DEDICATED TO MAKING A DIFFERENCE

measuring eco-efficiency

a guide to reporting company performance

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foreword

We believe this report will help companies around the world measure their progress toward sustainable development. It is the product of a two-year project to develop a framework for assessing and reporting eco-efficiency which can be used across all industries.

The concept of eco-efficiency was introduced by the WBCSD in 1992 and has been widely adopted. Many businesses in all continents have been pursuing ways of reducing their impact on the environment while continuing to grow and develop. But different companies have interpreted and measured it in different ways. Our task has been to find a common approach which will make it easier for companies to measure their performance and for stakeholders to assess the progress they are making.

We have done this by talking to many people, both inside and outside companies, who are responsible for or interested in corporate eco-efficiency. Most importantly, we have tested the framework with 22 companies from more than 10 industrial sectors and 15 countries.

That rigorous testing has shown that the approach, principles, definitions and the indicators explained here can be implemented by all companies. We have not attempted to define a rigid straitjacket and believe we have left room for the flexibility which is required by the natural diversity of business activity. But the year-long pilot testing has shown that the indicators presented here can be used right across the business world, while we also provide guidance on other measures which will help to flesh out an individual company's eco-efficiency profile.

We would like to thank the many people who have contributed to this work, especially the managers in the pilot companies who have done the hard work of putting these ideas into practice on the ground.

We urge companies to adopt this framework as a way of measuring and reporting their progress and contributing to a more sustainable society. We believe it will help to forge the link between environmental and economic performance which is essential for sustainable development.

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executive summary

THE MEASUREMENT FRAMEWORK

The concept of eco-efficiency was developed by the WBCSD in 1992 and has become widely recognized by the business world. It brings together the essential ingredients – economic and environmental progress – which are necessary for economic prosperity to increase with more efficient use of resources and lower emissions.

Approaches to implementing the concept and measuring performance have varied widely, however. This report sets out a framework which can be used by any business to measure progress toward economic and environmental sustainability.

The framework is flexible enough to be widely used and easily interpreted across the business spectrum, recognizing the diversity of businesses. But it provides a common set of definitions, principles and indicators.

A small number of indicators have been identified as being valid for virtually all businesses. These are called "generally applicable". They are widely relevant and subject to a common measurement approach. Other indicators need to be used by individual companies to fit their particular context – these are termed "business specific". The framework defines the generally applicable indicators and provides guidelines for companies to select their own business specific indicators. It also offers guidance on implementation and communication. The indicators have been rigorously tested in a year-long pilot program involving 22 companies from more than 10 different industry sectors. This test process has shown that the framework is appropriate for all companies and has helped to refine the approach to ensure the recommendations can be implemented on the ground.

THE INDICATORS

The indicators are based on 8 principles which ensure they are scientifically supportable, environmentally relevant, accurate and useful for all kinds of businesses around the globe. The

ultimate aim is to improve the performance of businesses and monitor performance with measures which are transparent and verifiable, and therefore meaningful to business managers as well as to external stakeholders. While the emphasis is on areas under direct management control, we also recognize there are relevant issues upstream (e.g. with suppliers) and downstream (e.g. in product use) of a company's activities.

Generally applicable indicators can be used by virtually all businesses. As well as being more or less universally relevant, each of these indicators relates to a global environmental concern or business value and methods for measurement are established and definitions accepted globally.

All other indicators which do not meet these criteria have been termed **business specific**, meaning that they are more likely to be individually defined from one business or one sector to another. These indicators are not necessarily less important than the first group. That judgment will depend on the nature of an individual business. They are merely less widely applicable. A company's eco-efficiency performance profile will include both types of indicators.

The indicators fall into two groups, based on the eco-efficiency formula which brings together the two eco dimensions of economy and ecology to relate product or service value to environmental influence. Eco-efficiency is represented by:

$$\frac{\text{Product or service value}}{\text{Environmental influence}}$$

Environmental influence includes aspects of product or service creation and aspects of product or service consumption or use.

The generally applicable indicators for product/service value are:

- **Quantity of goods or services produced or provided to customers**
- **Net sales**

Those relating to the environmental influence in product/service creation are:

- **Energy consumption**
- **Materials consumption**
- **Water consumption**
- **Greenhouse gas emissions**
- **Ozone depleting substance emissions**

While the environmental influence of products or services in use is important we have not identified any generally applicable indicators for this category of eco-efficiency. All indicators in this group are considered to be business or product specific.

The following additional indicators could become generally applicable if current efforts to develop global agreement on measurement methods are successful:

- **Additional financial value indicators**
- **Acidification emissions to air**
- **Total waste**

We believe the small number of generally applicable indicators is helpful in assessing companies' eco-efficiency because a proliferation of measures would make it difficult for reports to be clear and understandable, especially externally. A small core of common indicators will help learning and comparability across time, sectors and industries. At the same time, individual companies should develop a fuller description of their performance by adding business specific indicators.

PREPARING AND REPORTING INFORMATION

The pilot program identified several important practical issues for preparing a company's eco-efficiency profile and reporting internally and to external stakeholders. The report provides advice on selecting boundaries for the data, where to find data and how to compile it appropriately, taking account of sensitivity and error and problems of transformation and conversion. It is important that companies provide some perspective on issues such as the scope and limitations of their indicators, so that users understand the nature of the information provided.

The questions of aggregation and benchmarking are particularly important. While aggregation will often be desirable, it may obscure potentially important information about an enterprise's eco-efficiency performance. For example, different types of unrelated emissions, or emissions across different geographic locations, may be added together, preventing a valid assessment of potential influences on the environment. Similarly, eco-efficiency estimates from different products, processes, or geographic areas may be combined and averaged, obscuring details about the performance of individual units. Aggregation must

therefore be done with care, and transparently so that the limitations of the information can be properly understood. This is especially the case when data are reported publicly and comparisons between different companies, processes, or products are made.

Outside users of eco-efficiency information are likely to want to make comparisons between companies and over time but it is important to recognize the inherent diversity of business and the particular circumstances of individual companies. Comparisons should be made only when the companies being compared provide the same product/service. It is also important to recognize that the product portfolios of different businesses often change, and that this may affect eco-efficiency figures regardless of a firm's environmental efforts. The impact of such changes should be explained by companies in reporting eco-efficiency data, to allow users to interpret reports accurately. The corollary of this is that companies can use eco-efficiency information to develop their product mix and activity toward a more eco-efficient portfolio.

Trend data is important so that changes in performance over time or compared to a reference point can be assessed. Data can be presented as absolute figures, eco-efficiency ratios, indexed to a selected year, or expressed relative to a projected goal. The performance could also be expressed relative to an industry average, if that is available. If indices are used, however, the absolute numbers underlying them should also be published so that users can calculate their own ratios. It is crucial that data presented in such charts is truly comparable so that the trends depicted accurately represent eco-efficiency performance.

We propose the following five elements for a summary eco-efficiency profile, plus a verification statement if the report has been externally reviewed:

- **Organization Profile** – to provide a context for the eco-efficiency information, including the number of employees, business segments, primary products and major changes in the structure of the company.

- **Value Profile** – indicators from the "value" portion of the WBCSD framework, including financial information, the quantity of products, or functional indicators for specific products.

- **Environmental Profile** – including generally applicable environmental influence indicators as well as business specific indicators relating to product/service creation and use.

- **Eco-efficiency Ratios** – in addition to providing in the previous two elements the basic "numerator" and "denominator" data for estimating eco-efficiency, companies may also wish to provide calculations of eco-efficiency indicators that they consider most relevant and meaningful for their business.

- **Methodological Information** – covering the approach used to select indicators, data collection methodologies, and any limitations on use of the data.

WBCSD recommends that companies integrate eco-efficiency information into their overall decision making and communications processes. Internally, it should be part of routine management systems. Externally, eco-efficiency indicators could be provided in corporate environment or sustainability reports as one of the integrating element between the three pillars of sustainability, and could be included in existing financial reports as an extension to pure financial reporting.

Following is an exemple eco-efficiency profile of a virtual company to illustrate the approach. An information platform displaying corporate and site eco-efficiency profiles of pilot companies is accessible through WBCSD's website at: www.wbcsd.org.

Example eco-efficiency profile

The following is an illustrative "straw model" of how a company might apply the WBCSD framework. It illustrates the concepts set out in chapter 2 of this report and focuses particularly on the generally applicable indicators described in chapter 3.

The eco-efficiency profiles of several pilot companies are posted on the WBCSD website (www.wbcsd.org). These real profiles exemplify how companies chose to publish their eco-efficiency profiles as part of the pilot.

Organization Profile

Company name: **Exemplis Inc.**
Business segments: Pharmaceuticals (list of primary products)
Report for: **Fiscal Year 1999**
System boundaries: includes all consolidated units of Exemplis Inc., excludes joint ventures and minority activities
Number of employees: 2,500
Internet: Website, hyperlink to web-based sustainability report
Contact for additional information: Name, telephone, e-mail address

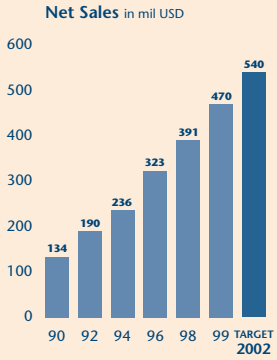
Methodological Information

ISO 14,031 was used to identify relevant aspects of our business activity and to select respective meaningful indicators.

Our data collection and use methodologies are available for review.

