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## **Classification of physical flows: Part II**

**SEEA-2003 revision issue paper for the 13<sup>th</sup> London Group  
meeting in Brussels, September/October 2008**

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## **Introduction**

1. The physical flows accounts in the SEEA 2003 describe flows within the economy as well as those between the economy and the natural environment. Four different types of flows are distinguished: natural resources, eco-system inputs, products and residuals. The recommended classifications underlying the physical flow accounts should be tuned to the various types of physical supply and use tables such as those for the subsystems on energy, water and materials. In order to guarantee compatibility between the subsystems and to support meaningful international comparisons between similar subsystems, a consistent scheme of classifications for the physical flow accounts in the SEEA is being required.
2. The SEEA follows, as far as possible, the basic concepts and classifications as presented in the SNA. As a result, physical flows can be linked to the monetary flows in the national accounts. In this way, environmental indicators on resource inputs and residual outputs can be directly compared to national accounts indicators on value added, employment etc.
3. Guidelines for the SEEA subsystems have been developed or are currently being compiled. For water accounts, the SEEAW was published in 2007. Currently the SEEA-MFA and the SEEA-Energy are being developed. It will be essential that all SEEA classifications of physical flows match the classification developed for the subsystems. Each of these subsystems must be mutual consistent. This is particular relevant for those flow categories that are presented in two or more subsystems (e.g. physical energy carriers).

## **Outcomes previous LG meeting**

4. The first paper on classification of physical flows was presented in the LG meeting in Rome 2007. The discussion of the paper resulted in the following outcomes:
  - The London Group endorsed the recommendation in the paper to develop separate classifications for three main flow categories: materials (MFA); water; and energy with different kind of accounting units (respectively kilograms, cubic metres and joules). It was recommended that overlaps between these three subsystems should be consistently classified to the extent possible.
  - The London Group suggested that in addition to the flow classifications, supplementary classifications by purpose should be developed. These classifications would allow to specify how materials (e.g. packaging), water (e.g. cooling) and energy products

(e.g. for energy or non-energy purpose) are used, which is crucial for a better understanding and quantification of environmental impacts.

### **Objectives of this paper**

Issues that will be considered:

- 1) The presentation of physical flows in three subsystems (materials, energy and water) that are mutual compatible with the help of one consistent classifications scheme.
- 2) Flow classifications can to a large extent be developed independently for each subsystem. However, overlaps between those systems require specific attention. Classifications by purpose can be a tool to identify overlaps between the subsystems.
- 3) Industrial classifications for each subsystem should be harmonised to the extent possible. This for the purpose of broad indicator comparisons.

Issues that will not be considered

- 1) Detailed classifications for each subsystem. Their development is part of the work on SEEA-MFA, SEEA-Energy and the future reviews of the SEEA-Water.

### **A complete system of physical flow accounts**

5. Each main category of physical flows, water, energy and materials, has its own requirements with regard to developing classifications. A comprehensive economy-wide presentation of energy relies, among other things, on one meaningful accounting unit, i.e. joules. Water flow accounts are generally expressed in cubic meters and material flows in kilograms. In the last LG meeting it was, therefore, recommended to have at least three types of physical supply and use subsystems in the SEEA: one for material flows (resource inputs, product throughputs and residual outputs), one for energy and one for water. These three subsystems, in the form of supply and use tables, are the basis of physical flow accounts in the SEEA.
6. It is important that subsystems are compatible with each other and with the monetary national accounts data. Compatible accounts will guarantee comparable economic and environmental indicators. Additionally, compatible accounts allow the compilation of indicators that combine different accounts (e.g. energy supply in joules per kg material or water use

in m3 per euro output). In order to compare subsystems with each other some leading principles that should be followed are presented below.

