Standardized Eco-Efficiency Indicators

— Report 1: Concept Paper

Kaspar Müller and Dr. Andreas Sturm

Revision: 1.0.5 / January 2001 (revision 1.0 was first published in May 2000). Please consult www.ellipson.com for the latest revision! This is work in progress! Please send comments and questions to:

eco_efficiency@ellipson.com

Your feedback is highly appreciated!

Ellipson AG
Leonhardsgraben 52
CH – 4051 Basel
Switzerland

Voice: +41-61-261 93 20
Fax: +41-61-261 93 13
E-fax: +44-870-133 68 31

mailbox@ellipson.com
www.ellipson.com

Content

Figures

Tables

ELLIPSON

Abbreviations and Acronyms

ACCA	Association of Chartered Certified Accountants
CBI	Confederation of British Industry
CEO	Chief Executive Officer
CER	Council on Economic Priorities
CERES	Coalition for Environmentally Responsible Economies
CICA	Canadian Institute of Chartered Accountants
CML	Centre of Environmental Science, University Leiden
cf.	Compare
e.g.	example given
ECOSOC	Economic and Social Council
EFFAS	European Federation of Financial Analysts' Societies
EIA	Environmental Impact Added
EMAS	Environmental Management and Eco-Audit System (EU)
EMS	Environmental Management Systems
EPE	Environmental Performance Evaluation
EPI	Eco-Productivity Index (Novo Nordisk)
EPS	Earnings Per Share
EU	European Union
FASB	Financial Accounting Standards Board
ff.	following
GEMI	Global Environmental Management Initiative
GHG	Greenhouse Gas Emissions
GRI	Global Reporting Initiative
GWP	Global Warming Potential
IAS	International Accounting Standard
IASC	International Accounting Standards Committee
ICC	International Chamber of Commerce
IPCC	Intergovernmental Panel on Climate Change
IRRC	Investors Responsibility Research Center
ISAR	Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting
ISO	International Organisation for Standardisation
LCA	Life Cycle Assessment
m.	Millions
MJ	megajoules
NGO	Non Governmental Organisation
NPO	Non Product Output
NRTEE	National Roundtable on the Environment and Economy
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substance
P/E	Price Earnings Ratio
P/L-statem	Profit and Loss-Statements
PPP	Pollution Prevention Pays
RER	Roche Energy Rate
SETAC	Society of Environmental Toxicology and Chemistry
TC	Technical Committees
TNC	Transnational Corporations
TRI	Toxic Release Inventory
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
USD	US Dollar
U.S.-GAAP	United States Generally Accepted Accounting Principles
VA	Value Added
WBCSD	World Business Council for Sustainable Development
WD	Working Draft
WEC	World Economic Forum
WRI	World Resource Institute

1 Purpose and Structure of This Report

The purpose of this report is to provide guidance on the identification, selection, and construction of the most useful eco-efficiency indicators. Such indicators must, as a minimum, be globally recognised, consistent and comparable within an enterprise and between enterprises. An eco-efficiency indicator puts an environmental performance figure in relation to a financial figure. There is a necessity to ensure that all environmental items are calculated on the same basis and are consistent with the financial items.

As will be explained in subsequent chapters, performance indicators can either be generic, that is, applicable to all enterprises, or industry-specific. Since a number of industries are already working on industry-specific indicators, we have chosen to work on generic indicators. However, the general principles for their construction and use with financial indicators are also applicable to the industry-specific indicators (cf. matrix in chapter 7.7).

Chapter two introduces basic material for those readers not conversant with environmental performance indicators or the concept of eco-efficiency and the link between financial and environmental performance. Chapter three identifies five generic environmental performance indicators, which meet the test of global recognition and chapter four identifies the financial performance indicator. Chapter five lists the proposed set of five generic eco-efficiency indicators. Chapter six opens the discussion on different accounting issues (e.g. consolidation).

This report is the first in the series on that topic and it gives a general overview of the problem and solution. By mid 2001 this report will be followed by *"Guidelines on Eco-efficiency Indicators for Users and Preparers"*.

It should be mentioned that other groups are working on the development of eco-efficiency indicators such as the World Business Council for Sustainable Development (WBSCD), the International Organisation for Standardisation (ISO), the Global Reporting Initiative (GRI) and UNCTAD/UN-ISAR[1] (see chapter 7.6):

The WBCSD has created a working group on Eco-efficiency Metrics and Reporting, which began analysing current practices and drawing up recommendations for standardising measurement and reporting procedures. The group developed metrics principles and defined key terms for evaluating eco-efficiency and sustainability performance. It also selected indicators, which it felt were universally measurable and comparable across all businesses. Member companies are testing the new system to measure their own eco-

[1] United Nations Conference on Trade and Development / Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting

efficiency performance. It has not addressed the specific methodology required to link financial and environmental indicators.

The ISO 14000 series of environmental management standards was initiated in 1992 as part of the response to the Rio summit and the primary standard is ISO 14001, which covers environmental management systems. ISO 14031/2 relates to environmental performance evaluation and was issued in 1999. ISO has defined the term 'environmental performance' as „the results of an organisation's management of its environmental aspects". This means that the performance may be measured against the enterprise's policy, objectives and targets. The guidance covers the 'local environment' as well as the global, and outlines some generic 'input' and 'output' indicators such as energy and waste. Crucially it omits the value added or any other financial parameter and leaves the selection of indicators to the individual enterprise.

The GRI is a long term project launched by the Coalition for Environmentally Responsible Economies (CERES) to establish, through a global, voluntary and multi-stakeholder process, a uniform framework for corporate sustainability reporting. The framework incorporates not only environmental indicators but also social and economic ones. Thus, it is a much broader exercise than the current one. Concerning the selection of generic indicators, there is a direct link between the results of this report and GRI's work. However, GRI is also producing sector specific environmental performance indicators as well as generic ones.

UNCTAD/UN-ISAR[2] has set up a project on "Standardised Environmental Performance Indicator. At present there has been no publication. A brief description of the project based on an internal draft report can be found in a WBCSD publication [WBCSD 2000].

[2] United Nations Conference on Trade and Development / Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting

2 Eco-efficiency Indicators

2.1 The concept of eco-efficiency

Enterprises can pursue different environmental strategies. Investors increasingly require that companies pursue eco-efficient strategies that reduce the damage caused to the environment while increasing or at least not decreasing, shareholder value (see box on „eco-efficiency). The World Business Council for Sustainable Development (WBCSD) describes the objective of eco-efficiency as „maximising value while minimising resource use and adverse environmental impacts...” [WBCSD 1996].

Eco-efficiency

An eco-efficiency indicator is the ratio between an environmental and a financial variable. The aim of environmentally sound management is to increase eco-efficiency by reducing the environmental impact added while increasing the value of an enterprise [SCHALTEGGER/STURM 1989]. The World Business Council for Sustainable Development describes how eco-efficiency is achieved: „Eco-efficiency is reached 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…“ The WBCSD goes one step further by including a clear target level: An eco-efficient state is reached when economic activities are at a level „…at least in line with the earth's estimated carrying capacity“. [WBCSD 1996]

The problem with this concept is that there are no agreed rules or standards for calculating the ecological variable item either within the same industry or across industries. Most importantly, there are no rules for consolidating ecological data for the entire enterprise so that such indicators can be used together with the enterprise's financial performance indicators.

Directors and investors need indicators that measure eco-efficiency in order to assess the outcome of various strategies. Eco-efficiency indicators can be used both for monitoring an individual company's performance as well as for comparing it across the industry (benchmarking).