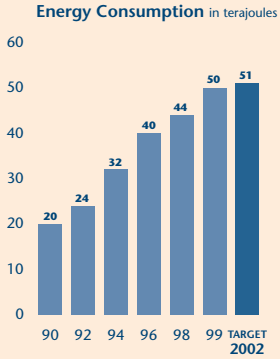
Value Profile

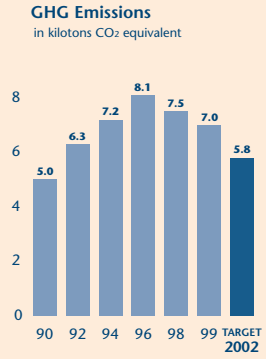
Mass of product sold = 300,000 kg
Net sales = 470 million USD
Value added = 220 million USD
Gross margin = 45 million USD
EBIT = 45 million USD



Environmental Profile

Energy consumed = 50,000 gigajoules
Material consumed = 4,500 tons
Water consumed = 60,000 m^3
GHG emissions = 7,000 tons CO_2 equiv.
ODS emissions = 25 tons CFC11 equiv.
Electricity consumed = 35,300 gigajoules
GHG from upstream
electricity gen. = 4,600 tons CO_2 equiv.
Natural gas consumed = 11,500 gigajoules
Acidification emissions = 400 tons SO_2 equiv.
VOC emissions = 230 tons
COD effluents = 86 tons
Total waste = 1,450 tons
Waste to landfill = 650 tons

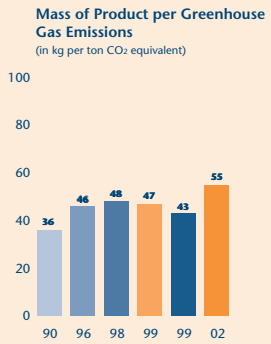


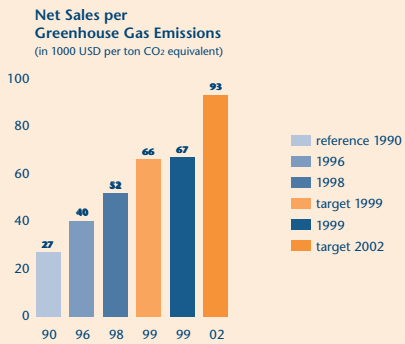


Eco-efficiency Ratios

Mass of product sold per:
Energy consumption = 6.0 kg per gigajoule
Material consumption = 66.7 kg per ton
GHG emissions = 42.9 kg per ton CO_2 equiv.

Net sales per:
Energy consumption = 9,400 USD per gigajoule
Material consumption = 104,000 USD per ton
GHG emissions = 67,100 USD per ton CO_2 equiv.





setting the scene

The rationale for measuring progress through eco-efficiency

The purpose of this report is to encourage the use of the eco-efficiency concept by proposing a common measurement framework that can guide all companies regardless of their business or geographic base. It is intended to enable company managers and external stakeholders to use eco-efficiency indicators as a means of making and measuring progress toward economic and environmental sustainability.

The objective is not to develop one single approach to measuring and reporting eco-efficiency, nor to develop a single measure of performance. Rather it is to establish a general framework that is flexible enough to be widely used, broadly accepted and easily interpreted by the full range of businesses. This is based on a recognition that the specifics of defining, measuring, and communicating eco-efficiency will necessarily vary from one business to another.

This framework has been tested in a pilot program involving 22 companies worldwide from more than 10 industry sectors over a period of 12 months. Results from the pilot are summarized in the last chapter of this report.

FRAMEWORK

The report describes a flexible framework for identifying and measuring eco-efficiency indicators and reporting eco-efficiency performance. It consists of:

- **a limited set of generally applicable indicators, which WBCSD believes are valid for virtually all businesses**
- **guidelines for the selection of business specific indicators relevant at company or sector level**
- **guidance for implementation**
- **recommendations for how to communicate eco-efficiency information to internal and external audiences**

" The eco-efficiency indicators framework is easy to understand and its use and application make good business sense to us. Keeping the framework flexible and avoiding a rigid reporting format wherever possible are key points for its acceptance and practicability."

EXPERIENCE SHARING MEETING IN TOKYO, SEPTEMBER 28, 1999

ECO-EFFICIENCY IN THE CONTEXT OF SUSTAINABILITY

WBCSD defines eco-efficiency as follows: *"Eco-efficiency is achieved by the delivery of competitively-priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the earth's estimated carrying capacity."*

Eco-efficiency is a key concept which can help companies, individuals, governments or other organizations become more sustainable. It brings together the essential ingredients – economic and ecological progress – which are necessary for economic prosperity to increase with more efficient use of resources and lower emissions of substances that can have adverse environmental consequences.

The concept calls for business to achieve more value from lower inputs of materials and energy and with reduced emissions. Companies need to apply creativity and innovation. For example, new technologies, improved supply chain practices and better products can all boost eco-efficiency. The incentive for businesses to improve eco-efficiency performance is the promise of achieving greater value with lower adverse environmental consequences.

While eco-efficiency is a helpful tool for businesses and a valuable policy concept for governments driving toward sustainability, it must be acknowledged that other steps are also necessary to achieve this long-term goal, which embraces economic, environmental and social aims.

Business exists to satisfy human needs and to be rewarded with profits for doing so. Responsible businesses also aim to improve the quality of life as part of a drive to become more sustainable. But this process within business alone is unlikely to prevent the growth of total resource use and environmental impact for the entire economy. Sustainability will only be achieved by business working together with governments and external stakeholders such as suppliers, customers and NGOs. For example it is important for governments to formulate economic and industrial policies which encourage eco-efficiency in business as well as reduce energy and resource use throughout the economy.

seven elements for eco-efficiency improvement

Eco-efficiency calls for business to achieve more value from lower inputs of materials and energy and with reduced emissions. It applies throughout a business, to marketing and product development just as much as to manufacturing or distribution. The range of possibilities outlined here demonstrates the pervasive nature of eco-efficiency:

1. **Reduced material intensity**
2. **Reduced energy intensity**
3. **Reduced dispersion of toxic substances**
4. **Enhanced recyclability**
5. **Maximized use of renewables**
6. **Extended product life**
7. **Increased service intensity**

DEFINITIONS

WBCSD proposes a framework containing three levels of organization for eco-efficiency information: categories, aspects and indicators. This is consistent with the terminology used in the ISO 14000 series, and in the Global Reporting Initiative (GRI).

Categories are broad areas of environmental influence or business value. Each has a number of **aspects**, which are general types of information related to a specific category. Aspects describe what is to be measured. **Indicators** are the specific measures of an individual aspect that can be used to track and demonstrate performance. A given aspect may have several indicators as demonstrated in detail in chapter 3.

A full list of categories, aspects and indicators is shown in appendix 1. The 3 **categories** identified in this report for eco-efficiency, and their main related **aspects** are:

Product/service value

- volume / mass
- monetary
- function

Environmental influence in product/service creation

- energy consumption
- materials consumption
- natural resources consumption
- non-product output
- unintended events

Environmental influence in product /service use

- product/service characteristics
- packaging waste
- energy consumption
- emissions during use/disposal

THE NEED FOR INDICATORS

Setting targets and monitoring performance with indicators are accepted management tools used throughout business. This includes environmental management and measurement of eco-efficiency, and is necessary to measure corporate progress toward a more sustainable future.

Companies may choose to measure their eco-efficiency performance for a number of reasons. These include tracking and documenting performance and progress, identification and prioritization of opportunities for improvement, and identifying cost savings and other benefits related to improving eco-efficiency. It may even be that a company wants to demonstrate why in certain areas improvement is limited or will not be possible to the degree expected by certain stakeholders.

Eco-efficiency indicators may also help managers take decisions on a product or business portfolio. They can provide managers with the information on how to make a business portfolio more eco-efficient or more sustainable overall.

Monitoring and reporting eco-efficiency publicly is also a way to communicate a key element of the corporation's progress on sustainable development to external audiences, including investors, insurers, consumers, and other interest groups.

MEASURING ECO-EFFICIENCY

Eco-efficiency brings together the two eco dimensions of economy and ecology to relate product or service value to environmental influence. It can be represented as:

$$\frac{\text{Product or service value}}{\text{Environmental influence}}$$

Progress in eco-efficiency can be achieved by providing more value per unit of environmental influence or unit of resource consumed.

There are numerous ways in which eco-efficiency can be calculated using this basic equation. Both product or service value and environmental influence include many different indicators which cannot be merged into one single number. Companies will need to choose eco-efficiency ratios that best serve their process for communication and decision making. Specific calculations will depend upon the needs of individual decision makers. For example, a plant manager may wish to focus on the number of products shipped per kilojoule of energy consumed during manufacturing. A financial analyst may instead focus on the economic value of products sold per kilojoule.

Value and environmental influence can also be measured for different entities, such as production lines, manufacturing sites, or entire corporations, as well as for single products, market segments or entire economies. In the same way, eco-efficiency ratios can be calculated and

used for many of these entities. The same indicator may not be suitable for each one. For example, an eco-efficiency indicator for the manufacture of detergent could be kilogram produced per kilojoule of energy consumed during manufacturing. Alternatively, the product manager could calculate an indicator on the basis of economic value (e.g. USD detergent sales) per kilojoule of manufacturing energy consumed, or on a function delivered basis (e.g. average laundry cycles per kilojoule of manufacturing energy consumed).

Indicators may also be useful in helping customers understand the environmental performance of products. Eco-efficiency ratios for single products or market segments can help express product performance in ways which are more meaningful to their users. Many businesses already use eco-efficiency ratios to express a product's functional use related to its impact. For example, the fuel efficiency of a car expressed in kilometers per liter of fuel used (or miles per gallon) is a well known eco-efficiency ratio.

Many companies and users so far have tracked environmental influence per unit of value – the inverse of the formula set out here. Such calculation results in impact intensity ratios, where a declining intensity ratio reflects a positive performance improvement.

WBCSD recommends the use of eco-efficiency ratios (value per environmental influence) since in this form an increasing efficiency ratio reflects a positive performance improvement. This parallels the way business tracks financial performance. Increasing key financial indicators, e.g. sales, profit, return on capital employed, reflect positive financial performance. Intensity ratios could be provided if a business and stakeholders agreed that these ratios are important business specific indicators for that business. The substantial information contained in both, efficiency and intensity ratios, is the same.

other indicator initiatives

Throughout this project, the WBCSD working group has maintained connections to other key initiatives in the area of indicators and reporting both for corporate performance (micro level) and for the performance of the entire economy (macro level).

The most relevant initiatives and programs have been:

the International Standards Organization's International Standard on Environmental Performance Evaluation (ISO 14031). In fact, ISO 14031 is recommended in the framework to be used as the primary approach for selecting sector or company specific environmental influence indicators.

the Coalition for Environmentally Responsible Economies (CERES) with the **Global Reporting Initiative (GRI).** GRI focuses on developing a common harmonized format for corporate sustainability reporting. The fact that the GRI reporting guidelines and the WBCSD framework were developed in the same period and partly with the support of the same companies, led to a high level of fruitful interaction, cross-fertilization and adaptation.

the Canadian National Round Table on the Environment and the Economy (NRTEE). NRTEE has conducted pilot studies on how to measure eco-efficiency in business, especially with respect to the use of energy and materials. The findings of the NRTEE pilot studies have been taken into consideration in developing the WBCSD framework.

OECD, UNCSD, and the European Environment Agency (EEA). These organizations are working on indicators to describe the performance of national or regional economies with regard to sustainability and/or eco-efficiency. WBCSD has worked with these groups to provide a linkage between the micro- and macro-level aspects of eco-efficiency indicators.

the core elements of the approach

Based on sound principles and practical concepts

Indicators of any kind should be based on a set of principles which define how they will be selected and used. This will help ensure that measurement programs are scientifically supportable, relevant, accurate and useful.