## **Main principles**

### *Industrial branches*

7. Each subsystem should be set up with compatible industrial branches. Activity classification should be according to the standard international industrial classification (ISIC).
8. Each subsystem has activities that are particularly relevant for its own system but might not be relevant to the other subsystems. For example, in the energy accounts, industrial branches that supply and use large quantities of energy carriers are of interest. These branches, however, may be of less interest in the water accounts.
9. In order to achieve compatible industrial branches between the subsystems two options are proposed. Firstly, each individual subsystem incorporates the classifications at the level of detail that is required in at least one of the three subsystems. This means, for example, that the industrial branches in the energy accounts that are relevant with regard to energy flows must also appear in the MFA and water accounts. Secondly, industrial branches are classified according to the greatest common divisor. That is, a level aggregation is determined that is common in all three subsystems. Thus, the industrial classification of each subsystem is at its required level of detail but can be aggregated to a level that appears in all three subsystems.

### *Products*

10. The products are classified according to a number of international and national standards. The Central Product Classification (CPC) was introduced by the 1993 SNA. In 2008 an updated draft of the CPC 2 was introduced. In order to ensure international comparability and coherence with the SNA, the CPC should be used in the SEEA as the basis for the classification of physical product flows. In this way compatible monetary and physical supply and use tables can be set up.

### *Water*

11. The SEEA-Water guidebook provides a standard for harmonized water accounts and builds on the methodologies presented in the SEEA 2003. The revised SEEA should adopt the classification used in the SEEAW. In table 1 a schematic presentation of the classification used in the SEEAW is given.

**Table 1: Categories of water flows and their purpose classification.**

		Water accounts 3) cubic metres									
		Surface water	Ground water	Soil water	Collection of precipitation	Sea water	Reused water	Waste water	Desalinated water	Tap water	Losses in water distribution
Resources	Hydroelectric power generation	■									
	Abstraction for own use										
	Irrigation water		■	■	■		■				
	Mine water		■	■							
	Urban run off	■	■								
	Cooling water		■	■			■	■			
	Other				■	■	■				
	Abstraction for distribution	■	■				■				
Products	Total								■	■	
Residuals	Total							■			■

12. With regard to water related products, the CPC specifies natural water (division 18), bottled mineral water (group 244) and steam and hot water (group 173). Not included in the CPC are specifications for surface water, ground water, soil water, waste water etc. The classifications used in the SEEAW expand the CPC classification to some extent and should, therefore, be adopted in the revised SEEA.

### *Energy*

13. The current SEEA does not provide a specific classification of energy flows. The physical flow accounts, as described in the current SEEA 2003, only present energy carriers that are included in the central product classification (CPC). These include class 0313 “Fuel wood”, divisions 11 “Coal and lignite; peat”, 12 “Crude petroleum and natural gas”, 17 “Electricity, town gas, steam and hot water” and 33 “Coke oven products; refined petroleum products; nuclear fuel”. Other materials such as biomass (except wood), solid waste and some gasses (biogas) are not specified in their function of energy carrier. At this point the CPC needs to be extended.
14. The sources by which electricity is generated are not specified in the SEEA 2003. Electricity can be generated by fossil energy carriers, solar power, hydro power, geothermal power, liquid bio fuels, fish oil etc. The means by which electricity is generated is important information and should be covered by the SEEA.
15. Work on the developments of a classification scheme for energy flows has taken place for the IRES (International recommendation for energy statistics) and the SEEA-Energy. The classification of energy flows in the revised SEEA should be congruent with the energy flow classifications developed for the SEEA-E.

### *Natural resources*

16. In accordance with SNA principles, harvest of cultivated biomass should be regarded as flows within the economy in the MFA. As a result ecosystem inputs should be taken as physical flows from the environment to the economy. For practical reasons in EW-MFA, the harvest of cultivated biomass (semi-natural resources) is regarded as flows from the environment to the economy (harvest approach). The outcome on how to deal with semi-natural resources in the MFA accounting scheme will be resolved during the work on the SEEA-MFA.

