

Resource Use Indicators in the European Union

Policy Processes, Indicator Sets and Criteria for a Headline Indicator

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Stefan Giljum
Friedrich Hinterberger
Sustainable Europe Research Institute (SERI)
www.seri.at



Mathis Wackernagel
Justin Kitzes
Global Footprint Network (GFN)
www.globalfootprint.org



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Background: Relevant Policy Processes in the EU

The past 30 years saw a change in complexity and scope of environmental problems in industrialised countries. Early environmental policy was mainly concerned with the reduction of local or regional environmental degradation through pollution of certain environmentally harmful outputs, such as air pollutants and hazardous wastes. Starting with reports such as *Limits to Growth* in the early 1970s, however, concerns about resource constraints have become increasingly prominent in environmental debates.

Much of the initial discussion of global resource constraints focused on the depletion of non-renewable resources, such as minerals, ores and petroleum. Today, however, it is becoming increasingly evident that renewable resources, and the ecological services they provide, are also at great or even greater risk of degradation and collapse (see, for example, WRI et al., 2000). Signs of ecological pressure include collapsing fisheries, carbon-induced climate change, stratospheric ozone depletion, species extinction, deforestation, desertification, and the loss of groundwater in many areas of the world. The depletion of these assets is serious, as human society is embedded within the biosphere and depends on ecosystems for a steady supply of the basic requirements for life: food, water, energy, fiber, waste sinks, and other services (Krautkraemer, 1998). As human demand for these resources grows, the Earth's life-supporting natural capital is being liquidated at ever faster rates.

These new environmental problems are closely related to the overall volume (or scale) of economic activities, rather than a result of the specific potential for environmental harm of specific substances (Giljum et al., 2005). Issues such as climate change, loss of biodiversity, unrelenting land use and land cover conversion, and high levels of energy and resource consumption are parts of these concerns. These problems are difficult to address, as they are typically highly complex, international or global in scope, and involve multi-dimensional cause-effect-impact relationships, and time-lags.

Along with this trend, a change in the political and institutional framework of environmental policy-making took place in the European Union, characterised by two main features: a broadening of the spectrum of actors towards a multi-level, multi-actor governance system, with an increasing importance of levels of governance other than the nation-state, and a change in steering approaches away from a virtual monopoly of regulatory regimes towards a mix of policy instruments, including economic and

voluntary measures (Hey et al., 2003). These trends are also reflected in the European Union's pillars for a renewed environmental policy (European Commission, 2003a), which comprise (1) the integration of environmental concerns into all other sectoral policies on the EU and the national levels, (2) the development of a new approach of implementation, including the modernisation of the regulatory framework and fostering market-based instruments, and (3) a wider dissemination of information of environmental consequences of economic activities in order to foster behavioural changes. Along with the changing nature of environmental problems, traditional approaches of state-oriented command-and-control instruments were increasingly complemented by economic and, more recently, by voluntary instruments.

Current European environment and sustainable development policy is characterised through a number of strategies and concepts, with the relation and integration of these processes in many cases remaining unsatisfying and thus reducing policy effectiveness due to partly contradictory policy goals. The most important processes are:

- The “**Lisbon Strategy**” for employment, economic reform and social cohesion, launched at the Lisbon Summit in 2000, to which the environmental dimension was added at the Stockholm Summit in 2001. After the mid-term review published in the “Kok Report” (High Level Group, 2004), a “new start for the Lisbon strategy” (European Commission, 2005b) was initiated by the European Commission and adopted by the European Council in 2005.
- The **Strategy for Sustainable Development** (EU SDS), which rests on the basis defined at the European Council in Gothenburg (2001). Also the EU SDS was under revision in 2005 and the renewed EU SDS was adopted by the European Council in June 2006.
- The **Sixth Environmental Action Programme** (6th EAP), setting out guidelines for European Environmental Policy and defining the core environmental policy inputs to the EU SDS. The objectives of the 6th EAP are implemented with seven “Thematic Strategies”. Evaluation and reporting of progress in the implementation of the 6th EAP in the context of the Lisbon Strategy is carried out by an Environmental Policy Assessment Process.

