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Measuring Environmental Sustainability: Draft Report of the Eurostat Task Force 2

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(for discussion)

D R A F T

MEASURING ENVIRONMENTAL SUSTAINABILITY

Report of Task Force 2 of the Sponsorship on Measuring Progress, Well-Being and Sustainable Development

INTRODUCTION

The growing importance of environmental factors, already acknowledged in high-level initiatives such as 'GDP and Beyond' and 'Europe 2020' motivates the need to more effectively measure our environment and its capacity to remain available to future generations. As a consequence, Task Force 2 was given the mandate from the Sponsorship Group to address the issue of environmental sustainability. Following the mandate, the TF took a rather focused approach of looking at the necessity to have robust data in order to fully understand and better assess our environmental resources and their preservation for the future. Nonetheless, the issue of whether environmental sustainability should and can be regarded in isolation from the wider concept of sustainable development was debated extensively.

Consequently, it was agreed that the broader work of the Sponsorship Group, and more specifically that of Task Force 4, should encompass sustainable development more comprehensively, to cover social and economic aspects as well as environmental ones, and should develop bridges that will position the outcome of our TF in this wider framework.

In the light of the previous paragraph, there are two different aspects concerning the environment which are important to measure. On the one hand, the present-oriented elements, that is, the well-being enjoyed by present generations from the current environmental resources and services. On the other hand, the future-oriented aspects, that is, how are we preserving the natural capital that future generations will inherit from us? Some have argued that policies have hitherto tended to focus on present-oriented elements and hence so have sustainability indicators, and further argue that all measures should take a more future-oriented capital-based approach. However it is clear that sustainability encompasses both the present efforts to preserve the environment and the future well-being and this is the focus taken in this report.

This report makes reference to environmental accounting frameworks as well as to the capital approach as conceptual basis that underpin the measurement of environmental sustainability. It is emphasised that the reference to the capital approach does not imply a proposal to valuate natural assets in monetary terms. Instead, it offers a conceptual framework from which to identify the resources and ecosystems that we should be able to measure in physical terms (or, as in the case of some natural resources such as energy commodities, also in monetary terms). The fact that important information gaps currently exist and that the methodologies to measure these natural assets are not yet fully developed render the proposals made here rather general and with a medium term perspective. Moreover, the capital approach should not be seen as the sole conceptual basis from which the measurements of environmental sustainability should be drawn. An important subset of indicators should focus on aspects of environmental well-being linked to the quality and quantity of natural resources currently available or to the benefits obtained by present generations from ecosystem services.

This report considers as essential the good interaction with policy-makers. While respecting the independence of statistical organisations, it is strongly recommended that a regular and constructive dialogue is established during several stages of the development and publication of indicators. This holds specifically true when identifying the indicators, advising the setting of specific targets or thresholds and devising the evaluation process. In particular, the trade-off between stability and continuing policy relevance is expected to be a specific challenge to be tackled.

In this context, the TF considers that while this report is mainly aimed at official statisticians with senior management responsibilities, it could also serve as guidance to policy-makers as it outlines the benefits and challenges of this interaction. The issues mentioned in the previous paragraph are especially relevant for the purpose of communication at the political level.

Other aspects of importance are the analysis of the data and the communication to the general public of the measures and of the attainment of the targets, if any. While it is recognised that many analysis and communication aspects are not specific to this domain several specificities are addressed here. One example concerns the use of Supply and Use Input-Output Tables (SUIOT) when measuring environmental impacts and the economy, with the purpose of looking at the consumption rather than production perspective. Another example relates to using statistical decomposition analysis to measure the impact attributed to each of several pressures or policy actions.

The report contains a set of basic principles to be followed by statistical organisations when undertaking the task of developing, maintaining, assessing and disseminating indicator sets. A section is devoted to environmental accounting not only as a basic framework but also due to its potential to be a primary source from where consistent indicators can be drawn. As a consequence, the development of a system of environmental accounts can be considered an important step to developing a satisfactory set of indicators and, conversely, a hopefully large number of the indicators selected should be derived from the accounting tables. Nevertheless, the TF recognises the limitations in obtaining from accounting frameworks all the indicators needed to measure environmental sustainability. These limitations are even more acute at present due to the preliminary stage of implementation of these accounts. Therefore, while strongly recommending to prioritise the further development of the accounts, the report recognises that other sources are also needed.

The report therefore provides a series of recommendations both for environmental accounts and for indicator sets and presents for the purpose of illustration some national good practices. Section 3 displays the indicators more commonly used, indicates actions to be taken when developing indicator sets and analyses their potential for short or medium term implementation. Although the TF does not recommend a specific indicator set, since the choice of suitable measures also depends on the dialogue between statisticians and policy-makers, on data availability, and last but not least, on national specificities such as environmental priorities of society and the scarcity of specific natural assets, the actions proposed aim at parallel national developments in line with international standards that will enhance international comparability.

The TF recognises the existence of other initiatives, in particular the WG on Measuring Sustainable Development (UNECE, OECD, Eurostat) which, though working on a wider perspective, looked also at environmental aspects, developing thinking towards a

capital based framework. The work of the WG is presented in its report[1]. A subsequent task force aims at further developments including aspects on distributional justice and quality of life. The work presented here complements these undertakings and builds on them to present practical recommendations aimed at the managerial level. The TF also recognises the work done in the Eurostat Working Group on Sustainable Development Indicators (WG SDI) and the indicators system which was developed by this WG.

1. PRINCIPLES FOR MEASURING ENVIRONMENTAL SUSTAINABILITY

Environmental sustainability is a complex, multidimensional phenomenon, the measurement of which requires a comprehensive set of indicators, showing the developments in its various dimensions. Therefore, this report will focus on indicators sets.

This chapter lays down the fundamental principles that should be the basis of any practical work related to the design, production and communication of an indicators set for measuring environmental sustainability. These principles will be further detailed in the recommendations and approaches described in the subsequent chapter.

Different occurrences of these indicators sets receive a variety of names such as dashboards, scoreboards, etc. This report considers this a communication issue and, in order to avoid the risk of confusion avoids choosing a name that may give the impression that a specific set is privileged, but instead opts to maintain throughout the text the neutral term of **indicator set.**

Principle 1: Indicators should be derived from a consistent framework and, as far as possible, should be internationally harmonised.

There should be a clear identifiable rationale underlying the process of indicators selection. While this rationale should be consistent with a more general framework encompassing other sustainability aspects, notably economic and social, this report also advocates for the use of the environmental accounts as a statistical framework, complemented by the concept of the capital approach, as important elements of the underlying framework. (See principles 2 and 3).

Taking into account the global nature of many environmental issues, for example, climate change, which are not confined within national borders, the international comparability of indicators on environmental sustainability becomes all the more important. Thus, it is important to put efforts on harmonisation of the indicators among countries as far as this is possible and relevant.

[1] See http://www.unece.org/stats/publications/Measuring_sustainable_development.pdf

Principle 2: Environmental accounts offer a consistent and comprehensive statistical framework for environmental sustainability and should be developed gradually, making use of already existing data where possible.

Information on environmental sustainability should be coherent with a framework that displays the relations between the different datasets and connects them to other information outside the environmental domain.

Frameworks have been developed at international and also national levels and where possible these should be used as references. In particular, a major international endeavour has been the development and current revision of the 2003 SEEA (System of integrated Economic Environmental Accounts) that lays out various accounting modules and connects them to the System of National Accounts (SNA).

In such a framework, the trade-offs between the environment on the one hand and economic and social issues on the other hand can be analysed in more detail. It also provides an appropriate information base for economic-environmental modelling.

When starting the compilation of an environmental accounting framework, which normally comprises several different modules, a step-by-step approach based on already existing data sources is strongly recommended. The framework, consisting of several building blocks (or modules), also allows for such a stepwise approach. The main criteria for prioritising the modules for further development comprise the methodological readiness, the availability of the core data and the high political priority for certain types of accounts (e.g. energy accounts). Currently, environmental accounts are not at the stage of full development where they can provide a large amount of data; therefore their further advancement is strongly encouraged.

Principle 3: The capital approach provides a good conceptual support for designing an indicator set.

The capital approach is a simple way of conceptualising sustainability, namely as maintaining the stock of an asset - including environmental natural capital, over time. In other words, the capital approach sees the environment, including natural resource stocks (i.e. reserves), land and ecosystems, as "natural capital", essential for the long-term well-being and sustainable development of humankind. If natural resources are depleted beyond their ability to restore themselves and to provide their natural functions, any pattern of development that relies on them is unsustainable. It is therefore a good conceptual framework to be considered when designing a set of indicators on environmental sustainability.

This notion of capital should be considered in a broad sense. As far as available indicators on quality of the environment, the physical quantities of resources, and the current state of the environment can describe changes of environmental assets. In the absence of stock indicators, flow indicators can be used as substitutes (“proxies”) for stock indicators (e.g. 'emissions of greenhouse gases' is actually a flow indicator, but it is used as a stock

indicator) to convey information on how a current situation or evolution impacts on the future of environmental assets.

