUSTION ACTIVITIES**		
1.A.1	**Energy Industries**		
1.A.1.a	Public Electricity and Heat Production	01 01	Public power (01.01.01 to 01.01.05)
1.A.1.a	Public Electricity and Heat Production	01 01 01	Combustion plants >= 300 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 01 02	Combustion plants >= 50 and < 300 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 01 03	Combustion plants < 50 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 01 04	Gas turbines
1.A.1.a	Public Electricity and Heat Production	01 01 05	Stationary engines
1.A.1.a	Public Electricity and Heat Production	01 02	District heating plants (01.02.01 to 01.02.05)
1.A.1.a	Public Electricity and Heat Production	01 02 01	Combustion plants >= 300 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 02 02	Combustion plants >= 50 and < 300 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 02 03	Combustion plants < 50 MW (boilers)
1.A.1.a	Public Electricity and Heat Production	01 02 04	Gas turbines
1.A.1.a	Public Electricity and Heat Production	01 02 05	Stationary engines
1.A.1.b	Petroleum refining	01 03	Petroleum refining plants (01.03.01 to 01.03.06)
1.A.1.b	Petroleum refining	01 03 01	Combustion plants >= 300 MW (boilers)
1.A.1.b	Petroleum refining	01 03 02	Combustion plants >= 50 and < 300 MW (boilers)
1.A.1.b	Petroleum refining	01 03 03	Combustion plants < 50 MW (boilers)
1.A.1.b	Petroleum refining	01 03 04	Gas turbines
1.A.1.b	Petroleum refining	01 03 05	Stationary engines
1.A.1.b	Petroleum refining	01 03 06	Process furnaces
1.A.1.c	Manufacture of Solid fuels and Other Energy Industries	01 04	Solid fuel transformation plants (01.04.01 to 01.04.07)
1.A.2	**Manufacturing Industries and Construction**		
1.A.2.a	Iron and Steel	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.a	Iron and Steel	03 02 03	Blast furnace cowpers
1.A.2.a	Iron and Steel	03 03 01	Sinter and pelletizing plants
1.A.2.a	Iron and Steel	03 03 02	Reheating furnaces steel and iron
1.A.2.a	Iron and Steel	03 03 03	Gray iron foundries
1.A.2.b	Non-ferrous Metals	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.b	Non-ferrous Metals	03 03 04	Primary lead production
1.A.2.b	Non-ferrous Metals	03 03 05	Primary zinc production

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
1.A.2.b	Non-ferrous Metals	03 03 06	Primary copper production
1.A.2.b	Non-ferrous Metals	03 03 07	Secondary lead production
1.A.2.b	Non-ferrous Metals	03 03 08	Secondary zinc production
1.A.2.b	Non-ferrous Metals	03 03 09	Secondary copper production
1.A.2.b	Non-ferrous Metals	03 03 10	Secondary Aluminium production
1.A.2.b	Non-ferrous Metals	03 03 22	Alumina production
1.A.2.b	Non-ferrous Metals	03 03 23	Magnesium production (dolomite treatment)
1.A.2.b	Non-ferrous Metals	03 03 24	Nickel production (thermal process)
1.A.2.c	Chemicals	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.d	Pulp, Paper and Print	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.d	Pulp, Paper and Print	03 03 21	Paper-mill industry (drying processes)
1.A.2.e	Food Processing, Beverages and Tobacco	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 01 (a)	Manuf. indus. combust. in boilers, gas turbines and stationary engines (03.01.01 to 03.01.06)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 02 04	Plaster furnaces
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 02 05	Other furnaces
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 11	Cement (f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 12	Lime (includ. iron and steel and paper pulp industr.)(f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 13	Asphalt concrete plants
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 14	Flat glass (f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 15	Container glass (f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 16	Glass wool (except binding) (f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 17	Other glass (f)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 18	Mineral wool (except binding)
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 19	Bricks and tiles
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 20	Fine ceramic materials
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 25	Enamel production
1.A.2.f.i	Stationary combustion in manufacturing industries and construction: Other (Please specify in your IIR)	03 03 26	Other process with contact

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
1.A.2.f.ii	Mobile Combustion in manufacturing industries and construction (Please specify in your IIR)	08 08	Other mobile and machinery/Industry
1.A.3	**Transport**		
1.A.3.a	Civil Aviation	08 05	Air traffic
1.A.3.a.i	i International (b)	08 05 02	Internat. airport traffic (LTO cycles - <1000 m)
1.A.3.a.i	i International (b)	08 05 04	International cruise traffic (>1000 m)
1.A.3.a.ii	ii Domestic	08 05 01	Domestic airport traffic (LTO cycles - <1000 m)
1.A.3.a.ii	ii Domestic	08 05 03	National cruise traffic (>1000 m)
1.A.3.b	Road Transportation	07 01	Passenger cars (07.01.01 to 07.01.03)
1.A.3.b	Road Transportation	07 02	Light duty vehicles < 3.5 t (07.02.01 to 07.02.03)
1.A.3.b	Road Transportation	07 03	Heavy duty vehicles > 3.5 t and buses (07.03.01 to 07.03.03)
1.A.3.b	Road Transportation	07 04	Mopeds and Motorcycles < 50 cm3
1.A.3.b	Road Transportation	07 05	Motorcycles > 50 cm3 (07.05.01 to 07.05.03)
1.A.3.b	Road Transportation	07 06	Gasoline evaporation
1.A.3.c	Railways	08 02	Railways (08.02.01 to 08.02.03)
1.A.3.d	Navigation		
1.A.3.d.i	i International Marine (b)	08 04 04	International sea traffic (internat. bunkers)
1.A.3.d.ii	ii National navigation	08 04 02	National sea traffic within EMEP area
1.A.3.d.ii	ii National navigation	08 03	Inland waterways
1.A.3.d.ii	ii National navigation	08 03 01	Sailing boats with auxilliary engines
1.A.3.d.ii	ii National navigation	08 03 02	Motorboats / workboats
1.A.3.d.ii	ii National navigation	08 03 03	Personal watercraft
1.A.3.d.ii	ii National navigation	08 03 04	Inland goods carrying vessels
1.A.3.e	Other	08 10	Other off-road
1.A.3.e	Other	01 05 06	Pipeline compressors
1.A.4	**Other Sectors**		
1.A.4.a	Commercial / Institutional	02 01	Commercial and institutional plants (02.01.01 to 02.01.06)
1.A.4.a.i	Commercial / Institutional: stationary	02 01 01	Combustion plants >= 300 MW (boilers)
1.A.4.a.i	Commercial / Institutional: stationary	02 01 02	Combustion plants >= 50 and < 300 MW (boilers)
1.A.4.a.i	Commercial / Institutional: stationary	02 01 03	Combustion plants < 50 MW (boilers)
1.A.4.a.i	Commercial / Institutional: stationary	02 01 04	Stationary gas turbines
1.A.4.a.i	Commercial / Institutional: stationary	02 01 05	Stationary engines
1.A.4.a.i	Commercial / Institutional: stationary	02 01 06	Other stationary equipments (n)
1.A.4.b	Residential	02 02	Residential plants (02.02.01 to 02.02.05)
1.A.4.b.i	Residential: stationary	02 02 01	Combustion plants >= 50 MW (boilers)
1.A.4.b.i	Residential: stationary	02 02 02	Combustion plants < 50 MW (boilers)
1.A.4.b.i	Residential: stationary	02 02 03	Gas turbines
1.A.4.b.i	Residential: stationary	02 02 04	Stationary engines
1.A.4.b.i	Residential: stationary	02 02 05	Other equipments (stoves, fireplaces, cooking,...)
1.A.4.b.ii	Residential: mobile	08 09	Household and gardening
1.A.4.c	Agriculture / Forestry / Fishing	02 03	Plants in agriculture, forestry and aquaculture (02.03.01 to 02.03.05)
1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary	02 03 01	Combustion plants >= 50 MW (boilers)
1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary	02 03 02	Combustion plants < 50 MW (boilers)
1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary	02 03 03	Stationary gas turbines
1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary	02 03 04	Stationary engines
1.A.4.c.i	Agriculture / Forestry / Fishing - Stationary	02 03 05	Other stationary equipments (n)
1.A.4.c.iii	Agriculture / Forestry / Fishing - National fishing	08 04 03	National fishing
1.A.4.c.ii	Agriculture / Forestry / Fishing - Off-road vehicles and other machinery	08 06	Agriculture