There exists wide consensus in the EU that the Lisbon strategy is no stand-alone undertaking, but has to be treated as part of the EU sustainable development efforts,

complementing the EU SDS: “the European Council reaffirms that the Lisbon growth strategy itself is to be seen in the wider context of the sustainable development” (European Council, 2005). Although they have been described by the Commission as the short term and the long term contributions to sustainable development of the EU, the *existing* Lisbon and sustainability strategies, however, do not support this claim, in particular, as they do not cover comparable territory and thus harmonisation between and integration of the two is still an open issue. While the renewed EU SDS integrates social and economic concerns to a larger extent than the original SDS, the revised Lisbon strategy is structured by a hierarchy of policy fields, with a clear primacy of economic planning ensured by the so called Broad Economic Policy Guidelines (Spangenberg, 2005). According to the European Council (2005), these guidelines “will ensure the overall economic consistency of the three dimensions of the strategy”. Thus, in the Lisbon process, the social and environmental dimensions are added with the intention to make them comprehensive with the economic ones, rather than vice versa (EPSD, 2004).

The EU frequently emphasises the need to speed up the pace of reforms to improve the state of the environment both in Europe and internationally (for example, European Commission, 2003a). This becomes in particular challenging, as the Lisbon Strategy defines the general goal of an annual economic growth rate of three per cent. Consequently, decoupling of economic growth from the use of natural resources and the production of waste and emissions is regarded as the overall goal of environmental governance and the core strategy to reconcile environmental protection and continued economic growth (for example, European Commission, 2003c).

Review of Existing Indicators and Indicator Sets

A variety of initiatives from different European institutions is being pursued to develop indicator sets for monitoring progress towards the goals of the various strategies and processes. In most cases, however, it remains unclear how these different sets are related to each other and whether efforts are undertaken to harmonise the different approaches.

Structural Indicators

The unbalanced standing of the environmental dimension within the Lisbon strategy is reflected in the EU structural set of indicators, through which progress of this and many other European policy processes are evaluated. The Structural Indicators (European Commission, 2003b) cover the six domains of General Economic Background, Employment, Innovation and Research, Economic Reform, Social Cohesion as well as the Environment and are published by the Statistical Office of the European Union (EUROSTAT)¹. In the Spring Reports 2004-2006, a short list of only 14 indicators (out of a pool of 125 Structural Indicators) is used for reporting, which should allow for a more concise presentation and a better assessment of achievements over time vis à vis the Lisbon agenda. Within this shortlist, only 3 concern the environmental dimension:

- greenhouse gas emissions,
- energy intensity of the economy and
- transport volume relative to GDP.

Only the first indicator can be understood as a real indicator of environmental pressure, while the other two are an interlinked economic-environmental indicator and an economic indicator. In addition to these three short listed “environmental” indicators, the full list also includes:

- road share of passenger and freight transport (also an economic indicator);
- municipal waste (generated, land filled and incinerated);
- share of electricity from renewable energy;
- protected areas for biodiversity;
- population trends of farmland birds and
- healthy life years at birth (rather a social indicator).

No comprehensive headline indicator measuring natural resource use (materials, energy, land) is (so far) included in the set of Structural Indicators.

¹ See http://epp.eurostat.cec.eu.int/pls/portal/url/page/PGP_DS_STRIND/PGE_DS_STRIND_01.

Sustainable Development Indicators

A set of Sustainable Development Indicators (European Commission, 2005a) has been developed by the Commission and EUROSTAT with inputs from a group of national experts (the 'Sustainable Development Indicators Working Group'), in order to monitor, assess and review the EU Sustainable Development Strategy². The indicators are organised in 10 (partly overlapping) themes, of which seven (poverty and social exclusion; ageing society, public health; climate and energy; management of natural resources; transport; global partnership) correspond to the priority areas of the 2001 SDS Communication by the Commission and the 2002 Communication on Global Partnership, while two others (production and consumption patterns; good governance) arise from the Plan of Implementation of the World Summit on Sustainable Development. The theme on economic development highlights the economic dimension of sustainable development and bridges the SDS indicators to the Lisbon Process (EUROSTAT, 2005b).

In order to facilitate communication, the indicator set is built as a three-level pyramid: Level I includes headline indicators for initial policy analysis and monitoring progress towards headline policy objectives, Level II allows evaluation of core policy areas and more detailed monitoring of progress in achieving headline objectives and Level III enables further policy analysis and better understanding of the trends and complexity of issues and their interrelations.