2.2 The link of environmental and financial performance

Environmentally conscious managers can increase eco-efficiency by decreasing environmental impacts while increasing the added value by the enterprise. This goal can be reached in various ways. The approach that most clearly shows the link is the shareholder-value approach by Rappaport (see box on shareholder value). Applied to environmental issues in management the links can be generally described as follows:

Eco-efficient enterprises use fewer resources, and they cause fewer emissions to soil, water and air while producing the same output as their competitors. This higher productivity leads to an increase in the operating margin due to lower costs. Moreover, in many cases, it also leads to higher sales due to an enhanced value of the products to the customer or due to an improved public image. In addition, the risks of environmental liability decreases, resulting in a lower discount factor (the price for taking risks) and lower (contingent) liabilities. Wise environmental investment programmes also focus on a reduction of working capital. A lower use of resources leads to lower stocks of materials and energy. Focusing on integrated solutions and avoiding end of the pipe investments can decrease incremental investments in fixed assets. Finally, tax relief may be obtained.

There has been interest in linking environmental performance with financial performance either with the shareholder value approach described above[3] or other empirical methodologies. Given the many variables, which affect financial performance, such a relationship would be hard to calculate with precision. Therefore, eco-efficiency is seen by a growing number of experts as one way of establishing this link grosso modo.

Eco-efficiency indicators linking the environmental and financial performance can be used to forecast the impact of environmental issues on future financial performance. Such eco-efficiency indicators will allow better investment decisions. It can be said that an above average environmental performance by an enterprise means that, in all probability, this enterprise has a higher and more sustainable margin. In addition, the need for future investments will decrease (compared to competitors with a worse performance). Lower future investments and higher margins are important value drivers, substantially influencing future free cash flows, and thus positively contributing to shareholder value.

Eco-efficiency is relevant to the financial valuation of an enterprise because it could lead to or result in:

- higher margins
- lower incremental investments in current and fixed assets
- lower discount factors
- lower tax burden

[3] WWF Forests for Life Campaign, Sustainable Forestry Pays; New Findings on the Impact of Sustainable Business Strategies, A WWF Research Report, 1999 [www.panda.org/resources/publications/forest/gffi-forestry.html]

Shareholder Value Approach

The shareholder value approach allows for the financial quantification of a business strategy [Rappaport 1986]. The basic logic behind the financial quantification of a business strategy is that every strategy leads to specific plans and actions. These include an investment programme or an increase in recurring costs for environment and safety. These actions lead to future cash outflows. Yet, plans also lead to future cash inflows e.g. from sales or avoided cash outflows. The balance of out- and inflows is called „free cash flows". They represent the financial value of the strategy. The free cash flow of a period is calculated as follows:

	Earnings before Interest and Taxes (EBIT)
+	*Depreciation on Fixed Assets*
–	*Taxes on Operating Profit*
=	*Cash Flow from Operations*
+/–	*Incremental Working Capital*
+/–	*Investments in Fixed Assets*
=	*Free Cash Flow*

The total of all future free cash flows is equal to the corporate value. In order to add free cash flows from different periods, the annual free cash flows are discounted by a discount factor. The shareholder value approach additionally deducts total debt from the corporate value and thus arrives at the shareholder value, which is the dynamic value of the shareholders' equity. It is proven that there is a high correlation between the stock market valuation and the financial value of a business strategy (based on future free cash flows). Thus, discounted free cash flows are a valuable indicator for the valuation of an enterprise on stock markets and for owners of unlisted companies. Moreover, it is a future oriented approach, which emphasises the importance of a long-term view. It is repeatedly asserted that financial markets focus on the short-term performance but the shareholder value approach shows that approximately 80% of the financial value of an enterprise stem from long-term free cash flows.

These results will create higher free cash flows and thus generate greater financial corporate value. Moreover, eco-efficiency could lead to lower liabilities and in turn to more of the free cash flows being available for distribution to shareholders. The market capitalisation, which is a sign of its attractiveness to investors, is assessed in part by measuring future cash flows and so can reflect the enhanced investment profile. By adopting the shareholder value approach, the environmental implications are translated directly into financial consequences.

2.3 The need for standardisation of eco-efficiency indicators

In order to enable users of environmental reports to evaluate an enterprise's eco-efficiency, it is essential to have comparable and reliable eco-efficiency indicators. This can be achieved by the standardisation of relevant environmental and financial variables. First, the same method should be used to construct eco-efficiency indicators across enterprises. Second, the method for constructing eco-efficiency indicators should be consistent with the method used for financial variables.

The Adams' survey [ADAMS 1998] found that there is no consensus either on the use of eco-efficiency and environmental performance indicators or on their standardisation. The lack of comparability makes it impossible to either measure progress over time or to compare the performance of one enterprise with another (benchmarking). Non-comparable information can result in misleading assessments of an enterprise's own eco-efficiency. With non-comparable information, a enterprise can only assess whether its performance is meeting targets set by its management. However, if the information allows performance to be compared across enterprises in general and within the same industry in particular, then an eco-efficiency indicator has a higher value.

An enterprise's environmental performance is important to a number of stakeholders including financial markets, because improved performance in that field generally leads to higher, more sustainable financial value. Many stakeholders, and in particular the financial services sector want standardised environmental performance indicators that can be linked to financial performance. Such eco-efficiency indicators could improve the quality of decision-making of enterprise owners, investors and financial analysts. On the other hand there is no standard procedure available that gives guidance to preparers of such information. Standardised eco-efficiency indicators try to fill this gap.

A number of proposals for measuring and disclosing environmental performance already exist or are under development. As of today they are of limited use because

- there is no agreement on which indicators to use within an enterprise;
- the indicator and information disclosed may change from year to year;
- the methodology for the construction of indicators varies across enterprises;
- the methodology for combining environmental and financial data varies resulting in variables that are not consistent.

In the few areas where a consistent methodology has been created this has not been widely communicated, leading to a very low level of implementation. Elsewhere the lack of consistency with financial indicators and lack of a generally accepted methodology has further detracted from the use of environmental or eco-efficiency indicators.

2.4 Definition and classification of eco-efficiency indicators

Eco-efficiency indicators measure the enterprise's efficiency in the consumption of resources with reference to the ability to produce economic value. This view is consistent with the WBCSD definition of eco-efficiency mentioned earlier. Therefore eco-efficiency indicators that give an indication on a company's eco-financial performance consist of a combination of two independent variables; an environmental variable measuring the environmental performance and a financial variable measuring the economic performance. Environmental performance of a company is defined as the impact of the company caused by its activities during a specific period (usually one year) measured in physical or synthetic units. Economic performance of a company is defined as the financial value produced by the same activities during a specific period (usually one year) measured in monetary units.

Generally speaking eco-efficiency can be defined as:

$$\textit{eco-efficiency} = \frac{\textit{environmental performance}}{\textit{financial performance}}$$

Using the language of accounting, a performance ratio is calculated using two „items"[4]. Thus, standardising an eco-efficiency indicator requires the standardisation of two single items; one environmental and one financial (all readers not familiar with this terminology can use the term „variable" as a synonym).

The ratio of these two items should measure the environmental burden per unit of economic value, for example kilogram carbon dioxide emissions per dollar of sales or MJ energy per dollar of value added. This is similar to measuring the energy intensity on a national level (MJ energy per unit of output MJ energy per unit of GDP). Others calculate the ratio in reverse as the ratio of a financial or operational item per unit of environmental burden (GRI, WBCSD). Both approaches are equally valid mathematically and the choice of numerator/denominator is based on past custom and process.

Note: Some initiatives and authors do not clearly distinguish between environmental performance and eco-efficiency. In this report the term „environmental performance" is used only in cases where there is no reference made to an economic figure. On the other hand the term „eco-efficiency" is used only, when an environmental performance figure is referenced to an economic performance figure.