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
1.A.4.c.ii	Agriculture / Forestry / Fishing - Off-road vehicles and other machinery	08 07	Forestry
1.A.5	**Other**		
1.A.5.a	Other, stationary (including military)	02 01	Commercial and institutional plants (02.01.01 to 02.01.06) (military only)
1.A.5.b	Other, mobile (including military, land based and recreational boats)	08 01	Military
1.B	**FUGITIVE EMISSIONS FROM FUELS**		
1.B.1	**Solid fuels**		
1.B.1.a	Coal mining and handling	05 01	Extraction and 1st treatment of solid fossil fuels (05.01.01 to 05.01.03)
1.B.1.a	Coal mining and handling	05 01 01	Open cast mining
1.B.1.a	Coal mining and handling	05 01 02	Underground mining
1.B.1.a	Coal mining and handling	05 01 03	Storage of solid fuel
1.B.1.b	Solid fuel transformation	04 02 01	Coke oven (door leakage and extinction)
1.B.1.b	Solid fuel transformation	04 02 04	Solid smokeless fuel
1.B.1.c	Other		
1.B.2	**Oil and natural gas**		
1.B.2.a	Oil	04 01	Processes in petrol. indust. (04.01.01 to 04.01.05)
1.B.2.a.iv	Refining / storage	04 01 01	Petroleum products processing
1.B.2.a.iv	Refining / storage	04 01 02	Fluid catalytic cracking - CO boiler
1.B.2.a.iv	Refining / storage	04 01 03	Sulphur recovery plants
1.B.2.a.iv	Refining / storage	04 01 04	Storage and handling of petroleum produc. in refinery
1.B.2.a.iv	Refining / storage	04 01 05	Other
1.B.2.a.i	Exploration production, transport	05 02	Extraction, 1st treatment and loading of liquid fossil fuels (05.02.01 to 05.02.02)
1.B.2.a.i	Exploration production, transport	05 02 01	Land-based activities
1.B.2.a.i	Exploration production, transport	05 02 02	Off-shore activities
1.B.2.a.iv	Refining / storage	05 04	Liquid fuel distribution (except gasoline distribution) (05.04.01 to 05.04.02)
1.B.2.a.iv	Refining / storage	05 04 01	Marine terminals (tankers, handling and storage)
1.B.2.a.iv	Refining / storage	05 04 02	Other handling and storage (including pipeline) (q)
1.B.2.a.v	Distribution of oil products	05 05	Gasoline distribution (05.05.01 to 05.05.03)
1.B.2.a.v	Distribution of oil products	05 05 01	Refinery dispatch station
1.B.2.a.v	Distribution of oil products	05 05 02	Transport and depots (except 05.05.03)
1.B.2.a.v	Distribution of oil products	05 05 03	Service stations (including refuelling of cars)
1.B.2.a.vi	Geothermal energy extraction	05 07	Geothermal energy extraction
1.B.2.b	Natural gas	05 03	Extraction, 1st treat. and loading of gaseous fossil fuels (05.03.01 to 05.03.03)
1.B.2.b	Natural gas	05 03 01	Land-based desulfuration
1.B.2.b	Natural gas	05 03 02	Land-based activities (other than desulfuration)
1.B.2.b	Natural gas	05 03 03	Off-shore activities
1.B.2.b	Natural gas	05 06	Gas distribution networks (05.06.01 to 05.06.02)
1.B.2.b	Natural gas	05 06 01	Pipelines (q)
1.B.2.b	Natural gas	05 06 03	Distribution networks
1.B.2.c	Venting and flaring	09 02 03	Flaring in oil refinery
1.B.2.c	Venting and flaring	09 02 06	Flaring in oil and gas extraction
2	**INDUSTRIAL PROCESSES**		
2.A	**MINERAL PRODUCTS**		
2.A.1	Cement Production	04 06 12	Cement (decarbonizing)
2.A.2	Lime Production	04 06 14	Lime (decarbonizing)
2.A.3	Limestone and Dolomite Use	04 06 18	Limestone and Dolomite Use

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
2.A.4	Soda Ash Production and use	04 06 19	Soda Ash Production and Use
2.A.5	Asphalt Roofing	04 06 10	Roof covering with asphalt materials
2.A.6	Road Paving with Asphalt	04 06 11	Road paving with asphalt
2.A.7	Other	04 06 13	Glass (decarbonizing)
		04 06 15	Batteries manufacturing
		04 06 16	Extraction of mineral ores
		04 06 17	Other (includ. asbestos products manufacturing)
2.B	**CHEMICAL INDUSTRY**		
2.B.1	Ammonia Production	04 04 03	Ammonia
2.B.2	Nitric Acid Production	04 04 02	Nitric acid
2.B.3	Adipic Acid Production	04 05 21	Adipic acid
2.B.4	Carbide Production	04 04 12	Calcium carbide production
2.B.5	Other	04 04 01	Sulfuric acid
		04 04 04 to 04 04 06	Ammonium sulphate / nitrate / phosphate
		04 04 07 and 04 04 08	NPK fertikisers, Urea
		04 04 09 to 04 04 11	Carbon black, Titanium dioxide, Graphite
		04 04 14	Phosphate fertilisers
		04 04 15	Storage and handling of inorganic products
		04 04 16	Other process in inorganic chemical industry
		04 05	Processes in organic chemical industry except adipic acid (04.05.01 to 04.05.20, 04.05.22 to 04.05.26 and 04.05.34)
2.C	**METAL PRODUCTION**		
2.C.1	Iron and Steel Production	04 02 02	Blast furnace charging
		04 02 03	Pig iron tapping
		04 02 05 to 04 02 10	Furnace steel plant, Rolling mills, Sinter and pelletizing plants (except combustion), Other
2.C.2	Ferroalloys Production	04 03 02	Ferro alloys
2.C.3	Aluminium production	04 03 01	Aluminium production (electrolysis)-except SF6
2.C.4	SF6 Used in Aluminium and Magnesium Foundries	03 03 10	Secondary aluminium production
		04 03 01	Aluminium production (electrolysis)-SF6 only
		04 03 04	Magnesium production - SF6 only
2.C.5	Other	04 03 03 to 04 03 05	Silicium, Magnesium, Nickel production
		04 03 06	Allied metal manufacturing
		04 03 07	Galvanizing
		04 03 08	Electroplating
		04 03 09	Other processes in non-ferrous industries
2.D	**OTHER PRODUCTION**		
2.D.1	Pulp and Paper	04 06 01	Chipboard
		04 06 02 to 04 06 04	Paper pulp
2.D.2	Food and Drink	04 06 05 to 04 06 08	Bread, Wine, Beer and spirits
2.E	**PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE**		
2.E.1	By-Product Emissions	04 08 01	Halogenated hydrocarbons production -By-products
		04 08 04	Sulphur hexafluoride production - By-products
2.E.2	Fugitive Emissions	04 08 02	Halogenated hydrocarbons production -Fugitive
		04 08 05	Sulphur hexafluoride production - Fugitive