Performance measurement and reporting must be practical and straightforward for the whole business community to follow. This is why our concept calls for two types of indicators – generally applicable and business specific. This approach allows companies to keep their measurement system focused on the relevant issues, as well as provide information in a form which is commonly understood and broadly accepted.

Principles

Indicators should:

❶ be relevant and meaningful with respect to protecting the environment and human health and/or improving the quality of life

❷ inform decision making to improve the performance of the organization

❸ recognize the inherent diversity of business

❹ support benchmarking and monitoring over time

❺ be clearly defined, measurable, transparent and verifiable

❻ be understandable and meaningful to identified stakeholders

❼ be based on an overall evaluation of a company's operations, products and services, especially focusing on all those areas that are of direct management control

❽ recognize relevant and meaningful issues related to upstream (e.g. suppliers) and downstream (e.g. product use) aspects of a company's activities

The WBCSD recommends that the following eight principles be adopted for indicators in any field, including eco-efficiency. WBCSD believes that these principles are applicable to all elements of measuring the performance of a company, and could apply to other areas of sustainability such as social impact. Indicators should:

❶ be relevant and meaningful with respect to protecting the environment and human health and/or improving the quality of life

The primary goal of the eco-efficiency concept is to improve the environmental performance of a company relative to the value of the products and services it provides to society. In order to ensure that companies and stakeholders focus their attention on high priority areas, all indicators should be clearly related to issues for which there is a clear need to improve an organization's environmental performance, or that improve the value of the product to users and society.

❷ inform decision making to improve the performance of the organization

Ultimately, the purpose of eco-efficiency indicators is to help facilitate decisions about a company's performance. The primary value is to help management make decisions about how production processes and product designs can be most effectively modified to reduce resource use or environmental burdens; or how the performance of a product can be improved in ways that improve its eco-efficiency. Eco-efficiency indicators may also be used by external audiences. For example, stakeholders such as financial institutions may be able to use eco-efficiency indicators to inform decision making about the economic risks associated with a company's environmental performance.

❸ recognize the inherent diversity of business

One of the key challenges of developing indicators is that every business is different. For instance, the factors most relevant to the environmental performance of a chemical company are different to those of an automobile manufacturer. While it is tempting to presume that there could be a "universal" set of indicators that would apply to all businesses, in practice the environmental aspects and values of a company's activities and products depend heavily on the specific nature of its business.

❹ support benchmarking and monitoring over time

Improving the eco-efficiency of a company's activities or products requires the use of indicators that can be consistently followed over time, and confidently related to both past and current performance. To maximize the value of benchmarking and monitoring, indicators must be designed to minimize the influence of extraneous factors that are not related to either environmental performance or product value. Otherwise users could observe "false" changes in eco-efficiency. Indicators must also be based on robust and reproducible measurement systems that stand the test of time, and care

must be taken in the aggregation of data across different processes or products to ensure that the resulting information is meaningful. Benchmarking is primarily about learning, and not about ranking. Where benchmarking or monitoring performance over time is carried out, it is important that the indicators from different processes, products, or businesses are defined in the same way, so that "apple-to-apple" comparisons are made rather than putting apples and pears in the same basket.

❺ be clearly defined, measurable, transparent and verifiable

In order to genuinely inform decision making, indicators should be clearly defined and directly measurable, or calculated by clearly defined estimation methodologies. The definition, means and boundaries of measurement should be available to decision makers, and the process of data collection (including issues related to variability and quality control procedures) should be subject to verification either internally or externally.

❻ be understandable and meaningful to identified stakeholders

To facilitate decision making it is important that indicators be clearly understandable to both company managers and external stakeholders. Indicators should not be so complex that they are difficult to use effectively. The aggregation of data across different processes or products should be carefully considered so that individual indicators and their limitations are clearly understood.

❼ be based on an overall evaluation of a company's operations, products and services, especially focusing on all those areas that are of direct management control

In defining indicators that are appropriate for its business, and that meet the needs of users both inside and outside the company, an organization should examine all of the relevant areas of its operations, products or services. As a minimum, this evaluation should focus on those areas that a business can control or influence directly (often referred to as "gate-to-gate"). This would include, for example, the selection of raw materials, the use of natural resources, the organization's manufacturing operations, the characteristics of its products, the distribution of those products to markets.

❽ recognize relevant and meaningful issues related to upstream (e.g. suppliers) and downstream (e.g. product use) aspects of a company's activities

In addition to those areas that are directly influenced or controlled by a company, there may be other areas that are equally relevant (environmentally, economically or socially). These could include, for example, the eco-efficiency of the production of raw materials by key suppliers ("cradle-to-gate" issues), or issues associated with the use and disposal of products by users ("gate-to-grave" issues). In general, these areas should be differentiated from indicators that are directly controllable by a company, because the control that an organization has over such activities is often limited.

"We believe that the quality of decision-making increases with the level of detail and diversity of indicators used. It is also helpful to be aware of common global concerns. The WBCSD model provides very useful information for companies to develop their own indicators."

"The concept can increase the quality of decision-making dramatically, not only with regards to where to invest but also with regards to how much."

"The approach adds a new perspective on usual indicators and drives the organization to review the soundness of existing indicators. Due to the fact that eco-efficiency indicators and trends can be used to validate business decisions, we are better able to set objectives and make internal and external benchmarks."

EVALUATION OF THE CONCEPT BY PILOT COMPANIES, MARCH 2000

Concepts

The WBCSD defines two types of indicators to help companies keep their reporting system flexible. This allows more efficient decision-making internally and fulfills stakeholder requirements. This section explains the concept behind this approach, provides the necessary guidance for companies, and lists the generally applicable indicators that are valid across all businesses.

GENERALLY APPLICABLE AND BUSINESS SPECIFIC INDICATORS

Some indicators are universally applicable to all businesses but many will not be. This may be due to fundamental differences between the value and environmental aspects of a company's different operations and products, a lack of well-established methods for measuring some parameters, or different priorities for specific environmental issues throughout the world. Some indicators may also measure different parameters for different businesses (e.g. air emissions from a refinery are different than those from a power plant). Finally, some of the indicators simply are not significant issues for particular businesses.

WBCSD has chosen the term **"generally applicable"** to describe the indicators which can be used by virtually all businesses, although they may not be of equal value or importance for all companies. For each of these there must be general international agreement on the following:

the indicator is related to a global environmental concern or business value

it is relevant and meaningful to virtually all businesses

methods for measurement are established and definitions accepted globally

All other indicators which do not meet these three criteria have been termed **"business specific"**, meaning that they are more likely to be individually defined from one business to another. There is also probably a diversity of approaches with respect to how they are measured and defined, and their relevance and meaningfulness varies from one business to another.

It must be stressed that these distinctions do not imply that "generally applicable" indicators are more important than "business specific" indicators. This will depend upon the nature of an individual business. The distinction is drawn merely to identify a small set of indicators which all businesses should be able to use, out of the wider collection which are available and meaningful to an individual organization.

GUIDANCE ON SELECTING BUSINESS SPECIFIC INDICATORS

The WBCSD eco-efficiency indicators framework provides a menu of indicators that cover the broad spectrum of environmental aspects related to the production and use of products and services. The framework also contains options for measuring the "value" of products or services. Combined together, these can be used to describe a company's eco-efficiency. All the indicators are not necessarily applicable to all companies. So each company must evaluate its own business to determine what "business specific" indicators are applicable and useful to management and external stakeholders, in addition to the generally applicable indicators.

WBCSD recommends that ISO 14031, concerned with "Environmental Performance Evaluation" be used to guide the selection of relevant business specific indicators. This standard describes an internal management process and tools designed to provide management with reliable and verifiable information. It outlines general procedures for selecting environmental indicators, collecting and analyzing data, assessing and reporting the resulting information. The most relevant type of indicator for the purpose of eco-

pilot learning: how to select business specific indicators

Selecting business specific indicators which are relevant and meaningful for the particular site, business unit or corporation under scope was a central element of the pilot application program described in more detail in chapter 4.

Pilot companies which were just beginning to implement a data collection system had to go through this process from scratch. Others who had well established environmental data collection systems used the pilot for a review of their existing procedures, for adding new elements or for widening the area of application from one geographical region to their global corporation.

In order to select business specific indicators for a particular business unit one pilot company used – besides relevance to the business – resonance within the unit, simplicity and availability of data as additional selection criteria.

efficiency according to the ISO classification is the Operational Performance Indicator (OPI).

The selection of value indicators depends upon the ways in which the eco-efficiency indicators will be used for decision making. For example, process engineers may want to evaluate eco-efficiency in terms of the number or mass of products being manufactured. Financial analysts or business managers may want to analyze eco-efficiency in terms of a company's total turnover or earnings to assess economic risks/benefits. For a specific product, decision makers may want to consider eco-efficiency in terms of the function or service that the product provides (e.g. expressing value relative to passenger-km of travel for an automobile, or hectares of land treated in the case of an agricultural product).

Volume and mass indicators such as number of product units and quantity of product, are relatively straightforward. However, the aggregation of different products may create issues. For example, 1000 passenger automobiles is clearly not equivalent to 1000 commercial transport vehicles. Care should be taken if volume indicators for different products are aggregated, or if the eco-efficiency of different kinds of products is compared.

Financial performance indicators, in general, are well established. WBCSD recommends that companies use recognized accounting terms and methods for selecting such indicators.

Functional value indicators provide a measure of the task that a product or service performs for its end-user. In many respects this is the purest expression of eco-efficiency because it specifically relates the environmental attributes of a product to the value that it provides, and it maximizes the ability to examine the influence of innovations that either reduce environmental burdens or improve product performance.

But this approach has several limitations:

- It is often difficult to quantify clearly the "function" that a product performs. For example, how does one quantify the functional value of cosmetic products or of a television set?
- Individual products often perform multiple functions. For example, paper towels are used throughout the home for a variety of tasks.
- Secondary value parameters that are often very important to the user such as aesthetics and comfort, cannot be easily integrated in a quantification.
- It is also important to recognize that eco-efficiency estimates cannot be aggregated across products that perform different functions.

pilot learning: financial issue versus mass or volume

Companies' experience in selecting and applying value indicators during the pilot program showed that some value indicators are more useful for tracking performance at the corporate level, e.g. Net Sales, while others are more useful for developing actions to improve performance, e.g. Quantity of Production at a site level. On a site level sometimes Net Sales figures are even not available and alternative financial figures, e.g. Cost of Goods Sold, must be found instead to express value in monetary terms.