[4] An item in the P/L statement are for example „sales", „operating profit" or „interests". In other words an item is a „line" defined within a certain framework. As we develop eco-efficiency indicators for communication to financial markets we decided to apply this wording to the environmental performance indicators too. Therefore an environmental item is a „line" in an environmental accounting framework, e.g. „toxic waste", „water" or „carbon dioxide emissions". It is important to note that environmental items are measured in physical units like kilograms, tons, MJ or kWh, while financial items are measured in a financial unit.

All of the international groups working on eco-efficiency indicators (GRI, WBCSD, UN-ISAR and others, see chapter 7.6) use a similar methodology and calculate a similar set of ratios. „Energy“, „material input“ and „waste produced“ being the most common environmental items, „sales“ or „production tons“ being the most widely proposed economic item to which the environmental item is referred.

The use of a ratio is common to most approaches, as it would be very difficult to account for the constant change that companies are naturally facing every day. Their activities change, they grow or shrink, investment is made, technology changes, they outsource processes while keeping sales at the same level, they switch suppliers thus changing their cost structure etc. To reflect how well a company is managed on an environmental level such factors have to be considered. That is why the selection made on the reference item must appropriately reflect these constant changes. This decision is of the utmost importance when calculating an eco-efficiency figure.

Eco-efficiency indicators are most useful and meaningful to users if they are

- disclosed over time,[5]
- appropriately reflect the constant change a company undergoes and are
- comparable within the enterprise, across different enterprises within the same sector or even across different enterprises of different sectors.

There are three types of combinations of possible two-item indicators that can be used to describe eco-efficiency:

- an environmental item relative to another environmental item in physical terms (e.g. waste produced relative to resources used)
- an environmental item in physical terms relative to a financial item (e.g., CO_2-emissions per unit of sales).
- an environmental item valued in monetary terms relative to a financial item (e.g., energy purchased in relative to energy costs).

Reaching a precise definition of eco-efficiency indicators requires selecting and defining the environmental and the financial item that make the indicator.

[5] There are no requirements that enterprises make the environmental data available to the public they can be used for internal control purposes only. However, most enterprises have chosen to publish one or more eco-efficiency indicators in their stand-alone corporate environmental report.

Chapter 3 and 4 propose and define environmental performance indicators and financial reference items that can be used to calculate and report eco-efficiency. Chapter 3 starts with the selection and definition of appropriate environmental performance indicators.

3 Selecting Generic Environmental Items

3.1 Case for generic and sector specific environmental performance indicators

Given the desire to link financial and environmental performance through the concept of eco-efficiency, there is a need to *first* select the environmental components of the eco-efficiency indicators. This chapter deals with the approach for identifying generic environmental items or performance indicators. Generic indicators are indicators that can be applied

- world-wide
- by all enterprises
- across all sectors.

Generic indicators are not necessarily more important than industry-specific indicators but they merely have wider applicability (see chapter 7.7). Thus, the generic indicators should be seen in conjunction with industry specific indicators that take the specific environmental profile of a sector into account. Some enterprises might find it useful to construct both generic and specific indicators. In accordance with the objectives of this report, *five generic* indicators are identified.

Standardised generic environmental performance indicators would fulfil the following criteria:

- address world-wide environmental problems,[6]
- l• ink an environmental problem that is relevant for all industries at the macro level to activities of enterprises at the micro level,7
- have a direct impact on the environment,
- can be linked to financial performance.

In other words the environmental indicator should be of world-wide concern, be related directly to the enterprise's production processes, products or services and their respective environmental impact and have a positive or negative impact on free cash flows of the enterprise (see chapter 2.2).

[6] „World-wide" means global and common for all countries/regions.

[7] „Macro-micro link" means a link of an environmental problem (e.g. global warming) at the macro economic level to enterprise activities (e.g. use of energy) at the micro economic level.

3.2 General approach for identifying generic environmental performance indicators

Generic environmental performance indicators are best developed by a process which includes both preparers and users and which is marked by political and technical consensus. In this context, political and technical acceptances are of importance. First, there should be a political consensus or acceptance that the environmental performance indicators reflect a significant environmental problem. Second, there must be a technical consensus or acceptance that includes an agreed procedure to be used to calculate the figure that indicates a company's contribution to that environmental problem. In other worlds a methodology is needed to calculate indicators for a specific environmental problem based on a company's physical metabolism.

This chapter proposes five generic environmental performance indicators. The approach chosen is a consensus based two step approach:

Step 1: We identify world-wide environmental problems (macro level) that can be linked to a company's activities (micro level). The result is a list of environmental problems.

Step2: We then propose a methodology of how to measure a company's contribution to the selected environmental problems. The result is

- a list of environmental performance indicators
- a list of environmental items needed for the calculation and
- tables with factors for each environmental item that help to convert the item into the unit of the environmental indicators (e.g. converting a global warming gas emission [kg of substance A] to a global warming contribution [kg global warming contribution] by using a conversion factor [Global Warming Potential in CO_2 equivalents/kg of substance A]

3.3 Step 1: Identifying generic environmental problems

The ideal way to reach politically and technically accepted generic environmental performance indicators is to base the indicators on international agreements as far as possible. The basic idea behind this proposal is that all stakeholders (e.g. governments, business associations, financial community, NGOs), directly or indirectly, influence the development of international agreements. This also means that the underlying environmental issues have been accepted as being significant problems, which require a solution.

Generic indicators can thus be designed for issues/problems which have already been debated and for which there is an international agreement or consensus. Currently, the following four agreements seek to remedy universally recognised environmental problems:

- Agenda 21[8] covering economic and social development that is consistent with the needs of future generations;
- Montreal Protocol covering ozone-depleting substances;
- Kyoto Protocol covering global warming gas emissions[9]
- Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal.

3.3.1 Agenda 21

Agenda 21 is the most comprehensive agreement to date, which was adopted by more than 178 governments at the United Nations Conference on Environment and Development (UNCED) known as „Earth Summit" held in Rio de Janeiro, Brazil, June 1992.

Of the issues contained in Agenda 21 section two „Conservation and Management of Resources for Development", chapters 9 to 22 are relevant.[10] Table 1 analyses the various environmental issues according to whether they address a world-wide environmental problem, whether the link from the macro level with the micro economic level can be made and whether the respective environmental problem has a direct impact on both the environmental and financial performance of an enterprise (see grey shaded fields in Table 1). Of the 14 issues treated therein there are three global actions that lend themselves to generic indicators. These are:

1. protection of the atmosphere (chapter 9)
2. protection of the quality and supply of freshwater resources (chapter 18)
3. environmentally sound management of solid wastes (incl. hazardous waste) and sewage related issues (chapter 21)

[8] Earth Summit, United Nations Program of Action for the Environment, Rio de Janeiro 1992; New York, 1992.

[9] The text of the Protocol to the UNFCCC was adopted at the third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan, on 11 December 1997; as at 13 January 2000, 84 Parties have signed the Kyoto Protocol.

[10] Earth Summit, the United Nations Programme of Action: Rio de Janeiro 1992; New York, 1992.