With regard to the issue of resource use, Theme 6 “Production and consumption patterns” is of utmost importance. *“Production and consumption patterns are at the heart of the sustainable development concept. Social, environmental and economic considerations should be integrated into all parts of the life-cycle from extraction, processing, production and consumption through to disposal and recycling. Businesses, public administrations and consumers are all collectively responsible for the global environmental and social impacts of their decisions”* (citation taken from EUROSTAT SD indicators webpage).

The selected “best-needed” headline indicator for theme 6 is “Total Material Consumption (TMC)”, an indicator derived from material flow accounts on the national level, which comprises domestic extraction of natural resources (used plus unused) plus imports (including their indirect material requirements) minus exports (and their indirect material requirements). TMC thus reflects all natural resources directly and indirectly (in

² See http://epp.eurostat.cec.eu.int/pls/portal/url/page/PGP_DS_SUSTDEVIND/PGE_DS_SUSTDEVIND_01.

other countries) necessary for production and consumption of domestically consumed products. However, as data quality (in particular on unused domestic extraction and indirect material requirements of traded products) is still unsatisfying, it is recommended to use DMC (domestic material consumption, which only considers direct material flows) as a proxy for TMC.

The working group explicitly recommends to fully develop level 1 headline indicators (including TMC) as top priority and to further develop national accounting systems, including NAMEA (national accounting matrix including environmental accounts) and material flow accounts as the basic data for calculation of resource use indicators (EUROSTAT, 2005a).

The indicators on level 2 and 3 are organised along four major themes: eco-efficiency, consumption patterns, agriculture and corporate responsibility.

In addition to the theme on production and consumption patterns, Theme 5 “Climate and energy” and Theme 7 “Management of natural resources” are also directly relevant for the issue of material and energy use. Both themes list two headline indicators, the former “total greenhouse gas emissions” and “gross inland energy consumption (by fuel)”, the latter “population trends of farmland birds” and “fish catches outside safe biological limits”. Also Theme 8 “Transport” has links to energy use, with the single headline indicator “total energy consumption of transport” (EUROSTAT, 2005b).

With regard to the category of land, “land use” is one of one of four sub-themes in Theme 7 “Management of natural resources” with “Land use change, by category” as the envisaged indicator on Level II. However, as data is not readily available, it is recommended to use “Built-up area as a percentage of total land area” as a proxy.

Indicators by the European Environment Agency (EEA)

The EEA in Copenhagen is developing a constantly expanding database with environmental indicators for a variety of environmental issues. For each of these indicators, EEA provides fact sheets for free download (see <http://themes.eea.eu.int/indicators>). From this large pool of indicators, EEA selected a core set of 37 indicators, subdivided into the following 10 themes: air quality, ozone depletion, climate change, biodiversity, terrestrial, water, waste, agriculture, energy, fishery and transport. This core set aims to provide a manageable and stable basis for indicator reporting by the EEA, to prioritise

improvements in the quality and geographical coverage of data flows, and to streamline EEA contributions to other European and global indicator initiatives, such as the structural indicators and the sustainable development indicators. The EEA core indicator set does not comprise one comprehensive headline indicator for natural resource use, however, a number of indicators contain information on specific problems related to material and energy metabolism and land use. These include e.g. total energy consumption, use of freshwater resource, greenhouse gas emissions, municipal waste generation and expansion of built-up land.

EEA is also working on issues of natural resource use, material flow accounting and land use data. For example, EEA commissioned studies calculating comprehensive resource use indicators such as Total Material Requirement (TMR) of the EU-15 (Bringezu and Schütz, 2001). With regard to land use, EEA is maintaining a computerised inventory on land cover for European countries (CORINE; EEA, 2005a). Furthermore, regular EEA report, such as the European environmental assessment reports (EEA, 2003) and the recently published European environmental outlook report (EEA, 2005b) contain chapters on material flows, waste generation and land use.

The EEA also publishes reports under the EU's transport and environment reporting mechanism (TERM). TERM indicators are used to answer a set of policy questions related to the integration of environmental concerns into transport policies and include environmental indicators such as energy consumption and emissions by freight and passenger transport (see EEA, 2002 for the latest TERM report).

Indicator Work at the European Topic Centres (ETCs)

European Topic Centres (ETCs) are centres of thematic expertise contracted by the European Environment Agency (EEA) to carry out specific tasks identified in the EEA strategy and the annual management plans and to provide information for the implementation of the priority issues included in the 6th Environmental Action Programme and the Sustainable Development Strategy.