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
2.E.3	Other	04 08 03	Halogenated hydrocarbons production -Other
		04 08 06	Sulphur hexafluoride production - Other
2.F	**CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE**		
2.F.1	Refrigeration and Air Conditioning Equipment	06 05 02	Refrigeration and air conditioning equipment using halocarbons
2.F.2	Foam Blowing	06 05 04	Foam Blowing
2.F.3	Fire Extinguishers	06 05 05	Fire Extinguishers
2.F.4	Aerosols	06 05 06	Aerosol cans
2.F.5	Solvents	06 01 to 06 04	Solvents concerning halocarbons
2.F.6	Other	06 01 to 06 04	Sources concerning SF6
		06 05 07	Electrical equipment
		06 05 08	Other
2.G	**OTHER**		
		06 05 03	Refrigeration and air conditioning equipment using other products
3	**SOLVENT AND OTHER PRODUCT USE**		
3.A	**PAINT APPLICATION**		
		06 01	Paint application (06.01.01 to 06.01.09)
3.B	DEGREASING AND DRY CLEANING		
		06 02	Degreasing, dry cleaning and electronics (06.02.01 to 06.02.04)
3.C	CHEMICAL PRODUCTS, MANUFACTURE AND PROCESSING		
		06 03	Chemical products manufacturing or processing (06.03.01 to 06.03.14)
3.D	OTHER		
		06 04	Other use of solvents and related activities (06.04.01 to 06.04.12)
		06 05 01	Anaesthesia
		06 05 08	Other except for halocarbons and SF6
4	AGRICULTURE		
4.A	ENTERIC FERMENTATION		
4.A.1	Cattle		
4.A.1.a	Dairy	10 04 01	Dairy cows
4.A.1.b	Non-Dairy	10 04 02	Other cattle
4.A.2	Buffalo	10 04 14	Buffalos
4.A.3	Sheep	10 04 03	Ovines
4.A.4	Goats	10 04 07	Goats
4.A.5	Camels and Llamas	10 04 13	Camels
4.A.6	Horses	10 04 05	Horses
4.A.7	Mules and Asses	10 04 06	Mules and asses
4.A.8	Swine	10 04 04 and 10 04 12	Fattening pigs, Sows
4.A.9	Poultry	10 04 08 to 10 04 10	Laying hens, Broilers, Other poultry
4.A.10	Other	10 04 11 and 10 04 15	Fur animals, Other animals
4.B	MANURE MANAGEMENT		
4.B.1	Cattle		
4.B.1	a Dairy	10 05 01	Manure management of organic compounds - Dairy cows

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
4.B.1.b	Non-Dairy	10 05 02	Manure management of organic compounds - Other cattle
4.B.2	Buffalo	10 05 14	Manure management of organic compounds Buffalos
4.B.3	Sheep	10 05 05	Manure management of organic compounds - Sheep
4.B.4	Goats	10 05 11	Manure management of organic compounds - Goats
4.B.5	Camels and Llamas	10 05 13	Manure management of organic compounds - Camels
4.B.6	Horses	10 05 06	Manure management of organic compounds - Horses
4.B.7	Mules and Asses	10 05 12	Manure management of organic compounds - Mules and asses
4.B.8	Swine	10 05 03 and 10 05 04	Manure management of organic compounds - Fattening pigs, Sows
4.B.9	Poultry	10 05 07 to 10 05 09	Manure management of organic compounds - Laying hens, Broilers, Other
4.B.10	Anaerobic	10 09 01	Manure management of nitrogen compounds Anaerobic
4.B.11	Liquid Systems	10 09 02	Manure management of nitrogen compounds Liquid Systems
4.B.12	Solid Storage and Dry Lot	10 09 03	Manure management of nitrogen compounds Solid Storage and Dry Lot
4.B.13	Other	10 09 04	Manure management of nitrogen compounds - Other Management
		10 05 10 and 10 05 15	Manure management of nitrogen compounds - Fur animals, Other animals
4.C	RICE CULTIVATION		
4.C.1	Irrigated	10 01 03 and 10 02 03	Rice field with/without fertilisers (c)
4.C.2	Rainfed	10 01 03 and 10 02 03	Rice field with/without fertilisers (c)
4.C.3	Deep Water	10 01 03 and 10 02 03	Rice field with/without fertilisers (c)
4.C.4	Other	10 01 03 and 10 02 03	Rice field with/without fertilisers (c)
4.D	AGRICULTURAL SOILS		
		10 01	Cultures with fertilizers except 10 01 03 (10.01.01, 10.01.02 and 10.01.04 to 10.01.06)
		10 02	Cultures without fertilizers except 10 02 03 (10.02.01, 10.02.02 and 10.02.04 to 10.02.06)
		11 05	N2O from leakage of N into Wetlands
		11 06	N2O from leakage of N into Waters
4.E	PRESCRIBED BURNING OF SAVANNAS		
			No item allocated here (not relevant for Europe)
4.F	FIELD BURNING OF AGRICULTURAL WASTES		
4.F.1	Cereals	10 03 01	Cereals
4.F.2	Pulse	10 03 02	Pulse
4.F.3	Tuber and Root	10 03 03	Tuber and Root
4.F.4	Sugar Cane	10 03 04	Sugar Cane
4.F.5	Other	10 03 05	Other

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
4.G	OTHER		
		10 06 01 to 10 06 04	Use of pesticides and limestone (except CO2)
5	LAND USE CHANGE AND FORESTRY		
5.A	CHANGES IN FOREST AND OTHER WOODY BIOMASS STOCKS		
5.A.1	Tropical Forests	11 21 01	Tropical Forests
5.A.2	Temperate Forests	11 21 02	Temperate Forests
5.A.3	Boreal Forests	11 21 03	Boreal Forests
5.A.4	Grasslands/Tundra	11 21 04	Grasslands/Tundra
5.A.5	Other	11 21 05	Other
5.B	FOREST AND GRASSLAND CONVERSION		
5.B.1	Tropical Forests	11 22 01	Tropical Forests
5.B.2	Temperate Forests	11 22 02	Temperate Forests
5.B.3	Boreal Forests	11 22 03	Boreal Forests
5.B.4	Grasslands/Tundra	11 22 04	Grasslands/Tundra
5.B.5	Other	11 22 05	Other
5.C	ABANDONMENT OF MANAGED LANDS		
5.C.1	Tropical Forests	11 23 01	Tropical Forests
5.C.2	Temperate Forests	11 23 02	Temperate Forests
5.C.3	Boreal Forests	11 23 03	Boreal Forests
5.C.4	Grasslands/Tundra	11 23 04	Grasslands/Tundra
5.C.5	Other	11 23 05	Other
5.D	CO2 Emissions and Removals from Soil		
		10 06 01 to 10 06 04	Use of pesticides and limestone (CO2 only)
		11 24	CO2 Emissions from / or removals into soils (except 10.06)
5.E	OTHER		
		11 11 04 to 11 11 17	Managed broadleaf forests
		11 12 04 to 11 12 16	Managed coniferous forests
		11 25	Other
6	WASTE		
6.A	SOLID WASTE DISPOSAL ON LAND		
6.A.1	Managed Waste disposal	09 04 01	Managed Waste disposal
6.A.2	Unmanaged Waste Disposal	09 04 02	Unmanaged Waste Disposal
6.A.3	Other	09 04 03	Other
6.B	WASTEWATER HANDLING		
6.B.1	Industrial Wastewater	09 10 01	Waste water treatment in industry
6.B.2	Domestic and Commercial Wastewater	09 10 02	Waste water treatment in residential and commercial sectors
		09 10 07	Latrines
6.B.3	Other		
6.C	WASTE INCINERATION		
		09 02 01 and 09 02 02	Incineration of municipal/industrial wastes
		09 02 04	Flaring in chemical industry
		09 02 05	Incineration of sludges from wastewater
		09 02 07	Incineration of hospital wastes
		09 02 08	Incineration of waste oil
		09 07	Open burning of agricultural wastes (not on field)
		09 09	Cremation (09.09.01 to 09.09.02)

IPCC classification		CORINAIR / SNAP classification	
Code	*Label*	*Code*	*Label*
6.D	OTHER WASTE		
		09 10 03	Sludge spreading
		09 10 05	Compost production from waste
		09 10 06	Biogas production
		09 10 08	Other production of fuel (refuse derived fuel,...)
7	OTHER		
		05 07	Geothermal energy extraction
		SNAP ITEMS NOT ALLOCATED IN IPCC	
		07 07	Automobile tyre and brake wear
		04 04 13	Chlorine
		11 01	Non-managed broadleaf forests (11.01.04 to 11.01.11 and 11.01.15 to 11.01.17)
		11 02	Non-managed coniferous forests (11.02.04 to 11.02.12 and 11.02.15 to 11.02.16)
		11 03	Forest fires (11.03.01 and 11.03.02)
		11 04	Natural grassland (11.04.01 to 11.04.05)
		11 05	Wetlands (marshes - swamps) (11.05.01 to 11.05.06) except for N2O from leakage of N into wetlands
		11 06	Waters (11.06.01 to 11.06.07) except for N2O from leakage of N into waters
		11 07	Animals (11.07.01 to 11.07.03)
		11 08	Volcanoes
		11 09	Gas seeps
		11 10	Lightning

(a) When relevant economic sector split data are available in CORINAIR/NAD module, data can be allocated to sub-categories a to f.

