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Environmental Indicators:
Issue Paper for the London Group Meeting in Johannesburg

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ENVIRONMENTAL INDICATORS: ISSUE PAPER FOR THE LONDON GROUP MEETING IN JOHANNESBURG

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Summary: The SEEA2003 includes many environmental indicators, but falls short of a complete list of indicators or a recommended set. This paper can be seen as a first step to develop a more coherent treatment of indicators in the revised SEEA2012. Firstly, we will discuss the purpose of indicators in general and environmental indicators in particular. Secondly, we provide an overview of all indicators which are discussed in the SEEA2003. Thirdly, a number of criteria are proposed to select a recommended set of indicators. Finally, the issues and problems related to environmental indicators in the SEEA2012 are summarized.

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1.

1. Introduction

Indicators play a key role in bridging the gap between statistics and their users. First of all, they reduce the number of measurements and parameters that normally would be required to give an exact presentation of a situation (e.g. OECD, 2003). Secondly, they simplify the communication process by which the results of measurement are provided by the user. Indicators for the environment can be used at international and national levels in state of the environmental reporting, measurement of environmental performance and reporting on progress towards sustainable development (e.g. OECD, 2003; Schoer, 2006). Indicators derived from the environmental accounts may play a key role as they are part of an integrated framework and their linkages between economic and social issues (Schoer, 2006).

The SEEA2003 includes many environmental indicators, but falls short of a complete list of indicators or a recommended set of indicators. One of the topics which will have to be discussed in the revision process of the SEEA is the role of environmental indicators within the system. This paper is a first attempt to summarize the issues which need resolution. More specifically, this paper has the following aims:

1. To summarize the environmental indicators in the SEEA2003.
2. To question whether and how a discussion on indicators should be included in SEEA2012.
3. To formulate ways of prioritizing indicators to arrive at a recommended set.
4. To propose, as an intermediate step towards a set of recommended indicators, a list of environmental themes for which indictors should be developed.
5. To summarize all issues related to environmental indicators in the SEEA.

It should be stressed that this paper is only a first attempt at resolving the aims above. We provide a number of proposals, but no definitive conclusions are drawn yet. Our paper simply serves as a basis upon which the discussion in the London Group can take place. However, we do hope that with the help en support of the other members of the London Group, we will be bring this issue to a satisfactory conclusion for the revision of SEEA .

In section 2 the topic of economic and environmental indicators is introduced. Section 3 provides a summary of the indicators which have been included in the SEEA2003. In section 4 we formulate a number of criteria which can be used to prioritize indicators. In section 5 we use these criteria to select a list of environmental-economic themes for which indicators should be developed. Finally in section 6, we summarize all the issues related to environmental indicators which need to be discussed by the London Group. In de appendices some indicators for specific subjects will be discussed.

2. Indicator basics

Indicators are quantitative parameters that can be used to illustrate and communicate complex phenomena in a simple way (e.g. EEA, 2005). They make it possible to quantify the development and progress of the phenomenon over time, and if the necessary data is available, between countries. They are often aggregates which provide summary measures for the developments in question. This makes them very useful to communicate broad developments to wider audiences.

2.1 Economic indicators

The System of National Accounts (SNA) provides a number of well known aggregate indicators, such as Gross Domestic Product (GDP), capital formation, employment, etc. which play a prominent role in economic policy and society in general. The SNA says the following of these aggregates: "The aggregates of the System--for example, value added, income, consumption and saving--are composite values which measure the result of the activity of the entire economy considered from a particular point of view. They are summary indicators and key magnitudes for purposes of macroeconomic analysis and comparisons over time and space. The SNA aims to provide a simplified but complete and detailed picture of complex economies, so the calculation of the aggregates is neither the sole nor the main purpose of national accounting. Nevertheless, summary figures are very important." (United Nations, 1993 paragraph 2.169).

In the SNA93 the indicators that can be derived from the system are usually not described in detail. There is, for example, no special section that lists the main indicators that can or should be obtained. There is also in SNA93 no recommendation of the key accounts and indicators that should be compiled.

2.2 Environmental indicators

A wide array of environmental indicators has been compiled by different international organisations and countries. For a recent overview see publications by OECD (2003), EEA (2005), and Eurostat (2006). These indicators are used for the follow-up of different strategies, as is the case with the indicators presented in Eurostat 2006 in relation to the sustainable development strategy of the European Union. In the case of the EEA and the OECD the indicators are used to follow the general agreed areas in need of monitoring. The indicators in these cases are based on data derived from areas within energy statistics, air emissions statistics etc (thus not from the environmental accounts).

In this paper we will concentrate on environmental indicators taken both from the physical and monetary aspects which are consistent with the National accounts, since this is the domain of the SEEA. The advantage of the SEEA-indicators is they

are part of a comprehensive framework that integrates relevant environmental and economic topics (see also Schoer, 2006). Accordingly, we can list the following advantages for these indicators:

- Consistency
- Completeness
- Direct linkage to economic (and social) statistics
- Provides the level of detail needed for modelled policy analyses (decomposition analyses, IO-analyses, etc.)

The comments about economic indicators made above also apply to environmental indicators in the SEEA2003: the indicators are not the sole purpose of the accounting system but nevertheless are very important summary figures. They provide information about how certain phenomena, which are related to the environment, are developing.

2.3 Levels of indicators

In general, indicators from the environmental accounts can be compiled at three different levels:

1) *Indicators for the economy as a whole*. These indicators provide information for environmental phenomenon on a national level. Examples are the total output of greenhouse gasses of the economy, the net energy consumption of the economy, the total stock value of natural resources and the total revenues from environmental taxes.

2) *Detailed indicators. Indicators* can also be compiled on a more disaggregated level, for example by sector (NACE, ISIC etc), for different environmental domains, or by region. Depending on the user purpose, these indicators can be very valuable. Examples are the total greenhouse gas emissions of the transport sector, the energy consumption of households or the groundwater usage in a certain river basin area, following the residential principle of the national accounts.

3) *Ratio indicators*. Since the environmental accounts are consistent with the national accounting system, various ratio's can be calculated. These "ratio" indicators relate the environmental indicators to all kinds of economic and social parameters, such as GDP, production, or population data. Well known indicators of this kind are resource productivity (similar to labour productivity, a key indicator in core economic analysis), the energy and CO_2-intensity, the revenues from environmental taxes as percentage of total GDP, or the waste production per capita. Table 1 provides some more examples of ratio indicators.