#### *Solid waste*

17. As a starting point, the recent developed European Waste Statistic Regulation can be used for classifying solid waste. The classification consists of several levels of detail. The most aggregated level is similar to the classification of solid waste residuals in annex 4 of the SEEA 2003.
18. In the SEEA 2003, most waste products in the CPC appear in a single waste category (39 Wastes and scraps). Some waste categories appear in other CPC classifications or are covered together with products in a single category. In the paper by Schoer on SEEA-MFA, disaggregated CPC are shown with corresponding classifications from the European Waste Statistic Regulation (WStatR).
19. Although all CPC waste categories can be allocated to a WstatR classification, some waste types, like chemical and construction waste, do not have a corresponding CPC classification (see table 1). Also the CPC, obviously, does make a distinction between hazardous and non-hazardous waste. Therefore, CPC classifications are not sufficient to set up the waste accounts. Classification from the European Waste Statistic Regulation should be used as starting point.

**Table 1, Examples of waste categories from the European Waste Statics Regulation that can not be linked to CPC waste classification codes**

Manure  
Mineral waste like asbestos and constuction and demolition waste  
Used cars  
Discarded equipment like cart, computers etc.  
Specified chemical waste like paints or used oils

#### *Emissions to air and water*

20. Emission to air and water classifications can be taken from the residual classification presented in annex 4 of the SEEA 2003. In the SEEA 2003, the residuals classification includes: “Returned water and memorandum items for mass balancing” and “Dissipative use of products and dissipative losses”. Both items are mainly for the purpose of mass balancing and are

useful for EW-MFA. The classification of these latter items will be part of the discussion on the SEEA-MFA.

### **Overlap between the subsystems of the environmental accounts**

21. The recommended three supply-use subsystems for materials, energy and water will overlap. It is recommended that overlapping cross-sections follow as much as possible unique classifications. This may require supplementary functional or purpose type classifications.

#### *Overlap between energy accounts and MFA*

22. Non-renewable energy carriers, like coal or oil products, are included in the energy flow subsystem as well as the material flow subsystem. Considering overlaps between energy and material flows, the classification of fossil fuels will not lead to problems. For these energy carriers there will be a direct relation between the kilograms in the MFA and the Joules in the energy accounts.
23. Considering biomass that can be used for both energetic and non-energetic purposes, the overlap between the material and energy subsystem is somewhat more complicated. Take for example the use of wood; in the MFA the total extracted amount in Kg will be recorded while the energy accounts record only the amount (in Joules) that is used for energy generation. In this case, for the same class of biomass, the total amount in Kg in the MFA does not necessarily match the amount of joules in the energy accounts. This discrepancy is partly solved when the industrial branches are taken into account: power plants use wood for energetic purposes. However, a distinction between energetic and non-energetic use can not always be made on the basis of industrial branch alone. To fully solve this discrepancy, relevant materials in the MFA should be classified to their purpose of use: energetic or non-energetic.
24. Waste incineration can result in the generation of energy. This type of energy generation can be distinguished in the energy accounts by its use of material: waste. To match the energy flows with the material flows in the MFA and waste accounts, its use of purpose, waste incineration in order to generate energy, should be distinguished.

#### *Overlap between water accounts and MFA*

25. Bulk water is excluded from EW-MFA. Therefore, there will be no overlap with the water accounts.
26. MFA in a broad sense does include water. In the LG paper by Schoer the classification of water taken from SEEA-W is presented as part of the MFA.

This suggests a straightforward linkage between the m<sup>3</sup> of the SEEAW with the Kg in the MFA.

*Overlap between water accounts and energy accounts.*

27. In the water accounts the amount of water that is used to generate hydroelectric power is specified. This amount will correspond to the amount of joules generated by water power in the energy accounts. Classifications in both subsystems are compatible and, therefore, a link between m<sup>3</sup> and joules seems feasible.