(b) not to be included in national totals of emission inventories, but to be reported separately

(c) Low emissions are expected for European countries and deals mainly with continuously flooded process.

Annex 3: Hierarchical classification list of economic activities as included in Eurostat's 2008-questionnaire for Air Emissions Accounts

The classification of production activities is based on NACE rev. 1.1. The latter employs the following aggregation levels and terminologies:

level	terminology	coding
Level 1	17 sections	identified by alphabetical letters A to Q
intermediate level	31 sub-sections	identified by two-character alphabetical codes
Level 2	60 divisions	identified by two-digit numerical codes (01 to 99)
Level 3	224 groups	identified by three-digit numerical codes (01.1 to 99.0)
Level 4	514 classes	identified by four-digit numerical codes (01.11 to 99.00)

Activities of private households are classified into three sub-items:

- Transport;
- Heating;
- Others

The following hierarchical classification list of economic activities as employed for Eurostat's Air Emissions Accounts comprises production activities and private household's activities.

Code	Label
A_Q 01-99	**Total industries**
A	**Agriculture, hunting and forestry**
A01	Agriculture, hunting and related service activities
A02	Forestry, logging and related service activities
B	**Fishing**
C	Mining and quarrying
CA	***Mining and quarrying of energy producing materials***
CA10	Mining of coal and lignite; extraction of peat
CA11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction excluding surveying
CA12	Mining of uranium and thorium ores
CB	***Mining and quarrying except energy producing materials***
CB13	Mining of metal ores
CB14	Other mining and quarrying
D	**Manufacturing**
DA	***Manufacture of food products; beverages and tobacco***
DA15	Manufacture of food products and beverages
DA16	Manufacture of tobacco products
DB	***Manufacture of textiles and textile products***
DB17	Manufacture of textiles
DB18	Manufacture of wearing apparel; dressing; dyeing of fur

Code	Label
DC	***Manufacture of leather and leather products***
DD	***Manufacture of wood and wood products***
DE	***Manufacture of pulp, paper and paper products; publishing and printing***
DE21	Manufacture of pulp, paper and paper products
DE22	Publishing, printing, reproduction of recorded media
DF	***Manufacture of coke, refined petroleum products and nuclear fuel***
DG	***Manufacture of chemicals, chemical products and man-made fibres***
DH	***Manufacture of rubber and plastic products***
DI	***Manufacture of other non-metallic mineral products***
DJ	***Manufacture of basic metals and fabricated metal products***
DJ27	Manufacture of basic metals
DJ28	Manufacture of fabricated metal products, except machinery and equipment
DK	***Manufacture of machinery and equipment n.e.c.***
DL	***Manufacture of electrical and optical equipment***
DL30	Manufacture of office machinery and computers
DL31	Manufacture of electrical machinery and apparatus n.e.c.
DL32	Manufacture of radio, television and communication equipment and apparatus
DL33	Manufacture of medical, precision and optical instruments, watches and clocks
DM	***Manufacture of transport equipment***
DM34	Manufacture of motor vehicles, trailers and semi-trailers
DM35	Manufacture of other transport equipment
DN	***Manufacturing n.e.c.***
DN36	Manufacture of furniture; manufacturing n.e.c.
DN37	Recycling
E	**Electricity, gas and water supply**
E40	Electricity, gas, steam and hot water supply
E41	Collection, purification and distribution of water
F	**Construction**
G	**Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods**
G50	Sale, maintenance and repair of motor vehicles
G51	Wholesale trade and commission trade, except of motor and motorcycles
G52	Retail trade, except of motor vehicles, motorcycles; repair of personal and household goods
H	**Hotels and restaurants**
I	**Transport, storage and communication**
I60	Land transport; transport via pipelines
I61	Water transport
I62	Air transport
I63	Supporting and auxiliary transport activities; activities of travel agencies
I64	Post and telecommunications
J	**Financial intermediation**
J65	Financial intermediation, except insurance and pension funding
J66	Insurance and pension funding, except compulsory social security
J67	Activities auxiliary to financial intermediation
K	**Real estate, renting and business activities**
K70	Real estate activities
K71	Renting of machinery and equipment without operator and of personal and household goods
K72	Computer and related activities
K73	Research and development
K74	Other business activities
L	**Public administration and defence; compulsory social security**
M	**Education**
N	**Health and social work**
O	**Other community, social, personal service activities**
O90	Sewage and refuse disposal, sanitation and similar activities
O91	Activities of membership organization n.e.c.

Code	Label
O92	Recreational, cultural and sporting activities
O93	Other service activities
P	**Activities of households as employers of domestic staff**
Q	**Extra-territorial organizations and bodies**

Households, totals

- Transport
- Heating
- Other

Annex 4: Country examples from Denmark for the distribution of road transport emissions over NACE rev.1.1 divisions and private households

Source: personal communication Statistics Denmark

In the following, tables are presented for the following air emissions: CO_2, N_2O, CH_4, NOx, SO_2, NH_3, CO, and NMVOC

country: DK ***air pollutant: CO_2*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.21	6.84	2.11	0.10	0.21
NACE 02	0.01	0.34	0.09	0.00	0.01
NACE 05	0.01	0.35	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.11	0.07	0.00	0.01
NACE 15	0.29	1.18	2.44	0.01	0.29
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.04	0.24	0.08	0.00	0.04
NACE 18	0.04	0.15	0.05	0.00	0.04
NACE 19	0.02	0.02	0.00	0.00	0.02
NACE 20	0.04	0.31	0.20	0.00	0.04
NACE 21	0.04	0.07	0.03	0.00	0.04
NACE 22	0.17	0.53	0.07	0.02	0.17
NACE 23	0.01	0.01	0.02	0.00	0.01
NACE 24	0.15	0.22	0.16	0.00	0.15
NACE 25	0.08	0.33	0.18	0.01	0.08
NACE 26	0.06	0.52	1.30	0.00	0.06
NACE 27	0.02	0.08	0.04	0.00	0.02
NACE 28	0.15	2.74	0.55	0.03	0.15
NACE 29	0.20	2.59	0.36	0.02	0.20
NACE 30	0.00	0.04	0.00	0.00	0.00
NACE 31	0.05	0.67	0.09	0.00	0.05
NACE 32	0.02	0.16	0.01	0.00	0.02
NACE 33	0.05	0.22	0.01	0.00	0.05
NACE 34	0.02	0.12	0.04	0.00	0.02
NACE 35	0.01	0.25	0.02	0.00	0.01
NACE 36	0.09	0.64	0.26	0.01	0.09
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	0.86	0.50	0.00	0.03
NACE 41	0.00	0.08	0.00	0.00	0.00
NACE 45	0.58	34.55	5.48	0.08	0.58
NACE 50	1.18	6.25	1.32	0.36	1.18