Table 1: Examples of ratio indicators

Ratio indicator	Definition	Units
Natural resource intensity	Use of natural resource/GDP or output	kg/euro
Energy intensity	Energy use/GDP or output	PJ/euro
Residual intensity	Residual output / GDP or output	kg/euro
Natural resource productivity	Inverse of resource intensity	euro/kg
Energy productivity	Inverse of energy intensity	euro/PJ
Residual productivity	Inverse of residual intensity	euro/kg
Natural resource use per capita	Use of natural resource/population	kg/capita
Energy use per capita	Energy use /population	PJ/capita
Residual output per capita	Use of natural resource/population	kg/capita
Environmental protection expenditure	Expenditure / GDP	%
Environmental taxes (1)	Environmental taxes/total taxes	%
Environmental taxes (2)	Environmental taxes/GDP	%
Environmental taxes (3)	Environmental taxes/emissions or energy use	euro/kg or PJ
Environmental subsidies (1)	Environmental subsidies /total subsidies	%
Environmental subsidies (2)	Environmental subsidies /GDP	%
Environmental subsidies (3)	Environmental subsidies /emissions or energy use	euro/kg or P
Eco-industries (1)	Value added of eco-industries/GDP	%
Eco-industries (2)	Output of eco-industries/total output	%
Eco-industries (3)	Employment of eco-industries/total employment	%
Eco-industries (4)	Exports of eco-industries/total exports	%

2.4 Aggregation

One of the most contentious issues in the domain of environmental indicators is the issue of aggregation. In which situation can information on environmental phenomenon be aggregated? The debate is most relevant in the measurement of environmental pressure. Basically, the debate has two views.

1. "A composite indicator for environmental pressure is feasible and valuable". The first view is that environmental pressure can be translated into a single indicator. These indicators have a natural appeal to policy makers because they provide a single unit with which the environmental pressure can be measured. It also makes it easy to relate the economy to the environment because both are represented by a single indicator. Aggregation can take place by one of two methods: choice of a common unit or weighting.

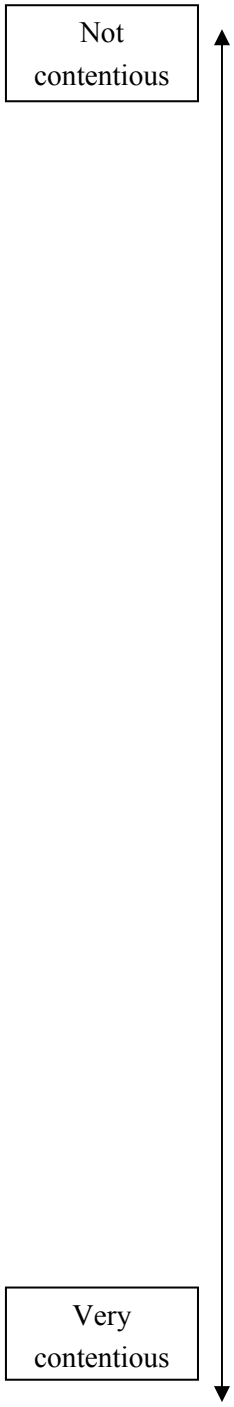
    a. *Common unit.* The SEEA includes two main approaches. The material flows accounts (MFA) use mass as a common unit to produce indicators. The indicators in chapter 9 of SEEA2003 use monetary units as a common unit of measurement to adjust the economic indicators. A well known indicator which is not mentioned in the SEEA in the ecological footprint, for which the unit is land use (Wackernagel and Rees, 1996).

    b. *Weighting schemes.* A second approach is to assign weights to various separate environmental pressures (for a variety of methods

see Nardo et all, 2005). Many of these weighting schemes are arbitrary (constant weight) or imply political preferences (Jesinghaus, 1999) which is probably why they are not named in the SEEA.

2. "A composite indicator for environmental pressure is not feasible". In this view the issues of environmental pressure is deemed to be a multidimensional phenomenon which cannot be represented by a single indicator. A certain amount of aggregation is possible, but only based on scientific relationships. The environmental theme accounts of the SEEA are created based on this principle. For example, the emissions of greenhouse gasses are aggregated according to their global warming potential.

Of course, these are the extreme viewpoints in the debate. One does not need to be a proponent of one or the other. However, in this paper we would like to stimulate the debate on this issue by proposing a "list of contentiousness". In this list we rank the aggregation methods which we have just discussed based on their scientific merits for the SEEA. We identify four levels of contentiousness:



1. Individual residuals or assets. The annexes of the SEEA provide detailed classification schemes for residuals, assets etc. If indicators are based on the most disaggregated classification schemes then the resulting indicators are scientifically robust, because aggregation is kept to minimum. This would produce a plethora of indicators which would be unable to
2. Environmental indicators based on scientific weights. Sometimes residuals contribute to the same environmental problem (or theme). In these cases aggregation can take place based on the scientific knowledge about the contribution of each residual to the environmental problem. However, problems arise if cause-effect relationships are non-linear (de Haan, 2004).

2. Composite indicators using monetary units for depletion. The methods for monetary valuation of depletion are fairly well developed. Many countries and institutes have experiences in this area. An added benefit is that there is clear link with the SNA, which also includes mineral reserves as non-financial assets.
3. Composite indicators using mass units. The relationship between mass and environmental pressure is not constant and therefore the use of mass as a unit for an environmental pressure indicator is fairly weak.

3. Composite indicators using monetary units for degradation. The methods for valuation of degradation are fairly weak. Methods for the valuation of ecosystems or climate systems are discussed in chapter 9 of the SEEA, but fall short of forming the basis of a statistical standard.
4. Composite indicators using weighting schemes. Since these are based on arbitrary or political weighting schemes they should play no part in an accounting system.

If the London Group can agree to some sort of ranking of the aggregation methods, conclusions may be drawn about the indicators in the SEEA. In this paper, we will assume that levels 1 and 2 in the above list can be recommended by the SEEA. We would propose that other indicators should either be rejected by the SEEA or categorized as “work in progress” before acceptance as a statistical standard.

3. Environmental indicators in SEEA2003

The SEEA2003 contains many suggestions for environmental indicators, but there is no systematic listing or prioritization.[2] This chapter is a first attempt to produce a comprehensive list of indicators from the SEEA2003. We have chosen to summarize the indicators based on the core accounts: physical flow accounts, asset accounts, environmental theme accounts, monetary accounts and environmentally-adjusted monetary accounts.

The physical flow accounts, which are the integrative accounting system, are discussed in Chapter 3 of the SEEA. The asset accounts (SEEA-Chapters 7 and 8) and environmental theme accounts (SEEA-Chapters 4) cover the two most important problems in the relationship between the environment and the economy: depletion and pollution/degradation respectively. The monetary accounts show the transactions in the 'regular' monetary National Accounts which are related to the environment (chapters 5 and 6). Finally, the SEEA describes a number of monetary accounts which are environmentally-adjusted (chapter 10).