National indicators can be also adjusted for external factors allowing the measurement of the impact of local activities beyond frontiers, and therefore their contributive impact on globalized phenomena such as CO_2 emissions. It is also suggested that the interactions between the three dimensions of sustainability are taken into account including aspects of efficiency and equity.

When considering in particular valuation in monetary terms, there are today simply too many empirical and conceptual challenges to measuring certain types of capital and in particular to valuing them in monetary units. Where valuation is uncertain, observable physical and quantitative measures of natural assets should be given priority.

Principle 4: Both the producer and the consumer perspective should be represented.

Much effort has been directed to monitoring the pressures on environmental assets that arise from production activities. However, in a globalised economy, and for global environmental assets such as the climate system, direct and indirect pressures from consumption activities are also important to measure. 'Indirect pressures' relate to the case where domestic production of goods and services, along with the associated environmental pressures, is substituted by imports from abroad. This is in line with the consumer approach and the household perspective highly recommended by the Commission on Measuring Economic Performance and Social Progress ("Stiglitz Commission")[2]. Therefore, tracking the direct and indirect effects of consumption is an important complement to monitoring the effects of production on environmental assets.

Principle 5: When devising indicators, communication and cooperation with stakeholders and users are important to ensure their policy relevance. The indicators should be limited in number, documented and explained.

A good communication with stakeholders and users is also important in the early consultation phase as well as during the monitoring and evaluation of the indicators, especially when some of them are linked to official targets.

In order to be easy to communicate and clear, the set should be limited to a fairly small number of indicators and furthermore a hierarchy between a core set of a few main indicators and a supplementary set of illustrating indicators could be introduced (see Section 2.3 on indicators).

To enhance their fitness for policy management (policy design, follow up and assessment), all indicators should have their "user guide": information provided on the interpretation of indicators. As far as possible, the figures should also be benchmarked to measurable goals reflecting political decisions or orientations: thresholds, limits, targets (dated or not), or trends. The Eurostat monitoring

[2] Commission on the Measurement of Economic Performance and Social Progress, http://www.stiglitz-sen-fitoussi.fr/en/index.htm.

report of the EU sustainable development strategy or the German indicator report on Sustainable Development are examples of how indicators can be used to monitor targets of policies. Further work on indicators assessment is being currently done in the "Expert Group on Indicator-based Assessment" that is chaired by Switzerland and with the participation of Eurostat and several Member States.

Time and effort should be spent on communicating the information around indicators. This relates to carefully phrasing key messages arising from the evolution of indicators as well as to the usage of new communication tools such as web-based presentations, dynamic graphics and user-friendly interfaces.

Principle 6: The aggregation of indicators should be limited to generally accepted methods with a sound scientific basis agreed upon by the statistical community.

One of the most contentious issues in the domain of environmental indicators is the issue of aggregation. In which situation can information on environmental phenomena be aggregated? The debate is most relevant in the measurement of the impact of environmental pressures on ecosystems. In the case of official statistics, the aggregation should be limited to transparent methods with a sound scientific basis agreed upon by the statistical community. This does not preclude the calculation of some aggregate indicators on an experimental basis. For a further discussion on the aggregation of indicators, see Section 2.3 of this Report.

Principle 7: Strict quality rules should apply and priority should as far as possible be given to existing official statistics.

Data compiled and treated by national statistical institutes and other producers of official statistics are usually of known and documented quality, fulfilling at least minimum quality standards, required under the Code of Practice, and their usage in environmental accounts, including for indicators derived from such a framework, enhances the credibility and reliability of the indicators. Although priority should be given to official statistics as far as possible, in the specific case of environmental indicators the use of appropriate non-official statistics such as scientific data or data derived from research exercises may be necessary. In such a situation, it is recommended that the quality of these non-official statistical data should be reviewed, if possible, by the relevant statistical authorities before usage, following strict quality assessment protocols. In relation to the above, the availability of appropriate metadata is considered highly relevant.

Principle 8: The timeliness of the indicators should be an objective.

Environmental indicators compete with economic information and the latter sets the standards for timeliness and frequency. Environmental indicators that report with a time lag of more than one year risk being discarded simply on the basis of being outdated. It is therefore highly desirable to update and 'now-cast' environmental indicators even if this involves estimates and approximations as far as these remain reliable. An environmental accounting framework may provide useful coefficients in now-casting environmental indicators.

2. RECOMMENDATIONS AND GOOD PRACTICES

2.1. Framework – the role of Environmental Accounts and the Capital Approach

As indicated in Principle 1, there should be a rationale behind the design of an indicator set to measure environmental sustainability. This should be consistent with a wider framework encompassing all aspects of sustainability, therefore covering its economic, social and environmental dimensions. The framework endorsed in this Report is that comprising the integrated system of environmental economic accounts. Furthermore, the capital approach is considered a proper way to conceptualize environmental sustainability.

As a first step towards building bridges between the environmental and the social and economic aspects of sustainable development, it is suggested that these interactions between the three dimensions of sustainability are taken into account in an extended framework including aspects of efficiency (interactions between the environmental and economic dimensions) and of equity (interactions between the environmental and social dimensions). It is expected that this wider perspective is confirmed when the more comprehensive work of the Sponsorship, in particular of TF4, is achieved.

Furthermore, the current state of development of the environmental accounting system limits in the short term the use of data from this system when building the indicators. While it is recommended to progress in the implementation of the different environmental accounts modules, it is recognised that other data sources should be used at present to develop the indicators needed. The table of indicators presented in Annex illustrates this situation.

*The conceptual framework underlying the sustainable development indicators system in **Switzerland (MONET)** is a good illustration of the above. Such a framework, although wider and designed to cover the three dimensions of sustainable development (environmental, economic and social), can be easily adapted to the specific needs of the measurement of environmental sustainability. It has the advantage of encompassing the capital approach (stock and flow indicators) and making use of the environmental accounts wherever possible to enhance consistency in the data used. But it also takes into account interactions with the other dimensions of sustainable development.*

Conceptual frameworks, such as for example the one developed by Switzerland, are useful to define a typology of indicators, which improves the selection process. The following six categories of indicators can be considered:

- Environmental capital stocks indicators: what stocks of different environmental assets do we have and what is the quality of these stocks? For example: cropable land, population of breeding birds, concentration of breathable fine particles, nitrate concentrations in groundwater, ecological quality of forests, etc.

- Efficiency indicators: are the stocks consumed in an efficient way? For example: energy intensity, CO_2 intensity and waste recycling.

- Equity indicators: does everyone have an equitable access to environmental goods and services? For example: does every individual have the same chance to breathe unpolluted air at work or at home? Or are there inequalities due to income levels or social status? This kind of indicators is foreseen in the OECD's "Green Growth" and "How's life?" initiatives.

- Level indicators: to what extent are the needs of present-generation individuals (and of society in general) met? Meeting the needs of individuals is presented as a horizontal issue that is relevant to all three dimensions (environmental, economic and social) of sustainability. Therefore, it is not possible to define a single indicator to show how meeting the needs of the present generation can be achieved specifically by using environmental capital (for example, long life expectancy in good health is a need that is met not only by consuming environmental stocks such as clean air, clean water and good quality food, but it is also related to economic and social stocks). The purpose of such indicators is not so much to measure used stocks but to test whether the needs of the individual or those of society are met.

- Flow indicators: they describe the flows to and from the environmental stocks to meet the need of the present. In the absence of stock indicators, flow indicators can be used as substitutes ("proxies") for stock indicators (e.g. 'emissions of greenhouse gases' is actually a flow indicator, but it is used as a stock indicator).

- Response indicators: what are we doing to counter undesired developments? An example is environmental taxes.

2.2. Environmental Accounts

Recommendation 1: Support the development of environmental accounts (based on the SEEA) as a satellite to the System of National Accounts (SNA).

A policy for sustainable development has to foster simultaneously different goals for economic, social and environmental development, which requires the monitoring of developments in these areas. Moreover, policy-makers need to know about the interrelations between the different aspects of sustainability and the consequences of political measures for these different aspects.

What does this mean for measuring environmental sustainability? Ideally, measuring should be based on an overall statistical framework which includes the different aspects of sustainable development and consequently allows analysis of the interrelations between them. The accounting framework is the statistical answer to this requirement and could give a broad picture on economic, environmental and social aspects.

So called satellite systems to the national accounts enlarge the system to achieve a more comprehensive picture including environmental or social variables. As a starting point, the SNA gives concepts, definitions, classifications and consequently a coherent basis for the satellites. Environmental accounts are such a satellite, which connects environmental data

to the national accounts. (Social accounts could enlarge the framework further but this is not part of this chapter.)

By making sure that the environmental variables follow the concepts and structure of the national accounts, it is possible to design a coherent and consistent data framework comprised of environmental accounts and national accounts on an equal level. Only such a data framework allows for reliable analysis of interrelations between the environment and the economy, in particular when trying to assess the levels of environmental sustainability.