country: DK ***air pollutant: CO_2*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 51	2.06	9.32	6.72	0.10	2.06
NACE 52	0.37	6.02	0.93	0.05	0.37
NACE 55	0.08	1.46	0.31	0.01	0.08
NACE 60	1.11	3.05	64.75	0.04	1.11
NACE 61	0.02	0.06	0.01	0.00	0.02
NACE 62	0.02	0.07	0.02	0.00	0.02
NACE 63	0.26	1.09	2.61	0.01	0.26
NACE 64	0.16	2.25	0.32	0.00	0.16
NACE 65	0.07	0.19	0.03	0.00	0.07
NACE 66	0.03	0.02	0.00	0.00	0.03
NACE 67	0.02	0.03	0.00	0.00	0.02
NACE 70	0.16	1.78	0.31	0.05	0.16
NACE 71	0.06	0.15	0.08	0.00	0.06
NACE 72	0.29	0.59	0.03	0.03	0.29
NACE 73	0.03	0.10	0.02	0.00	0.03
NACE 74	0.88	6.38	0.82	0.13	0.88
NACE 75	0.70	2.16	1.51	0.45	0.70
NACE 80	0.24	0.59	1.00	0.60	0.24
NACE 85	0.40	2.09	1.03	0.01	0.40
NACE 90	0.03	0.28	2.68	0.00	0.03
NACE 91	0.04	0.15	0.05	0.01	0.04
NACE 92	0.15	0.61	0.57	0.02	0.15
NACE 93	0.07	0.42	0.25	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	10.81	99.35	99.63	2.17	10.81
private households	89.19	0.65	0.37	97.83	89.19
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK ***air pollutant: N_2O*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.21	7.10	2.17	0.10	0.21
NACE 02	0.01	0.36	0.09	0.00	0.01
NACE 05	0.01	0.37	0.05	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00

country: DK air pollutant: N_2O year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.11	0.07	0.00	0.01
NACE 15	0.29	1.18	2.55	0.01	0.29
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.04	0.23	0.09	0.00	0.04
NACE 18	0.04	0.15	0.05	0.00	0.04
NACE 19	0.02	0.02	0.00	0.00	0.02
NACE 20	0.04	0.31	0.21	0.00	0.04
NACE 21	0.04	0.06	0.03	0.00	0.04
NACE 22	0.17	0.47	0.07	0.02	0.17
NACE 23	0.01	0.01	0.02	0.00	0.01
NACE 24	0.15	0.21	0.16	0.00	0.15
NACE 25	0.08	0.31	0.18	0.01	0.08
NACE 26	0.06	0.54	1.36	0.00	0.06
NACE 27	0.02	0.08	0.04	0.00	0.02
NACE 28	0.16	2.79	0.57	0.03	0.16
NACE 29	0.21	2.65	0.37	0.02	0.21
NACE 30	0.00	0.04	0.00	0.00	0.00
NACE 31	0.05	0.66	0.09	0.00	0.05
NACE 32	0.02	0.16	0.01	0.00	0.02
NACE 33	0.05	0.20	0.01	0.00	0.05
NACE 34	0.02	0.11	0.05	0.00	0.02
NACE 35	0.02	0.26	0.02	0.00	0.02
NACE 36	0.09	0.62	0.27	0.01	0.09
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	0.81	0.52	0.00	0.03
NACE 41	0.00	0.07	0.00	0.00	0.00
NACE 45	0.59	35.53	5.70	0.08	0.59
NACE 50	1.19	6.14	1.34	0.36	1.19
NACE 51	2.06	9.27	7.02	0.10	2.06
NACE 52	0.37	5.74	0.96	0.05	0.37
NACE 55	0.08	1.26	0.31	0.01	0.08
NACE 60	1.15	3.22	64.08	0.04	1.15
NACE 61	0.02	0.06	0.01	0.00	0.02
NACE 62	0.02	0.06	0.02	0.00	0.02
NACE 63	0.27	1.07	2.67	0.01	0.27
NACE 64	0.16	2.28	0.34	0.00	0.16
NACE 65	0.07	0.16	0.03	0.00	0.07
NACE 66	0.03	0.01	0.00	0.00	0.03
NACE 67	0.02	0.03	0.00	0.00	0.02
NACE 70	0.16	1.72	0.31	0.05	0.16
NACE 71	0.06	0.15	0.08	0.00	0.06
NACE 72	0.29	0.52	0.03	0.03	0.29
NACE 73	0.03	0.09	0.02	0.00	0.03
NACE 74	0.89	6.05	0.82	0.13	0.89
NACE 75	0.71	2.12	1.42	0.45	0.71
NACE 80	0.24	0.54	0.87	0.60	0.24

country: DK air pollutant: N_2O year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 85	0.41	2.00	0.81	0.01	0.41
NACE 90	0.03	0.28	2.81	0.00	0.03
NACE 91	0.04	0.14	0.04	0.01	0.04
NACE 92	0.15	0.56	0.56	0.02	0.15
NACE 93	0.07	0.41	0.26	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	10.93	99.32	99.63	2.17	10.93
private households	89.07	0.68	0.37	97.83	89.07
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK air pollutant: CH_4 year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.12	5.46	2.09	0.10	0.12
NACE 02	0.01	0.24	0.09	0.00	0.01
NACE 05	0.01	0.25	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.08	0.07	0.00	0.01
NACE 15	0.27	1.18	2.44	0.01	0.27
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.03	0.31	0.08	0.00	0.03
NACE 18	0.03	0.20	0.05	0.00	0.03
NACE 19	0.01	0.02	0.00	0.00	0.01
NACE 20	0.03	0.33	0.20	0.00	0.03
NACE 21	0.04	0.11	0.03	0.00	0.04
NACE 22	0.16	0.88	0.07	0.02	0.16
NACE 23	0.01	0.02	0.02	0.00	0.01
NACE 24	0.15	0.27	0.16	0.00	0.15
NACE 25	0.07	0.42	0.18	0.01	0.07
NACE 26	0.04	0.41	1.29	0.00	0.04
NACE 27	0.02	0.09	0.04	0.00	0.02
NACE 28	0.13	2.46	0.55	0.03	0.13