Table 1: Chapters 9 to 22 of Agenda 21: Conservation and management of resources for development

Agenda 21: Section 2: Conservation and Management of Resources for Development Chapter	Criteria world-wide problem (1)	macro-micro link (2)	impact on industry's environmental performance	financial performance
9. Protection of the atmosphere	**yes(3)**	**yes**	**Yes**	**yes**
10. Integrated approach to the planning and management of land resources	**yes**	n. p. (4)	no (5)	no
11. Combating deforestation	**yes**	n. p.	no	no
12. Managing fragile ecosystems: Combating desertification and drought	**yes**	n. p.	no	no
13. Managing fragile ecosystems: Sustainable mountain development	no	n. p.	no	no
14. Promoting sustainable agriculture and rural development	**yes**	n. p.	no	no
15. Conservation of biological diversity	**yes**	n. p.	no	no
16. Environmentally sound management of biotechnology	**yes**	n. p.	no	no
17. Protection of the oceans, all kinds of seas, incl. enclosed and semi-enclosed seas/coastal areas, the protection, rational use and development of their living resources	no	n. p.	no	no
18. Protection of the quality and supply of freshwater resources	**yes**	yes	**yes**	**yes**
19. Environmentally sound management of toxic chemicals, including prevention of illegal international traffic in toxic and dangerous products	**yes**	n. p.	**yes**	**yes**
20. Environmentally sound management of hazardous wastes including prevention of illegal international traffic in hazardous wastes	**yes**	n. p.	**yes**	**yes**
21. Environmentally sound management of solid wastes and sewage related issues	**yes**	**yes**	**yes**	**yes**
22. Environmentally sound management of radioactive wastes	**yes**	n. p.	**yes**	**yes**

(1) World-wide means global and common for all countries/regions. (2) Macro-micro link means a link of an environmental problem from the macro level to enterprise activities at the micro level. For generic indicators the problem must be relevant for ALL industries (3) yes = criterion fulfilled (4) n. p. = not possible. (5) no = criterion not fulfilled.

The other issues that were reviewed do not fulfil the requirements for generic environmental performance indicators (see Table 1). The reasons are:

- They were found to be industry specific (e.g. number 22: radioactive waste)
- They cannot be directly linked to an enterprise's production processes, products or services (e.g. number 15: biological diversity)
- While they dealt with global problems, the impacts depended heavily on local environmental conditions (e.g. number 12: desertification) or on a regional or country specific definition of the problem (e.g. number 16: environmentally sound management of biotechnology).

3.3.2 Kyoto Protocol, Montreal Protocol and Basel Convention

Looking at the other agreements can give further guidance within the chosen categories especially on the issue of „Protection of the atmosphere". The Montreal Protocol covers ozone-depleting substances. The Kyoto Protocol covers industrial and energy linked global warming gas emissions. The Basel Convention covers waste related issues.

3.3.3 Selected environmental problems

Basing the selection of the environmental problem on these conventions and taking the requirements for standardised generic environmental performance indicators from the beginning of this chapter into account, the following five environmental problems have been selected:

- depletion of non-renewable energy resources,
- depletion of fresh water resources,
- contribution to global warming,
- depletion of the ozone layer,
- disposal of solid and liquid waste (incl. hazardous waste).

3.4 Step 2: Quantifying an enterprise's contribution to the selected environmental problems

For the selected environmental problem a methodology is needed to calculate a company's contribution to that problem. The problem is twofold:

1) Environmental items have to be selected that contribute to one (or more) of the environmental problems selected. In the standard life-cycle-assessment terminology this step is called classification. The question is: To which class of environmental problems does a variable contribute?

2) In the case where the different items can not be simply added up because of different contributions to the environmental problem, an assessment approach is needed. In the standard life-cycle-assessment this step is called characterisation. The question is: To which extent does a variable contribute to the environmental problem?

3.4.1 Non-renewable primary energy input

Selecting the environmental items for non-renewable primary energy input

The environmental items needed for the calculation of the company's contribution to the problem of the depletion of non-renewable energy resources covers all kind of energies a company purchases (e.g. electricity, coal, fossil fuels etc.). The key question is whether or not one kWh of energy purchased by an enterprise corresponds to one kWh of non-renewable primary energy? The obvious answer is no. Simply converting the different kind of energy into a common unit like kWh or MJ and adding them up gives us no indication of the amount of non-renewable energy used for the amount of energy purchased. The second question is whether an adjustment should be made? The answer is yes, because of substantial differences between different kinds of energies purchased by an enterprise and the non-renewable primary energy input needed for that amount and because conversion factors are widely accepted.

The non-renewable primary energy needed to generate a certain amount of energy purchased by an enterprise can be determined with the help of life-cycle-assessment data (LCA). This data is country or region specific because they depend heavily on the energy-mix and technology used for electricity generation. The conversion factors for energy purchased to the corresponding non-renewable primary energy input are listed in the second column in table 3. The third column lists the CO_2-emissions that correspond to the amount of non-renewable energy input. This information is needed for the environmental performance indicator on global warming (see chapter 3.4.2).

Table 2: Conversion factors for non-renewable primary energy input and CO_2 -emissions (European Situation)[11]

Energy purchased by an enterprise [1 kWh]	corresponding non-renewable primary energy input [kWh]	corresponding CO_2 -emissions based on primary energy input [kg]
Oil	1.30	0.095
Oil (low sulphur)	1.30	0.0895
Fuel (unleaded)	1.30	0.103
Fuel (leaded)	1.34	0.105
Diesel	1.21	0.1
Diesel (low sulphur)	1.21	0.1
Propane	1.22	0.069
Natural gas	1.27	0.069
Wood/Biomass	0.07	0.0033
Coal	1.20	0.133
Brown Coal	1.40	0.133
District heat (60% waste incineration)	0.55	0.0365
Electricity	3.07	0.14
Solar energy (heat)	0.14	0.06
Solar energy (electricity)	0.65	0.0030

3.4.2 Global warming contribution

Selecting the environmental items for global warming contribution

The selection of the environmental items needed for the calculation of a global warming indicator can be based on the agreed list of the Intergovernmental Panel on Climate Change (IPCC), which has highlighted a number of chemicals that contribute to global warming. Six of

[11] Conversion tables must be specified for each region. Based on the data sets available and their high quality, this task is easily done. What is needed on a country specific basis is the energy mix by which electricity is generated. Knowing these relations, the available data for fossil, nuclear and hydropower electricity generation can be used to calculate the specific primary energy input and the corresponding CO2-emissions for electricity generation [ELLIPSON 1997, preliminary results].

these substances have been specifically selected in the Kyoto protocol for measurement in calculating national reduction targets. The following six substances make the emissions a company needs to account for:

- Carbon Dioxide
- Methane
- Nitrous Oxide
- Sulphur Hexafluoride
- Perfluorocarbons
- Hydrofluorocarbons

In that context CO_2-emissions need special attention. CO_2 is the main contributor to global warming. To a large extent CO_2-emissons stem from the use of non-renewable energy sources. As mentioned earlier, energy linked CO_2-emissions heavily depend on the energy source and the technology used for the conversion. As with the performance indicator for energy, energy linked CO_2-emissions are calculated using non-renewable primary energy input rather than the amount of energy purchased.

The following example illustrates the issue: Company A only uses purchased electricity that is generated by a coal-fired power plant. Company B uses coal to produce electricity on-site. Calculating CO_2-emissions based on the amount of energy purchased company A has zero CO_2-emissions while company B would have significant emissions. If CO_2-emissions are based on non-renewable energy input needed for a certain amount of energy purchased the problem is solved. The appropriate conversion factors for CO_2-emissions based on the non-renewable primary energy input are listed in the third column of Table 3.