All these accounts provide indicators. As is discussed in section 2, these can be totals for the whole economy, disaggregates or ratio indicators. In a sense all values in an accounting system are indicators of their own, as they measure some phenomenon which is relevant to the relation between economy and environment. However, the indicators of most interest are the summary indicators on the national scale. Table A.1. (in appendix A) is a first attempt to summarize these aggregate indicators. This table is by no means complete. Perhaps, it can be elaborated in the future with the help of the specialists for each account.[3]

The columns of table A.1. shows the dimensions for which the indicators can be disaggregated. For example, the use of natural resources can be recorded per industry per type of natural resource. The SEEA does not dictate any classification scheme, although it does include a number of suggestions in the annexes. Because of the importance of classification schemes in the production of internationally comparable environmental indicators, the categories are discussed in some detail below table A.1.[4]

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[2] Chapter 11 does discuss environmental indicators explicitly, but falls short of a systematic or complete discussion of this topic.

[3] For the sake of brevity, we have not included here ratio indicators such as intensity or productivity.

[4] Note that other satellite accounts, such as the Tourism Satellite Accounts, include detailed recommendations on classification categories.

4. Criteria for prioritization of environmental indicators

To arrive at a set of recommended indicators, it is useful to formulate criteria upon which these indicators may be chosen. In section 2 we have already discussed the issue of scientific merits of certain aggregation methods. In this section we pursue three other strategies. Firstly, we investigate the use of indicator properties to choose indicators. Secondly, we summarize the environmental indicators in indicator sets which have been developed in other institutes and working groups. Thirdly, we discuss the European Strategy on Environmental Accounts (ESEA).

4.1 Indicator properties

One way to prioritize indicators is to analyze the properties of the indicators. Many authors discuss the properties which indicators can or should have. A very comprehensive list of provided by the OECD (2003, p. 5), which we have reproduced in appendix B.

Due to time constraints we have not yet been able to judge the indicators in Table A.1 based on these (or other) criteria.

4.2 Indicator sets

Quite a few institutes and international working groups have produced indicator sets for environmental and sustainable development. Implicitly these indicator sets reveal the priorities in environmental indicators which are the result of many years of discussions. It is therefore useful for the London Group to take stock of these indicators sets. The following is a non-exhaustive list.

1. The Lisbon strategy. In March 2000, the European Council agreed in Lisbon to set a strategic goal for the EU for the next decade "of becoming the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion". A set of “structural indicators” (SI) was adopted, including a couple of environmental indicators. These are published on the Eurostat home page (http://ec.europa.eu/growthandjobs/index_en.htm).
2. Sustainable Development Indicators (SDI) of the European Union. The SDI’s were developed to monitor the Sustainable Development Strategy adopted by the European Council in June 2002 and amended in 2006. A task force of sustainable development indicators created a list of 155 indicators of which a sizeable portion are environmental.
3. Commission on Sustainable Development Indicators for Sustainable Development (CSD). The United Nations CSD also produced a set of indicators to track sustainable development (see the CSD webpage http://www.un.org/esa/sustdev/natlinfo/indicators/isd.htm).

4. OECD Environmental indicators. The OECD has produced a set of key environmental indicators (KEI) and a set of core environmental indicators (CEI) (OECD, 2003).
5. Working Group on Statistics on Sustainable Development (WGSSD). This working group was formed by the UNECE, OECD and Eurostat in 2006 to further develop a theoretical basis for statistics on sustainable development (UNECE, 2006). The approach which has been adopted is the capital approach which is related to the chapter 7-10 of the SEEA. The WGSSD has not yet produced a specific indicator set, but will do so in the course of 2007.

In table 1 we have summarized the environmental indicators from these first four indicator sets. Since each of these groups also assign different levels of importance to indicators, we have only shown the most important environmental indicators (Structural indicators: "shortlist"; SDI: Level 1 and level 2; CSD: all indicators; OECD: Key environmental indicators). Note also that very few of these indicators are from the SEEA accounting system, for example Domestic material Consumption and the newly adopted structural indicator of implicit tax rate on energy. All other indicators are based on statistics. Others for example, the indicators on greenhouse gases are based on the UNFCCC[5] reporting.

The table shows that air emissions, in particular greenhouse gasses, energy use and municipal solid waste play a prominent role in most indicator sets. In the other areas there set of recommended indicators is quite diverse.

4.3 The European Strategy for Environmental Accounting

In 2003 the SPC adopted the European strategy for environmental accounting (Eurostat, 2003)[6]. In this document the following shortlist of environmental accounts is presented that is recommended for harmonized reporting:

- Air emission and energy accounts
- Water flow accounts (water supply and use)
- Economy-wide material flow accounts
- Environmental protection expenditures and eco-industries
- Environmental taxes
- Forest timber accounts
- Subsoil assets (oil and gas)

[5] United Nations Convention for Climate Change

[6] The European strategy on environmental accounts is currently under review.

He criteria that were used to select these accounts include that there is a clear EU-level demand, that the area is a core competence of statistical offices, that statistical concepts and frameworks are established, that methods and data sources are available and that costs (in terms of person months needed) are low. The ESEA2003 can be used to prioritize for what indicators should be recommended. However, it should be recognized that the priorities may differ in EU countries relative to the global level and that the environmental accounts are generally on a more advanced level in EU countries. They may not address the specific needs of natural resource depending countries.

Conclusion on selection criteria

Summarizing, we propose the following three main criteria for compiling indicators from SEEA:

1. **Policy relevance**

   First of all, there must be a clear policy demand for the indicators. Indicators should address the politically important issues including pollution issues and issues related to natural resources and assets (OECD, 2003). The selected indicators should give a broad overview of the main environmental issues in de world and inform policy makers and the public about the progress made and to be made. In addition, the indicators should be relevant is all or at least the majority of countries in the world. Integrated indicators from SEEA are particularly useful to address the issues of sustainability (Schoer, 2006).

   We suggest that the review of indicator sets and the ESEA2003 document can be used as a starting point to determine the areas for which there is a clear policy demand.

2. **Well developed methodology of the accounts**

   Indicators can be recommended only for those accounts for which the methodology is well matured and already adopted by a number of countries. This means that the accounts from which the indicators are developed should be part of the statistical standard that is being developed (Part A of the proposed structure of the SEEA2012).

3. **Analytical soundness**

   The method by which the indicators are compiled should be theoretically well founded in technical and scientific terms. Accordingly, the methods of aggregation for the indicators should not be controversial. Only when there is common agreement on the methods on aggregation, the indicators can be expected to be accepted to be used by the community as a whole.

5. Towards a proposed set of environmental indicators

In order to include a recommended set of indicators in SEEA2012, the following steps / decisions have to be taken:

A. To decide whether to include a set of recommended indicators or not.

B. To select the environmental themes (or concerns) for which indicators can be recommended.

We propose the following shortlist of environmental themes. This is by no means meant to be a definitive list, and is meant to feed the discussion.