country: DK ***air pollutant: CH_4*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 29	0.18	2.23	0.36	0.02	0.18
NACE 30	0.01	0.04	0.00	0.00	0.01
NACE 31	0.05	0.71	0.09	0.00	0.05
NACE 32	0.02	0.17	0.01	0.00	0.02
NACE 33	0.05	0.34	0.01	0.00	0.05
NACE 34	0.02	0.13	0.04	0.00	0.02
NACE 35	0.01	0.24	0.02	0.00	0.01
NACE 36	0.08	0.76	0.26	0.01	0.08
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	1.14	0.50	0.00	0.03
NACE 41	0.00	0.11	0.00	0.00	0.00
NACE 45	0.47	29.50	5.46	0.08	0.47
NACE 50	0.97	6.81	1.32	0.36	0.97
NACE 51	1.92	9.55	6.70	0.10	1.92
NACE 52	0.35	7.50	0.93	0.05	0.35
NACE 55	0.08	2.49	0.31	0.01	0.08
NACE 60	0.28	2.16	65.08	0.04	0.28
NACE 61	0.02	0.08	0.01	0.00	0.02
NACE 62	0.02	0.16	0.02	0.00	0.02
NACE 63	0.22	1.19	2.59	0.01	0.22
NACE 64	0.15	2.08	0.32	0.00	0.15
NACE 65	0.07	0.33	0.03	0.00	0.07
NACE 66	0.03	0.03	0.00	0.00	0.03
NACE 67	0.02	0.04	0.00	0.00	0.02
NACE 70	0.15	2.09	0.31	0.05	0.15
NACE 71	0.05	0.11	0.07	0.00	0.05
NACE 72	0.29	0.95	0.04	0.03	0.29
NACE 73	0.03	0.13	0.02	0.00	0.03
NACE 74	0.81	8.05	0.82	0.13	0.81
NACE 75	0.50	2.39	1.45	0.45	0.50
NACE 80	0.13	0.85	0.93	0.60	0.13
NACE 85	0.26	2.56	0.95	0.01	0.26
NACE 90	0.02	0.30	2.67	0.00	0.02
NACE 91	0.03	0.18	0.05	0.01	0.03
NACE 92	0.11	0.85	0.57	0.02	0.11
NACE 93	0.07	0.50	0.25	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	8.65	99.51	99.63	2.17	8.65
private households	91.35	0.49	0.37	97.83	91.35
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK air pollutant: NOx year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.17	6.66	2.09	0.10	0.17
NACE 02	0.01	0.33	0.09	0.00	0.01
NACE 05	0.01	0.34	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.10	0.07	0.00	0.01
NACE 15	0.28	1.18	2.41	0.01	0.28
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.03	0.25	0.08	0.00	0.03
NACE 18	0.03	0.16	0.05	0.00	0.03
NACE 19	0.01	0.02	0.00	0.00	0.01
NACE 20	0.04	0.32	0.19	0.00	0.04
NACE 21	0.04	0.08	0.03	0.00	0.04
NACE 22	0.17	0.58	0.07	0.02	0.17
NACE 23	0.01	0.01	0.02	0.00	0.01
NACE 24	0.15	0.22	0.16	0.00	0.15
NACE 25	0.08	0.34	0.17	0.01	0.08
NACE 26	0.05	0.51	1.28	0.00	0.05
NACE 27	0.02	0.08	0.04	0.00	0.02
NACE 28	0.15	2.71	0.54	0.03	0.15
NACE 29	0.20	2.54	0.36	0.02	0.20
NACE 30	0.01	0.04	0.00	0.00	0.01
NACE 31	0.05	0.67	0.09	0.00	0.05
NACE 32	0.02	0.16	0.01	0.00	0.02
NACE 33	0.05	0.24	0.01	0.00	0.05
NACE 34	0.02	0.12	0.04	0.00	0.02
NACE 35	0.01	0.25	0.02	0.00	0.01
NACE 36	0.08	0.66	0.26	0.01	0.08
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	0.90	0.50	0.00	0.03
NACE 41	0.00	0.08	0.00	0.00	0.00
NACE 45	0.53	33.90	5.43	0.08	0.53
NACE 50	1.09	6.32	1.33	0.36	1.09
NACE 51	2.00	9.35	6.65	0.10	2.00
NACE 52	0.36	6.21	0.93	0.05	0.36
NACE 55	0.08	1.59	0.32	0.01	0.08
NACE 60	0.75	2.93	64.94	0.04	0.75
NACE 61	0.02	0.06	0.01	0.00	0.02
NACE 62	0.02	0.08	0.02	0.00	0.02
NACE 63	0.25	1.10	2.59	0.01	0.25
NACE 64	0.15	2.23	0.32	0.00	0.15
NACE 65	0.07	0.20	0.04	0.00	0.07
NACE 66	0.03	0.02	0.00	0.00	0.03
NACE 67	0.02	0.03	0.00	0.00	0.02

country: DK **air pollutant: NOx** **year: n.s.**	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 70	0.15	1.82	0.31	0.05	0.15
NACE 71	0.05	0.14	0.07	0.00	0.05
NACE 72	0.29	0.64	0.04	0.03	0.29
NACE 73	0.03	0.10	0.02	0.00	0.03
NACE 74	0.85	6.59	0.83	0.13	0.85
NACE 75	0.61	2.19	1.51	0.45	0.61
NACE 80	0.19	0.62	1.00	0.60	0.19
NACE 85	0.34	2.15	1.07	0.01	0.34
NACE 90	0.02	0.28	2.65	0.00	0.02
NACE 91	0.04	0.15	0.05	0.01	0.04
NACE 92	0.13	0.64	0.58	0.02	0.13
NACE 93	0.07	0.43	0.25	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	9.87	99.37	99.63	2.17	9.87
private households	90.13	0.63	0.37	97.83	90.13
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK **air pollutant: SO_2** **year: n.s.**	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.21	6.83	2.13	0.10	0.21
NACE 02	0.01	0.34	0.09	0.00	0.01
NACE 05	0.01	0.35	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.11	0.07	0.00	0.01
NACE 15	0.29	1.18	2.46	0.01	0.29
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.04	0.24	0.08	0.00	0.04
NACE 18	0.04	0.15	0.05	0.00	0.04
NACE 19	0.02	0.02	0.00	0.00	0.02
NACE 20	0.04	0.31	0.20	0.00	0.04
NACE 21	0.04	0.07	0.03	0.00	0.04

country: DK ***air pollutant: SO_2*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 22	0.17	0.54	0.07	0.02	0.17
NACE 23	0.01	0.01	0.02	0.00	0.01
NACE 24	0.15	0.22	0.16	0.00	0.15
NACE 25	0.08	0.33	0.18	0.01	0.08
NACE 26	0.06	0.52	1.31	0.00	0.06
NACE 27	0.02	0.08	0.04	0.00	0.02
NACE 28	0.15	2.74	0.55	0.03	0.15
NACE 29	0.20	2.59	0.36	0.02	0.20
NACE 30	0.00	0.04	0.00	0.00	0.00
NACE 31	0.05	0.67	0.09	0.00	0.05
NACE 32	0.02	0.16	0.01	0.00	0.02
NACE 33	0.05	0.22	0.01	0.00	0.05
NACE 34	0.02	0.12	0.04	0.00	0.02
NACE 35	0.01	0.25	0.02	0.00	0.01
NACE 36	0.09	0.64	0.27	0.01	0.09
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	0.86	0.50	0.00	0.03
NACE 41	0.00	0.08	0.00	0.00	0.00
NACE 45	0.58	34.54	5.53	0.08	0.58
NACE 50	1.18	6.25	1.33	0.36	1.18
NACE 51	2.06	9.32	6.78	0.10	2.06
NACE 52	0.37	6.03	0.94	0.05	0.37
NACE 55	0.08	1.47	0.32	0.01	0.08
NACE 60	1.09	3.05	64.43	0.04	1.09
NACE 61	0.02	0.06	0.01	0.00	0.02
NACE 62	0.02	0.07	0.02	0.00	0.02
NACE 63	0.26	1.09	2.63	0.01	0.26
NACE 64	0.16	2.25	0.33	0.00	0.16
NACE 65	0.07	0.19	0.03	0.00	0.07
NACE 66	0.03	0.02	0.00	0.00	0.03
NACE 67	0.02	0.03	0.00	0.00	0.02
NACE 70	0.16	1.78	0.31	0.05	0.16
NACE 71	0.06	0.15	0.08	0.00	0.06
NACE 72	0.29	0.59	0.03	0.03	0.29
NACE 73	0.03	0.10	0.02	0.00	0.03
NACE 74	0.88	6.38	0.82	0.13	0.88
NACE 75	0.70	2.16	1.52	0.45	0.70
NACE 80	0.23	0.59	1.01	0.60	0.23
NACE 85	0.40	2.09	1.04	0.01	0.40
NACE 90	0.03	0.28	2.71	0.00	0.03
NACE 91	0.04	0.15	0.05	0.01	0.04
NACE 92	0.15	0.61	0.58	0.02	0.15
NACE 93	0.07	0.42	0.25	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	10.78	99.35	99.62	2.17	10.78
private households	89.22	0.65	0.38	97.83	89.22

country: DK air pollutant: SO_2 year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK air pollutant: NH_3 year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.11	6.49	1.99	0.10	0.11
NACE 02	0.01	0.32	0.09	0.00	0.01
NACE 05	0.01	0.33	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.10	0.07	0.00	0.01
NACE 15	0.26	1.18	2.32	0.01	0.26
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.03	0.26	0.08	0.00	0.03
NACE 18	0.03	0.17	0.04	0.00	0.03
NACE 19	0.01	0.02	0.00	0.00	0.01
NACE 20	0.03	0.32	0.19	0.00	0.03
NACE 21	0.04	0.08	0.03	0.00	0.04
NACE 22	0.16	0.62	0.06	0.02	0.16
NACE 23	0.01	0.01	0.02	0.00	0.01
NACE 24	0.15	0.23	0.15	0.00	0.15
NACE 25	0.07	0.35	0.17	0.01	0.07
NACE 26	0.04	0.49	1.23	0.00	0.04
NACE 27	0.02	0.09	0.04	0.00	0.02
NACE 28	0.13	2.68	0.52	0.03	0.13
NACE 29	0.18	2.50	0.34	0.02	0.18
NACE 30	0.01	0.04	0.00	0.00	0.01
NACE 31	0.05	0.68	0.08	0.00	0.05
NACE 32	0.02	0.16	0.01	0.00	0.02
NACE 33	0.05	0.25	0.01	0.00	0.05
NACE 34	0.02	0.12	0.04	0.00	0.02
NACE 35	0.01	0.25	0.02	0.00	0.01
NACE 36	0.08	0.67	0.25	0.01	0.08
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	0.93	0.47	0.00	0.03

