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Air emissions by production activities and households

1990-2007

The data, produced accordingly to the Namea[1] satellite account methodology, allow to compare national accounting economic aggregates (production, value added, employment, households' consumption) with the environmental pressures generated by the various production and households' consumption activities.
The 1990-2007 time series cover nineteen pollutants: carbon dioxide (CO_2), sulphur oxides (SO_x), nitrogen oxides (NO_x), nitrous oxide (N_2O), ammonia (NH_3), methane (CH_4), carbon monoxide (CO), Non-Methane Volatile Organic Compounds (NMVOC), particulate matter (PM_{10}), fine particles (PM2,5), arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (P_b), selenium (Se) e zinc (Zn). The set of Tables include a *bridge table* that identifies the items that make up the differences between the Namea emission totals and emission totals calculated by Istituto Superiore per la Ricerca e la Protezione Ambientale (Ispra) within the framework of international conventions: United Nations Framework Convention on Climate Change (UNFCCC) and the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP).

As far as production activities are concerned, in 2007 air emissions – for the 19 pollutants listed above – were mainly generated by the following economic sectors:

- "Agriculture, Hunting And Forestry"[2], generating 42 per cent of acidification emissions[3], 25 per cent of PM_{10} and 20 per cent of $PM_{2,5}$)[4];
- "Manufacturing"[5], the main emission source for both greenhouse gases[6] (28 per cent of emissions) and particulate matter (28 per cent for PM_{10} and 27 for $PM_{2,5}$) and a significant source of emissions of potentially acidifying substances and tropospheric ozone potential[7] (respectively 18 and 24 per cent). Two specific activities of the manufacturing sector - *Manufacture of other non-metallic mineral products* and *Manufacture of basic metals* - are the main emission source for most heavy metals;
- "Electricity, gas, steam and hot water supply"[8], accounting for 26 per cent of greenhouse gas emissions and for a significant share of chromium (37 per cent) and selenium (29 per cent);
- "Transport"[9], contributing to potential acidification (13 per cent) and tropospheric ozone formation (12 per cent), to particulate matter emissions (11 and 13 per cent for PM_{10} and $PM_{2,5}$ respectively) and copper (13 per cent).
- "Sewage and refuse disposal, sanitation and similar activities"[10], mainly causing emissions of nickel (53 per cent) and cadmium (23 per cent), but also of mercury (15 per cent) and lead (14 per cent).

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[1] *National accounting matrix including environmental accounts*
[2] Section A of Nace Rev 1.1.
[3] Sulphur oxides (SOx), Nitrogen oxides (NOx), Ammonia (NH3).
[4] PM_{10} = particles of 10 micrometers or less; $PM_{2,5}$ = particles less than 2.5 micrometers in aerodynamic diameter
[5] Section D of Nace Rev 1.1.
[6] Carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4).
[7] Nitrogen oxides (NOx), methane (CH4), carbon monoxide (CO), Non-Methane Volatile Organic Compounds (NMVOC).
[8] Division 40 of Nace Rev 1.1.
[9] Divisions 60-63 of Nace Rev 1.1.
[10] Division 90 of Nace Rev 1.1.

As regards households' final consumption, in 2007 this source accounted for 37 per cent of the emissions related to tropospheric ozone formation, more than 20 per cent of particulate matter (22 per cent of PM_{10} e 25 per cent $PM_{2,5}$), 23 per cent of copper e 18 per cent of greenhouse gases[11]. The use of fuels for private transport purposes explains most of the emissions causing tropospheric ozone formation and almost entirely copper emissions. Heating is the primary cause of particulate emissions. Heating and private transport are at the root of greenhouse gases emitted by households in the same amount.

For more detailed information please refer to the Italian version

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[11] See the Tables for the share of households' emissions concerning other pollutants.

Methodology

In the National Accounting Manual "Integrated Environmental and Economic Accounting 2003" (commonly referred to as SEEA2003)[12] the term Namea (the acronym for National Accounting Matrix including Environmental Accounts) is used for Hybrid Flow Accounts. In hybrid flow accounts, national accounts in monetary terms (economic module - NAM) and flow accounts in physical units (environmental module - EA) based on common national accounts principles are presented in a common matrix presentation (hence the use of the term "hybrid")[13]. Both the economic module and the environmental module can assume different forms, depending on the purposes of the analysis and data availability:

- the **economic module** generally consists of a supply and use table, of an input-output table or of a National Account Matrix (NAM);
- the reference framework for the **environmental module** are the SEEA2003 physical flow accounts describing how natural resources and ecosystem inputs are used in the economic system and how residuals are created by the economy itself.