- Energy consumption
- Water consumption
- Emissions of greenhouse gases
- Emissions of acidifying gases
- Production and recycling of waste
- Depletion of natural resources

This selection is based on the review of indicator sets and the ESEA2003 document (see paragraph 4). Note that at this stage we have not included a theme related with environmental expenditure, environmental taxes or eco-industries, as these subjects to not appear in the indictor sets. Furthermore, it is important to know that we have excluded indicators for MFA from the list as we believe the method for aggregation is still contentious (see paragraph 2.4). The status of MFA indicators needs further discussion.

C. To decide on the aggregation issue. We have identified three methods which we deem to be acceptable for aggregation purposes: individual residual or assets, aggregation based on scientific weights and depletion-adjusted monetary values. It should be decided whether we restrict ourselves to these three methods of aggregation.

D. To propose the best indicators for each environmental theme. An important issue will also be the total number of indicators we would like to propose.

6. Issues to be discussed by the London Group

This paper is a first attempt to discuss the indicators in the SEEA in a coherent manner. Its main aim is to be a basis for further discussion by the London Group as we move forward towards the revision of the SEEA. Based on our paper a number of issues which need discussion-resolution are summarized in this section.

The role of indicators in the SEEA

The most important issue is whether indicators should obtain more explicit attention in SEEA2012. The implicit assumption of this paper is that the environmental indicators warrant more consideration that has been given in the SEEA2003. This however raises a number of questions:

- *Should indicators be given more explicit attention in the next SEEA?*
- *If so, in what way?*

  There are a number of possibilities to include a discussion on indicators in the handbook.

  A) *Position within the handbook ?*

  - Inclusion in Part I: the statistical standard
  - Inclusion in Part III: Applications and policy uses

  A possible outcome could be to define the indicators in Part I and to present a list of recommended indicators in part III.

  B) *What should be described ?*

  - Just a general description of what kind of indicators can be derived from the environmental accounts.
  - A more specific list of indicators, along the lines of table A.1. in appendix A, that can be derived from the system.
  - A recommendation of a core set of indicators that should be developed. If so, are there other ways of aiding the selection process, which have not been discussed in this paper?

Ratio indicators

Some of the important aggregated indicators for "the economy as a whole" are rather similar to environmental indicators already in existence, which are based on the territorial principle. The most obvious example is the total output of greenhouse gases, which for most countries is a few percent higher than the Kyoto figure. Other examples are the total net energy consumption or the total solid waste production.

Most policy uses are presently focused on the environmental indicators based on the territory principle. It is not to be expected that a switch will be made to indicators from the environmental accounts in the near future. There is currently a discussion going on at European level to include indicators from land accounts within the set of sustainable development indicators. However, at the moment there is a high lack of data and also of comparable data across the European Statistical System (ESS).

However, the unique feature of data from the environmental accounts is that the data are compiled according to the concepts to the National accounts. Accordingly, they can readily be combined with other economic data sources to produce data on intensity, productivity, etcetera. These indicators provide important information on the interactions between environment and economy (and other social parameters), such as addressing the issue of weak or strong decoupling. A number of these indicators have already been included in the indicators sets proposed by international organizations and working groups (see paragraph 4).

- *Should we in SEEA2012 pay extra attention to the issue of ratio indicators to illustrate the value of the environmental accounting system?*

Aggregation

The issue of aggregation was raised in section 2. In a preliminary "list on contentiousness" we identified three types of aggregation which we deemed to be acceptable for the SEEA.

- *Does the London Group agree with the "list of contentiousness" and its implications for the acceptable and unacceptable indicators?*
- *Which aggregation methods should be rejected outright?*
- *Which aggregation methods should be deemed "work in progress"?*

International dimensions

One of the most important questions in environmental economics is the issue of the shifting of pollution intensive production from rich to poor countries. Despite its importance, few indicators from the accounting systems provide information on these shifts. Only the material flow accounts have "balance of trade" indicators.

Note that it is possible to produce indicators for this phenomenon, but it requires to combine the information in the accounting systems with input-output modeling techniques[7].

- *What role is there in the SEEA for indicators which are also based on modeling?*

[7] Overviews concerning the embodied pollution in trade flows have recently appeared in *Ecological Economics* (Turner et al (forthcoming) and Wiedmann et al. (2007)).

Climate change

The discussion of the indicator sets in section 4 has shown that climate change is one of the most important environmental problems. Its prominence has been given a further boost by the recent IPCC report (IPCC, 2007), Stern review (Stern, 2006) and Al Gore's movie "An Inconvenient Truth". The SEEA2003 does not really reflect the societal and scientific importance which is given to climate change. Greenhouse gases are included in the air emissions accounts and the environmental theme accounts but many common terms are given little or no attention (adaptation, mitigation, clean development mechanism, joint implementation, emission rights). The topic of climate change almost seems to merit an account of its own, with indicators to go with it.

- *Should more attention be given to formulating indicators for climate change in the revised SEEA?*

Categorization

The discussion of the categories below in table A. of appendix A shows that the SEEA could be more explicit about its recommendation of the categories of industries, products, residuals etc have not yet been fully defined. A common categorization is very important for international comparison of indicators.

- *Should the revised SEEA further improve upon the categorization? In Part I or III ?*

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Appendix A. Preliminary list of indicators from the SEEA

Table A.1.preliminary indicators from the SEEA

Accounts/aggregate indicator	**SEEA sections / Tables**	**Units**	Industry, final demand and international trade categories	Product categories	Residual categories	Natural resource categories	Ecosystem input categories	Energy categories	Waste categories	Asset categories	Environmental theme categories
PHYSICAL FLOW ACCOUNTS											
Generic accounts											
Supply of residuals	Table 3.11	kg	X		X						
Use of natural resources	Table 3.11	kg	X			X					
Use of ecosystem inputs	Table 3.11	kg	X				X				
Specific accounts-Material Flow Accounts											
Direct Material Input (DMI)	3.198-3.208	kg									
Total Material Requirements (TMR)	3.198-3.208	kg									
Domestic Processed Output (DPO)	3.198-3.208	kg									
Total Domestic Output (TDO)	3.198-3.208	kg									
Direct Material Output (DMO)	3.198-3.208	kg									