Product or market mix is a key issue with the use of value indicators. Diverse groups which manufacture many different products, would want to present eco-efficiency as an aggregated average figure across different product lines. If the relative contribution of different products to the business changes, the eco-efficiency value may change without any genuine change in eco-efficiency. Thus, for example, if the company sells more of its material-intensive products (due to increased customer demand), then its average material use eco-efficiency will decrease, even though the actual eco-efficiency of the individual products has not altered.

Some companies use an indicator known as the "Statistical Unit." This is a hybrid of financial and volume indicators and is defined as the number of products equivalent to a fixed value of sales. The advantage of the "Stat Unit" is that it normalizes different kinds of products within a company's business to a fixed unit of financial value and avoids problems caused by changes in product mix.

THE SET OF GENERALLY APPLICABLE INDICATORS

WBCSD has worked in the course of the creation of this concept and during the pilot exercise to come up with a set of generally applicable indicators that can be used by all businesses and provides a globally accepted description and measurement method for them. This will help for a common understanding. The following indicators meet the three criteria for general applicability and should therefore be used by all companies. More detailed descriptions of these generally applicable indicators are given in chapter 3.

Product/service value

- **Quantity of goods/services produced or provided to customers**
- **Net sales**

Environmental influence in product/service creation

- **Energy consumption**
- **Materials consumption**
- **Water consumption**
- **Greenhouse gas (GHG) emissions**
- **Ozone depleting substance (ODS) emissions**

There are no generally applicable indicators for the environmental influence of product/service use. All indicators in this group are considered to be business specific.

The following additional indicators could become generally applicable if current efforts to develop global agreement on measurement methods are successful:

- **Additional financial value indicators**
- **Acidification emissions to air**
- **Total waste**

WBCSD recommends that all companies collect and report data on the generally applicable indicators. But these indicators alone will not necessarily represent the eco-efficiency performance of a company. They will normally be combined with appropriate business specific indicators and meaningful eco-efficiency ratios to provide a company's eco-efficiency performance profile.

pilot learning: comparisons using generally applicable indicators

Comparisons between companies are more likely to be valid for generally applicable than for business specific indicators. However, especially when stakeholders try to compare the performance of companies, it is important to recognize business' inherent diversity, and understand that comparisons are primarily for learning to understand differences and trends and to identify potential for improvements.

Comparison are only meaningful when a company's individual circumstances can be taken into consideration. Comparison between different indicators should normally be done only between like products, services, or operations. Differences observed should be discussed and explained. When data are aggregated across different operations, geographies, or products/services, it becomes more difficult to make meaningful comparisons, even for generally applicable indicators.

gathering information

Using the right indicators

Only a small number of indicators fit the three criteria necessary for them to be generally applicable to all companies: concerned with a global business value or environmental issue, relevant to virtually all businesses and having an agreed measurement method and definition. While there are many issues and associated indicators, most fail to meet at least one of these three criteria.

This is actually helpful in assessing companies' eco-efficiency, especially in external reporting, because a proliferation of measures would make it difficult for reports to be clear and understandable. A small core of common indicators, on the other hand, will help learning and comparability across time, sectors and industries. At the same time, individual companies will develop a fuller description of their performance by adding a number of business specific indicators.

This chapter describes the generally applicable indicators, with explanations of what should be included and excluded. The table details all the indicators identified, with measurement references and the sources of data which companies could use to gather the information.

DEVELOPING INDICATORS

The purpose of developing indicators and encouraging companies to collect and publish the information is to improve eco-efficiency. Yet, companies should beware of producing excessive information. While in theory each value indicator could be used in combination with each indicator of environmental influence to produce an extensive list of eco-efficiency ratios, it is not necessary or desirable to use all possible combinations. Only the most meaningful combinations should be used, with the aim of concentrating on measuring performance in the most relevant way and providing the most useful information for decision-making.

"We should follow the rule of 'collect less and use it', meaning that any data collected must be used for something. That's the best way for companies to help drive performance improvements."

EXPERIENCE EXCHANGE MEETING IN CINCINNATI, JULY 27/28, 1999

The same applies to data collection, which can exclude minor quantities of data as long as the remaining figures cover at least 90% of the total and provide sufficient understanding for good decision-making. This 90% rule is intended to avoid disproportionate effort and cost being expended in gathering data on the final few percentage points of usage. It should not be used to exclude even small quantities of especially significant material or other sources of environmental influence.

So far as product/service creation is concerned the definition of generally applicable indicators includes only those aspects under the direct control of the company. Influences outside a notional "fence" beyond the direct control, up-stream or down-stream in the value chain (i.e. controlled by suppliers or customers, such as emissions emerging from electricity generation by power utilities) need to be covered with business specific indicators if these aspects are relevant for a certain business. The fence should not be seen as a physical representation, however. Thus distribution businesses should account for their operations beyond physical corporate boundaries, just as airlines should include flight operations.

GENERALLY APPLICABLE VALUE INDICATORS

Quantity of product/service[1] produced or sold is a physical measure or count of product or service produced, delivered or sold to customers. It is most useful in product specific situations such as individual factories or service units. It can be measured in mass, volume or number. In most cases this information can be obtained from existing and readily available internal reports. Summing numbers for different products for an entire corporation should be done carefully, recognizing the limitations of the aggregated information. Corporate level information may be useful for tracking overall performance but product specific information is more useful to develop action plans to improve performance.

Net sales is the total recorded sales less sales discounts and sales returns and allowances. It is the most easily measurable and available value indicator for all businesses. Using sales as a value indicator for measuring factory performance is more problematic since production units are not generally linked to sales figures. It must also be recognized that sales values can be influenced by a variety of factors which do not bear on eco-efficiency, such as commodity prices and currency exchange rates, which could distort performance figures.

1 For simplicity in the rest of this chapter, output is described only as "product". The term should be taken to mean either product or service, as appropriate to the business concerned.

pilot learning: the mining industry

Mining is a "price-taker" rather than a "price-maker" since most of its products are traded on central commodity exchanges. Revenue streams may fluctuate from one year to the next without any underlying changes in operating processes taking place. Using "Net sales" as a value indicator for eco-efficiency performance tracking for the mining industry has therefore limited meaning.

In the mining sector the environmental influence caused by extraction operations is primarily driven by the amount of material handled. "Total material moved" or "Tons of ore milled" might therefore be more useful business specific value indicators to relate to environmental influence indicators to track eco-efficiency performance of the extraction operations.

Since "Total material moved" and "Tons of ore milled" seem to work as value indicators for both, mining extraction operations, and aggregating different mining products, the "Quantity of goods produced" does not. Aggregating quantities of different mining products is not practical, since amounts of some products are measured in carats and ounces, while others are measured in kilotons.

GENERALLY APPLICABLE ENVIRONMENTAL INFLUENCE INDICATORS

Energy consumption is a global issue and relevant to all businesses across sectors. The total energy consumed equals energy purchased or obtained (e.g. coal, natural gas) minus energy sold to others for their use (e.g. electricity, steam). The definition agreed for general applicability relates solely to energy consumed and transformed on site, which means that electricity companies would report the purchased energy amount and subtract energy sold, keeping generation and transfer losses as part of their consumption. Companies could further elaborate on energy use by identifying separately the renewable energy consumption and a breakdown into different types of energy sources such as natural gas, oil and others.

Water consumption is the sum of all fresh water purchased from a water supplier or obtained from surface or ground water sources. Availability of fresh water is a global issue. Even though for many areas there may be no local concern about availability, it is increasingly costly to generate clean water. "Fresh water" includes water used for cooling purposes even if there is no physical contact to process materials, and excludes sea water.

Material consumption is the sum of weight of all materials purchased or obtained from other sources such as extraction, including raw materials for conversion, other process materials (such as catalysts, solvents), and pre- or semi-manufactured goods, parts and modules (such as automobile parts, computer parts). Dematerialization is a global requirement for sustainability, which makes materials use an issue of global concern and relevance to virtually all businesses. Material included in this indicator excludes water and fuels, which are identified as separate generally applicable indicators. Packaging materials are also excluded from this item. Packaging is clearly important, especially in consumer industries. But packaging fails the generally applicable criteria of being meaningful to virtually all businesses and there is no agreement on measurement methodology. This issue should be dealt with as a business specific indicator for product use.

This item, representing the weight of all materials used, provides a useful denominator for material efficiency ratios. Companies might also expand measurement to identify specific material categories such as replaceable (e.g. natural crops, wood from managed forests), non-renewable, hazardous, non-hazardous materials categories.

Greenhouse gas (GHG) emissions include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), hydro- and perfluorocarbons (HFCs, PFCs) and sulfur hexafluoride (SF_6) emissions from fuel combustion, process reactions and treatment processes. The climate change issue related to increasing concentrations of greenhouse gases is a global concern and – because it is closely linked to emissions from energy sources – is relevant across businesses. The definition of the GHG emissions covers the gases detailed in annex A of the Kyoto Protocol and their relative contributions are commonly accepted as detailed in the work of the Intergovernmental Panel on Climate Change.

The concept of the "boundary fence" is very important for this indicator. This generally applicable indicator covers only emissions from direct corporate activities, although companies may choose to track significant GHG emissions from suppliers such as electricity providers and also from product use where they feel they are relevant. WBCSD participates in a joint effort together with World Resources Institute (WRI) and other organizations to develop a broadly accepted protocol to measure and report greenhouse gas emissions (www.ghgprotocol.org). This protocol will provide further detail on comprehensive GHG reporting.

Ozone depleting substance (ODS) emissions are a global concern, defined in the Montreal Protocol which lists the groups of gases that are contributing to the effect and describes their impact potential. This issue has relevance across business, even though the markets of the most dangerous gases have been strongly reduced and less harmful alternatives introduced. Even though the effect will be visible in the stratospheric ozone layer over many decades or even centuries, the indicator might lose its relevance in the near future, when policies to eliminate ODS from applications continue to be implemented successfully on a global scale.

POTENTIAL GENERALLY APPLICABLE INDICATORS

The small number of generally applicable indicators could eventually be expanded by the addition of others which currently do not quite meet the three criteria.
The following three items are clearly important for eco-efficiency but there is currently no consensus for measuring them. This may change in the near future, in which case they could become generally applicable indicators. When using these indicators it is important that reporters specify the definition which they apply.