The European Topic Centre on Resource and Waste Management (ETC/RWM), established in 1997, is one of five Topic Centres and most relevant for the resource use issue. The mission of the Topic Centre is to provide reliable and comparable data and information on resource and waste in Europe to decision-makers and the public. The

Topic Centre is a consortium of seven specialist partner organisations, led by the Danish Topic Centre on Waste. The ETC/RWM is working on issues related to waste, life cycle assessment and material flows. It is a major source for resource use data and related indicators, which have been published in several studies (for example, Moll et al., 2003) and are available for download at <http://waste.eionet.eu.int/etcwmf>.

The European Topic Centre on Terrestrial Environment (ETC/TE) is developing data sets related to land use and land cover change (for example, due to urban sprawl) and calculates land-related headline indicators for EEA reports (see <http://terrestrial.eionet.eu.int>).

State of the Art in Academia and Statistical Institutions

The past 15-20 years saw rapidly increasing academic interest in the quantitative assessment of the interrelations between society and nature. Research fields such as ecological economics and industrial ecology put the issue of natural resource use for production and consumption activities (from the micro to the macro scale) in the core of their research activities. The use of physical units of measurement is regarded as a crucial requirement for sustainability-oriented analyses since pure monetary approaches possess a number of shortcomings. These include the insufficient reflection of physical scarcities, the systematic bias against the future due to discounting practices, or the assumption of complete substitutability between natural and man-made capital (see, for example, Ekins, 2001; Rees, 1999). Within ecological economics and industrial ecology, a number of approaches have been developed to provide information on these society-nature interrelations in biophysical terms (see, for example, Daniels and Moore, 2002 for an overview). The most important and influential accounting concepts for deriving indicators on natural resource use on the macro level are material flow accounting and ecological footprint accounting.

Material Flow Accounting (MFA)

Material flow accounting and analysis builds on earlier concepts of material and energy balancing, as introduced, for example, by Ayres (1978). Since the beginning of the 1990s, when first material flow accounts on the national level were presented (for example, Environment Agency Japan, 1992), MFA has been a rapidly growing field of scientific interest and major efforts have been undertaken to harmonise methodological approaches developed by different research teams (for example, Adriaanse et al., 1997; Matthews et al., 2000). In an international working group on MFA, standardisation for economy-wide material flow accounting was for the first time achieved and published in a methodological guidebook by the Statistical Office of the EU (EUROSTAT, 2001a).

MFA defines the system boundaries in accordance with the System of National Accounts (SNA). This structure allows direct integration of monetary and physical information within one accounting framework and thus enables compiling consistent data bases for policy-oriented analyses of economy-environment interactions. The usefulness of these integrated accounting schemes is also increasingly highlighted on the international level, resulting for example in the publishing of the United Nations “System for Integrated Environmental Economic Accounting (SEEA)” (for the latest version, see United Nations, 2003). With regard to assessing the material base and resource throughput of national economies, MFA has been established as a widely applied methodological approach and is recognised as a key tool for evaluating eco-efficiency policies, for example by the European Union (European Commission, 2003c) and the OECD (2004).

The principle concept underlying the economy-wide MFA approach is a simple model of the interrelation between the economy and the environment, in which the economy is an embedded subsystem of the environment and - similar to living beings - dependent on a constant throughput of materials and energy. Raw materials, water, and air are extracted from the natural system as inputs, transformed into products, and finally re-transferred to the natural system as outputs (waste and emissions). To highlight the similarity to natural metabolic processes, the terms ‘industrial metabolism’ (Ayres, 1989) and ‘societal metabolism’ (Fischer-Kowalski, 1998) were introduced as key interrelational terms.

A large number of aggregated resource-use indicators can be derived from economy-wide material flow accounts. These indicators can be grouped into (a) input, (b) output, (c)

consumption and (d) trade indicators. Consumption indicators, such as DMC and TMC are regarded as the most useful headline indicators for natural resource use of national consumption patterns (see also above). Input indicators, on the other hand, relate to the total production of a national economy (including goods produced for exports) (see Moll and Bringezu, 2005).

The compatibility of MFA with the System of National Accounts (SNA) enables direct relation of material flow indicators with indicators of economic performance, such as GDP on the national and sectoral level. These interlinkage indicators quantify the eco-efficiency (or resource productivity) of an economic system by calculating economic output (measured in monetary units) generated per material input (in physical units), for example GDP/DMC. Eco-efficiency indicators thus are suitable tools to monitor processes of de-linking or de-coupling of resource use from economic growth as the key strategy toward a more sustainable use of natural resources (Giljum, 2006).