Table 3: From emissions to global warming contribution

Environmental Problem:		**Global Warming**	
Reference substance:		**Carbon Dioxide (CO_2)**	
emission	**amount [kg]**	**global warming potential [kg CO_2 equivalent/kg]**	**global warming contribution [kg CO_2 equivalent]**
Carbon Dioxide	100’000	1	100’000
Methane	1’000	21	21’000
Nitrous Oxide	100	270	27’000
Total			*148’000*

Selecting the assessment approach for global warming emissions

Because substantial differences in the potential of a substance to contribute to global warming exist, an adjustment has to be made to take this into account. The calculation can be done using the widely accepted concept of „global warming potential" as defined by the IPCC. By standardising global warming emissions in relation to a reference substance (CO_2) by their potential to contribute to global warming, different emissions can be multiplied by their respective global warming potential and then summed up to a single figure. Table 3 illustrates this approach. A list of the global warming potential (see chapter 7.1) of different substances is contained in the Kyoto Protocol.

The advantage of this approach is that it focuses attention on high problem contributions rather than high emission figures. This could lead to more efficient and effective decisions that minimise impacts while increasing (or at least not decreasing) financial values.

3.4.3 Contribution to ozone depletion

Selecting the environmental items for ozone depletion

The Montreal Protocol defines a list of substances that contribute to ozone depletion (see appendix 3). The protocol not only covers actual emissions but also ozone depleting substances in use or in closed systems (potential emissions). Therefore, the environmental items needed to calculate an enterprise contribution to ozone depletion should also cover both aspects.[12]

Selecting the assessment approach for ozone depleting emissions

Different emissions of ozone depleting substances have different impacts on the depletion of the ozone layer. One kg CFC 11 emitted by an enterprise does not correspond to one kg of CFC 113 emitted. Therefore, an adjustment has to be made to take this into account. The calculation can be done using the widely accepted concept of „ of ozone depletion potential " as defined by the Montreal Protocol [MONTREAL 1987] and IPCC [IPCC 1996].

All ozone depleting emissions are standardised by their potential to contribute to the depletion of the ozone layer in relation to a reference substance (CFC-11), different ozone depleting emissions can be multiplied by their respective ozone depletion potential. Once all emissions can be expressed in corresponding ozone depleting potentials the emissions can then be summed up to a single figure. A chart of the ozone depletion potential of substances contained in the Montreal Protocol can be found in the appendices.

[12] The environmental performance indicator for the depletion of the ozone layer does therefore include potential emission too! If ozone depleting substances are disposed of properly (without emissions) the amount in use or closed systems decreases and the indicators decrease too.

3.4.4 Waste disposed

Selecting the environmental items for waste disposal

Waste can be defined as material with a negative economic value. Waste streams can be broken down to two categories:

- solid non-mineral waste
- liquid waste.

Disposal of waste that is of a mineral quality is not regarded as a major issue. Special attention should be drawn to hazardous waste - solid and liquid. A list of the categories of hazardous waste contained in the Basle Convention can be found in chapter 0.

Selecting the assessment approach for waste disposal

Substantial differences in the quality of different types of waste (such as toxicity, contents of defined critical substances) exist. Therefore, different types of waste cannot be simply added up. An assessment approach would be required. Yet, there is no consensus methodology on how to add different types of waste. This is why waste can only be described in general terms.

3.4.5 Water usage

Selecting the environmental items for water use

The problems linked to the depletion of freshwater resources are twofold:

- the depletion caused by the extraction of freshwater
- the depletion caused by the pollution of freshwater

To consider both issues an enterprise should on one hand account for the total amount of water used and on the other hand distinguish between the effect of this usage: a) water that is chemically altered (polluted with chemicals) and b) water that is physically altered (higher or lower temperature). In the case of water related environmental problem it is obvious that industry specific indicators e.g. for the chemical industry are of great importance.

Selecting the assessment approach for waste use

The impact of 1000 litres of water used in a desert cannot be compared with the use of 1000 litres of water used by a company in Scandinavia. As in the case of waste, there is no assessment approach on how to add water used in water-rich and water-poor regions. Therefore, the amounts of water used have to be carefully interpreted. To do this further qualitative information is needed.

3.4.6 Summary

Table 5 gives an overview of the proposed environmental performance indicators based on the selection of environmental problems and the analysis of available and accepted assessment approaches.

Table 4: Environmental problems, environmental items, assessment approach and environmental performance indicators.

Environmental Problem	Environmental Item	Sub-items		Assessment	Environmental Performance Indicator
depletion of non-renewable energy resources	energy purchased	purchased fossil energy	oil gasoline coal natural gas liquid gas & others	primary energy requirements	non-renewable primary energy input
		purchased electricity			
depletion of fresh water resources	water use	water purchased water extracted on site	chemically altered ~ physically altered ~	none	water use
contribution to global warming	global warming emissions	energy linked global warming gas emissions	Carbon Dioxide	global warming potential	global warming contribution
		other industrial emissions contributing to global warming	Carbon Dioxide Methane Nitrous Oxide Sulphur hexafluoride Perfluorocarbons Hydrofluorocarbons		
depletion of the ozone layer	ozone depleting substances	actual emissions of ~	CFC-11 CFC-12 CFC -113	ozone depletion potential	contribution to ozone depletion
		~ purchased and in use in closed systems	others (see chapter 7.3)		
waste disposal	solid and liquid waste	solid non-mineral waste	~non-hazardous ~hazardous	none	waste disposed
		liquid waste	~non-hazardous ~hazardous		

4 Selecting a Generic Financial Reference Item

Two different approaches are currently being used to define the denominator of the environmental performance indicator. The denominator is either in physical or financial terms, in other words the performance is either given in units of physical activity (i.e. production in tons) or in units of value (i.e. sales in units of currency). Looking at the different industries and enterprises, it is almost impossible to standardise a common physical unit of activity or output such as „tons of production", „volume of production" or „amount of service units sold" as a standard reference item.

4.1 Financial reference items

Eco-efficiency indicators linking environmental and financial performance use an environmental item as numerator and a financial item as denominator. The financial item is measured in monetary units. The following items could be used:

- Sales;
- Value Added
  (= sales minus costs of goods and services purchased).

4.2 Value added vs. sales: General Considerations

The environmental item of an eco-efficiency indicator is measured within the boundaries of the company. The question is: How many resources does the company purchase, how many emissions does the company produce, how much waste does a company generate? This is in contrast to the life-cycle-analysis approach where the system boundaries are extended to include the whole life-cycle of products and services. Here the questions are: How many resources do all the involved parties in the life cycle of a product and service purchase, how many emissions do they produce, how much waste do they generate?

For the purpose of calculating eco-efficiency indicators for companies, resources used, waste generated and emissions caused by suppliers or customers are not counted for. Therefore, the financial item should reflect the same part of the life cycle or value chain as the environmental item. In other words, the value of goods and services produced by suppliers and the value added to the products and services by the customers should not be included. A financial figure that does cut the system boundaries at an enterprises gate is value added: „sales" minus „costs of goods and services purchased". Value added covers only that part of the life cycle where the respective enterprise transforms the input from suppliers into products and services while using environmental resources and producing emissions and waste. Value added mirrors the system boundaries used for calculating the environmental item exactly.

In contrast to the company focused eco-efficiency approach, life cycle analysis accumulates environmental items over the whole life cycle. [13] Consequently, the financial item should reflect the accumulated economic value within the same boundaries. One such possible financial item would be sales. Contrary to a company's value added, sales add up in the whole life cycle of a product up to the point where the last enterprise transfers it to the customer.

We would like to illustrate the link between sales, purchased goods and services and value added with an example (see Company B has the highest eco-efficiency (lowest indicator value) meaning that the company uses the least amount of water per unit of value added.

Figure 1 and Table 5). Starting point are three companies A, B and C. It is assumed that company A produces everything in-house and uses 80 units of water. Thus, company A has no suppliers and therefore no purchased goods and services. It is further assumed that company A sells its whole production (sales of 125) to company B.