Additional financial value indicators: We were striving to find additional financial value indicators (other than Net Sales), such as indicators for profitability or value added. Profitability being the measure of the overall financial performance of a business entity, is obviously a relevant and important value indicator for business around the world. As virtually all companies measure it, it might appear peculiar that we have not categorized it as a generally applicable indicator. However, profitability is a very broad term and can mean different things to different companies. Thus, when using profitability information, it is important to specify which definition is used, e.g. the US generally accepted accounting principles (GAAP) for profit, earnings or income.
There are still wide differences in the meaning and measurement for financial measures such as "Earnings before interest and tax" (EBIT), Gross Margin or Value Added. We list these under business specific indicators. Businesses which wish to relate environmental influence to such measures should again specify the definition they are using.

Acidification emissions to air include acid gases and mists (e.g. ammonia, hydrochloric acid, hydrogen fluoride acid, nitrogen oxides, sulfur dioxide and sulfuric acid) from fuel combustion, process reactions and treatment processes. Measurement methods and effect definitions are as yet not globally agreed, although many European companies have used factors which have been developed for the relative strength of various acids to the effect of acidification. This indicator could become generally applicable if a global agreement on measurement methods can be reached.

Total waste is the total amount of substances or objects destined for disposal. Waste is certainly an issue of growing global concern. However the term is used very differently by different industries and in different countries, even though there exists a global convention ratified by many countries that includes a definition. Total waste could become a generally applicable indicator if agreement can be reached on a definition and measurement method, possibly based on the Basel Convention approach. Until then companies will need to specify the definition and measurement method used to track and report their waste amounts. In any case companies are likely to include business specific indicators to cover different types of non-product output, identifying the type of waste (e.g. hazardous/non-hazardous) or its final destination (e.g. landfill, recycling or incineration).

BUSINESS SPECIFIC INDICATORS

Some examples of business specific indicators are included in Appendix 2 to help companies to identify their relevant indicators and to provide guidance based on the experience gained during the pilot exercise. The descriptions, measurement methods and data sources are taken from information provided by pilot companies. Many of these indicators are used in these companies in examples which can be seen on the WBCSD website at www.wbcsd.org.

pilot learning: waste is a tricky issue

The working group as well as pilot companies discussed at length how to use and describe waste indicators for total amounts and for particular types of wastes, relative to their composition or their final way of disposal.

Discussions centered on the problem of a commonly accepted definition for waste. Some participants recommended as generally applicable simply-defined indicators for "Total Waste" (e.g. following the Basel Convention), or "Total Non-Product Output", including effluents to water and emissions to air. Particular waste types such as "Waste to Landfill" or "Waste to Incineration" would be left as business specific indicators. For such types of wastes participants did not see commonly accepted definitions to emerge.

Reduction of waste has been a focus for many companies for some time. These sometimes prefer to work with waste or non-product output (NPO) instead of total materials consumption because purchased amounts are only available in monetary terms, while waste or NPO are traditionally tracked in tons.

One company has set a long-term goal to reduce total NPO, including anything that does not go into products (waste, air emissions and water emissions), because it leads to maximum eco-efficiency. For paper as an illustrative example, of an original value of e.g. 1000 USD/ton, recycling allows for a benefit of e.g. 100 USD/ton while 900 USD/ton are lost, but could be saved by reducing total NPO.

Table of indicators

GENERALLY APPLICABLE VALUE INDICATORS

INDICATOR	UNIT	MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Quantity Physical measure or count of product or services produced, delivered or sold to customers	as appropriate for the particular business, such as number or mass	Company specific method used to measure the quantity, e.g. mass or number of product or service produced or sold	Cost, production, or sales reports Annual financial reports
Net Sales Total recorded sales less sales discounts and sales returns and allowances	in USD, Euro, Yen, or company's usual currency	International Accounting Standards Committee (IASC), Generally Accepted Accounting Principles (GAAP)	Annual financial reports

GENERALLY APPLICABLE ENVIRONMENTAL INFLUENCE INDICATORS

INDICATOR	UNIT	MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Energy Consumption Total sum of energy consumed (equals energy purchases minus energy sold to others for their use), including: • electricity and district heat • fossil fuels (e.g. natural gas, oil, coal) • other fuel based energy (e.g. biomass, wood, waste fuel) • non-fuel based energy (e.g. solar, wind)	in gigajoules (or other appropriate multiplier of joule)	Transformation factors: • fuel high (gross) heating value (HHV) based on combustion products (physical states) of water (liquid), carbon dioxide (gaseous) and nitrogen (gaseous). • electricity and district heat as amount end energy purchased	Procurement files Site energy/fuel use inventories Facility management reports Literature
Material Consumption Sum of weight of all materials purchased or obtained from other sources, including: • raw materials for conversion • other process materials (such as catalysts, solvents) • pre- or semi-manufactured goods and parts excluding packaging, water consumption and materials used for energy purposes	in metric tons	Company specific method used to measure quantity used	Procurement files Manufacturing reports Cost reports
Water Consumption Sum of all fresh water purchased from public supply, or obtained from surface or ground water sources (including water for cooling purposes)	in cubic meters	Company specific method	Procurement files Manufacturing reports Cost reports
Ozone Depleting Substance (ODS) Emissions Amount of ODS emissions to air from processes and losses/replacement from containments (chillers)	in metric tons of CFC11 equivalents	List of controlled ODS and Ozone Depletion Potentials: Montreal Protocol, Annex A to E	Plant surveys EHS reports Estimation or calculation

INDICATOR	UNIT	MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Greenhouse Gas (GHG) Emissions Amount of GHG emissions to air from fuel combustion, process reactions and treatment processes, including CO_2, CH_4, N_20, HFCs, PFCs and SF_6 (excluding GHG emissions released in generation of purchased electricity)	in metric tons of CO_2 equivalents	- List of greenhouse gases: Kyoto Protocol, Annex A - Global Warming Potentials: IPCC, Climate Change 1995, Second Assessment Report - Transformation factors for fuels: from fuel carbon content e.g. Responsible Care: Health Safety and Environmental Reporting Guidelines, CEFIC November 1998, page 31f. GHG emissions from process reactions and treatment processes are calculated/estimated using specific knowledge of processes, waste composition and treatment efficiency.	Cost reports Fuel invoices Plant survey EHS records Estimation or calculation

Note: Businesses and their stakeholders may find it useful to provide additional information for some generally applicable indicators (e.g. Energy Consumption indicator for total energy consumption and energy consumption by specific sources such as electricity, fuel-based, and non-fuel based consumption; Greenhouse Gas Emissions in total CO_2 equivalents and specific CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 emissions).

POTENTIAL GENERALLY APPLICABLE INDICATORS

In this table we list indicators that might soon become generally applicable indicators if current efforts to develop common global agreement on measurement methods are successful.

VALUE INDICATORS

INDICATOR	UNIT	POTENTIAL MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Net Profit/Earnings/Income	in USD, Euro, Yen or company's usual reporting currency	Net sales minus all expenses for the period including: cost of goods sold; selling, general and administrative expenses; technology expenses; R&D costs; amortization and adjustment of intangible assets; restructuring and special charges; interest expenses; other expenses; income tax International Accounting Standards Committee (IASC) Generally Accepted Accounting Principles (GAAP)	Financial reports

ENVIRONMENTAL INFLUENCE INDICATORS

INDICATOR	UNIT	POTENTIAL MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Acidification Emissions to Air Amount of acid gases and acid mists emitted to air (including NH_3, HCl, HF, NO_2, SO_2 and sulfuric acid mists) from fuel combustion, process reactions and treatment processes	in metric tons of SO_2 equivalents	- List of acids: ICI: Environmental Burden The ICI Approach, 1997 - Acidification Potentials: Heijungs et al., CML University of Leiden, 1992; and Hauschild and Wenzel, Chapman & Hall, London, 1997	Plant surveys EHS reports Estimation or calculation
Total Waste Total amount of substances or objects destined for disposal	in metric tons	Definitions of waste and disposal: Basel Convention, 1992: Definitions and Annex IV	Plant surveys EHS reports Estimation or calculation

measurement and reporting in practice

Key lessons from the pilot program

A wide-ranging pilot program among 22 WBCSD member companies has tested the framework and recommendations which are contained in this report. Pilot results showed that the concept is valid for all company types and sizes and that the generally applicable indicators are appropriate across a wide range of sectors and across geography.

This chapter presents the lessons learned from the pilot program in the form of guidance on measurement and reporting. It also offers a proposal on how a company could present its performance in the form of an eco-efficiency profile. A comprehensive information platform displaying corporate eco-efficiency profiles is accessible through WBCSD's website at: www.wbcsd.org.

Measurement issues

"We expect that this pilot will allow us to develop clear criteria and comprise a transparent process to assess whether an indicator is relevant and meaningful. We also see in it an opportunity to set the right goals."

PILOT KICK-OFF MEETING IN ST. LOUIS, APRIL 26/27, 1999

"We involved in the pilot activity not only business decision makers, but also marketing, financial, product development and production people. We found this very important for the success of our efforts."

EXPERIENCE SHARING MEETING IN MONTERREY, MEXICO, OCTOBER 26/27, 1999

It is clear that gathering and presenting eco-efficiency data is currently not as straightforward as with financial information, where there are well-established methodologies and the unifying force of monetary value. In contrast, environmental performance spans a complex mix of parameters which relate to different impacts and for which measurement methodologies are often very new or still not widely agreed.

This has a number of important practical implications for preparing an eco-efficiency profile of a company or operation.

SELECTION OF BOUNDARIES

Defining the boundaries of an eco-efficiency analysis is a key challenge for any organization. Principles 7 and 8 relate to this issue. They suggest that the priority should be areas that are under direct control by the company, but that relevant and meaningful upstream and downstream issues should also be addressed even though they are not directly controllable.

Even within a company's operations, there are numerous boundaries that must be defined for the selection and use of indicators. For example, within a given process, there may be multiple inputs of energy and multiple outputs of emissions from various sub-processes. How one selects which sub-processes to include, and how to allocate measurements across different sub-processes can have a great influence on a specific indicator. These issues have been the focus of Life Cycle Assessment methodologies for a number of years, and it is recommended that the ISO 14040 series of international standards be consulted for guidance.

Boundaries should be selected based on the information needs of users (e.g. management, outside stakeholders). The entity to which the information refers to should be specified in an eco-efficiency or sustainability report.

pilot learning: system boundaries for generally applicable indicators

Pilot companies found that the concept of the "boundary fence" is important for the definition of generally applicable indicators. This is seen clearly in the different approaches e.g. to GHG emissions and electricity use.

Upstream GHG emissions are measured, tracked and reported by the supplier company. For example, emissions released by the supplier of purchased electricity will be reported by the supplying utility and shall not be included in a company's own measurement again. The generally applicable indicator description for GHG emissions covers therefore only emissions from direct corporate activities.