The number of countries, which already compiled or currently are in the stage of compiling economy-wide material flow accounts according to the methodological guidelines presented above, is rapidly increasing. So far, full MFAs have been presented for the USA, Japan, Austria, Germany and the Netherlands within the framework of two projects co-ordinated by the World Resources Institute (WRI). In addition to a large number of studies presented by national statistical institutions in Europe, MFA input indicators for all former EU-15 countries were calculated in studies commissioned by the European Statistical Office and the EEA (see above). MFA studies exist for transition economies in Eastern Europe (Hungary, Poland, Czech Republic) and for Australia. Concerning countries in the global South, economy-wide MFAs have been presented for Brazil and Venezuela, for Chile and for China. Concerning the material basis of the global economy, the first time series of total material input for all countries of the world has recently been compiled (Behrens et al., 2005)³.

Several important shortcomings and limits of the standard MFA method can be identified (see Wiedmann et al., 2006 for a comprehensive discussion). The two main shortcomings are (a) the aggregation of different qualities of material flows to derive aggregated indicators and the weak links between MFA indicators and environmental impacts and (b) the missing separation of the production (including interindustry

3 Data can be downloaded from www.materialflows.net.

relationships) and the consumption sphere. With regard to point a, one important issue is that big material flows in terms of weight (such as construction minerals or specific metal ores) dominate all MFA indicators and can bias interpretation of aggregated results, as detailed information on developments of other material groups or economic sectors is diluted or obscured (see, for example, Giljum, 2004 for an empirical example). Collection and interpretation of MFA data should therefore always be carried out on a level, which disaggregates material groups and, if possible, different economic sectors.

Another major point of critique is the fact that weight-based MFA indicators do not inform about actual environmental impacts. Although correlations can be observed between weight-based and impact-based resource flow indicators (in particular, in the short time frame; see van der Voet et al., 2005a), detailed qualitative characteristics of different material input or output flows cannot be adequately depicted by quantitative numbers. These different qualities are, however, an important factor in the evaluation of economic development from the perspective of environmental sustainability (Wiedmann et al., 2006). The focus on the reduction of aggregated resource use is a necessary, but not sufficient, precondition for achieving environmental sustainability. Small material flows, which might be neglected in aggregated weight-based indicators, can have large environmental impacts. Therefore the question arises which material use exactly should be reduced to achieve a sustainable resource throughput. Although problems related to weight-based aggregation are in principle recognised by the MFA community and first evaluation procedures have been suggested (for example, van der Voet et al., 2005a,b), an internationally standardised procedure for considering qualitative differences in the quantitative concept of MFA is so far still missing.

With regard to shortcoming b, the key next step is to link MFA accounts with economic input-output tables, which disaggregate economic branches or to compile physical input-output tables, which have been published for several countries.

Ecological Footprint

The second method for natural resource accounting, which has gained increasing support in the past 10 years, expresses human resource needs and availability of ecological resources in terms of use of biologically productive land and water areas. This approach, introduced by Rees and Wackernagel (1992), is generally referred to as the Ecological

Footprint. A Footprint is defined as the total biologically productive area required to produce the resources a population consumes, and to assimilate the waste it generates, using prevailing technology (Wackernagel and Rees, 1996). Its purpose is to answer the question of how much regenerative capacity of the biosphere is occupied by human activities.

The Ecological Footprint can track use and availability of ecological capital at all levels, from farm or household to city, region, nation and globe as a whole (Wackernagel et al., 1999). By comparing the land appropriation of the population of a country with the ecological capacity available within the country, national ecological deficits or reserves can be quantified. Since global sustainability depends on avoiding global overshoot, the Ecological Footprint therefore is often used as a measure of this minimum ecological requirement for sustainability.

So far, several different approaches to national footprint accounting have been developed based on the first method presented by Wackernagel and Rees. Global Footprint Network is currently running an initiative to achieve standardisation between all institutions active in the field of Footprint accounting (see www.footprintnetwork.org).

National Ecological Footprint accounts build to a large extent on data from national material flow accounts. They start from a population's resource consumption expressed in mass flows (tonnes per year). These physical flows are then converted into area equivalents, expressed in units of global hectares (hectares with world-average biologic productivity), using productivity data (annual tonnes/hectare). This approach is repeated for six major "land types": crop land, pasture, fisheries area, forest land, built-up area, and energy land. The use of these six major "land types" can further be divided amongst different categories of consumption, such as food, housing, mobility, goods, and services.