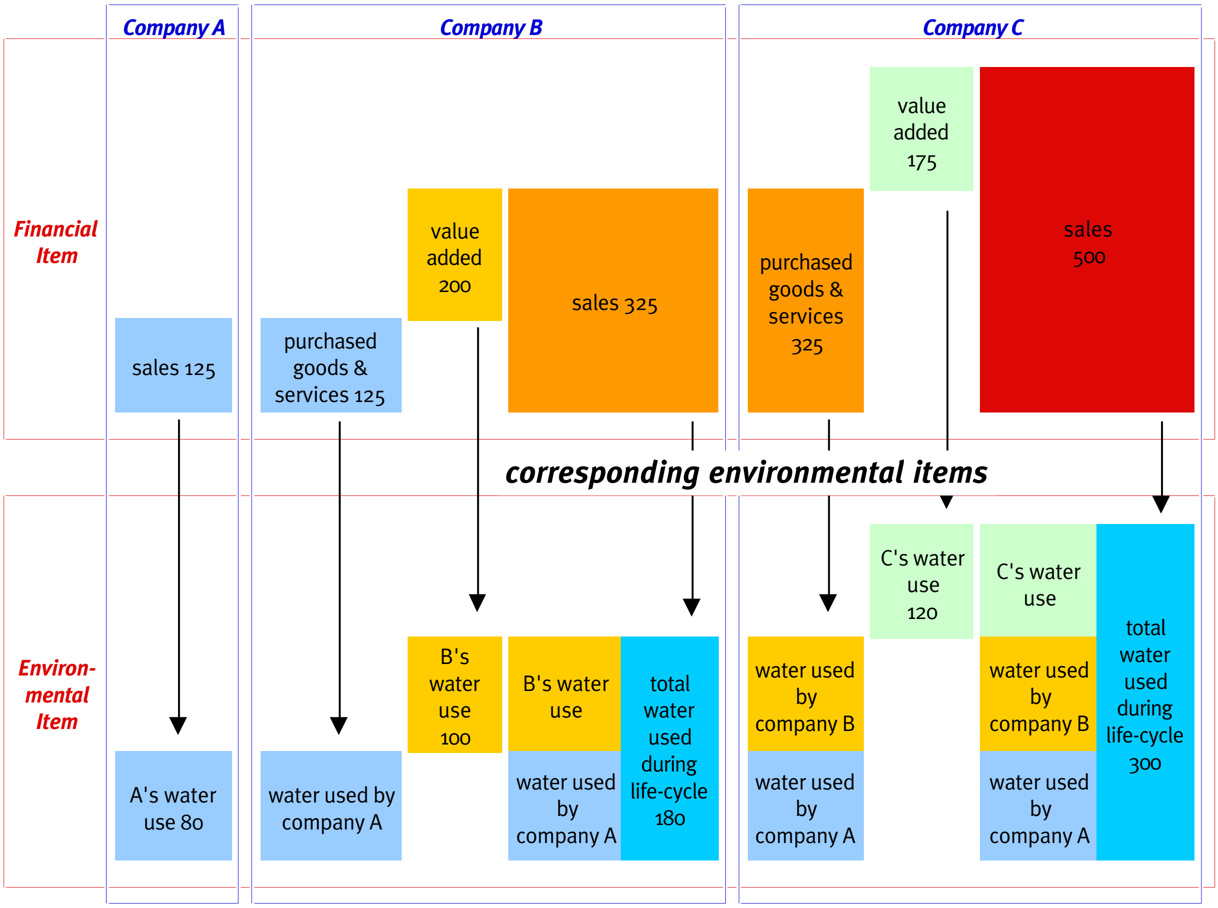
Table 5: The link between sales, purchased goods and services and value added

Financial items [monetary units]	**Enterprise A**	**Enterprise B**	**Enterprise C**
Sales	125	325	500
Goods & Services purchased	0	125	325
Value added	125	200	175
Environmental items [physical units]			
Water use	80	100	120
Eco-efficiency indicator			
Water used/value added	0.64	0.50	0.69

Company B has the highest eco-efficiency (lowest indicator value) meaning that the company uses the least amount of water per unit of value added.

[13] Eco-efficiency indicators are restricted to in-house processes and therefore do not fully reflect environmental impacts of products and services. Other tools such as life cycle analysis can accurately assess these impacts. Life cycle analysis would require a substantial amount of data that would need to be collected from a myriad of suppliers and customers along the full value chain. The cost of such data collection would be extremely high. The boundaries of life cycle analysis are not yet universally agreed and the standardisation of data to be aggregated has not yet been considered.

Figure 1: The link between sales, purchased goods and services and value added



Subsequently, the amount of purchased goods and services of company B (where the only supplier is company A) is 125. B uses 100 units of water to add incremental value of 200 and transfers the whole production (sales of 325) to company C. Finally, company C whose only supplier is company B uses another 120 units of water and adds incremental value of 175. This leads to a sales volume of company C of 500. In the case of company C, the in-house water use of 120 units is directly linked with adding 175 units of value.

Contrary to a company's value added, sales is a financial figure that accumulates value added over the whole life cycle or value chain up to the point where the last enterprise transfers it to the customer. If we take 500 sales of company C as a reference figure the corresponding environmental item would be the total water use over the life cycle up to the point where the products and services are sold to the customer. This includes the water use of companies A (80 units) and B (100 units) and C (120 units) resulting in 300 units total water used during the life cycle.

This report is not focused on the assessment of products. Therefore, the boundaries of a company are relevant for both the environmental and financial item. Consequently value added is the most appropriate financial item.

4.3 Value added vs. sales: Implications on outsourcing and insourcing

If a company outsources part of its operations, the company not only „loses“ the environmental item related to these processes but the item „purchased goods and services“ goes up as more goods and services has to be purchased from third parties (sales of suppliers), which - assuming sales are not affected by the outsourcing decision - would lead to a lower value added. So both items of the eco-efficiency indicator reflect the change.

Three situations can be distinguished:

- If the outsourced processes have a water intensity that is at the average for that group, the decision to outsource leads to no change in eco-efficiency. (The average water intensity of company C is 0.69. The ratio would remain 0.69 in the case of outsourcing operations creating 35 units of value added and using 24 units of water).
- If the outsourced processes have a water intensity that is below the average for that company, the decision to outsource leads to a decrease in eco-efficiency. (The average water intensity of company C is 0.69. The ratio would decrease to 0.59 in the case of outsourcing operations creating 40 units of value added and using 40 units of water).
- If the outsourced processes have a water intensity that is above the average for that company, the decision to outsource leads to an increase in eco-efficiency. (The average water intensity of company C is 0.69. The ratio would increase to 0.71 in the case of outsourcing operations creating 20 units of value added and using 10 units of water).
  In the case of insourcing additional activities, the same comments can be made.

Calculating an eco-efficiency indicator before and after the decision to outsource a process using sales as a reference item always leads to a sharp increase in eco-efficiency. Why? As the environmental item goes down, sales stay at the same level. Here lies another substantial advantage of taking value added instead of sales or production tons or a similar purely output based reference item.

Therefore, value added as a reference item depicts a more accurate picture than purely output-based figures. If „true and fair view“ is an issue in environmental performance reporting of companies as it is in financial reporting one should opt for value added. However, this does not release preparers from disclosing relevant data on outsourcing or insourcing. To interpret an outsourcing decision, appropriate information on the outsourced entity should be available. This information basically consists of data on the outsourced value added, the outsourced environmental item and the respective average eco-efficiency figure of the company before outsourcing. Only with additional disclosures is a user capable of interpreting eco-efficiency indicators reported by an entity.