Environmental accounts encompass different modules, grouped under three main headings:

Physical flow accounts (measures in physical units, such as mass):

- Resource use, energy, air emissions, waste, waste water, material flows, etc.

Monetary flow accounts (measured in monetary units, such as currency):

- Environmental protection expenditure, environmentally-related taxes and rents, subsidies, goods and services, etc.

Asset Accounts (measures in physical units and where possible, also in monetary units)

- Resources, land, water, forests, etc.

As stated earlier, the approach is to implement them gradually in a step-by-step manner, progressively developing the environmental accounting framework (see Recommendation 2).

The UN System of integrated Environmental Economic Accounting (SEEA) is the global conceptual basis for environmental accounts. The SEEA is envisaged to become a UN statistical standard in 2012. Moreover conceptual and practical guidelines are available for different modules of environmental accounts from Eurostat[3]*. The environmental accounts are designed to be internationally comparable through these common frameworks, concepts and methods.*

A first EU Regulation on environmental economic accounts is envisaged to enter into force in 2011 (for more information on the future expansion of the Regulation, see Recommendation 2). Moreover, many Member States have already implemented important parts of the SEEA. With the expected legislation, the development of the work has increased considerably, so that most countries are now implementing the system.

Recommendation 2: Gradually implement the different accounting modules using a stepwise approach.

In Europe, the European Statistical System Committee has agreed on a common European Strategy for the development of the system of environmental accounts (ESEA). A first phase of this Strategy corresponds to setting up a legal

[3] For a list of manuals, see the Eurostat Dedicated Section on Environmental accounts: http://epp.eurostat.ec.europa.eu/portal/page/portal/environmental_accounts/methodology/manuals.

framework for the modules on air emissions accounts, economy-wide material flow accounts and environmentally-related taxes by economic activity. Those three modules form the first batch to be part of the upcoming EU Regulation on European Environmental Economic Accounts, currently in the legislative process. These modules, of course, should get highest priorities.

The draft Regulation envisages an obligation on the Commission to report on the readiness and feasibility for introducing additional modules. A stepwise approach seems to be the easiest way to proceed with work on those modules which are the most relevant and for which there already is both a developed methodology and national experience. In this regard, current further work focuses on modules such as energy accounts, environmental protection expenditure and environmental goods and services. Once they reach sufficient methodological maturity and there is experience with data collection, they could become the next likely candidates for inclusion into the Regulation.

Recommendation 3: As environmental accounts rely to a large degree on already existing data, it is important to map and evaluate the existing environmental data sources, in particular with regard to their quality and consistency.

There is a need for increased knowledge on existing environmental data. Some countries have mapped their existing data in order to keep track of which agency (or institutional body) is producing what data and who is using it, and to assess gaps, streamline data collection and improve coordination for a better use and for implementation of the SEEA. When compiling metadata, it is recommended to map all available information sources, in order to achieve a good overview of input from official statistics, input derived from other data sources and any remaining gaps in the information base.

The accounts are usually not based on specific new surveys; therefore implementing them does not increase the response burden. The work consists of identifying concepts and systematising existing economic and environmental data so that a picture of the interplay between environment and economy can be grasped and completed.

Recommendation 4: Environmental accounts should be used for various forms of analyses, indicators, modelling or now-casting. In order to expand their analytical potential, the data from environmental accounts should be linked to Supply and Use Tables and Symmetric Input-Output Tables from the national accounts; or to information from other frameworks outside of the environmental domain.

Environmental accounts have two advantages which make them very useful for environmental economic analysis. Firstly, the data is collected in a manner consistent with the national accounts so that time series of macro-economic and labour data can be depicted alongside the environmental indicators. Secondly, the environmental data can be easily linked to the supply and use framework and input-output tables of national accounts, as they are based on the same classification system (for instance, breakdowns by economic activities). This

allows for a number of input-output modelling techniques to be used for analysis of the relationship between the economy and environment (see Recommendation 5).

For example, economic data like value added and employment by economic activity can be supplemented by data on air emissions or resource use. That is an important feature for **descriptive analyses**. The uses of the environment or the eco-efficiency of different industries can be compared and further analysed.

The calculation of eco-efficiency **indicators** like energy productivity requires accounting data. The energy productivity of the different economic sectors, for example, is calculated as gross value added (price adjusted) per unit of final energy consumption of the sector (e.g. steel industry). Such mixed indicators that combine monetary and physical data have to be compiled in a consistent manner. If accounting data are used, the numerator and denominator would have the same underlying concepts and definitions. That means they are consistent and fit together. (See in detail Chapter 2.3 on Indicators.)

An important and often used method to identify driving forces of a development is the **decomposition analysis.** It provides another example of environmental–economic analysis that can be done using information from the environmental accounts. Structural decomposition analysis enables, for instance, detailed accounting for changes in emissions. Factors relating to the mix of fossil fuels, the share of fossil fuels in total energy consumption, the energy required to produce a unit of GDP, GDP per capita, and population can be brought together in a framework that allows the contribution of changes in each factor to be related to changes in total emissions. Decomposition analysis can also focus on individual industries.

Econometric modelling is another important tool that can benefit from environmentally extended Input-Output Tables. In most Member States econometric modelling is not a task of the national statistical institutes but of research institutes. Econometric models need a comprehensive and consistent data base. That is the reason why the data from environmental accounts and especially from extended Input-Output Tables are used for such calculations. Such models enable simulations to quantify not only the effects of political measures on the target variable but also the effects on other economic, environmental and social variables as far as they are included in the modelling. That is very helpful information for the development of political measures.

Recommendation 5: Use environmental accounts, consistent with the input-output tables from the national accounts, to investigate the indirect impact of consumption on the environment, otherwise known as the **consumer perspective**.

Instead of allocating the burden of reducing emissions to the producer (the polluter pays principle), this burden can be also allocated to the consumer (consumer should pay principle). For example, when it comes to GHG emissions, this consumer approach is better known as the *carbon footprint concept*. By applying environmentally extended input-output analyses, which combine data from the air emissions accounts with symmetric input-output tables from the national accounts, emissions embodied in global trade can be

calculated. The concept of a carbon footprint[4] has captured the interest of businesses, consumers and policy makers. It can be defined as the direct and indirect greenhouse gas emissions stemming from a given level of consumption expenditure. In recent years a lot of research has been devoted to calculate carbon footprints (see for example EXIOPOL[5] and WIOD[6] projects).

The extended analysis derived from complementing the data from environmental accounts with input-output tables from the national accounts can shed more light on environmental pressures. For example, domestically generated greenhouse gases (like those reported under the Kyoto Protocol) can be supplemented by data on the effects of foreign trade. With the help of environmental accounts, greenhouse gases generated by the production of imports abroad and accordingly also greenhouse gases generated by production of exports can also be accounted for. That allows answering the question to what extent is foreign trade responsible for generation of greenhouse gases abroad due to domestic demand for imported goods or, on the other hand, how much environmental pressure is caused by domestic activities abroad. Similar data can be compiled for other air emissions, water, energy or other resources etc.

It must be noted, however, that the regional nature of certain environmental problems (e.g. water availability) may render this type of analysis difficult or even unsuitable, in particular if it attempts to assume a global perspective.

It must be noted as well that the input-output tables are produced only every five years, which affects the annual compilation of the extended analyses showing the consumption perspective. Even though would be preferable to have annual input-output tables, the analysis can still be carried out on the basis of tables available every five years as the changes are usually not very substantive.

2.3. Indicators

Indicators are a way of making statistics easier to understand for users. First of all, they reduce the number of measurements and parameters that normally would be required to provide a comprehensive overview of a multidimensional phenomenon. Secondly, they simplify the communication process by which the results of measurement are provided to the users.

Indicators for the environment can be used at international and national levels for reporting on the state of the environment, the measurement of environmental performance, and reporting on progress towards the environmental component of sustainable development. Indicators derived from environmental accounts may play a key role as they are part of an integrated framework in which the linkages between the environment and economic and social issues are displayed.

[4] The term carbon footprint is a bit of a misnomer: it refers to the mass of accumulated CO_2 emissions through a supply chain, not some sort of measure of area.
[5] EXIOPOL is a project funded by the European Commission under the 6th Framework Programme, priority 6.3 Global Change and Ecosystems: http://www.feem-project.net/exiopol/index.php
[6] World Input-Output Database, project funded by the European Commission under the 7th Framework Programme, Theme 8: Socio-Economic Sciences and Humanities. http://www.wiod.org/

The work with indicators generally includes communication by several consecutive steps.

1) Defining the framework from which indicators should be derived.
2) Identifying possible indicators, selecting a limited number of indicators as "headline" or "key" information;
3) Identifying data sources and choosing methods for calculation;
4) Fixing indicator targets, baselines and benchmarks, or at least a desired direction;
5) Producing the indicators;
6) Generating outputs: indicator reports, indicators sets, publications, web pages, etc.