For all OECD and many of the newly industrialising countries (NIC's), the largest share of the Ecological Footprint consists of CO₂ land – the amount of biologically productive land required to absorb for the excess CO₂ released by these nations. Consistent with the research question behind the Ecological Footprint, this area reflects that amount of the Earth's biologic capacity that is demanded as a waste sink by fossil fuel based economies. This method of calculation is the most conservative of a number of approaches that could be used, such as the land area that would be required to produce an equivalent amount of energy using renewable energy resources.

Ecological Footprint calculations have been carried out for almost all countries of the world by Global Footprint Network (see WWF et al., 2004; EEA 2005c). In-depth studies on the Footprint of Europe and the Asia-Pacific region have also recently been published (WWF et al., 2005a, 2005b). The Footprint approach is also widely used for regional and local sustainability assessments.

Footprints can be analysed from a consumption perspective (how much biological capacity is needed for supporting final consumption of residents in a country?) or primary production perspective (how much ecological capacity is needed for supporting primary production of a national economy?). For example, a recent study for WWF UK has focused on breaking down national footprints by economic sectors (Wiedmann et al., 2006).

As with MFA-based indicators, several critiques of the Ecological Footprint concept have been brought forward. The method of accounting for energy land has been criticized as “hypothetical land,” since the area required for CO₂ absorption cannot be physically located in the same manner as the area occupied by other human demands. However, Footprint proponents would argue that what others call “hypothetical land” ecologists would call overshoot. This is parallel to Footprint accounting in other areas: for example a Footprint of forest products is larger than the harvested forest, if the forest is harvested above regeneration rate. Footprints larger than biocapacity are not a reflection of “hypothetical nature of Footprints” but of human demand exceeding renewable levels of ecological supply.

Another critical point is that the Footprint very likely underestimates true human impact on the biosphere, as many less visible ecological impacts, such as soil degradation and accumulation of toxic chemicals, do not appear directly in Footprint accounts. Again, Footprint proponents would argue that the approach tries not to exaggerate human demand and not to underestimate ecological supply in order not to exaggerate ecological overshoot.

The descriptive comparison of available biocapacity within each country with the level of consumption of the country's population (ecological deficits and reserves) must also be interpreted carefully, as this analysis has often been interpreted as biased against small and densely populated nations or nations with low ecosystem productivities. Due to their

richness in natural resources, countries such as Canada and Australia have substantial ecological reserves per capita despite very high consumption levels, whereas many sub-Saharan countries have ecological deficits, although the consumption levels are far below levels of a humane way of life. National deficits and reserves do not point directly to sustainability or un-sustainability, but only to existing assets and liabilities that will become increasingly significant in a world of increasingly scarce ecological resources.

Furthermore, measurements of Footprint and biological capacity only reflect pressures placed on ecosystems used by human society in a past year. This analysis does not reflect future changes to demand on or supply of ecosystems that might occur with growing populations, increasing standards of living, or changing technology and efficiency. Finally, the Footprint approach may not yet take the same system boundaries as MFA and thus cannot always be directly related to other economic and social indicators derived from the System of National Accounts. However, standardization efforts aim towards building high compatibility with other environmental accounting approaches.

Physical Accounting in National Statistics

In the past few years, considerable progress has also been made with regard to the integration of physical accounting approaches in standard environmental statistics and reporting. On the international and European level, increasing standardisation of physical/environmental accounts and integration with economic accounts is being achieved.

With regard to the world-wide level, the most relevant process is the elaboration of a “System for Integrated Environmental Economic Accounting (SEEA)” by the United Nations (for the latest version, see United Nations, 2003), which sets guidelines for accounting and integration of environmental data on the national level. MFA as well as land accounts build core accounting sets within SEEA, representing the overall physical structure of national economies. Other physical accounts include energy accounts and physical input-output tables.

In Europe, a similar process has been initiated within the “NAMEA” (National Accounting Matrix including Environmental Accounts) framework. While NAMEA data initially only focused on emission data on the level of different economic sectors

(EUROSTAT, 2001b), material flow accounts (including water accounts) and energy accounts are included in national NAMEA in an increasing number of countries (for example, Statistik Austria, 2004).