Figure 1 presents an example of a hybrid flow account where the economic module, represented by the shaded cells, is in the form of a monetary *supply and use* table, which presents the monetary value of products by producing industry and the use of products by industries (intermediate use) and by several final use categories such as final consumption expenditure, gross capital formation, and exports.

The first row/column pair presents the "Goods and Services account". The column presents the supply of goods and services, with the distinction between domestic industry products[14] and imports. It also records trade and transport margins charged on products and indirect taxes minus subsidies on products; they ensure that the supply and use totals match[15]. The row shows the uses of goods and services; possible uses include intermediate consumption by industries, final consumption, gross capital formation and exports. Households' consumption by purpose is singled out in order to meet one of the of the main objectives of the Namea: to show which households' consumption activities are associated to air emission.

In addition to the economic transactions in goods and services presented in the economic module, the Namea framework also includes flows other than product-flows concerning the economy-environment interface.

These additional flows mainly concern natural resources (minerals, energy resources, water and biological resources) as well as solid, liquid and gaseous residuals.

For both natural resources and residuals, the Namea framework describes the origin and the destination of the flows. As far as natural resources are concerned, the accounting framework describes the intake of natural resources by industries and households. As regards residuals, the accounting framework describes their origin/supply - production activities (industries), consumption activities (private households), capital and imports - as well as their destination/use, which includes their use as input for industries, as capital stock (residuals going to landfill) and as exports. The balance between residuals supplied by the economy and those used by the economic system itself is the quantity of residuals released to the environmental system (national or belonging to the Rest of the World). For both production activities and households, environmental pressures are allocated to

[12] The Seea2003, published by United Nations, European Commission, International Monetary Fund, Organisation for Economic Co operation and Development, World Bank is the main international reference for the analysis of the relationship between the environment and the economy in a satellite account form. See http://unstats.un.org/unsd/envaccounting/seea.asp.

[13] There is no valuation issue in hybrid accounts.

[14] Measured at basic prices. The basic price is the price receivable by the producers from the purchaser for a unit of a good or service produced as output minus any tax payable on that unit as a consequence of its production or sale (i.e. taxes on products), plus any subsidy receivable on that unit as a consequence of its production or sale (i.e. subsidies on products).

[15] Measured at purchasers' prices. The purchaser's price is the amount actually paid by the purchaser per unit of goods or service bought. It includes taxes, with VAT counting only for its non-deductible part, and the subsidies on the products are deducted. It also includes the costs of transport paid separately by the purchaser to take possession of the products at the place and time required. It does not include any added interest in the event of the granting of a loan.

whom is directly responsible for their generation (due to production or consumption processes respectively in the case of industries and households)[16]. In the specific case of air emissions, the amount of residuals used by the economic system (destination), is negligible; hence total supply equals the amount of residuals released to the environmental sphere.

In the Namea framework, the environmental module reports - in physical units - the environmental pressures generated by the economy (atmospheric emissions, direct intake of natural resources, etc.) while the economic module reports - in monetary units – the socio-economic parameters (production, value added, employment, etc.) corresponding to the economic activities (industries and households) that generate environmental pressures. In the case of industries, for each economic sector, the framework reports two joint results generated by the activity carried out: the economic values (output, value added, ….) and pressures exerted to generate the economic values themselves. As far as households are concerned, the pressures generated by various consumption activities are compared with the expenses incurred by households to purchase products whose use is at the root of the environmental pressures themselves.

Figure 1 – S*upply and use* based Namea

	Products	Industries	Final uses			Residuals
Products		Products used by industry (intermediate consumption)	Products consumed by households	Products converted to capital	Products exported	
Industries	Products made by industry					*Residuals generated by industry*
Consumption			Of which: households' consumption by purpose			*Residuals generated by households' consumption*
Capital						Residuals generated by capital
Imports	Products imported					Residuals imported
Margins	Trade and transport margins					
Net taxes on products	Taxes less subsidies on products					
Value added		*Value added by industry*				
Natural resources[17]		Natural resources used by industry	Natural resources consumed by households		Natural resources exported	
Residuals[18]		Residuals re-absorbed by industry		Residuals going to landfill	Residuals exported	

Source: based on: Seea2003 (§ 4.36)

Flows included in the Italian Namea - in italic in Figure 1 – include the emissions of 19 air pollutants caused by industries and households' consumption activities.

[16] This is the so called "production perspective", under which air emissions – e.g. due to electricity production - are entirely assigned to the producing industries and not to users.