Recommendation 6: An indicator set for measuring environmental sustainability permits the monitoring of the various aspects of the phenomenon. This set should be limited to a fairly small number of indicators derived from a consistent framework and be as far as possible internationally harmonised. The set should rely as much as possible on the reuse of already existing data and indicator systems such as, for example, the Sustainable Development Indicators sets. Timeliness and the same reference period are two essential characteristics of an indicator set. In addition, quality aspects should be taken into account during the process of selection of indicators.

Some of the main characteristics of an indicator set on environmental sustainability are therefore:

- **Indicators derived as much as possible from a consistent and comprehensive statistical framework** such as environmental accounts. The link between the indicators and the conceptual framework should be clearly described. Such an indicator set should preferably include indicators echoing the capital approach to sustainability. In addition, well-chosen physical indicators may need to be selected, which would focus on dimensions of environmental sustainability that are either already important or could become so in the future.

- **Small number of indicators** in order to facilitate their communication. It is necessary to realise that there is a steep trade-off in terms of the possibility to communicate on a large set of indicators and to frame clear messages.

*Experiences from countries, for instance **Germany**, show that a set of 35 indicators organised in 20 themes allows striking a reasonable balance between communication requirements and comprehensiveness of the information provided. In **Switzerland**, two approaches are used to deal with this trade-off. Both approaches are based on an indicator system including a large amount of indicators (more than 50). The first approach is to make extracts (less than 20 indicators) from the whole system (e.g. Key Indicators), with selection criteria based on the conceptual framework of the system.*

- **Reuse as much as possible of existing data**. Reuse of data is important in order to limit response burden, to meet financial restrictions and to encourage

the coherence of the statistical system. Recent developments in certain important areas that are not yet well covered by official statistics should be also considered.

- **Indicators should be timely** and refer to the same reference period. Timeliness is especially important to users, especially policy-makers, who need up-to-date relevant information as well as data on historical developments.

- The indicators should be based on good **quality** data that are readily available and/or can be produced at a reasonable cost and be updated at regular intervals. Indicators on environmental sustainability have to adhere to the principles and standards of official statistics, as enshrined in the Fundamental Principles (FP) of Official Statistics and in the European Statistics Code of Practice (CoP). When non-official statistics are used it is recommended that they should be reviewed, if possible, by the relevant statistical authorities in accordance with the quality criteria referred to in the CoP.

Recommendation 7: The system of environmental and economic accounting should be the priority source to provide a range of important aggregates which can logically be defined within the SEEA's accounting identities. These main aggregates should be considered important indicators on environmental economic relationships and have the potential to be used to monitor environmental sustainability. Furthermore, the breakdowns by economic activity permit the detailed analysis of environmental economic relations in a consistent way.

As currently many environmental indicators (see also Annex) are primarily based on existing environmental statistics, the gradual development of environmental accounts would allow to expand or replace some of them with new indicators derived from the accounting framework. Even though the basic environmental statistics will remain important for the compilation of the accounts and for building some of the indicators, the value added of accounts is their direct linkage and consistency with economic data.

In general, indicators from the environmental accounts can be compiled at **three different levels**. **First,** the system of environmental and economic accounting provides a range of important accounting aggregates which can logically be defined within the SEEA's accounting entities. This accounting design is quite similar to that of the System of National Accounts (SNA). In the SNA economic transactions are ordered in such a way that the system provides in a systematic way a range of balancing items that are considered to represent meaningful aggregates for economic policy analysis. Examples in relation to the environmental accounting framework are *net emission totals*, *waste recycled by economic activity*, *national expenditure on environmental protection* or *national saving net of total natural resource depletion*.

Second, some important indicators can be directly derived from individual tables, for example the *recycling rate of solid waste* and the *expected life length of a natural resource asset*.

Third, there are so-called ratio indicators. Since the environmental accounts are consistent with the national accounting system, various ratios can be calculated for specific economic activities (e.g. manufacturing industries). These "ratio" indicators relate the environmental indicators to all kinds of economic and

social parameters, such as Gross Domestic Product (GDP) or gross value added (GVA) for a breakdown by specific industry, production (output), or population data. Examples are *resource productivity per economic activity* (similar to labour productivity, a key indicator in core economic analysis), *energy and CO_2-intensity of individual industries, revenues from environmental taxes as percentage of total GDP,* or *waste production per capita*.

In the forthcoming revised SEEA the main accounting aggregates will be explicitly addressed in Volume I, which will constitute the statistical standard for environmental accounting.

*The 2002 national strategy for sustainable development of the **German Federal Government** has made sustainability a fundamental principle of national policy. To measure the effectiveness of the strategy, a set of sustainability indicators was specified for several thematic fields at the political level. Furthermore, both target values and years were assigned to the majority of these indicators. Environmental-economic accounting supports the federal government's sustainability strategy by analysing and specifying detailed trends of various environmental indicators and revealing interrelations with economic and social aspects. This relates, in particular, to the indicators on energy and raw material productivity, greenhouse gas emissions, the growth of settlement and traffic areas, the intensity of passenger and freight transport and air pollutants.*

***Statistics Netherlands (CBS)** annually publishes the report 'Environmental Accounts of the Netherlands', which presents a quantitative overview of the state of the environment. This report includes a table with key figures that can be derived from the environmental accounts. As such, it presents an overview of the most relevant indicators.*

***The Swiss** Sustainable Development indicators cover the three target dimensions "environmental responsibility", "economic efficiency" and "social solidarity". Some of the indicators in the first two dimensions are based on the SEEA: Environmental taxes, Total Material Requirement (TMR), Material Intensity, Material Requirement abroad for imports.*

Recommendation 8: Dialogue with different stakeholders is an important part of the indicator selection and development process. The selection of the indicators should be made with a governmental mandate and include the National (resp. European) Statistical Office. In order to ensure good quality of the indicators and the underlying data, the Statistical Office could propose a first set of indicators with a view of ensuring their statistical quality.

There are several approaches to developing and adopting a set of sustainable development indicators. In order to achieve relevance, wide acceptance and use of the indicators, it is very important that they are developed in dialogue with stakeholders and taking into account the needs of the target audiences.

Identifying priority issues facing society today and devising strategies for how to deal with them are in general political and societal choices and the responsibility of policy- and decision-makers. Therefore, it is beneficial to have

a governmental mandate to deal with the subject of sustainable development and more concretely, of environmental sustainability. Ideally, this process should be accompanied by public discussions between politicians, experts from science, societal organisations, interest groups and statisticians.

Agreeing on a set of indicators is not easy, especially for a consensus-based process. A clear conceptual basis is useful to ensure that the indicators are not perceived as biased and to prevent various stakeholders from influencing the selection and interpretation in their favour.

The important task of official statistics in this first step of communication is a professional advisory service concerning the proposal and selection of indicators for the selected subjects. This task will comprise verification of data availability, giving detailed indicator definitions, applying appropriate methods for the indicator calculation, all in order to ensure quality aspects and particularly to provide reliable data. Only if there is a lack of appropriate official statistics concerning a special subject would other data sources need to be used – or new official statistics need to be created.

It is a challenge to establish a policy relevant indicator set while still keeping it stable enough when policy priorities change. Preferably, indicators should be stable and long-lived to describe long-term progress like sustainable development. But changes of priorities, developments or knowledge will lead inevitably to changes in sustainability issues and indicators. So another task of the communication process between politics and statistics is to maintain a balance between the constancy of an indicator set and the change of some of its parts.

*In **Germany**, the indicator set for the national sustainability strategy from 2002 has been chosen by the various functional departments of the government (ministries), advised by their special institutions (e.g. the Federal Environmental Agency), scientists, associations and others. Since 2006 the Federal Statistical Office is part of the process. It has an advisory role in a political board on sustainability and has been assigned to provide the reporting on the indicators for sustainable development. This responsibility of official statistics is very important for the credibility of the governmental sustainability policy.*

***France** has developed in this respect the concept of "Governance at five", that beyond the area of statistical governance, has been implemented at the political level on all of the axes of the sustainable development policy, notably with the 2007-2008 initiative "Grenelle de l'environment" e.g. Environment Round Table. "Governance at five" means involving the State government, local authorities, businesses, trade unions and NGOs dedicated to environmental protection. Thus, all sectors of the civil society take part in defining a shared vision on sustainable development and the environment.*

*In addition**,** the **French** set of national Sustainable Development Indicators, endorsed by the intergovernmental commission on sustainable development, alongside the new National Sustainable Development Strategy, had been the result of both a national conference involving about 400 representatives of the civil society, and the intense collaborative work of a working group on indicators under the auspices of the National Economic, Social and*

Environmental Council, of the National Statistical Information Council, and of the Intergovernmental Commission for Sustainable Development.

Recommendation 9: At least a desired direction should be defined for each indicator and, if available, a target or a limit value. The fixing of these target values or desired directions represent political goals and are therefore a political task, which could be supported by experts and/or statisticians.