On the other hand, purchased electricity is part of the total energy consumption of an entity. Therefore it is included in the energy consumption indicator and eco-efficiency profile of this entity.

Following indicator principle 8, companies may nevertheless wish to track significant impacts from upstream and downstream, such as impacts from purchased electricity generation and product use. They can track these as business specific indicators where they identify them as relevant for their business.

DATA AVAILABILITY

Tracking eco-efficiency performance should wherever possible be based on information that is already available in the business or can be acquired at a reasonable cost relative to its value for users. Some information must be estimated because it is not practical to obtain actual measurements (e.g. GHG emissions associated with purchased electricity). But most of the information needed to develop the recommended indicators for product/service value and creation (except the function delivered aspect) can generally be obtained from the following mainstream business information sources:

production reports

cost reports

annual financial reports

material safety data sheets

environmental reports (internal management and external regulatory)

Despite this availability it may not be easy to compile the information needed to track eco-efficiency performance. Most mainstream business systems are not set up to generate this kind of information for the enterprise as a whole. The information is typically tracked and managed at a facility, process or sub-process level.

In some cases data may not be disaggregated sufficiently to identify the numbers needed for indicators with specific products or processes. For example, shared resources are not always allocated by process or end-product, especially at integrated, multi-product facilities. Also, recycled or reused materials may not easily be allocated back to a specific process. Nor can their "historic" environmental burdens be easily quantified.

In the absence of the kind of well-developed codification available for financial information, companies may also need to grapple with problems of definition. This is especially the case for international companies, where there may be differences in definition or presentation from country to country, including units of measure. But it is also true that definitions of common terms (e.g. solid waste and hazardous waste) can be different from state to state as well as between sectors.

Information needed to develop the indicators for the product/service use category is often particularly difficult to obtain because it relates to the specific way in which products are used. Such information may be available internally as a part of business plans, but may not necessarily be available in mainstream business information sources such as financial and cost reports. Such information is highly product specific and cannot be meaningfully aggregated across different products.

Each business needs to develop an enterprise level information system that addresses these challenges in collecting, managing, analyzing and reporting data. The basis for information (measurements or estimates & methodology) and terminology used needs to be documented in reports. As far as possible, the terminology and definitions used should be those presented in chapter 3, but there are some genuine differences from country to country (e.g. regulatory differences in the definition of hazardous waste).

pilot learning: a journey

Pilot companies found that "building a sound system of performance evaluation and reporting is a journey" and normally needs a corporation's efforts over several years.

One company proposed that implementing a sound system should comprise the following four steps:

1. **select business specific indicators meaningful to the business**
2. **implement new data systems on these indicators**
3. **select the indicators to be used for external reporting**
4. **establish corporate goals**

SENSITIVITY AND ERROR

It is important to bear in mind the relevance or materiality of data to ensure that effort invested in gathering information is proportionate to its importance. Information used to develop eco-efficiency indicators should be of sufficient quality to meet the needs of users, especially with respect to tracking performance. But it is not always necessary to have high precision on all of the information. For example, if three out of ten raw materials used in a process constitute ninety percent by volume of the total, the volume precision on those three major materials needs to be high and the volume for the other seven could be estimated without sacrificing much precision in the overall figures. Similarly, if ninety percent of energy use for a business occurs at one of ten locations, the energy use precision for that one location needs to be high, while energy use for the other nine could be estimated.

TRANSFORMATION AND CONVERSION

For several of the generally applicable indicators there are internationally recognized methods for the transformation of data into common units (e.g. the calculation of greenhouse gas equivalents). However, for many other parameters, such as hazardous waste, there are no commonly agreed methods for this type of conversion. In these cases care needs to be taken when data are transformed, and the method of transformation should be clearly described.

AGGREGATION

Eco-efficiency information will generally be aggregated and reported for an enterprise as a whole, rather than for individual products and facilities. This is especially so when reporting to outside stakeholders (e.g. in a corporate sustainability report), and for large companies with tens or hundreds of facilities and products, distributed worldwide. Some businesses may choose to report enterprise, segment and/or product level eco-efficiency performance. But most are likely to limit it to the enterprise level to protect confidential business information, or to keep volume limited.

While aggregation will often be necessary, it is likely to obscure potentially important information about an enterprise's eco-efficiency performance. For example, different types of unrelated emissions, or emissions across different geographic locations, may be added together, preventing a valid assessment of potential influences on the local environment. Eco-efficiency estimates from different products, processes, or geographic areas may be combined and averaged, obscuring details about the performance of individual units. As a result, aggregation of data should be done carefully, and with transparency to the end-user, so that the limitations of the information can be well understood. This is especially the case when data are reported publicly, where comparisons between different companies, processes, or products could be made.

INTERPRETATION AND BENCHMARKING

Eco-efficiency reporting serves to track performance, identify potential improvement opportunities and document progress. Within a company, benchmarking could be made to track year-to-year performance and to compare against targets.

For comparisons between companies it is important to recognize the inherent diversity of business. Comparisons should be made only when the companies being compared provide the same product/service (e.g. electricity). It is also important to recognize that the product portfolios of different businesses often change, and that this may affect eco-efficiency performance, independent of a firm's environmental activities. The impact of such changes should be discussed in reporting eco-efficiency data, to allow users to interpret year-to-year trends accurately.

"Interpretation of the data is the central issue of performance evaluation and reporting. Decision makers want to know what their own figures mean for the various businesses in relation to peers and targets. It is important to have trends over several years for good interpretation."

EXPERIENCE SHARING MEETING IN LONDON, JULY 6/7, 1999

Reporting issues

The primary aim of most business measurement systems is to collect performance information for internal management purposes. But while the primary audiences for eco-efficiency information are within a company there are also various external audiences that will be interested in the information, especially at the corporate level.

WBCSD does not recommend that companies prepare a separate or stand-alone eco-efficiency report, but rather integrate eco-efficiency information into their overall decision making and communications processes. Internally, it should be part of routine management systems.

Externally, eco-efficiency indicators could be provided and interpreted in corporate environmental or sustainability reports as one of the integrating element between the three pillars of sustainability, and integrated into existing financial reports. Eco-efficiency information can be communicated on a facility, regional, divisional, or corporate basis, recognizing the risks already identified of aggregating data across different products and/or operations.

UNDERSTANDING THE NEEDS OF USERS

When deciding how to communicate eco-efficiency information, companies need to understand the users and their needs, and present data accordingly. Eco-efficiency information can be used by a wide variety of audiences, both inside and outside companies.

Internally:

Management uses the information for decision making such as how to improve products and processes, and to set business goals

Employees in functions such as finance, process engineering and environmental management may have a professional interest in the eco-efficiency performance of a company, especially in the context of how they can work to make improvements. All employees are also likely to be interested in their company's performance and their role in it.

Boards of Directors may incorporate eco-efficiency information and other sustainability issues in their strategic decision making.

External audiences may include:

Investors, accountants, shareholders, and analysts, who are beginning to look at how eco-efficiency performance of a company can influence its financial value and the quality of investments in it.

Bankers attempting to integrate eco-efficiency in their lending decisions and their view of a company's creditworthiness.

Insurers may be able to use eco-efficiency indicators as a means to identify potential insurance risks and set premiums, as well as assess the economic consequences of environmental performance.

International Standards Bodies may seek to integrate eco-efficiency indicators into the standards for management practices.

Communities may be interested in the performance of facilities in their area.

Consumers may want to include eco-efficiency performance information as a part of their purchase decisions.

Interest groups may request that companies describe and quantify eco-efficiency in their public reporting as a means to help document their progress toward sustainability.

MEETING AUDIENCE NEEDS

The following questions may help to develop a communications approach by focusing a company's efforts on the key needs of its audience(s), and identifying key issues that must be dealt with.

- What do specific audiences want from the company?
- What is the goal of reporting?
- What is the added value for the company of reporting eco-efficiency?
- What is the risk (and how can the risk be managed) of reporting or not reporting the information with respect to :
  - not meeting the user's expectations
  - corporate reputation
  - managing perceived "bad news"
  - raising new, previously unknown issues?
- Are there competitive issues associated with reporting eco-efficiency information such as disclosing potentially confidential or sensitive details, and how can those concerns be managed?
- Should the information be evaluated and verified by an independent third party to improve its credibility with an audience?

- What is the best means of communication (e.g. paper reports, Internet)?

- Should a company provide benchmarking information (e.g. from other companies or industry averages) and how?

- Are there any issues that need to be communicated about the influence on eco-efficiency performance of
  - changing technologies
  - changing markets
  - new environmental knowledge?

- What is the environmental/human health relevance and scientific basis of the data?

- Are there geographic issues and special concerns to be considered and communicated?

SCOPE AND LIMITATIONS

It is very important that companies provide some perspective on the scope and limitations of their indicators. Information should be provided on issues such as accuracy and precision (e.g. margins of error); the degree to which data have been aggregated; boundaries of data collection; environmental relevance; the influence of market changes that may be unrelated to changes in eco-efficiency; the limits of comparisons; etc.. The purpose of these explanations is to ensure that users understand the nature of the information provided.

"After we have now successfully applied this approach at one of our sites, we intend to expand it to other sites of the same business unit and finally to the entire corporation. The study team gained a lot of experience and will also be able to help other companies in the future."

"As a company we learned that we still have many opportunities to improve our eco-efficiency, even though we felt we already were a highly profitable and environmentally responsible business when we engaged in this pilot."

PILOT CONCLUSIONS MEETING, NYON SWITZERLAND, MARCH 27/28, 2000

The eco-efficiency profile

There are no "rules" for communicating eco-efficiency information and WBCSD does not propose a standard format because of the flexibility required to meet the needs of different audiences. One approach is illustrated in the example at the beginning of this report and within this section.

In general, eco-efficiency information must be presented in a substantive and clear manner that is accurate, not misleading, and consistent with the technical background of the end-user.

Users may want to express eco-efficiency with a number of different ratios combining various value and environmental influence indicators.

So while companies may want to publish their own eco-efficiency ratios it is recommended that environmental and value data also be reported separately as gross numbers (e.g. tons of materials or emissions, total gigajoules of energy used, total earnings). The calculation of additional eco-efficiency ratios can then be done by the end-user.

THE ELEMENTS OF A COMPANY'S ECO-EFFICIENCY PROFILE

WBCSD proposes the following five elements for a summary report. If the report has undergone third party review, a verification statement might also be included.

Organization Profile – to provide a context for the eco-efficiency information. A typical profile might include the number of employees, business segments and primary products, system boundary conditions, and contacts for additional information. This section should also include a description of major changes in the structure of the company since a previous report was issued.