*Overlap between material flows within the MFA*

28. The MFA are build up from different data sources, some of which environmental sub-accounts. Examples of these sub-accounts are the waste accounts, emissions to air and water accounts. Information on products can, for example, be derived from international trade data. Because MFA are compiled from different data sources, overlap between materials can occur. This issue is discussed below.
29. Solid waste consists of all kinds of materials. Some waste may have a monetary value for the generator and can be considered a product. These waste products also appear as products in the material flow accounts. When compiling waste accounts it is important to included both waste residuals (no monetary value) and waste products. When compiling a complete MFA, all materials including products and waste, double counting of waste products can be avoided by omitting waste products from the waste accounts.
30. Although conceptually not correct, double counting of small (but toxic) flows should not be considered a problem because it enables complete and meaningful individual environmental accounts (i.e. waste accounts, air emission accounts, water emission accounts). For example, materials classified in annex 4 of the SEEA under “Dissipative use of products and dissipative losses” might appear in the MFA as “other products” but also in the air accounts or the water accounts. In the case of total accounting for all flows (full MFA) some explicit measures might be taken to avoid double counting.
31. These classification issues are important for compiling MFA and are discussed in the SEEA-MFA guideline. Also, these issues do not affect the presentation of subsystems that are mutual compatible. Therefore no recommendations are made here.

*Overlap between the SNA and physical flows of resources*

32. Overlap between the SNA and the physical flows regarding resources depend on the approach adopted in the MFA. If the harvest approach is adopted, some coherence with the national accounts is given up.
33. The harvest approach is not consistent with the system boundaries conventions of the SNA. According to the SNA the harvest of cultivated resources must be regarded as flows within the economy. Ecosystem inputs (resulting in growth) are regarded flows from nature to economy. As a result of the deviation from the SNA conventions, the physical flows from cultivated biological assets are classified as products in the SNA and as natural resources in the SEEA.
34. The outcome of discussion on which approach to follow for cultivated biomass will determine the overlap between the sub-systems.
35. In order to incorporate the waste accounts in the EW-MFA and to match the waste accounts with the SNA, solid waste with and without market values should be classified, respectively, as waste products and waste residuals. The distinction between solid waste residuals (without market values) and products (with market values) provides consistency with the SNA because in the SNA only products are considered.

#### **Questions and points for discussion**

- Classifications regarding industrial branches.
  - i. Do you agree that a compatible industrial branch classification between the subsystems is required and that is should be set up according to the greatest common divisor i.e. at an aggregation level common in all three subsystems?
  - ii. Would an ISIC industrial classification on a 2-digit division level for manufacturers and a 1-digit section level for all other industrial branches be sufficient or is more detailed required (see for example paper Schoer on SEEA-MFA)?
- Classifications of the three subsystems (materials, water, energy).
  - i. Detailed classifications of the subsystems should be discussed in the issue papers on energy flows and material flows.
  - ii. The question if a product classification according to the CPC is sufficient for all three subsystems should be discussed in the LG papers on energy and materials. The suitability of the CPC classifications for residuals and resources should be discussed by the UNSD.
  - iii. Do you agree with a classification of waste according to the classification of the European Waste Statistic Regulation?

- iv. Do you agree with residual classification (apart from solid waste) as presented in the SEEA 2003?
- Classifications regarding overlap between the subsystems. Are the following issues required to satisfy the condition of compatible classification of the three subsystems with their unique physical units (energy, water and MFA) and the National accounts:
  - i. materials in the MFA used for generating energy should be classified to its purpose of use (energetic versus non-energetic).
  - ii. in the energy accounts, the classification of materials used to generate energy should be on the level of the material classification use in the MFA.
  - iii. electricity generated by hydropower should be classified.
  - iv. a distinction between waste products and waste residuals in the MFA must be made.
- Are there issues regarding the overlap between the three subsystems (materials, energy and water that are not mentioned?)