An important subject for communication is the selection of target values for indicators. Fixing targets is clearly a political decision because it is a societally driven selection of priorities concerning our future conditions. Politicians decide on target values as a trade-off between conflicting political interests. This process is recommended to be accompanied by communication and advice of experts including statisticians and different interest groups. For example, the selection of the baseline year can have a significant effect on the performance of an indicator, where the same procedure including experts is also recommended.

It is helpful to combine target values with target years. Target years should preferably be the same for all indicators of the set to ensure comparability of the valuation of success. A short distance target year and a second one more distant, give good guidance. In this way, the valuation on the distance of target (success or failure of the indicator development) could already apply to the nearer time horizon.

Target values should be kept until the end of their run as well, regardless of their possibly recognizable failure, otherwise credibility is lost. In the case of an inevitable change of a target in the running period, this fact should be transmitted to the public for reasons of credibility.

If a consensus on quantitative targets is not feasible at least the direction of a desired development of an indicator should be determined. For example, in the case of air pollutants where there are no official targets, the intuitive direction of development for the indicator is a reduction of the air pollutants. Where the direction is not so obvious, it should be explicitly stated.

*Most of the **German** and some of the **French** sustainability indicators are combined with targets chosen by the political administration. This attribute constitutes the informative value of the indicators and their impact on political perception.*

*In **Switzerland**, a desired direction is defined or each Sustainable Development indicator, which allows an assessment of the evolution of the indicators in relation to Sustainable Development. The desired direction is given by postulates which are based on official strategies and documents.*

Recommendation 10: Indicators that involve aggregation should be compiled using a sound scientific basis, conforming to the quality standards of official statistics. Indicators expressed in physical terms are usually more relevant in

the context of environmental sustainability than indicators expressed in monetary terms.

The aggregation of data is only possible if the measure of these data is made in the same units. The SEEA includes two main approaches. The physical flows accounts typically use *mass* as a common unit to produce indicators. The indicators in chapter 9 (techniques for measuring degradation) of the SEEA2003 use *monetary units* as a common unit of measurement to adjust the economic indicators.

Individual indicators should be aggregated at the right level: indicators based on the most disaggregated classification schemes are scientifically robust. But they may be too numerous and unable to convey a coherent message. There are two specific cases of aggregation that are relevant in the context of environmental sustainability:

1. *Indicators using scientific weights:* Sometimes residuals contribute to the same environmental issue. In these cases aggregation can take place based on the scientific knowledge about the contribution of each residual to the environmental problem (e.g. the emissions of greenhouse gases are aggregated according to their global warming potential). However, difficulties may arise if cause-effect relationships are non-linear.[7]

2. *Indicators using input-output tables:* For targeting the environmental pressure from a consumption perspective, it is recommended to use input/output tables in the aggregation process (e.g. raw material consumption and carbon footprint[8]).

Recommendation 11: Indicators expressed in monetary units should be treated with caution as they may be either not fully relevant for measuring environmental sustainability or not compatible with the quality standards of official statistics. Two different cases can be considered here:

1. *Indicators expressed in monetary units for depletion:* the methods for monetary valuation of depletion are fairly well developed and benefit from clear links with the SNA. Whereas, from an economic point of view, indicators of natural stocks or annual extracted flows expressed in monetary values may make sense, they could reflect rapidly increasing and often volatile prices for the assets, which may give misleading signals. In the context of the measurement of environmental sustainability, observable physical and quantitative measures of natural assets may be more relevant.

2. *Indicators using monetary units for degradation.* The methods for valuation of degradation are still experimental. Methods for the valuation of ecosystems or climate systems are discussed in chapter 9 of the SEEA 2003, but fall short of forming the basis of a statistical standard for the time being. Work is in hand to improve the methods in the current revision of SEEA for 2013).

[7] de Haan, 2004.
[8] See also recommendation 5

Recommendation 12: Composite indicators are hardly compatible with the quality standards of official statistics and are therefore not recommended.

A composite indicator is formed when individual indicators are combined into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured[9]. Composite indicators are based on sub-indicators that have no common meaningful unit of measurement and there is no obvious way of weighting these sub-indicators[10].

The selection process of sub-indicators, the normalisation towards a single unit of measurement and the application of weighting schemes that are implied in the models for calculating composite indicators leave too much room to arbitrary choices so they cannot be labelled as official statistics. They should remain in the research or political sphere.

2.4. Communication

Communication is an important consideration for the success of the environmental sustainability indicators. It may be argued that the importance of communication is in this area similar to other statistical domains. However, in the case of environmental sustainability, citizens and consumers are important actors in the implementation of the policies which in many cases affect societal patterns such as consumption and living habits (for instance, transport). As a consequence, one can see two general target audiences for the indicators: First, the general public for which the interest focuses on a small number of figures transmitting easy to interpret messages. Second, policy makers for which in addition, more detail is needed in order to understand the underlying phenomena and identify relationships. This second group needs access to large amounts of well structured information.

Communication does not only concern the final phase of disseminating the indicator data but the whole process, from identifying and selecting the indicators to their dissemination and gathering feedback from users. In order to have successful and well-accepted indicators, a clear communication policy is needed already from the outset when the indicators are selected.

This section on communication particularly refers to the dissemination of the indicator set and to the role of communication:

a) to inform on the current situation, monitor policy impact, etc. and
b) to obtain feedback for further developments of indicator sets.

Recommendation 13: There has to be a clear communication policy for the indicators, identifying target audiences, products, main channels and frequency

[9] OECD glossary of statistical terms.
[10] http://composite-indicators.jrc.ec.europa.eu/FAQ.htm

of communication. Indicators should be communicated regularly to inform politicians, the administration, the public and researchers on the success or failure of the sustainability policy of a country. The results of a transparent statistical calculation could be visualised by symbols or in other pedagogical ways.

It is important to identify the purpose and target audiences for the indicators. Often, the principal audience for the sustainable development indicators is the general public, media, decision makers in national administrations, policy makers and the academia. In some cases, different indicators target different audiences.

As their main purpose, the indicators can be used to:

(a) Monitor sustainable development strategies and indicate success and failure,

(b) Make an assessment on the status of environmental sustainability for selected issues;

(c) Raise awareness of sustainable development and environmental sustainability concerns;

(d) Influence the political decision-making processes;

(e) Help to define national priorities in this area.

It is recommended to have a policy for communication of indicators that establishes the target audiences and main messages to be delivered. Media relations strategy can form part of this policy. Different audiences may be reached through different forms of reporting, dissemination or presentation.

Based on the communication strategy, it has to be decided what kind of communication products will be used (in hard copy or web format or both; voluminous indicator reports or small booklets, indicators sets, leaflets, etc.) and how to use modern visualisation tools to help reach different audiences. Besides regular publication of indicators, single indicators could be updated on the Internet more frequently, according to the time of their data availability for revision.

It is helpful to find a robust structure for the reports, including informative graphs and text with clear indicator definitions, fixed issues and a valuation of the indicators development or distance to target. The latter could be demonstrated by special symbols showing the success of sustainable development. The use of symbols (traffic lights, smileys, weather symbols) has to be transparent and based on clear criteria and appropriate calculation methods. Symbols have a potential drawback in that media may become focused on such assessments and not on the wider issues behind the indicators. However, these representations can give an idea at a glance of whether the situation is improving.

*The Indicator Report on Sustainable Development in **Germany** is released by the Statistical Office every second year, as a handy pocket book as well as online. A progress report on sustainability, issued by the government and released every fourth year, refers to its results. A graph with time series is*

presented in a limited space for each of the 35 indicators, combined with a descriptive text in a preferably strong structure and endowed as far as possible with supplementary analysis from environmental economic accounting.

*Concerning the valuation of the indicator development in **Germany** similar to the Eurostat sustainability reporting, four different "weather symbols" are used. The symbols are reported in connection with the indicator sheets and as an overview in an appendix as well. The rules for the statistical calculation of the indicators' status as a base for the symbols are introduced. The evaluation is not a political assessment or a forecast, but just the result of a simple forward calculation of the past years with reference to the given targets.*

*The endorsement of the **French** set of National Sustainable Development Indicators in late July 2010 has given the opportunity to disseminate a handy pocket book to most representatives of the civil society and to the MPs. This pocketbook will be issued on a regular basis.*

Recommendation 14: The communication of indicators should be a delegated responsibility of the producers of official statistics to ensure impartiality and professionalism.

Regular communication of the indicators is the main instrument to inform all interested groups and the public on the situation of sustainable development. The reporting on sustainable development and the calculation of the distance to target should clearly be the task of the official statistics, which ensures methodological competence as well as continuity and neutrality. As a result of the politically driven character of the sustainability strategy, there is strong communication between politicians and statistics as partners in this part of the process. Impartial reporting by official statistics also raises the credibility of politics and thus helps the whole process of sustainable development.