Total Material Output (TMO)	3.198-3.208	kg									
Domestic Material Consumption (DMC)	3.198-3.208	kg									
Total Material Consumption (TMC)	3.198-3.208	kg									
Net Additions to Stock (NAS)	3.198-3.208	kg									
Physical Trade Balance (PTB)	3.198-3.208	kg									
Specific accounts-Energy accounts											
Gross domestic energy production	4.45-4.73	PJ						X			
Gross domestic energy consumption	4.45-4.73	PJ						X			
ASSET ACCOUNTS											
Generic Accounts											
Opening stocks	7.95-7.143	Monetary and physical	X							X	
Changes due to transactions	7.95-7.143	Monetary and physical	X							X	
Additions to stocks	7.95-7.143	Monetary and physical	X							X	
Deductions from stock levels	7.95-7.143	Monetary and physical	X							X	
Other changes in stock levels	7.95-7.143	Monetary and physical	X							X	
Closing stocks	7.95-7.143	Monetary and physical	X							X	
ENVIRONMENTAL PRESSURE ACCOUNTS											
Environmental pressures per themes	4.94-4.107		X								X
MONETARY ACCOUNTS											
Specific accounts- Environmental protection expenditure accounts (EPEA)											
Total environmental protection expenditure	Table 5.8	Monetary	X								X
Total environmental protection investments	Table 11.4	Monetary	X								X
Environmental taxes	Table 6.2	Monetary	X								X
Environmental fees	Table 6.2	Monetary	X								X
Environmental subsidies	Table 11.4	Monetary	X								X
Value added of eco-industries	Table 11.4	Monetary									
Output of eco-industries	Table 11.4	Monetary									

Employment in eco-industries	Table 11.4	Employment									
Exports of eco-industries	Table 11.4	Monetary									
ENVIRONMENTALLY-ADJUSTED MONETARY ACCOUNTS											
Defensive expenditure-adjusted GDP	Table 10.5	Monetary									
Defensive expenditure-adjusted NDP	Table 10.5	Monetary									
|Depletion-adjusted operating surplus	10.68-10.105	Monetary									
|Depletion-adjusted saving	10.68-10.105	Monetary									
Depletion-adjusted NDP (dpNDP)	10.152	Monetary									
|Damage -adjusted saving	10.159	Monetary									
Damage adjusted NNI (da-NNI)	10.152	Monetary									
Environmentally-adjusted GDP (ea-GDP)	10.185	Monetary									
Environmentally-adjusted NDP (ea-NDP)	10.185	Monetary									
Greened-economy GDP (ge-GDP)	10.195	Monetary									
Greened-economy NNI (ge-NNI)	10.203	Monetary									

Discussion of categories in the columns of table A.1

1) Industry, final demand and international trade categories. This shows whether the indicator can be disaggregated per industry, final demand group, imports and exports. The SEEA does not make any recommendation with respect to the industry breakdown or other categories.

2) Product categories. The SEEA provides a list of physical products based on the CPC classification scheme (Annex 3 of the SEEA, p. 521-525). Some categories, such as CPC 29 (wastes of scraps) are more aggregated than one would expect from an environmental accounting system. In chapter 3, the physical accounts distinguish 7 types of products (e.g. see Table 3.6, p. 96).

3) Residual categories. Annex 4 of the SEEA provides a list of residuals (p. 527-528). Note that these are however not harmonized with chapter 3 and 4 (e.g. see Table 3.8, p. 98 and Table 4.10, p. 153).

4) Natural resource categories. Annex 2 of the SEEA (p. 517-519) couples the SEEA asset categories to natural resources. However, it falls short of supplying a list of natural resources. In chapter 3, the physical accounts distinguish 7 types of natural resources (e.g. see Table 3.4, p. 93)

5) Ecosystem inputs. This is a specific type of resource (p. 77). In chapter 3, the physical accounts distinguish 2 types of ecosystem input (e.g. see Table 3.5, p. 94)

6) Energy categories. The SEEA does not recommend any categorization although 8 categories of energy are distinguished in Table 4.4 (p. 145). In principle, the energy categories should be linked to the product classification in Annex 3.

7) Solid waste categories. Solid waste is covered in the residual categories (Annex 4) as well as the product categories (Annex 3).

8) Asset categories. The SEEA identifies 4 general type of assets: Natural resources (EA.1); Land and surface water (EA.2); Ecosystems (EA.3); Memorandum item – Intangible environmental assets (EA.M). These 4 categories are further subdivided in Annex 1 of the SEEA (p. 511-515).

9) Environmental theme categories. The SEEA distinguishes 6 types of environmental themes in Table 4.10 (p. 153), including the recommended conversion factors.

Appendix B. List of criteria for environmental indicators (OECD, 2003)

OECD (2003) lists the following criteria for environmental indicators:

Policy relevance and utility for users

An environmental indicator should:

1. provide a representative picture of environmental conditions, pressures on the environment or society's responses;
2. be simple, easy to interpret and able to show trends over time;
3. be responsive to changes in the environment and related human activities;
4. provide a basis for international comparisons;
5. be either national in scope or applicable to regional environmental issues or national significance;
6. have a threshold or reference value against which to compare it, so that users can assess the significance of the values associated with it.

Analytical soundness

An environmental indicator should:

7. be theoretically well founded in technical and scientific terms;
8. be based on international standards and international consensus about its validity;
9. lend itself to being linked to economic models, forecasting and information systems.

Measurability

The data required to support the indicator should be:

10. readily available or made available at a reasonable cost/benefit ratio;
11. adequately documented and of known quality;
12. updated at regular intervals in accordance with reliable procedures.

Appendix C. Environmental indicators from indicator sets

Table C.1. Environmental indicators from indicator sets

AREA	STRUCTURAL INDICATORS (EC)	SUSTAINABLE DEVELOPMENT INDICATORS (EC)	INDICATORS FOR SUSTAINABLE DEVELOPMENT (CSD)	OECD KEY ENVIRONMENTAL INDICATORS
Air emissions	Greenhouse gas emissions Urban air quality	Total greenhouse gas emissions Greenhouse gas emissions by sector Greenhouse gas emissions from transport CO2 emissions per capita in the EU and in developing countries Weighted emissions of acidifying substances, by sector Weighted emissions of ozone precursors, by sector Emissions of ozone precursors from road transport	Emissions of Greenhouse Gases Ambient Concentration of Air Pollutants in Urban Areas Consumption of Ozone Depleting Substances	CO2 and greenhouse gas emission intensities SOx and NOx emission intensities Ozone depleting substances
Energy	Energy intensity of the economy Implicit tax rate on energy	Gross inland energy consumption, by fuel Energy intensity of the economy Final energy consumption, by sector Gross electricity generation, by fuel used in power-stations Electricity consumption by households	Annual Energy Consumption per Capita Share of Consumption of Renewable Energy Resources Intensity of Energy Use	Intensity of energy use
Waste		Municipal waste generated	Generation of Industrial and Municipal Solid Waste Generation of Hazardous Waste Management of Radioactive Waste Waste Recycling and Reuse	Municipal waste generation intensities

Natural resources, biodiversity, land use		Population index of farmland birds Fish catches taken from stocks outside safe biological limits Built-up areas Area under agri-environmental support Livestock density index	Arable and Permanent Crop Land Area Use of Fertilizers Use of Agricultural Pesticides Forest Area as a Percent of Land Area Wood Harvesting Intensity Land Affected by Desertification Area of Urban Formal and Informal Settlements Annual Catch by Major Species Area of Selected Key Ecosystems Protected Area as a % of Total Area Abundance of Selected Key Species	Intensity of use of forest resources Intensity of use of fish resources Threatened species
Water		Groundwater abstraction	Algae Concentration in Coastal Waters Percent of Total Population Living in Coastal Areas Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water BOD in Water Bodies Concentration of Faecal Coliform in Freshwater	Waste water treatment connection rates Intensity of use of water resources
Material flow accounts		Domestic material consumption EU imports of material from developing countries, by group of products	Intensity of Material Use	
Other	Volume of inland transport (tonne-km and passenger-km) relative to GDP	Enterprises with an environmental management system Sales of selected Fair trade labelled products		

Appendix D. Indicators for energy

Energy products are special in a sense that the different products can be aggregated depending on their energy content. Accordingly, indicators can be produced for the total energy production or energy usage of an economy. At present, energy accounts are not well described in SEEA2003, and also no information on indictors that can be derived from the accounts is available.