Value Profile – This section of the report provides a profile of both generally applicable and business specific indicators from the "value" portion of the WBCSD framework. This would include indicators such as financial information, the amount of products sold, or functional indicators for specific products.

Environmental Profile – including generally applicable environmental influence indicators as well as business specific indicators relating to product/service creation and use that are relevant and meaningful for the specific company.

organization profile

Company name:	**Exemplis Inc.**
Business segments:	**Pharmaceuticals (list of primary products)**
Report for:	**Fiscal Year 1999**
System boundaries:	**includes all consolidated units of Exemplis Inc., excludes joint ventures and minority activities**
Number of employees:	**2,500**
Internet:	**Website, hyperlink to web-based sustainability report**
Contact for additional information:	**Name, telephone, e-mail address**

value profile

Generally applicable indicators:	
Mass of product sold	**= 300,000 kg**
Net sales	**= 470 million USD**
Business specific indicators:	
Value added	= 220 million USD
Gross margin	= 130 million USD
EBIT	= 45 million USD

environmental profile

Generally applicable indicators:	
Energy consumed	**= 50,000 gigajoules**
Material consumed	**= 4,500 tons**
Water consumed	**= 60,000 m^3**
GHG emissions	**= 7,000 tons CO_2 equiv.**
ODS emissions	**= 25 tons CFC11 equiv.**
Business specific indicators:	
Electricity consumed	= 35,300 gigajoules
GHG from upstream electricity gen.	= 4,600 tons CO_2 equiv.
Natural gas consumed	= 11,500 gigajoules
Acidification emissions	= 400 tons SO_2 equiv.
VOC emissions	= 230 tons
COD effluents	= 86 tons
Total waste	= 1,450 tons
Waste to landfill	= 650 tons

Eco-efficiency Ratios – In addition to providing the basic "numerator" and "denominator" data for estimating eco-efficiency, companies may also wish to provide calculations of eco-efficiency indicators that they regard as most relevant and meaningful for their business.

Methodological Information – covering the approach used to select indicators, data collection methodologies and any limitations on use of the data.

Business specific indicators and information should be provided using the same format as for the generally applicable indicators, both in absolute terms and if relevant and meaningful, as eco-efficiency ratios. The appropriate indicators would be determined by the company's specific circumstances.

eco-efficiency ratios

Mass of product sold per

Energy consumption	= 6.0 kg per gigajoule
Material consumption	= 66.7 kg per ton material
GHG emissions	= 42.9 kg per ton CO_2 equiv.

Net sales per

Energy consumption	= 9,400 USD per gigajoule
Material consumption	= 104,000 USD per ton material
GHG emissions	= 67,100 USD per ton CO_2 equiv.

methodological information

ISO 14,031 was used to identify relevant aspects of our business activity and to select respective meaningful indicators.

Our data collection and use methodologies are available for review.

environmental reports

An analytical survey was carried out in the course of our pilot program on 29 most recent corporate environmental and sustainability reports. The study analyzed the companies' reporting practices in their use of the recommended reporting elements, generally applicable indicators (value and environmental influence), eco-efficiency ratios and reporting vis-à-vis targets.

These were our main findings:

- The recommended organizational profile information is not fully included.
- While net sales are provided in a majority of reports, product quantity is included only in one third.
- 15% of the reports provide no value indicators at all.
- While a majority reports on total energy and water consumption, materials figures are only included in 20% of the reports.
- Greenhouse gas emissions were reported in some form or fashion by over 60 % of the companies, but few reported on Ozone Depleting Substances.
- Over 70% of the reports include indicators on waste, but with varying definitions and scopes.
- Where ratios are used, they are still most often in the form of intensity ratios, not eco-efficiency ratios.
- Targets are very rarely used.

Recommendations on general reporting practices concluded from the study include the need for clear definition of indicators and scope of the report, consistent units for data of the same kind, and use of graphs that allow exact reading of the data or provide the data separately.

REPORTING TRENDS OVER TIME

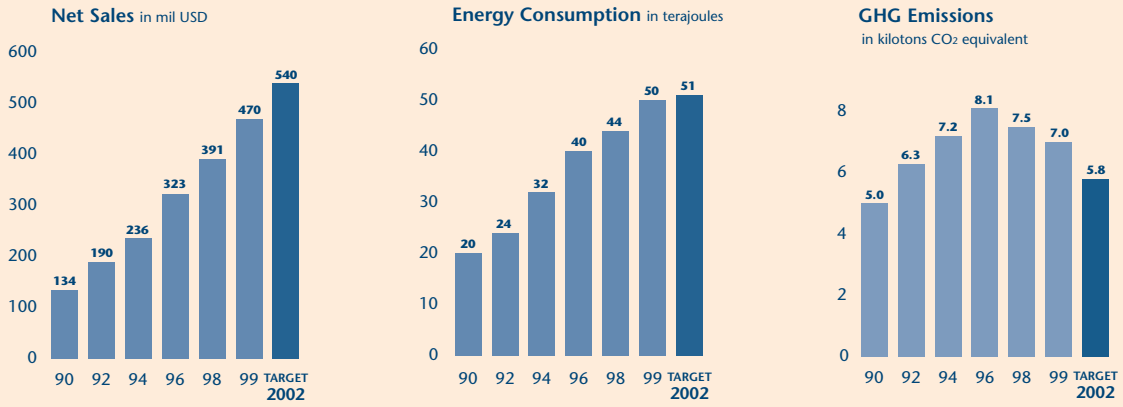
Trend data is important so that changes in performance over time or compared to a reference point can be assessed. Data can be presented as absolute value and environmental influence figures or as eco-efficiency ratios, or indexed to a selected year, or expressed relative to a projected goal. The performance could also be expressed relative to an industry average, if that is available. If indices are used, however, the absolute numbers underlying them should also be published so that users can calculate their own ratios.

A report could therefore include data from several years, as well as a reference year and targets in order to illustrate improvements over time and demonstrate achievements against targets, as shown in the example below. It is crucial, however, that data presented in such charts is truly comparable so that the trends depicted accurately represent eco-efficiency performance.

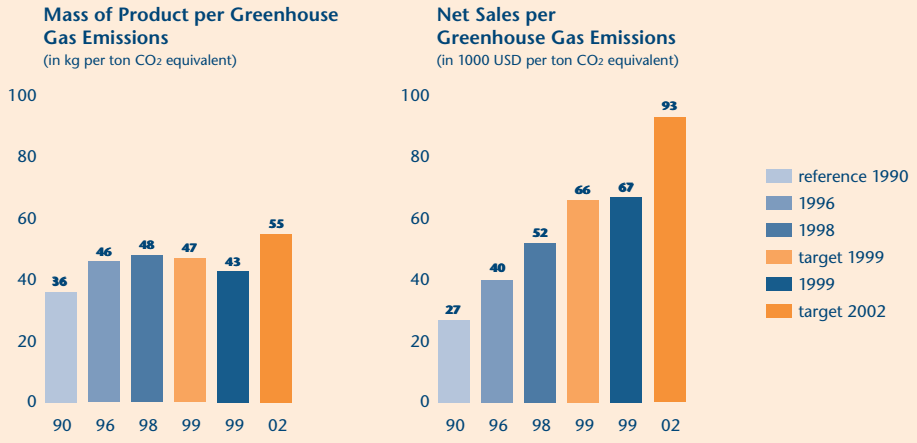
" Strong emphasis should be placed on the use of trends or comparisons over periods of time with the eco-efficiency calculations. When they stand alone, these indicators have little meaning in comparison to the environmental impact they represent."

EVALUATION OF THE CONCEPT BY PILOT COMPANIES, MARCH 2000

performance over time



eco-efficiency ratios



appendices

Appendix 1: List of categories, aspects and examples of indicators

CATEGORY	ASPECT	EXAMPLE INDICATOR
Product/Service Value	Volume	• Units (e.g. number) sold • Statistical Unit (e.g. averaged, indexed) • Employees (e.g. numbers, labor hours) • Space (e.g. in building management)
	Mass	• Quantity (e.g. kilograms) sold • Quantity (e.g. kilograms) produced
	Monetary	• Net Sales/Turnover • Gross Margin (Net Sales - Cost of Goods Sold) • Value Added (Net Sales - Costs of Goods Purchased) • Income / Earnings / Profits • Share Value • Liabilities (e.g. Insurance Costs) • Reserves / Provisions • Investments and Write-offs • Costs (e.g. Cost of Goods Sold, Production, Energy, Materials, Waste Disposal, Pollution Control)
	Function	• Product Performance (e.g. laundry loads washed, number of diapers used in a baby's life time) • Services Delivered (e.g. standard banking transactions) • Agricultural Yield (e.g. bushels harvested) • Agricultural Effectiveness (e.g. hectares treated) • Product Durability/Lifetime (e.g. vehicle miles traveled) • Transport Capacity (e.g. ton-kilometers, passenger-kilometers) Note: Function describes the functional value of a product/service to the end-user. As a result, they are highly specific and can only be used for individual products and services.
	Other Potentially Relevant Information	• Product Price • Market Share • Margins • Market Mix
Product/Service Creation Environmental Influence	Energy Consumption	• Gigajoules consumed • Fossil Fuel Type (e.g. gigajoules of coal, natural gas, fuel oil, etc.) • Source (e.g. gigajoules of renewable, non-renewable) • Emissions (e.g. tons of SOx, NOx, VOC, greenhouse gases)
	Materials Consumption	• Tons consumed • Type (e.g. tons of raw material, indirect/ancillary materials) • Source (e.g. tons of renewable, non-renewable, recycled, virgin, extraction rucksack) • Characteristics (e.g. tons of materials with certain environmental safety/risk characteristics)
	Natural Resource Consumption	• Tons consumed (e.g. water, wood, minerals) • Source (e.g. tons of renewable, non-renewable, m^3 of groundwater, fresh surface water, salt water) • Land Use (e.g. hectares of biodiversity/species conservation habitat) • Non-process Water (e.g. m^3 of utility, product consumption)

CATEGORY	ASPECT	EXAMPLE INDICATOR
	Non-product Output	• Before Treatment (e.g. tons of process material inputs minus tons of product output) • Techniques of Treatment (e.g. quantity to bio-treatment, incineration, landfill) • Releases to Land or Water After Treatment (e.g. quantity to on-site/ off-site treatment, quantity of hazardous/non-hazardous, quantity to surface water, underground injection, tons of effluent BOD5 and/or COD, tons of N&P nutrification emissions) • Air Emissions (e.g. tons of NO_2/NOx, SO_2/SOx acidification, greenhouse gases, ozone depleting substances, volatile organic compounds) • Priority Heavy Metals Releases (e.g. tons of releases) • Persistent, Bio-accumulative and Toxic Releases (e.g. tons of POPs releases)
	Unintended Events	• Accidental Releases (e.g. number of releases)
Product/Service Creation Environmental Influence	Product/Service	• Characteristics (e.g. recyclability, reusability, bio-degradability, durability safety/risk)
	Packaging Waste	• Tons sold • Source (e.g. virgin material, recycled)
	Energy Consumption	• Same as above for Product/Service Creation
	Emissions During Use and Disposal	• Releases to land, water and air from use and disposal

Appendix 2: Examples for business-specific indicators

Some examples of business specific indicators are included in this appendix to help companies and provide some guidance based on the experience gained during the pilot exercise. The descriptions, measurement methods and data sources are taken from information provided by pilot companies. Many of them are used in these companies. Environmental business specific indicators can be identified in the following areas:

- **Indicators on emissions of individual or groups of gases and metals to air or water (e.g. VOC, SO_2, NOx, priority heavy metals)**

- **Environmental burden/effect indicators (e.g. eutrophication, photosmog, human toxicity):** Environmental burden/effect indicators are summary indicators for different gases or effluent substances that contribute to the same environmental burden or effect. Weighting factors (e.g. Heijungs et al. at Leiden University (1992); ICI: Environmental Burden, The ICI Approach, 1997; Responsible Care: Health Safety and Environmental Reporting Guidelines; CEFIC November 1998), with which individual gases or effluent substances contribute to environmental effects, have been developed for some indicators. In some regions (e.g. Europe) the weighting factor concept is used quite broadly.