The communication mechanisms should provide an opportunity to obtain ongoing feedback from users and stakeholders in terms of a consultation process. Different tools for user engagement can be used for that: websites, social networks, wikis, focus groups, seminars/workshops, etc.

3. FROM RECOMMENDATIONS TO ACTIONS

The approach followed in this report has been to present recommendations that will act as guidelines for choosing a set of indicators. They therefore provide hints on what can be done, what should not be done, and what could be cautiously done. The importance of international comparability is outlined and, although the use of an accounting framework based on the SEEA standard would be the way to enable it, it has to be recognised that prior work on developing specific indicators is important for that comparability purpose.

As said in the introduction, this report is not aiming at recommending a specific list of indicators as there are many different initiatives that are working in that direction (the work of the Task Force on Sustainable Development of the

UN/ECE/Eurostat/OECD, the Green Growth Initiative of the OECD and the Resource Efficiency Europe, currently being launched by the European Commission). Nevertheless, the TF considers it important to look at possible joint actions that will permit the parallel development of indicators, therefore enhancing comparability and providing synergies in the methodologies used.

This section aims at achieving that in a three step process: firstly, by making an analysis of the current situation concerning indicators; secondly, by sketching a global picture of what would be a satisfactory situation concerning availability of indicators in the long term; and thirdly, by proposing a set of actions to be launched and even completed within the next 5 years in order to achieve highest convergence in the construction of indicators at national level.

3.1. Overview of current situation

The table in the following pages provides an inventory of the indicators currently used to measure environmental sustainability in the countries represented in the TF. Although we have not aimed to exhaustively cover all countries, the table already shows several important features as described below. This results in a diversity of indicators as shown in the table.

1. It can be seen that indicators used by different countries are different in definition and probably in the production methodology while they aim at measuring similar concepts.

2. This results in a diversity of indicators that hampers international comparability.

3. A dearth of data coming from environmental accounts is noticeable. This prevents from benefitting from the use of international standards when developing measures and also reduces the analytical possibilities that could be offered by linking environmental and socio-economic information.

4. Very rarely, and mainly in marginal cases, indicators of natural assets are included in the list. While this information is recognised as important for the purpose of measuring sustainability, it is clear that the methodologies to produce them belong to the domain of research. The investment both in resources and know how that statistical organisations have to put to incorporate them is not at all negligible.

5. The possibility of analysing many of the environmental impacts from the consumer perspective is limited by the absence of regularly produced environmentally extended supply and use input-output tables.

Indicators on Environmental Sustainability			
Theme	**Existing Indicators**	**Data Sources**	**Comments/Future Developments**
01. **Land and land use**, *of which*:		LUCAS CORINE Farm Structure Survey Agricultural surveys	This theme requires further development of land use derived indicators (e.g. landscape fragmentation, built-up areas), then on indicators derived from land asset accounts and as well on agricultural surface from agricultural surveys (FSS).
01.01. Non-agricultural uses	Increase in land use for housing and transport (DE)		
	Land use and land cover (DE)		
	Value of land (NL)		
	Built-up area (CH)		
	Built-up area per capita (CH)		
	Artificialisation of soils (also under Soils) (FR)		
	Dwelling density (UK)		
	Land use (UK)		
01.02. Agricultural uses	**Area under organic farming (PL, FR)**		
	Cropable land (CH)		
	Landscape fragmentation (also under Biodiversity) (CH)		
	Land recycling (UK)		
	Land used for organic farming (DE)		
02. **Water**, *of which*:		JQ / OECD Water statistics In the long-term and additionally, water accounts	This theme has a high political priority and also requires further development in the medium term. Many problems of sustainable water use are of regional nature (e.g. over-exploitation of groundwater in the South-East of Spain) and will be masked by indicators established for national territories only. Therefore, in order to be relevant, sustainability indicators for water must be regional and/or available for river basins (Water Framework Directive!) or sub-units. The Water Exploitation Index (WEI), i.e. the abstractions as share of resources, is wide-spread as sustainability indicator but too simplistic: the main shortcomings are: - it merges and lumps together different water resources (surface and groundwater), internal flow and external
02.01. water quantity	*Annual water abstraction by source and sector (ESTAT)*		
	Renewable water resources (ESTAT)		
	Water use by supply category and user (ESTAT)		
	Resources, abstraction and use by households and industry (PL)		
	Abstraction and use (ground-, surface- and tapwater) (NL)		
	Surface and groundwater abstraction as a share of available resources (SDI)		
	Water resource use (abstractions) (UK)		
	Domestic water consumption (UK)		
	Water stress (geographic distribution of seasonal limitations on new abstractions) (UK)		
02.02. water quality	Biochemical oxygen demand in rivers (SDI)		

	Nitrate concentrations in groundwater (CH) *Nutrients discharged to water (NL)* *Heavy metals discharged to water (NL)* River quality index (FR) **Phosphorus concentrations in lakes (CH)** River quality - biological / chemical (UK) Resident population connected to wastewater collection and treatment systems (ESTAT)		inflow; - it does not take into account the nature of the water use after abstraction (consumption/return, pollution, etc.); - the commonly used threshold values (20% and 40%) are very arbitrary. In order to develop water accounts the underlying water statistics need to be consolidated. It should be taken into account that the "Water Blueprint" will propose a new indicator on resource efficiency in
	Treatment capacity of wastewater treatment plants (ESTAT)		
	Generation and discharge of wastewater (ESTAT)		
	Population connected to urban wastewater treatment with at least secondary treatment (SDI)		
	Wastewater collection system and treatment (PL)		
03. **Energy**, *of which*:		Energy statistics In the future, energy accounts	This theme has high political priority and is already under quite advanced development. A comprehensive Regulation on energy statistics is in force. Nevertheless, the development of energy accounts is a prerequisite for the future availability of indicators such as: - the consumption perspective (DE) - Final energy consumption by economic activity - Final energy consumption by households (DE)
03.01. Efficiency	Energy productivity (DE)		
	Energy intensity (CH, FR) and by industry (DE, NL)		
	Material productivity (FR)		
03.02. Stocks (reserves)	**Stocks of natural gas, oil and other energy carriers (NL)**		
03.03. Renewable energy	Renewable energy (UK)		
	Share of renewable energy sources in total energy consumption (DE, FR)		
	Share of renewable energy sources in gross final energy consumption (SDI, official EU target, CH)		
	Value of renewable energy (NL)		
03.04. Consumption and production	Electricity generation (UK)		
	Household energy use (UK)		
	Indigenous energy supply (UK)		
	Final energy consumption (ESTAT, CH)		
	Energy consumption per capita (FR)		
	Transport energy consumption and GDP (FR)		
	Combined heat and power generation (PL)		
	Energy production and consumption (PL)		
	Electricity consumption of households (SDI)		
03.05. Dependency, imports and exports	*Imports and exports (DE, NL)*		
	Energy dependency (ESTAT, CH)		

04. **Air**, *of which*:		Air emissions accounts (Regulation on European environmental economic accounts)	This theme already enjoys a good level of development as it is part of the first set of modules of the Regulation on EEAs. Potential future indicators may include: - Air pollutants by type and by economic activity - Air pollutants per capita It could be useful to analyse some aggregated categories of impacts (e.g. global warming, acidification, tropospheric ozone formation potential, particulate matter, eutrophication, etc.) in association with consumption patterns and internationalization of economy to provide complementary indicators on the "consumer perspective".
04.01. Emissions	*Total emissions of air pollutants (PL)*		
	Emissions of particulate matter (PL, NL, also an SDI)		
	Gaseous pollutants (PL)		
	Emissions of acidifying substances (NL, also an SDI)		
	Emissions of ozone-layer depleting substances (NL, also an SDI as emissions of ozone precursors)		
	Emissions of air pollutants ((NH3, NOx, PM10, SO2) (UK)		
	Air pollutants: sulfur dioxide, nitrogen oxides, ammonia and NMVOC (DE)		
	Air pollutants by economic activity (ESTAT)		
04.02. Concentrations	**Concentrations of respirable fine particles (CH)**		
	Concentrations of ozone (PL, CH)		
	Air quality (particles and ozone concentrations) (UK)		
04.03. Exposure and impacts	Ecological impacts of air pollution (exceedances of critical loads for deposition) (UK)		
	Urban population exposure to various air pollutants (SDI)		
05. **Biodiversity**, *of which*:		In the future, ecosystem services accounts ("Fast track implementation project")	This theme has received renewed political attention, cf. the Communication "Our life insurance, our natural capital: an EU biodiversity strategy to 2020", COM (2011) 244. However, the development of environmental accounts in this area is still long time ahead. The development of indicators in this area is hindered by the lack of comprehensive data on species. Traditionally, specialised bodies in the Member States have gathered species' data. If indicators on species diversity are desired (i.e. a diversity index covering a wide range of biological taxa), this can only come from scientific studies, but the value for statistics is very questionable because the results are only applicable to the study area and to the taxa selected. The most logical way to proceed could be to organise the collection of data for different fields of interest (e.g. LUCAS, birds, insects, soil invertebrates, etc.) to be collected from the same random (geo-referenced) plots in the same year. The results should be linked to the economic activity, e.g. Farm Structure
05.01. Species	Common bird index (SDI)		
	Population of breeding birds (CH)		
	Bird populations (farmland, woodland, sea, wintering wetland) (UK)		
	Biodiversity conservation (status of priority species and habitats) (UK)		
	Butterfly populations (not in SDI but in separate biodiversity indicators) (UK)		
	Bat populations (not in SDI but in separate biodiversity indicators) (UK)		
	State of population of major protected animals (PL)		
	Species diversity and landscape quality (DE)		
05.02. Marine resources	Fish stocks fished sustainably (UK)		
	Marine ecosystem (fish lengths) (not in SDI but in separate biodiversity indicators) (UK)		
	Fish catches outside safe biological limits (SDI)		
05.03. Landscape	Landscape fragmentation (also under Land) (CH)		