Energy accounts describe the supply and use of energy within the economy. The energy accounts can be compiled on three different levels, namely a) gross energy accounts, b) net energy accounts, c) emission related energy accounts. From each set of energy accounts indicators can be derived.

1. Gross energy accounts

De gross energy accounts are supply and use tables for energy products compiled according to the concepts of the National accounts. For each energy product (and thus also the total of all the energy products) the following relationship is valid:

Imports + domestic production + stock changes = intermediate consumption + final consumption by households + exports

The gross energy accounts have the following characteristics:

- Compiled according to the resident principle
- Internal use of energy is not part of the energy consumption (= energy consumption of products produced within the same company unit)
- Direct link with the monetary accounts
- Includes energy consumption for energetic and non-energetic purposes
- Gives total energy production and total energy use by industry
- Both physical and monetary accounts (which are consistent)
- Double counting (as energy products are converted into other energy products)
- Imports and exports according to the special trade system

From the gross energy accounts the following indicators can be derived:

- **Total gross domestic energy production (physical and monetary):** total domestic energy production for the whole economy.
- **Total gross domestic energy consumption: (physical and monetary):** total domestic energy production for the whole economy.
- **Average price of energy produced:** total energy produced (monetary) divided by total energy produced (physical)
- **Average price of energy consumed:** total energy consumed (monetary) divided by total energy consumed (physical)

Note: the total gross energy production and total gross energy consumption as an indicator for the whole economy is probably of less interest because of the double counting. In addition, the average prices for energy are of more interest on the more disaggregated level (for example the average energy price for households) than for the total economy. **The gross energy accounts are thus more suitable for analysis on a disaggregated level than for the compilation of (economy-wide) indicators.**

2. Net energy accounts

The net energy accounts consist of (net) supply and (net) use tables for energy products. In contrast to the gross energy accounts, only the final use of energy and conversion losses are taken into account on the use side of the tables (plus exports). On the supply side only domestic extraction of energy is taken into account plus imports and not the production of secondary energy products. Accordingly, only for the total of all energy products the following relationship is valid:

Imports + domestic production + stock changes = intermediate consumption + final consumption + exports

The net energy accounts have the following characteristics:

- Compiled according to the resident principle
- Internal use of energy is part of the energy consumption (= energy consumption of products produced within the same company unit)
- No direct link with monetary accounts : only physical accounts
- Includes energy consumption for energetic and non-energetic purposes
- Gives total energy production and total energy use by industry
- No double counting (net energy use and net energy supply)
- Imports and exports according to the special trade system

For the difference between gross energy and net energy see Table D.1.

PJ	Gross energy use	Net energy use	Net energy use for energetic purpose	Net energy use for non- energetic pu	Conversion losses
Agriculture, forestry and fishing	187,8	194,5	194	0,5	0
Mining and quarrying	248,4	56,3	56,1	0	0,2
Manufacture of petroleum products	2699,7	190,3	125,8	0,3	64,2
Manufacture of basic chemicals and man-made fibres	1189,1	730,9	369,1	338	23,8
Manufacture of basic metals	175,7	143,5	51,9	77,2	14,3
Other manufacturing	283,9	291	274	7,5	9,5
Electricity, gas and water supply	776,3	381,1	28,1	0	353
Construction	32,3	32,3	19,8	12,5	0
Trade, hotels, restaurants and repair	198,9	122,4	120,9	1,5	0
Transport, storage and communication	397,3	397,3	394	3,3	0
Financial and business activities	85,2	85,2	85,2	0	0
General government	70	70	69,3	0,7	0
Care and other service activities	101,1	143,1	102,9	0	40,1
Households	677,7	677,7	676,8	0,9	0
Total	**7123,5**	**3515,7**	**2568,1**	**442,5**	**505,1**

Table D.1: The gross and net energy use for the Netherlands (2003). The net energy use can be split into use for energetic and non-energetic purposes and conversion energy.

From the net energy accounts the following aggregated indicators can be derived:

- **Total domestic energy extraction:** equals the domestic extraction of all primary energy products (renewable and non-renewable).
- **Total energy requirement of the economy:** equals imports of energy products + domestic energy extraction This is also equal to the total net energy consumption + exports of energy products
- **Total net energy consumption:** equals the total net energy consumption of the economy: final energy use + conversion losses
- **Percentage of renewable energy consumption:** Renewable energy consumption as percentage of the total net energy consumption

In addition the following important ratio indicators can be calculated:

- **Total energy intensity for the economy:** equals total net energy consumption / GDP
- **Total energy consumption per capita:** equals total net energy consumption / total population

3. Emission relevant energy accounts

The emission relevant energy accounts register only energy consumption that is directly coupled to the emission of harmful gasses like CO_2, SO_2, NOx etc. Therefore, the following energy consumption is excluded:

- Consumption of “clean” energy products like wind, solar, and nuclear energy
- Consumption of electricity, hot water and steam
- Consumption of energy for non-energetic purposes (for example the production of plastics).

These accounts consist of an energy use table only.

Appendix E: indicators for water (extract from the draft "The Integrated environmental and economic accounting for water resources handbook" (UN, 2006, see Annex III)).

Water accounting has developed more recently than environmental statistics and associated water indicators, but water accounting provides a much more powerful tool for improved water management. Many water indicators can be derived from the water accounts and, in contrast to water indicators and statistics, water accounts also provide data in a structured framework linked to economic accounts that can be used much more effectively for quantitative analysis.