country: DK ***air pollutant: NH_3*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 41	0.00	0.09	0.00	0.00	0.00
NACE 45	0.45	33.27	5.19	0.08	0.45
NACE 50	0.93	6.39	1.26	0.36	0.93
NACE 51	1.90	9.37	6.36	0.10	1.90
NACE 52	0.34	6.40	0.88	0.05	0.34
NACE 55	0.08	1.72	0.30	0.01	0.08
NACE 60	0.13	2.82	66.58	0.04	0.13
NACE 61	0.02	0.07	0.01	0.00	0.02
NACE 62	0.02	0.09	0.02	0.00	0.02
NACE 63	0.21	1.11	2.50	0.01	0.21
NACE 64	0.15	2.20	0.31	0.00	0.15
NACE 65	0.07	0.22	0.03	0.00	0.07
NACE 66	0.04	0.02	0.00	0.00	0.04
NACE 67	0.02	0.03	0.00	0.00	0.02
NACE 70	0.15	1.85	0.29	0.05	0.15
NACE 71	0.04	0.14	0.07	0.00	0.04
NACE 72	0.29	0.68	0.03	0.03	0.29
NACE 73	0.03	0.11	0.02	0.00	0.03
NACE 74	0.80	6.80	0.77	0.13	0.80
NACE 75	0.46	2.22	1.43	0.45	0.46
NACE 80	0.11	0.65	0.94	0.60	0.11
NACE 85	0.23	2.21	0.98	0.01	0.23
NACE 90	0.02	0.29	2.54	0.00	0.02
NACE 91	0.03	0.15	0.05	0.01	0.03
NACE 92	0.11	0.67	0.54	0.02	0.11
NACE 93	0.07	0.44	0.24	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	8.26	99.39	99.65	2.17	8.26
private households	91.74	0.61	0.35	97.83	91.74
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK ***air pollutant: CO*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.11	5.24	1.98	0.10	0.11

country: DK air pollutant: CO year: n.s.	SNAP group (vehicle category)				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 02	0.01	0.23	0.07	0.00	0.01
NACE 05	0.01	0.23	0.03	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.08	0.05	0.00	0.01
NACE 15	0.26	1.18	2.07	0.01	0.26
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.03	0.32	0.10	0.00	0.03
NACE 18	0.03	0.20	0.04	0.00	0.03
NACE 19	0.01	0.02	0.02	0.00	0.01
NACE 20	0.03	0.33	0.15	0.00	0.03
NACE 21	0.04	0.12	0.02	0.00	0.04
NACE 22	0.16	0.93	0.15	0.02	0.16
NACE 23	0.01	0.02	0.02	0.00	0.01
NACE 24	0.15	0.27	0.19	0.00	0.15
NACE 25	0.07	0.43	0.20	0.01	0.07
NACE 26	0.04	0.39	1.10	0.00	0.04
NACE 27	0.02	0.09	0.03	0.00	0.02
NACE 28	0.13	2.42	0.53	0.03	0.13
NACE 29	0.18	2.18	0.41	0.02	0.18
NACE 30	0.01	0.04	0.00	0.00	0.01
NACE 31	0.05	0.71	0.09	0.00	0.05
NACE 32	0.02	0.18	0.01	0.00	0.02
NACE 33	0.05	0.35	0.05	0.00	0.05
NACE 34	0.02	0.13	0.05	0.00	0.02
NACE 35	0.01	0.24	0.01	0.00	0.01
NACE 36	0.08	0.78	0.28	0.01	0.08
NACE 37	0.00	0.01	0.03	0.00	0.00
NACE 40	0.03	1.19	0.58	0.00	0.03
NACE 41	0.00	0.12	0.00	0.00	0.00
NACE 45	0.46	28.72	5.32	0.08	0.46
NACE 50	0.94	6.90	1.97	0.36	0.94
NACE 51	1.91	9.59	5.97	0.10	1.91
NACE 52	0.34	7.73	1.23	0.05	0.34
NACE 55	0.08	2.65	0.55	0.01	0.08
NACE 60	0.17	2.02	61.10	0.04	0.17
NACE 61	0.02	0.09	0.01	0.00	0.02
NACE 62	0.02	0.17	0.05	0.00	0.02
NACE 63	0.21	1.20	2.32	0.01	0.21
NACE 64	0.15	2.05	0.24	0.00	0.15
NACE 65	0.07	0.35	0.11	0.00	0.07
NACE 66	0.03	0.04	0.04	0.00	0.03
NACE 67	0.02	0.04	0.00	0.00	0.02
NACE 70	0.15	2.14	0.55	0.05	0.15
NACE 71	0.04	0.11	0.08	0.00	0.04
NACE 72	0.29	1.01	0.16	0.03	0.29
NACE 73	0.03	0.14	0.01	0.00	0.03

country: DK ***air pollutant: CO*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 74	0.80	8.31	1.62	0.13	0.80
NACE 75	0.47	2.42	2.07	0.45	0.47
NACE 80	0.11	0.89	1.48	0.60	0.11
NACE 85	0.24	2.64	2.80	0.01	0.24
NACE 90	0.02	0.30	2.16	0.00	0.02
NACE 91	0.03	0.19	0.06	0.01	0.03
NACE 92	0.11	0.89	1.18	0.02	0.11
NACE 93	0.07	0.51	0.23	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	8.36	99.54	99.58	2.17	8.36
private households	91.64	0.46	0.42	97.83	91.64
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

country: DK ***air pollutant: NMVOC*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 01	0.13	5.91	2.03	0.10	0.13
NACE 02	0.01	0.27	0.08	0.00	0.01
NACE 05	0.01	0.28	0.04	0.00	0.01
NACE 10	0.00	0.00	0.00	0.00	0.00
NACE 11	0.01	0.01	0.00	0.00	0.01
NACE 12	0.00	0.00	0.00	0.00	0.00
NACE 13	0.00	0.00	0.00	0.00	0.00
NACE 14	0.01	0.09	0.06	0.00	0.01
NACE 15	0.27	1.18	2.32	0.01	0.27
NACE 16	0.00	0.00	0.01	0.00	0.00
NACE 17	0.03	0.29	0.08	0.00	0.03
NACE 18	0.03	0.19	0.04	0.00	0.03
NACE 19	0.01	0.02	0.01	0.00	0.01
NACE 20	0.03	0.33	0.18	0.00	0.03
NACE 21	0.04	0.10	0.02	0.00	0.04
NACE 22	0.16	0.76	0.08	0.02	0.16
NACE 23	0.01	0.02	0.02	0.00	0.01
NACE 24	0.15	0.25	0.16	0.00	0.15
NACE 25	0.07	0.39	0.18	0.01	0.07