	Ecological quality of forests (also under Forests) (CH)		Surveys. This would, however, be hugely expensive, including the analysis. Qualitative aspects are difficult to define (e.g. landscape and ecological quality) in a single indicator.
05.04. Protected areas	Sufficiency of sites under the EU Habitats Directive (SDI)		
	Protected areas (PL)		
	Extent and condition of protected areas (not in SDI but in separate biodiversity indicators) (UK)		
	Habitat connectivity (not in SDI but in separate biodiversity indicators) (UK)		
	Environmental stewardship schemes on farmland (UK)		
05.05. Forestry / plants	Ecological quality of forests (also under Forests) (CH)		
	Plant diversity (not in SDI but in separate biodiversity indicators) (UK)		
05.06. Financial / other	Investment outlays for the protection of biodiversity and landscape (PL)		
06. **Natural Resource Use**, *of which*:		Economy-wide material flow accounts MFA (Regulation on European environmental economic accounts)	This theme is rather well-developed as EW-MFA is already part of the first set of modules of the Regulation on EEAs. Further possible indicators may include: - DMC per capita - Material intensities by industry - Consumption perspective - Raw material equivalents of imports
06.01. Efficiency	Resource productivity (PL, also an SDI)		
	Material intensity (CH)		
	Material productivity (FR)		
	Raw material productivity (DE)		
	Domestic extraction used (PL)		
06.02. Material consumption	*Domestic material consumption (PL, NL, UK)*		
	Total material requirement (CH)		
	Consumption of organic products (CH)		
	Share of imports in domestic material consumption and associated indirect flows (FR)		
	Material requirement abroad for imports (CH)		
07. **Waste**, *of which*:		Waste Statistics Regulation JQ / OECD Waste stream specific Directives managed in the	This theme enjoys a good level of development thanks to the Regulation on waste statistics and many indicators are or can be derived from that data source as well as the data collected in Eurostat's data centre on waste. Further work is needed on devising a common nomenclature and streamlining of these indicators. Indicators on hazardous waste should also be considered as there is a Sustainable Development Target in the Rio
07.01. Waste generated	*Total waste supply by industry (NL, PL)*		
	Household waste (CH)		
	Total waste disposed of in landfill (UK)		
	Household waste arisings and amount recycled or composted (UK)		
	Radioactive waste generated (FR)		
	Municipal waste collected (PL)		

07.02. Treatment and recycling	Waste recycling (CH) Treatment of waste by type (NL)	frame of the environmental data centre on waste.	Declaration concerning chemicals. Even though waste accounts are not developed yet. at EU level, the Waste Statistics Regulation has recently been revised so that the establishment of waste accounts would be facilitated. Development work is required to transpose from NACE*19 aggregation level plus households to the NACE*64 breakdown. Possible future indicators include: - indicators derived from waste accounts - Food waste - Radioactive waste
08. **Forests**, *of which*:		JQ UN / FAO Ministerial Conference on the Protection of Forests in Europe (MCPFE) In the future, forest accounts.	This theme enjoys a certain level of development, however, further work needs to be done to improve the data availability and timeliness. Currently there is a collection of data on the production of and trade in wood and wood products as well as economic data on forestry and logging as part of the Integrated environmental and Economic accounting for forests (IEEAF). Indicators can be derived from forest accounts if countries would provide yearly data on the volume of standing timber. Five countries provide Eurostat with these data, which include increment and fellings. The FAO doesn't collect these data any more; only MCPFE does (5-yearly). Often only official inventory data are reported to MCPFE, while Eurostat is trying to encourage countries to do running estimates, based on inventories. Defoliation: the data are not sampled randomly and hence are unreliable. Hence, this indicator should be reconsidered. Deadwood is a good indicator of environmental quality. It must be noted that most forests are already under sustainable management plans.
08.01. Quantity	*Forest increment and fellings (SDI)*		
08.02. Quality	**Ecological quality of forests (also under Biodiversity) (CH)**		
	Forest trees damaged by defoliation (SDI)		
08.03. Management	Forestry under sustainable management (not in SDI but in separate biodiversity indicators) (UK)		
09. **Climate**, *of which*:		Official national greenhouse gas inventories	This theme has very high political priority and internationally binding commitments as well as official EU targets. In addition, GHGs are part of the Air emissions
09.01. Emissions	*Greenhouse gas emissions totals*		
	Greenhouse has emissions (including various sectoral		

	breakdowns)	submitted to the EEA	accounts module already incorporated in the Regulation on EEAs. Further indicators that can be developed include the national or EU carbon footprint. As on Air, it could be useful to analyse some aggregated categories of impacts (e.g. global warming, acidification, tropospheric ozone formation potential, particulate matter, eutrophication, etc.) in association with consumption patterns and internationalization of economy to provide complementary indicators on the "consumer perspective".
	CO2 emissions associated with consumption (UK)		
	Greenhouse gas emissions by economic activity		
	CO2 emissions(CH)		
09.01. Efficiency	CO2 intensity (CH)		
	Carbon productivity by economic activity (ESTAT)		
09.03. Consumption perspective	Carbon footprint (FR)		
	Carbon footprint (NL)		
10. **Soil**	Nitrogen surplus on agricultural land (CH)		The agro-environmental indicators (AEIs) contain a large number of readily available indicators, of which the pesticide use and Gross Nutrient Balances are both operative (even if more detailed data on pesticide use will not be available until 2015). In addition, there are the soil quality and soil erosion risk indicators already more or less ready.
	Pesticides use (FR		
	Artificialisation of soils (also under Soils) (FR)		
11. **Financial and monetary instruments**, *of which*:		Environmentally related taxes (Regulation on EEAs) JQ / OECD on EPER DG TAXUD tax data In the future, EGSS, RUMEA, etc.	Part of this theme - environmental taxes - has already been incorporated in the Regulation on EEAs while other parts can be added in the medium term (EPE and EGSS). Further work is required on the inclusion of additional modules in the Regulation. In addition, current work also includes: - Environmental subsidies, including harmful subsidies (pilot data collection has been launched in a task force) - Resource use and management accounts (pilot data collection has been launched in a task force).
11.01. Taxes	*Environmental taxes by economic activity (ESTAT)*		
	Environmental taxes (CH)		
	Implicit tax rate on energy		
	Environmental fees (PL)		
11.02. Env. expenditure	*Environmental expenditure by enterprises (NL, PL)*		
	Environmental investments by enterprises (NL, PL)		
	Unpaid costs of damage to natural assets (work in progress) (FR)		
11.03. Env. goods and services	*Environmental goods and services sector (NL, PL)*		
	Environmental employment (FR)		
11.04. Climate financing	*Emission permits shortage by industry (NL)*		
	Mitigation expenditure accounts (work in progress) (ESTAT)		

LEGEND:

Bold	stock indicators
Italics	flow indicators
Highlighted	indicators derived from accounts

3.2. The global picture for the future

The list of actions in the next pages provides the basis for the set of information that can be developed in order to have a complete and coherent set of indicators for environmental sustainability. It is clearly understood that many of these indicators will be work that cannot be supported in the coming developing years. The table is presented for the sake of completeness.