5 The Proposed Set of 5 Generic Eco-Efficiency Indicators

Based on the five universally recognised environmental problems and their corresponding eco-efficiency indicators, combined with the most suitable financial indicator, the following five eco-efficiency indicators are recommended for linking an enterprise's environmental performance with its financial performance (Table 6).

Table 6: Proposed set of eco-efficiency indicators

Environmental Problem	Eco-efficiency Indicators
depletion of non-renewable energy resources	non-renewable primary energy input / value added
depletion of fresh water resources	water use / value added
contribution to global warming	global warming contribution / value added
depletion of the ozone layer	contribution to ozone depletion / value added
waste disposal	waste disposed / value added

Three of the five selected problems can also be financially assessed (Table 7):

Table 7: Financial dimension of the proposed set of eco-efficiency indicators

Environmental Problem	Financially assessed
depletion of non-renewable energy resources	energy costs/value added
depletion of fresh water resources	water costs/value added
waste disposal	waste costs/value added

These eco-efficiency indicators forecast the impact of environmental issues on future financial performance. It can be said that an above average environmental performance of an enterprise means that, in all probability, this enterprise has a higher and more sustainable operating margin. All eco-efficiency indicators relate to an important environmental problem which results in production costs (such as energy costs, water costs, waste costs). Therefore, there is a direct link to the profit-margin. In addition, the pressure on future investments is lower (compared to competitors with a worse performance). Lower future investments and higher margins are important value drivers, substantially influencing future free cash flows, and thus positively contributing to shareholder value.

Investors use consolidated group accounts in order to assess the financial performance of enterprises and therefore have a reasonable expectation that environmental reporting will include all the significant activities that are within the control of an enterprise. The indicators proposed in this report are generic indicators, which allow comparison among different enterprises and across different industries. They are not by themselves capable of delivering a comprehensive analysis of the environmental and financial performance of an enterprise or of being able to be used to benchmark particular enterprises or industries. Apparent differences in performance may be due to differences in operating circumstances or enterprise structure as well as differences in the level of contracted out or bought in services. This set of generic eco-efficiency indicators do serve as a suitable starting point for qualitative analysis. A qualitative description of a group with additional information in the notes is important to users who want to reliably compare two groups [UNCTAD 1994]. This includes management discussions where analysts have to address the question of outsourcing and life cycle issues. Based on the received answers the analyst will be better placed to appropriately interpret the quantitative indicators and the ranking between different enterprises.

6 Accounting Issues in Standardisation

Eco-efficiency indicators are useful for investors and company directors when performance can be compared among enterprises in general and within the same industry in particular. Consequently a methodology for standardising eco-efficiency indicators is required. New standards are required in three fields:

- First, a conceptual ecological accounting framework has to be designed. This framework must be consistent with the framework for financial accounting.
- Second, ecological items have to be standardized and
- third, ecological data must be consolidated for the enterprise as a whole in a consistent way with financial data.

This chapter only briefly describes these three issues. They will be treated in detail in a second report aimed at preparers of eco-efficiency indicators.

6.1 Issue I: Conceptual ecological accounting framework

Accounting frameworks serve as a basis to consistently design accounting standards for different items. A conceptual ecological accounting framework has to provide the objective of ecological accounting, the underlying assumptions to meet the objectives, the qualitative characteristics that determine the usefulness of information in ecological accounting and guidance on how to recognize, measure and present relevant information [cp. IASC framework 1983 and the UNCTAD systematic framework published in ”Conclusions on Accounting and Reporting by Transnational Corporations; 1994].

Eco-efficiency indicators linking the financial and the environmental performance always consist of a combination of two independent items. Therefore the concepts underlying ecological and financial accounting have to be consistent. As the conceptual framework of financial accounting is given, the accounting framework for the ecological items should be consistent with the financial framework.

6.2 Issue II: Ecological items

The proposed eco-efficiency indicators use value added as a reference item (denominator). Value added is defined as „sales“ minus „costs of purchased goods and services“. Both items are dealt with within the existing framework of financial accounting. However, there is no generally accepted accounting standard on how to account for the environmental items (the numerator, measured in physical units). Based on the proposed set of eco-efficiency indicators, consensus has to be reached on the standardisation of the following ecological items and the respective sub-items (see chapter 3):

- energy purchased [MJ]
- water use [kg]
- global warming emissions [kg]
- ozone depleting substances [kg]
- solid and liquid waste

6.3 Issue III: Consolidation

The main objective of this report is to provide guidance on the identification, selection, and construction of eco-efficiency indicators that can be used for reporting eco-efficiency to financial markets. An investor values an enterprise with different subsidiaries based on the earning power and risk structure of the whole group. Therefore, consolidated data is particularly relevant. The IASC has noted that „users of financial statements of a parent are usually concerned with, and need to be informed about, the financial position, results of operations and changes in financial position of the group as whole. This need is served by consolidated financial statements. [IAS 27 par. 9].

There are rules and standards on consolidation for financial items. IAS and other standards allow three different methods of consolidation depending on the stake of the investor: Full consolidation, the method of equity consolidation or proportional consolidation. The rules are [IAS 22,27,31]:

Full consolidation

Under full consolidation, the financial statements of the enterprises in the group are combined on a line by line basis by adding together like items of assets, liabilities, equity, income and expenses. Interenterprise balances and interenterprise transactions are totally eliminated. Any unrealised profits resulting from interenterprise transactions are eliminated, and any unrealised losses would also be eliminated unless cost cannot be recovered. The carrying amounts of any interenterprise investments (in particular, those of the parent enterprise[14]) and the related portion of the equity of each of the group enterprises is eliminated.

Full consolidation is normally applied to all enterprises that are controlled by a parent enterprise. This means that, in practice, the parent enterprise owns or controls, directly or indirectly, 50% or more of voting rights. These enterprises are referred to as subsidiaries.

Equity method

Under the equity method, the investor's investment in an investee enterprise is initially recorded at cost and is adjusted thereafter for changes in the net assets of that enterprise [IAS 28, par. 3]. As is the case in Full Consolidation, interenterprise balances and interenterprise transactions are eliminated, together with any unrealised profits and losses relating thereto. The equity method is normally applied for investments in „associates." An „associate" is an enterprise which is neither a subsidiary nor a joint venture and in which the investor has a significant influence (normally, between 20% and 49%).

Standards issued by the IASC indicate that „an investment in an associate should be accounted for in consolidated financial statements under the equity method except when the investment is acquired and held exclusively with a view to its disposal in the near future in which case it should be accounted for under the cost method"15 [IAS 28, par. 8]. Significant influence is described by the IASC as „the power to participate in the financial and operating policy decisions of the investee but is not in control over those policies" [IAS 28, par. 3].

The Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting (ISAR) has indicated that, „under the equity method, an initial investment by a transnational corporation in another enterprise is so adjusted in the consolidated financial statements of the transnational corporation as to reflect its share of the net assets of the other enterprise. The consolidated income statements reflect the transnational corporation's share of the operating results of the other enterprise" [UNCTAD; 1994; par. 50]

Proportionate consolidation

Under proportionate consolidation, the parent's/investor's share of each of the assets, liabilities, income and expenses of the other group enterprises is combined on a line by line basis with similar items in the parent's/investor's financial statements. Again, interenterprise balances and interenterprise transactions are eliminated, together with any unrealised profits and losses relating thereto.

[14] „Parent" is defined by the IASC as „an enterprise that has one or more subsidiaries". [IAS 27 par 6]

[15] Under the cost method, the investment is recorded at its initial cost. The income statement reflects income from the investment only to the extent that the investor receives distributions from the accumulated net profits of the investee arising subsequent to the time of making the investment.