[17] Minerals, energy resources, water and biological resources are included (SEEA §2.31).

[18] Includes solid, liquid and gaseous wastes (SEEA §2.31).

Namea data can be further processed using Input Output Analysis to give a consumption perspective, in which air emissions are re-attributed to the production chains of final products[19].

The acronym Namea is also used with reference to data tables presenting industries (by NACE classification) and households' consumption functions in the rows and economic flow data (such as e.g. gross value added and/or output) as well as environmental data (such as e.g. air emissions, natural resource intake, waste) in the columns.

Calculating air emission accounts in the Italian Namea

The main requirement of the Namea framework is that environmental data are consistent with the National Accounts principles and classifications that hold for the economic data.

Since environmental statistics used as primary data for environmental accounts are not compiled according to National accounts principles in the first place, environmental statistics need to be adjusted in order to be included in the Namea framework. In the case of the Italian Namea, whose main input is the *national emission inventory* Corinair (Coordination-Information-Air)[20], the adjustment process includes reorganising the data according to economic activities (industries and households) as well as changing the total by adding/subtracting data so that the system boundaries correspond with the system boundaries of the National Accounts.

Calculating Namea total from Corinair total

Namea emission totals do not equal the sum of all process emissions included in the national emission inventories and do not equal the emission totals of the main international agreements on emissions of air pollutants and greenhouse gases derived from national emissions inventories – namely the United Nations Framework Convention on Climate Change (UNFCCC) and the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) with reporting to UNECE/EMEP.

This is due to two main features of the Italian Namea:

1. all of the emissions caused by economic activities are relevant; this 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; second, CO_2 emissions from biomass used as fuel – which are reported only as a *memorandum item* for the international conventions but excluded from official calculation of total CO2 emissions – should be included[21];
2. consistently with economic data, Namea air emissions 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 and exclude the activities of resident units operating abroad. In practice the adjustment is needed for economic activities that engage in international transport – by road, water and air – as well as for tourism consumption. However, in the Italian case, consumption data broken down by COICOP[22] are national territory related and therefore households' transport emissions are consistent with households' transport expenditure.

Assigning process based inventory emissions to economic activities – compilation steps

In order to achieve consistency between environmental and economic data, Namea compilers need to re-arrange emission inventories' data - originally broken down according to a process-oriented

[19] See, for example, Femia - Panfili (2005), *"The Italian Namea: from national to domestic air emissions"* in Statistics and environment, Università di Messina, September 21-23, 2005, Contributed Papers, Cleup editore, Padova.

[20] The National emission inventory CORINAIR is annually updated by Ispra (Istituto Superiore per la Ricerca e la Protezione Ambientale).

[21] Data released for Italy do not include CO_2 emissions from biomass used as fuel.

[22] *Classification of Individual Consumption by Purpose.*

nomenclature[23] - according to a Nace Rev.1 based classification – as far as production-related emissions are concerned - and to the private households' consumption function classification COICOP, as regards consumption-related emissions. Two are the steps needed in order to shift from the CORINAIR process-based classification to the economic classifications, namely: 1. assessment of the qualitative link between each SNAP 97 process and Namea activities; 2. allocation of the emissions of each SNAP 97 process to the related Namea activities, identified in the previous step.

Qualitative link

Assessing which economic activities are actually responsible for the emissions of individual SNAP processes requires a full understanding on the one hand of the basic assumptions and data that are behind the inventory itself and, on the other, of the specific features of the economic module. As regards the latter, one important feature that the compiler should take into account is that according to the European System of Accounts (ESA 1995) – fully implemented in Italy with the 2005 national accounts revision – economic data for a given industry (e.g. output, value added), relate to its principal activity, to its ancillary activities and to any possible secondary activity.

Processes can be split into two groups:

- processes with one link only to the activities of the Namea classification;
- processes with multiple links to the activities of the Namea classification.

Distributing process emissions to the related Namea activities

Emissions from all processes linked to one activity only can be directly allocated to the related NAMEA activity without further calculation. Emissions from all processes linked to more than one activity - mainly combustion, transport and heating processes - have to be distributed among the corresponding NAMEA activities; to this end the most suitable data are assessed, taking into account the basic data and methods used by Ispra to produce the emission inventory estimates.

The methods applied to distribute the emissions with multiple NACE associations can be grouped into three categories:

- activity-related CORINAIR background data;
- data on emissions by fuel;
- data on full time equivalent employees.

[23] Simplified nomenclature for air pollution (Snap97).