Non-prioritised list of actions for improving the availability of indicators on environmental sustainability

Climate

- Improve timeliness of indicators by using early estimates of CO_2 emissions based on monthly energy statistics
- Regularly produce environmentally-extended Supply and Use Input/Output Tables (ee-SUIOT) to investigate the "consumer perspective" of global climate change in order to develop carbon footprint indicators

Air

- Improve the timeliness of indicators on various air pollutants
- Regularly produce environmentally-extended Supply and Use Input/Output Tables (ee-SUIOT) to investigate the "consumer perspective" of global air pollution

Energy

- In the medium term, develop energy flows accounts, based on already existing energy statistics and derive indicators on that basis, such as for example energy use by economic activity
- Use energy accounts to link energy data to the economy: taxes, subsidies, prices, investments, greening of energy systems, etc.
- Develop an indicator on energy efficiency (savings)
- In the long term, develop energy asset accounts on physical (and, where possible, monetary) sub-soil stocks (reserves)

Natural resources

- Explore the possibility of producing the indicator "Raw material consumption" further to the ongoing pilot studies
- In the long term, develop asset accounts for natural resources

Water

- Improve the data coverage and quality of existing water statistics (abstraction, water use, pollution, etc.)
- Develop indicators for pressures on water resources on regional (or river-basin), rather than national aggregation
- Develop an indicator "River quality index"
- In the long term, develop water accounts to map out the use of water by the different economic activities

Waste

- Harmonise the presentation of the existing indicators on waste and their metadata along the on-going Eurostat indicator streamlining project.
- Develop indicators on radioactive waste, hazardous waste and food waste
- In the long term, develop waste accounts on the basis of already existing waste statistics

Biodiversity

- Explore the possibility of deriving indicators relevant to biodiversity measurement from the ongoing project to develop eco-system services accounts together with other stakeholders (e.g. the EEA).
- Improve the quality of already-existing SDIs such as "Common bird index", "Protected areas" and "Fish catches outside safe biological limits"
- Develop complementary indicators on fish catches, such as maximum sustainable yield and effective fishing capacity of the fishing fleet
- Collaborate actively with scientific or research sources for data on species (usually outside the remit of official statistics).

Forests

- Improve the availability of yearly estimates on the volume (including increment and fellings) of standing timber (currently data available only on a 5-year basis)
- Use deadwood as an indicator of environmental quality

Land use and soil

- Use Land Use/ Land Cover data to build relevant indicators such as Landscape- state and diversity, land use change
- Improve the quality of the indicator "Area under organic farming" (an SDI)
- Explore the potential of using the agri-environmental indicators; High Nature Value farmland; agricultural area under Natura 2000
- Develop an indicator on landscape fragmentation
- Promote the development of the following Agro-Environmental Indicators (AEI):
    - Agri-environmental soil quality index
    - Capacity of soil to agricultural biomass production
    - Carbon storage, filtering, buffering
    - Soil response to climatic variability

Financial and monetary instruments:

- In the medium term, improve the response rate to the Environmental goods and services sector (EGSS) data collection in order to derive indicators such as "'Green' employment" or "Turnover generated by 'green' economy" and work on developing a module for future inclusion of EGSS in the Regulation on European environmental economic accounts
- In the medium term, further consolidate the Environmental protection expenditure accounts (EPEA) and work on developing a simplified version in view of future inclusion of EPEA in the Regulation on European environmental economic accounts
- In the long term, develop indicators on environmental subsidies, including potentially harmful subsidies
- In the long term, develop Resource use and resource management accounts

3.3. Core priorities for development

The following priority areas are derived on the basis of the actions suggested under each theme, giving a perspective on where the focus should be in terms of resources and effort. In addition, since each area is at a different stage of development, it may require a different time span to be completed. Thus, some actions identified below can be easily completed in the short term (within a year), while others may require more time: medium term (in the next two-three years) or long term (beyond 2015).

First Level

→ Develop energy flows accounts, based on already existing energy statistics and derive indicators on that basis, such as for example energy use by economic activity (*in the medium term*).

Energy flows accounts allow for a more disaggregated picture of the different energy commodity flows through the economy. Several indicators, pertinent to sustainable use of energy policies, economic planning and analysis and sustainable production and consumption, can be derived from such accounts:

- *Energy consumption by economic activity (NACE breakdown)*
- *Energy efficiency by economic activity*
- *Energy productivity of the economic sectors*

→ Further develop indicators related to climate change, also by using data derived from accounts (*short to medium term*).

The module or Air emission accounts, covering greenhouse gas emissions, is already part of the first set of modules included in the EU Regulation on environmental economic accounts. Besides indicators derived on the basis of Air emission accounts, further indicators relevant to climate change mitigation and adaptation need to be developed in collaboration with other stakeholders.

- *Carbon intensity by economic activity (NACE breakdown)*
- *Carbon productivity by economic activity*
- *Expenditure related to climate change adaptation*

→ Improve timeliness of climate-related indicators by developing early estimates of CO_2 emissions based on monthly energy statistics (*in the short term*).

The methodology for using monthly energy statistics to produce early estimates of CO_2 emissions from energy is in an advanced stage of development by Eurostat. The basic data used by this methodology is the one currently reported under the Energy Statistics Regulation. Therefore, countries can follow a similar approach to develop their early estimates.

In addition, Eurostat is looking into developing "now-casting" techniques which could later be tested by EU Member States to be applied also at national level. With high political importance, such early estimates are also a priority

→ Regularly produce environmentally-extended Supply and Use Input/Output Tables (ee-SUIOT) to investigate the "consumer perspective" of global climate change or air pollution in order to develop footprint indicators (*in the medium term*).

The linking of environmental data with the economic Supply and Use Input/Output Tables from national accounts allows for an integrated analysis of

the so called "consumer perspective", which can render relevant indicators such as:
- *Emissions "embedded" in imports*
- *Emissions induced by final use of products, by product group*
- *National or EU carbon footprint*

➔ **Develop asset accounts for natural resources, including sub-soil assets and energy assets (*in the long term*).**
Asset accounts allow the calculation of indicators showing to what extent the stock of a given asset (e.g. energy reserves) has been sustained or not in both physical and monetary terms. Developing asset accounts would require intensified exchanges with the scientific community responsible for gathering primary data on the various resources, for example, forests, fish or minerals. Indicators can include:
- *Depletion (change in stock levels) of natural resources assets, e.g. energy reserves*
- *National saving net of total natural resource depletion*
- *Expected life length of a natural resource asset*

Second Level

➔ **Improve the response rate to the Environmental goods and services sector (EGSS) data collection and work on developing a module for future inclusion of EGSS in the Regulation on European environmental economic accounts (*medium term*)**
The development of the module on Environmental goods and services sector (EGSS) would permit the calculation of indicators such as:
- *'Green' employment*
- *Turnover generated by 'green' economy*

➔ **Explore the possibility of producing the indicator *Raw material consumption* further to the ongoing pilot studies (*short to medium term*).**
The indicator *Raw Material Consumption (RMC)* complements the already established indicator *Domestic Material Consumption*, derived from Material flow accounts (MFA). Its additional value lies in the fact that it accounts for the consumption of raw materials in third countries induced by imports of finished or semi-finished products. Eurostat is currently producing on a pilot basis the RMC at EU level. Many MS also plan to obtain the corresponding national indicator.

➔ **Use Land Use/ Land Cover data to build relevant indicators on landscape and biodiversity (*medium to long term*).**
The development of landscape and biodiversity indicators would require the intensified collaboration with the European Environment Agency and DG Environment on how best to utilise existing statistical information such as Lucas and Corinne to further develop the indicators, for example:
- *Landscape state and biodiversity*
- *Changes in land use*

Third Level

➔ **Further consolidate the Environmental protection expenditure accounts (EPEA) and work on developing a simplified version in view of its future inclusion in the Regulation on European environmental economic accounts (*in the medium term*).**

Environmental protection expenditure accounts can be used to identify and measure society's response to environmental concerns and behaviour aimed at preventing environmental degradation. Indicators that can be derived include:

- *National expenditure on environmental protection*
- *Total investment and current expenditure by households, government and industry*
- *Expenditure by environmental domain (air and climate, wastewater, waste, other)*

➔ **Improve the data coverage and quality of existing water statistics (abstraction, water use, pollution, etc.) and develop indicators for pressures on water resources on regional (or river-basin), rather than national aggregation (*medium term*).**

In the future, develop water accounts to map out the use of water by the different economic activities (*in the long term*).

Improving the existing water statistics and developing indicators on a river-basin or regional level are pertinent to measuring the environmental sustainability of water resources. In addition, water accounts might yield further insight into the use of water by different economic activities. Indicators derived can include:

- *Water abstraction and use by river basin or region*
- *Water use by economic activity (NACE breakdown)* – derived from accounts

➔ **Harmonise the presentation of the existing indicators on waste and their metadata along the on-going Eurostat indicator streamlining project (*short to medium term*).**

Develop waste accounts on the basis of already existing waste statistics (*long term*).

Waste statistics benefit from the already established EU Regulation in that area. Work that remains to be done concerns further improvements on the harmonisation and streamlining of indicators. In the longer term, developing waste accounts could render additional indicators, such as:

- *Waste generated by economic activities (NACE breakdown)*
- *Waste recycled by economic activity*
- *Recycling rate of waste by economic activity*

4. SOME FINAL COMMENTS

This work was carried out by Task Force 2 of the Sponsorship on Measuring Progress, Well-Being and Sustainable Development. The members of the Task Force are:

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The Task Force started their work in June 2010. Three physical meetings were organised. The method used was to split the work into three different drafting teams who dealt with the various subjects allocated to them. This report is the consensual outcome of the very valuable contributions of every member of the TF.

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