country: DK ***air pollutant: NMVOC*** ***year: n.s.***	*SNAP group (vehicle category)*				
	07 01	07 02	07 03	07 04	07 05
	Passenger cars (r)	Light duty vehicles < 3.5 t (r)	Heavy duty vehicles > 3.5 t and buses (r)	Mopeds and Motorcycles < 50 cm3	Motorcycles > 50 cm3
NACE 26	0.04	0.44	1.23	0.00	0.04
NACE 27	0.02	0.09	0.04	0.00	0.02
NACE 28	0.13	2.56	0.53	0.03	0.13
NACE 29	0.18	2.35	0.36	0.02	0.18
NACE 30	0.01	0.04	0.00	0.00	0.01
NACE 31	0.05	0.69	0.09	0.00	0.05
NACE 32	0.02	0.17	0.01	0.00	0.02
NACE 33	0.05	0.30	0.02	0.00	0.05
NACE 34	0.02	0.13	0.04	0.00	0.02
NACE 35	0.01	0.25	0.02	0.00	0.01
NACE 36	0.08	0.72	0.26	0.01	0.08
NACE 37	0.00	0.01	0.04	0.00	0.00
NACE 40	0.03	1.05	0.50	0.00	0.03
NACE 41	0.00	0.10	0.00	0.00	0.00
NACE 45	0.47	31.13	5.32	0.08	0.47
NACE 50	0.97	6.63	1.42	0.36	0.97
NACE 51	1.93	9.47	6.41	0.10	1.93
NACE 52	0.35	7.02	0.97	0.05	0.35
NACE 55	0.08	2.16	0.35	0.01	0.08
NACE 60	0.29	2.45	64.87	0.04	0.29
NACE 61	0.02	0.08	0.01	0.00	0.02
NACE 62	0.02	0.13	0.03	0.00	0.02
NACE 63	0.22	1.15	2.50	0.01	0.22
NACE 64	0.15	2.13	0.30	0.00	0.15
NACE 65	0.07	0.28	0.05	0.00	0.07
NACE 66	0.03	0.03	0.01	0.00	0.03
NACE 67	0.02	0.04	0.00	0.00	0.02
NACE 70	0.15	1.99	0.35	0.05	0.15
NACE 71	0.05	0.12	0.07	0.00	0.05
NACE 72	0.29	0.84	0.06	0.03	0.29
NACE 73	0.03	0.12	0.02	0.00	0.03
NACE 74	0.81	7.50	0.96	0.13	0.81
NACE 75	0.50	2.31	1.57	0.45	0.50
NACE 80	0.13	0.77	1.06	0.60	0.13
NACE 85	0.26	2.41	1.34	0.01	0.26
NACE 90	0.02	0.29	2.51	0.00	0.02
NACE 91	0.03	0.17	0.05	0.01	0.03
NACE 92	0.11	0.77	0.68	0.02	0.11
NACE 93	0.07	0.47	0.24	0.00	0.07
NACE 95	0.00	0.00	0.00	0.00	0.00
NACE 99	0.00	0.00	0.00	0.00	0.00
all industries	8.68	99.46	99.63	2.17	8.68
private households	91.32	0.54	0.37	97.83	91.32
total	100.00	100.00	100.00	100.00	100.00
n.s. = not specified					

Glossary

Air Emissions Accounts: Recordings of air emissions in a compatible way with National Accounts; the direct supply of air emissions by inducing economic activities (production activities of industries and activities of private households).

Air emissions: This Manual employs the term *air emission* to denote the physical flow of gaseous or particulate materials from the economic system (production or consumption processes) to the atmosphere which is part of the environmental system. Air emissions comprise emissions of greenhouse gases as well as emission of air pollutants such as e.g. SO_2, NOx, PM10 etc.

CLRTAP: UNECE/EMEP Convention on Long-range Transboundary Air Pollution. Since 1979 the Convention on Long-range Transboundary Air Pollution has addressed some of the major environmental problems of the UNECE region through scientific collaboration and policy negotiation. The Convention has been extended by eight protocols that identify specific measures to be taken by Parties to cut their emissions of air pollutants. The Convention, which now has 51 Parties, identifies the Executive Secretary of UNECE as its secretariat. The aim of the Convention is that Parties shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. Parties develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring

CORINAIR: used to be a programme to establish an inventory of emissions of air pollutants in Europe. It was initiated by the European Environment Agency Task Force and was part of the CORINE (Coordination of information on the environment) work programme set up by the European Council of Ministers in 1985. In 1995 the Agency's European Topic Centre on Air Emissions (ETC/AEM) was contracted to continue the CORINAIR programme.

CRF/NFR: Common Reporting Format / Nomenclature for Reporting: Harmonised classification for sources and removals of emissions. The CRF refers to the classification for inventories of greenhouse gases and NFR refers to the classification for inventories of air pollutants. CRF and NFR have been harmonised.

CRF Common Reporting Format: Classification of categories of emission sources and removals as defined in IPPC Guidelines for National Greenhouse Gas Inventories. The 2006 IPPC Guidelines group emissions and removals categories into five main sectors: (1) Energy, (2) Industrial Processes and Product Use (IPPU), (3) Agriculture, Forestry and Other Land Use (AFOLU), (4) Waste, and (5) Other.
The terminology for the hierarchical levels within the CRF is: (*i*) category, (*ii*) subcategory 1st order, (*iii*) subcategory 2nd order, (*iv*) subcategory 3rd order, etc.

Economic activities: comprise industry's production activities (classified according to the standard statistical classification NACE) as well as private households' activities.

EMEP (European Monitoring and Evaluation Programme): is a scientifically based and policy driven programme under the Convention on Long-range Transboundary Air Pollution for international co-operation to solve transboundary air pollution problems. The main objective of the EMEP programme is to regularly provide governments and subsidiary bodies under the CLRTAP with qualified scientific information to support the development and further evaluation of the international protocols on emission reductions negotiated within the convention.

EMEP/CORINAIR Emission Inventory Guidebook: the emission inventory guidebook prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections provides a comprehensive guide to state-of-the-art atmospheric emissions inventory methodology. Its intention is to support reporting under the UNECE/EMEP Convention on Long-range Transboundary Air Pollution and the EU National Emission Ceilings Directive.

Environmental Accounts: General term used for the statistical framework recording and presenting environmental data in a compatible and integrated way with National Accounts. The UN System of Integrated Environmental and Economic Accounts (SEEA) lays down internationally harmonised principles and methodological guidelines for Environmental Accounts.

ESA: European System of National and Regional Accounts; European version of the UN System of National Accounts. ESA95 refers to the version as of 1995.

IPCC: Intergovernmental Panel on Climate Change. The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP). The IPCC was established to provide the decision-makers and others interested in climate change with an objective source of information about climate change.

National Accounts: General term used for the statistical framework recording and presenting economic data on mainly national economy levels. International statistical standards for National Accounts are the UN System of National Accounts (SNA) and its European version ESA.

NSI: National Statistical Institutes

SEEA: UN System of Integrated Environmental and Economic Accounting. SEEA2003 refers to the 2003-version (*Handbook of National Accounting: Integrated Environmental and Economic Accounting 2003)*

SNA: UN System of National Accounts; international statistical standard for National Accounts. SNA93 refers to the version as of 1993.

SNAP (Selected Nomenclature for Air Pollution): Classification of sources of emissions of air pollutants as developed in the context of CORINAIR.

UNECE: United Nations Economic Commission for Europe. The United Nations Economic Commission for Europe (UNECE) was set up in 1947 and it is one of five regional commissions of the United Nations. Its major aim is to promote pan-European economic integration. To do so, UNECE brings together 56 countries located in the European Union, non-EU Western and Eastern Europe, South-East Europe and Commonwealth of Independent States (CIS) and North America. All these countries dialogue and cooperate under the aegis of the UNECE on economic and sectoral issues. To this end, it provides analysis, policy advice and assistance to governments; it gives focus to the United Nations global mandates in the economic field, in cooperation with other global players and key stakeholders, notably the business community. The UNECE also sets out norms, standards and conventions to facilitate international cooperation within and outside the region.

UNFCCC: United Nations Framework Convention on Climate Change. The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 192 countries having ratified. Under the Convention, governments: gather and share information on greenhouse gas emissions, national policies and best practices launch national strategies for addressing greenhouse gas emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries cooperate in preparing for adaptation to the impacts of climate change The Convention entered into force on 21 March 1994.

European Commission

Manual for Air Emissions Accounts

Luxembourg: Office for Official Publications of the European Communities

2009 — 196 pp. — 21 x 29.7 cm

ISBN 978-92-79-12205-7
ISSN 1977-0375

KS-RA-09-004-EN-N

Publications Office
Publications.europa.eu