1. Indicators derived from the water accounts

As a broad concept rather than a technical methodology, IWRM (integrated water resources management) does not adopt a particular set of indicators. However, the indicators derived from the water accounts cover many critical aspects of water management under an IWRM approach such as:

- Water resource availability
- Water use for human activities, pressure on water resources and opportunities to increase water efficiency
- Opportunities to increase effective supply through management of return flows, reuse, and system losses
- Water cost and pricing policy: the user-pays and polluter-pays principles
- Access to and affordability of water and sanitation services

The major indicators for each of these aspects of water management are discussed below. Although not shown explicitly, it should be understood that most of the indicators can be compiled not only at the national level, but at the regional level, such as for a river basin. The indicators can also be disaggregated by type of resource, for example, surface and groundwater. While a national overview is important, they will be more useful for IWRM if compiled at the level at which IWRM is likely to be implemented, the regional level, for a river basin or other water management area.

Water resource availability

Table 1 provides a list of indicators on the status of water resources in the environment and indicators on the pressure exerted by human activities. The first five indicators in this table assess water availability from a simple environmental perspective, the natural volume available. These indicators differentiate between domestic water resources and resources that originate externally because water managers must distinguish water resources that are entirely under national control (internal water resources) from those which must be shared with other countries. Indicators on the status of water resources in the environment can be used to assess and monitor water resources in a territory and compare them with those of other territories. These indicators allow for the evaluation of some natural characteristics - climatic, geographic and topographic – of a region. It is important to look at these indicators in addition to those on pressure caused by human activities in order to link water demand with water supply from the environment.

Table E. 1: Selected indicators of water resource availability and pressure on water derived from the water accounts

Internal renewable water resources	Average annual flow of rivers an recharge of groundwater generated from endogenous precipitation
External renewable water resources	Part of the country's renewable water resources shared with neighbouring countries
Total natural renewable water resources	The sum of the internal and external renewable water resources
Total actual renewable water resources	The sum of the internal and external renewable water resources, corrected for the flows reserved to upstream and downstream countries through foram and informal agreements
Dependency ratio	Ratio between the external and total natural renewable water resources
Exploitable water resources	Part of the water resources available for development
Per capita renewable resources	Ratio between total renewable water resources and population size
Density of internal resources	Ratio between the average internal flow and area of the territory
Annual withdrawel of groud- and surface water	Rotal abstraction of ground and surface water as a percentage of the toal annually renewable volume of freshwater
Consumption index	Ratio between water consumption and total renewable water resources

Water use for human activities

Water availability indicators provide policy-makers with a picture of water availability and stress, but in order to address water problems and prioritize actions, more detailed information is needed about how water is used in an economy and the incentives facing water users, the environmental impacts of water use and pollution, and the social aspects of water use. IWRM calls for treating water as an economic good, which takes into account the value of water in different uses, the costs of water pollution from economic activities, as well as the broader socio-economic benefits generated by use of water by different economic activities. Table III. 2 presents examples of indicators that can be derived from the supply and use tables

Table E. 2: Selected indicators of water intensity and water productivity

1. water use and pollution intesity (physical units)
m3 water / unit of physical output
Tons on pollution / unit physical output
2. water use and pollution intesity (monetary units)
m3 water / value of output
Tons on pollution / value of output
3. Water productivity ratios
GDP/ m3 water
Value added by sector / m3 water
4 water pollutivity ratios
sector share of pollution / sector share of GDP

Opportunities to increase effective water supply: return flows, reuse and system losses

Water supply and water productivity are not determined solely by natural conditions. The way that water is managed affects the amount of water that can be utilized by end-users and the productivity of water. Ways in which water availability and productivity can be increased include:

- Increase use of return flows by directing water to storage or other uses and minimizing pollution and salinity of return flows.
- Increase reuse of water
- Reduce system losses from leakages and other causes;

IWRM focuses strongly on these measures to increase effective supply of water. Indicators that could be derived from the water accounts for return flows, reuse, and losses are listed in Table III. 3.

Table E. 3: Indicators of opportunities to increase effective water supply

1. Return flows	
Quantity of return flows by source	
2. Water resuse	
Reuse of water as share of total industry water use	
Recycled water as share of total water use by sector	
3. Losses	
Losses in abstraction and treatment as share of toal water production	
Unaccounted for losses as share of total water use	

Water cost, pricing and incentives for conservation

IWRM notes that the provision of water and sanitation services must be financially sustainable, taking into account the costs of supplying water relative to the revenues generated by water tariffs. Table III. 4 presents examples of indicators that can be derived from the hybrid accounts in Chapter 5.

Table E. 4: Indicators for costs and price of water and wastewater treatment services

1. Cost and price of water	
Implicit water price	Volume of water purchased divided by supply cost
Average water price per m3 by industry	Volume of water purchased divided by actual payments
verage supply cost per m3 by industry	Volume of water purchased divided by cost of supply to that industry
subsidy per m3 by industry	Average water price minus average water supply cost
2. Cost and price of wastewater treatment services	
Implicit wastewater treatment price	Volume of water treated divided by supply cost
Average wastewater treatment price per m3 by industry	Volume of wastewater divided by treatment cost
average wastewater treatment cost per m3 by industry	Volume of wastewater divided by actual payments for treatment
subsidy per m3 by industry	Average wastewater price minus average wastewater supply cost

Appendix F: Indicators for residuals

Physical flow accounts for residuals show the origin and destination of different types of pollutants. The origin table distinguishes between residuals originating from consumers, producers and other sources. The destination table shows if the pollutants are readsorbed by the economy or end up in the environment.

Indicators for residual flows may be derived from the residual accounts at different levels, namely the gross emissions by residents, the net emissions by residents, and the net accumulation on the national territory.

Gross emissions by residents

The gross emissions by residents is equal to the total of the origin table (Table). This indicator represents the total output of residuals caused by economic activities. A problem with this aggregate is that it may be subject to double counting. For example, waste generated by households and companies is collected and processed by the waste disposal industries. This industry also produces waste such as slacks and other residues which cannot be processed any further. So, this wasteproduct is double counted in the accounts.

Table 3. Net emissions by residents and net accumulation on national territory, 2005.

	NO_x	SO_2	NH_3	P	N
	mln kg				
Emissions by consumers	66	1	9	13	125
Emissions by producers	518	149	126	58	597
Emissions by other sources	0	0	0	3	-6
Gross emissions by residents	584	150	135	74	716
Absorption by producers (-)	0	0	0	21	116
Net emissions by residents	**584**	**150**	**135**	**53**	**600**
Emission transfers from the ROW	203	133	24	16	342
Emission transfers to the ROW	575	126	71	15	483
Net accumulation on national territory	**212**	**157**	**88**	**54**	**459**

Source: Statistics Netherlands, 2006

Net emissions by residents

To prevent double counting, the gross emission by residents can be corrected by subtracting the amount of residuals that is reabsorbed by the economy (see Table). For example, most of the solid waste produced by economic activities is recycled or burned in waste incineration plants. Only a small part of the waste is and contributes to the environmental burden. So, the net emission by residents gives a better indication for pressure on the environment. The correction

for absorption by the economy only plays a role for emissions to water or the production of solid waste, and not for emissions to air as these are always directly emitted into the atmosphere.