Criteria for a European Headline Indicator

A headline indicator for natural resource use as part of core indicator sets in the European Union should fulfil a number of criteria.

- One crucial point is the **policy relevance** of a headline indicator. Such an indicator should provide the possibility to monitor and evaluate specific (sectoral and cross-sectoral) policies related to resource use (e.g. energy, transport, trade, agriculture, industry, etc.). This implies that it must be possible to disaggregate the indicator by economic branches.
- The indicator should be **easy to communicate**, in order to provide relevant information not only to a small group of experts, but to a large number of policy makers and actors from civil society.
- A headline indicator on resource use must provide **directionally safe information**, i.e. allow for a rough evaluation, whether a European country or Europe as a whole is moving towards reductions in natural resource use and related negative environmental impacts.
- The indicator should be based on a **consistent and transparent accounting scheme**. Double-counting must be avoided to allow aggregation of the indicator across countries and from the micro to the macro level. Used data and calculation procedures should be well documented and, if possibly, openly available for third users to allow expansion and improvement of the data bases.
- The indicator must express anthropogenic resource use in **absolute numbers**. It is not sufficient to illustrate the relative resource intensity per economic output, as it

is the absolute level, which determines actual environmental improvements or setbacks. From this perspective, it is crucial to distinguish between **relative and absolute decoupling**. When relative decoupling occurs, economic growth is accompanied with lower growth in environmental pressures. Related indicators illustrate a positive trend, although the absolute amount of environmental pressure is stable or even increasing. Therefore, only in the case of absolute decoupling, environmental pressures are absolutely decreasing also in a growing economy. This requires that the decrease in material, energy, pollution and land intensity is higher than the economic growth rate.

- The underlying **data base** for the calculation of comprehensive resource use indicators should be **harmonised**, independently from the aggregation of data across categories to calculate specific indicators. For example, a large part of the Ecological Footprint indicator on the national level is based on data from material flow and energy use accounts from international sources. These calculations should comprise the same data on material and energy use as aggregated material flow-based indicators such as Total Material Consumption (TMC).
- A headline indicator on natural resource use should be **comprehensive** with regard to the inclusion of **different categories of resources**. The indicator should include both biotic (renewable) resources (from agriculture, forestry, fishery) and abiotic natural resources, such as metals and construction minerals and should allow presentation of these categories in a disaggregated manner.
- The indicator should find a **balance between aggregation and disaggregation** of information. Aggregation of a large amount of statistical information into a few categories or even one number increases the communicability, but decreases scientific soundness and methodological consistency.
- The indicator should be comprehensive with regard to its **geographical coverage**. It should take a life-cycle perspective of production and consumption activities, including ecological rucksacks (embodied resource requirements) of products. Only thereby, Europe's global environmental responsibility can be adequately illustrated and taken into account in the evaluation of resource use and decoupling policies.

- The indicator should be **geographically explicit**, i.e. allowing an assessment of international trade relations; for example, it should illustrate, from which world regions Europe is importing which natural resources. Only thereby an analysis of trade impacts can be carried out with regard to specific countries and country groups, which is of particular importance for Europe's relation with developing countries.
- A resource use indicator should be directly **compatible with the system of national accounts**, in order to allow cross-sectoral policy analysis and modelling of integrated economic-environmental scenarios, which is crucial from the sustainable development perspective.

A Consensus Statement on the Importance of National Material Flow Accounting

A robust, harmonised and well documented statistical basis on material flows on the national level is the prerequisite for calculation and implementation of a headline indicator on resource use. Robust material flow accounts are vital for sustainability policy, for sustainability communication and for many areas of sustainability assessments including ecological footprinting, carbon and greenhouse gas accounting and analyses of environmental space.

SERI and GFN in collaboration with Friends of the Earth Europe (FOEE) and the Aachen Foundation have therefore co-initiated the preparation of a consensus statement on the importance of material flow accounting for tracking Europe's consumption of natural resources. The statement demands to

- strengthen national material flow accounting as the data basis for the calculation of a number of key environmental sustainability indicators,
- help overcoming existing data gaps to fully calculate comprehensive resource use indicators, in particular in the area of indirect material requirements of traded products, and to
- implement the indicator of "Total Material Consumption (TMC)" as a core headline indicator on resource use on the European level.

This consensus statement is published by the Aachen Foundation and can be downloaded from the website www.aachenfoundation.org. The statement can also be obtained from SERI, GFN and all other signing partners.

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