- **Summary parameters for water effluents (e.g. Chemical oxygen demand (COD) and others):** Summary parameters for water effluents are also very common. However, water effluent substances are not relevant for all type of businesses, and therewith neither are such summary parameters. Those businesses for which it is relevant will have to choose between alternative parameters and measurement methods.

- **Indicators on particular fractions of waste or non-product output (e.g. waste to landfill)**

- **Product use indicators (e.g. product packaging, energy consumption during product use):** These types of indicators can often be defined along similar terms as the indicators for product creation, however with a scope relative to the product usage.

- **Indicators on aspects of upstream impacts emerging at operations of suppliers:** These types of indicators can often also be defined along similar terms as the indicators for product creation, however with a scope relative to the product's upstream value chain or usage.

VALUE INDICATORS

INDICATOR	UNIT	POTENTIAL MEASUREMENT METHOD	POTENTIAL DATA SOURCE
EBIT Profit before interest expense and income tax	in USD, Euro, or Yen	International Accounting Standards Committee (IASC), Generally Accepted Accounting Principles (GAAP) e.g. at: www.aicpa.org	Financial reports Purchasing reports
Gross Margin Net sales minus costs of goods and services sold	in USD, Euro, or Yen	International Accounting Standards Committee (IASC), Generally Accepted Accounting Principles (GAAP) e.g. at: www.aicpa.org	Financial reports Purchasing reports
Value Added Net sales minus costs of goods and services purchased	in USD, Euro or Yen	International Accounting Standards Committee (IASC), Generally Accepted Accounting Principles (GAAP) e.g. at: www.aicpa.org	Financial reports Purchasing reports

ENVIRONMENTAL INFLUENCE INDICATORS

INDICATOR	UNIT	POTENTIAL MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Priority Heavy Metals (PHM) Emissions to Surface Water Total aquatic release of sum of heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn) and their compound to water	in metric tons of Cu equivalents	- Heavy Metals as defined in: Responsible Care: Health Safety and Environmental Reporting Guidelines, CEFIC November 1998, page 12 - Transformation factors: ibid Appendix 9, page 38	Water discharge reports EHS reports Estimation or calculation

INDICATOR	UNIT	POTENTIAL MEASUREMENT METHOD	POTENTIAL DATA SOURCE
Waste to Landfill Wastes from processes, treatments and packaging disposed of by landfill	in metric tons	Company specific method used to measure or track quantity (mass) of waste disposed of by landfill	Waste disposal reports EHS reports Estimation or calculation
Waste to Incineration Wastes from processes, treatments and packaging disposed of by incineration	in metric tons	Company specific method used to measure or track quantity (mass) of waste (as defined by applicable government authority) disposed of by incineration	Waste disposal reports EHS reports Estimation or calculation
Photochemical Oxidant Creation (POC) VOC (excluding methane) and NOx releases	in metric tons of VOC & NOx or Ethylene equivalents	- VOC as defined in Responsible Care: Health Safety and Environmental Reporting Guidelines, CEFIC November 1998, page 11 - Photochemical Oxidant Creation Potentials (POCP): Heijungs et al., CML University of Leiden, 1992 and Hauschild and Wenzel, Chapman & Hall, London, 1997	Plant surveys EHS reports Estimation or calculation
Eutrophication Emissions to Surface Water Total aquatic release of phosphorous and nitrogen compounds	in metric tons of phosphorus equivalents	Nutrification Potentials: Heijungs et al., CML University of Leiden, 1992	Plant surveys EHS reports Estimation or calculation
Chemical Oxygen Demand (COD) to Surface Water Total amount of oxygen required for the chemical oxidation of compounds in all water effluents	in metric tons of oxygen	COD as defined in: Responsible Care: Health Safety and Environmental Reporting Guidelines, CEFIC November 1998, page 12	Water discharge reports EHS reports Estimation or calculation
Packaging Packaging from purchased goods and for products	in metric tons	Company specific method used to measure or track packaging material amounts (mass)	Purchasing reports Waste disposal reports Estimation or calculation
GHG Emissions from Purchased Electricity GHG emissions released by the supplier of purchased electricity	in metric tons of CO_2 equivalents	- List of greenhouse gases: Kyoto Protocol, Annex A - Global Warming Potentials: IPCC, Climate Change 1995, Second Assessment Report - Transformation factors for fuels from fuel carbon content: e.g. Responsible Care: Health Safety and Environmental Reporting Guidelines, CEFIC November 1998, page 31f. GHG emissions released by supplier of purchased electricity are calculated/ estimated using specific knowledge of relevant electric supplier network.	Cost reports Estimations or calculations

Appendix 3: List of pilot companies

3M	Consumer Products	USA
Broken Hill Proprietary	Mining	Australia
Companhia Vale do Rio Doce	Mining	Brazil
General Motors	Transportation Products	USA
Grupo Vitro	Glass	Mexico
Monsanto Company	Life Sciences	USA
Noranda	Mining	Canada
Norsk Hydro	Conglomerate	Norway
Novartis International	Life Sciences	Switzerland
Novo Nordisk	Chemicals	Denmark
Procter & Gamble	Consumer Products	USA
Rio Tinto	Mining	UK
Shell Chemicals	Chemicals	UK
Sonae Investimentos	Forest product and Retail	Portugal
Sony Europe	Electronics, Entertainment	Europe
STMicroelectronics	Microelectronics	France
Suez Lyonnaise des Eaux	Utilities	France
TECO Electric & Machinery	Electrical	Taiwan
Tokyo Electric Power Company	Utilities	Japan
Toyota	Automobiles	Japan
Volkswagen	Automobiles	Germany
WMC Limited	Mining	Australia
Taiwan Ind. Sector Assoc.	Cement, Paper, Semiconductors	Taiwan

Appendix 4: Working group member companies and organizations

3M
Anova Holding
Arthur D. Little
AT&T
Aventis
BASF
BOC Group
Broken Hill Proprietary
CH2M HILL
Chemical Works Sokolov
CIMPOR
Companhia Vale do Rio Doce
Deloitte Touche Tohmatsu
Dow Chemical
DuPont
Eastman Kodak
Environmental Resources Management plc
Fiat Auto
General Motors
Gerling-Konzern Insurances
Grupo IMSA
Grupo Vitro
Interface
Johnson & Johnson
Kikkoman Corporation
Mitsui & Co
Monsanto Company
Noranda
Norsk Hydro
Novartis International
Novo Nordisk
Petro-Canada
PLIVA
PowerGen UK
Procter & Gamble
Rio Tinto
SC Johnson & Son
Samsung Electronics
Severn Trent
SGS Société Générale de Surveillance
Shell International
Sonae Investimentos
Sony
STMicroelectronics
Storebrand
Suez Lyonnaise des Eaux
Suncor Energy
ThermoRetec Corporation
Tokyo Electric Power Company
Toyota
UBS
Unilever
Volkswagen
Westvaco
Weyerhaeuser
WMC Limited
Zurich Financial Services Group

Austrian BCSD
BCSD Argentina
BCSD Brazil
BCSD Colombia
BCSD Taiwan
Environmental Forum of Zimbabwe
Industrial Environmental Forum of Southern Africa (IEF)

about the WBCSD

The World Business Council for Sustainable Development (WBCSD) is a coalition of 130 international companies united by a shared commitment to sustainable development. Its members are drawn from 30 countries and more than 20 major industrial sectors. The organization also benefits from a thriving global network of national and regional business councils and partner organizations.

The WBCSD aims to be a catalyst for change and fosters closer co-operation between business, government and other organizations concerned with sustainable development. It also serves as a forum where leading business people can exchange ideas and best practice in this field. The organization's work program reflects the determination of many in business to engage in an action-oriented approach. In particular, the WBCSD carries out a program covering the following focus areas: sustainability reporting; corporate social responsibility; sustainability through the market; innovation, technology, society and sustainability; climate and energy; and natural resources.

Further, there are currently four sectoral projects under way within the WBCSD on sustainable mobility, cement, mining and forestry.

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The WBCSD's working group on *Eco-Efficiency Metrics and Reporting* was fortunate to have the commitment and leadership of Robin Bidwell, chairman, ERM plc, and Hendrik Verfaillie, president of Monsanto Company. We would also like to extend our appreciation for the dedicated efforts provided by Charles W. Keffer, Director, EHS Operations Policy & SD Operational Excellence, Monsanto Company. Further, many thanks to Markus Lehni, Program Manager at the WBCSD, who oversaw the WBCSD's eco-efficiency work for the past three years, and brought the metrics and reporting project to a tangible outcome. Finally, we should like to thank all the individuals who participated in the year-long pilot program to test the indicators, refine them, and bring them to life.

Disclaimer

WBCSD reports, such as this document, are released in the name of the WBCSD. Each publication is the product of a working group, comprising executives of member companies, mandated by the council to address a particular topic, often drawing on the advice of internationally renowned experts.

Each working group is chaired by council members, who lead the clearance process, which includes the review of the text by all members and the final approval by the executive committee. This process ensures that each document represents the majority view of the WBCSD. However, it does not mean that every member agrees with every word.

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