Net accumulation on the national territory

When considering regional environmental problems the net emissions by residents is in some cases not an appropriate indicator. For example, the SO_2 emitted by seagoing vessels will not contribute to local air pollution problems. This can be corrected for by subtracting the emissions caused by residents abroad and adding the emissions caused by non-residents on the national territory. However, it should be noted that these aggregate indicators are no longer are consistent with National accounts definitions (resident principle) and can also simply be derived from the environmental statistics.

In addition, the net emissions by residents can be corrected by trans-boundary emissions not caused by economic activities. These are for example the deposition of pollutants transported from abroad by air or the influx of water pollutants by rivers. For some environmental problems, such as acidification, these inputs from abroad may have an important contribution. By correcting for the import and export of these emissions, a better estimate can be made. A mayor problem, however, is that in practice no data or inaccurate data is available for the trans-boundary flows of residuals. For example, the trans-boundary flows of acidifying substances have to be calculated by models. The outflows of rivers into the sea are often difficult to measure due to tidal movements. Often, the correction for these trans-boundary emissions has a significant effect, which makes them unsuitable for the compilation of a reliable indicator.

Environmental theme indicators

Pollutants may contribute to a different extent to certain environmental problems or *environmental themes*. For example, the emission of one kilogram methane contributes much more to the greenhouse effect than the emission of one kilogram of carbon dioxide. The environmental themes were introduced by De Haan *et al.* (1994) to surpass the measurement problems related to the impacts of environmental degradation. The themes-oriented representation of environmental pressures is particularly useful for the formulation of policy goals with respect to these pressures. The environmental themes establish a link between pressures on the environment and its state. They reflect the mechanisms by which specific pressures are related to particular environmental damages. A direct link is often difficult to establish. For example, in the case where the environmental damage manifests itself only if a specific threshold is exceeded.

In order to compare the influence of different pollutions to an environmental theme, the emissions of the pollutants are converted into so called theme-equivalents. The conversion factors used to calculate the theme-equivalents depend on the relative harmfulness or toxicity of the different substances. The different environmental themes and their conversion factors are listed in Table F.1.

Table F.1: Environmental themes for residuals.

Compartment	environmental theme	Theme equivalents	Conversion factors
Air	Greenhouse effect	CO2-equivalents	CO2: 1 CH4: 21 N2O: 310 F-gasses: various high converion fact
	Ozone layer depletion	CFK-12 equivalents	
	Acidification	Acidification-equivalents	NOx: 0,217 SO2; 0,313 NH3; 0,588
	Tropospheric ozone formation	TOFP-equivalents	NOx: 1,22 NMVOS: 1,0 CO: 0,11 CH4: 0,014
Water ansd soil	Eutrophication	Eutrophucation equivalents	N: 1 P: 10
	Dispersion of heavy metals	heavy metal equivalents	Zinc: 0,0333 Lead: 0,04 Chromium: 0,04 Arsenic: 0,1 Copper: 0,333 Cadmium: 5 Mercury: 33
Waste	Non hazardous waste	kg	-
	Hazardous waste	kg	-

The residual accounts contain two environmental themes that address global environmental problems: the greenhouse effect and ozone layer depletion. The greenhouse-effect theme relates to the danger of climate change caused by a concentration of greenhouse gases in the atmosphere. The greenhouse gases include carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). The ozone-layer-depletion theme relates to the potential negative effects of a higher exposure to UV-B radiation caused by chlorofluorocarbons (CFCs) and halons. These substances are sometimes also regarded as greenhouse gases, but the evidence is mixed. The resulting aggregated theme-indicators for the greenhouse effect and ozone layer depletion reflect the contribution of residents to these global environmental problems.

The other themes relate to internal environmental problems that are caused by the accumulation of pollution on the national territory. The acidification theme relates to the damage caused by the deposition of nitrogen oxides (NO_x), sulphur oxides (SO_2) and ammonia (NH_3) in soil and surface water. The eutrophication theme relates to the problem of accumulating nitrogen (N) and phosphorus (P) in soils and subsequently in groundwater and surface water. Acidification and eutrophication are serious threats, for example they endanger ecosystems and the quality of drinking water. Tropospheric ozone formation is caused by the emission of nitrogen oxides (NO_x), non methane volatile organic substances (NMVOS), carbon monoxide (CO) and methane (CH_4). Ozone formation contribution to local air pollution (smog formation) and constitutes a serious health problem. The accumulation of waste is a serious environmental problem as well. This theme is restricted to waste consisting of products that have lost their economic use. This kind of waste can be measured in kilograms (a distinction can be made

between hazardous and non hazardous waste). The composite theme-indicators for acidification, eutrophication, ozone formation and waste are estimates of the accumulation of the relevant substances in the natural environment.

Appendix G: Indicators for monetary accounts

In chapter 5 of SEEA2003 the expenses connected with environmental protection are identified within the present SNA. It describes the variety of environmental protection and resource use activities, such as investments in clean technologies, restoring the environmental after it has been polluted, recycling, the production of environmental goods and services etc. In chapter 6 other monetary transactions connected with the environment are described, such as environmental taxes and subsidies.

These chapters provide little information what key indicators can be derived from these accounts. In chapter 11 (11.51) of SEEA2003 a summary is given of the main information for policy makers that can be extracted from these accounts:

- An overview of the magnitude of environment protection expenditures and economic instruments in the economy.
- How environmental protection expenditure is related to specific production activities and environmental concerns.
- Whether the costs are incurred by the public or private sector, by industries (and if so which) or by households.
- The extent to which environmental taxes match the environmental burden caused by each industry.
- How important the environment protection industry is to the economy in terms of, for example, employment.

Table G.1 lists some of the important indicators for monetary transactions accounts:

Aggregated level	Combined indicator	Disaggregated level
Expenditure and investments		
Total environmental protection expenditure	as percenatge of GDP	environmental domains, NACE
Total environmental protection investments	as percenatge of total investments	environmental domains, NACE
Net environmental burden of companies		environmental domains, NACE
Taxes and subsidies		
Total green taxes	as percentage of total taxes as percentage of GDP per total emissions/energy consumption	Energy, transport, resource and pollution taxes, NACE
Total environmental fees	as percentage of total taxes as percentage of GDP per total emissions/energy consumption	Environmental domains, NACE
Total environmental subsidies	as percentage of total subsidies as percentage of GDP per total emissions/energy consumption	Energy, transport, resource and pollution taxes, NACE
Eco-industries		
Total value added	as percentage of GDP	pollution management/resource management; NACE
Total production	as percentage of total production	pollution management/resource management; NACE
Total employment	as percentage of total employment	pollution management/resource management; NACE
Total exports	as percentage of total exports	pollution management/resource management; NACE

See also Table 11.4 in SEEA2003.