Proportionate consolidation is normally only used in accounting for the interests in a joint venture (which has been defined by the IASC as „a contractual arrangement whereby two or more parties undertake an economic activity so as to obtain benefits from it." [IAS 31, par. 2]). Even in this situation, the method is not permitted in some jurisdictions. Theoretically, however, it could be applied in situations involving group accounts other than joint ventures.

These are the generally accepted consolidation rules in financial accounting. The consolidation rules for environmental items and their impact on the consolidation rules have never been discussed in detail. Without any consensus on this issue the eco-efficiency information reported to financial markets are of limited use for investors. This chapter therefore aims at opening the debate on appropriate consolidation rules and procedures for environmental items used as numerator in the calculation of eco-efficiency indicators. We will discuss three different approaches without claiming that one or the other method will be the future consensus. It could be that that the debate will unveil yet other approaches that even better serve the needs of financial markets.

But why is the question of consolidation of such importance? Why not just apply the rules of financial accounting while consolidating environmental items?

As seen above a group's value added can be calculated by taking the reported figures in the financial report: Using the direct method the item „costs of purchased goods and services" is deducted from the reported „sales" figure, using the indirect method the items „salaries", interests", „taxes" and „net income" are summed up. The simplified P/L-statements of two companies in Table 8 illustrate both methods.

Table 8: Starting point: P/L-statements of companies A and B (in monetary units)

P/L Statements	**Company A**	**Company B**
Sales	2000	1000
Purchased goods and services	500	500
Salaries	1250	400
Interests	70	10
Taxes	30	10
Net income	150	80
Value Added *(direct method)*		
Sales	2000	1000
minus purchased goods and services	500	500
Value Added	*1500*	*500*
Value Added *(indirect method)*		
Salaries	1250	400
Interests	70	10
Taxes	30	10
Net income	150	80
Value Added	*1500*	*500*

Environmental reports and financial reports are in most cases prepared by different organisational units and staff with a completely different background – a technical background in the field of environmental reports and a financial background for environmental reports. Environmental experts often are not aware of implications of different consolidation methods, the respective rules and the language used. Therefore we would like to illustrate the implications of financial consolidation on the example above. Let us look at three different cases:

- Case 1: Company A acquires 60% of company B, requiring full consolidation.
- Case 2: Company A acquires 30% of company B, requiring the application of the equity method.
- Case 3: Company A jointly controls 50% of company B, requiring proportionate consolidation (joint venture).

The first step in consolidation is to draw up the groups P/L-statement following the consolidation rules. In case 3 this procedure is quite simple: 50% of every single item of company's B P/L-statement is taken into account and added to A's P/L-statement. Case 1 where full consolidation rules apply is even simpler: The group P/L-statement is the addition of the two separate P/L-statements. The equity method though is very different: The only item of company B's P/L-statement taken into the group accounts is net income. Neither sales nor expenses or any other item in B's P/L-statement are consolidated into the group's P/L-statement. A fact that most non-experts are unaware of.

In a second step net income is adjusted for minority interests. In the case of a higher than 50% stake the investor has to take other investors minority interest into account, for a less than 50% stake these adjustments are made for the investors minority interests in an investee (share of the profits or losses). For case 1 (full consolidation) minority interests of other investors are deducted from the groups net income. In case 2 (equity method) A's share in B's net income is added to the groups net income.

The P/L-statement, the resulting value added of the group before any adjustments and the adjustments for minority interest is shown in Table 9 below. In the example it is assumed that there are no intercompany transactions between A and B and no dividends are paid.

Table 9: P/L-statements of companies A and B before adjustments for minority interests (in monetary units)

Consolidation			**Case 1**	**Case 2**	**Case 3**
		A's interest in B:	60%	30%	50%
		Method:	Full	Equity	Proportionate
Step 1: Group Results before adjustments					
P/L Statements (financial items)	**Company A**	**Company B**	**Group**	**Group**	**Group**
Sales	2000	1000	3000	2000	2500
Purchased goods and services	500	500	1000	500	750
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added (direct method)					
Sales	2000	1000	3000	2000	2500
– purchased goods & services	500	500	1000	500	750
Value Added	1500	500	2000	1500	1750
Value Added (indirect method)					
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added	1500	500	2000	1500	1750
Step 2: Group Results after adjustments					
Net Income			230	150	
Minority Interests in B's net income			-32 *=(1-0.6)*80*		
A's share of B's net income				24 *(= 0.3*80)*	
Adjusted group net income			198	174	

So far there is consensus as accounting rules and principles are applied to financial items only. We haven't had a closer look at consolidation of the environmental items. As there is no consensus on that issue we would like to illustrate the implications of different views on how to consolidate environmental items using the example above.

6.3.1 Approach 1: No consolidation

This group of experts opposes any consolidation of eco-efficiency indicators arguing that the problems linked to consolidation in financial reporting are of such severity that these problems should not be transferred to the field of environmental performance reporting. Another argument is that it makes a difference in what geographic context an environmental impact is caused a criteria that consolidated figures cannot reflect and therefore renders them useless (e.g. using water the Saharan dessert vs. using water in Scandinavia). The conclusion is not to report any consolidated figures on eco-efficiency but to stick with a site specific reporting.

This opinion avoids all possible problems with consolidation, as accounts are not consolidated. As a drawback, decision-makers within the company, investors and other stakeholders receive no indication on the environmental performance and eco-efficiency of a group.

6.3.2 Approach 2: Adapted application of account standards on environmental items

A second group of experts does not oppose consolidating. However, they propose not to apply the concepts developed by the financial community without adapting them. They argue that the financial concepts of consolidation are inappropriate for consolidation of eco-efficiency indicators that use value added as reference item. As a consequence the methods for financial consolidation are adapted and then applied to both the financial (denominator) and environmental item (numerator) of the eco-efficiency indicator.

The authors do not support this view.

6.3.3 Approach 3: Strict application of account standards on environmental items

Another group of experts argues that there is no obvious reason not to strictly apply the financial concepts to environmental items. They argue that consolidation rules (e.g. equity accounting) are defined by financial accounting standard setters and therefore are a requirement and can not be adapted. The financial item used for the calculation of eco-efficiency indicators should be exactly as reported in the consolidated financial statement. Consequently, in order to achieve consistency between the environmental and financial item, the same method should be applied for consolidating the environmental item. The authors support this view.

The main difference between approach 2 and 3 is the treatment of minority interests. For financial reporting purposes, minority interest refers to minority interest in net income and net assets in the case of full consolidation and the „investors share” in net income and net assets in the case of applying the equity method. The proposed set of eco-efficiency indicators uses value added as reference item and not net income which in itself is part of value added. That is exactly the starting point of significant disagreements among experts that needs further discussions to reach a consensus.

To demonstrate the implications of different methods of consolidating environmental items and financial items on eco-efficiency indicators we extend the example above as follows: The objective is to calculate the eco-efficiency indicator „water use (environmental item) per value added (financial item)“. Companies A uses 150 litre of water per year, company B 100 litre. Table 10 below summarizes the example.

Table 10: Water use/value added of companies A and B

Eco-Efficiency Indicator: Water Use / Value Added		
Financial Item [USD] **(P/L Statements)**	**Company A**	**Company B**
Sales	2000	1000
Purchased goods and services	500	500
Salaries	1250	400
Interests	70	10
Taxes	30	10
Net income	150	80
Value Added (direct method)		
Sales	2000	1000
minus purchased goods and services	500	500
Value Added	*1500*	*500*
Value Added (indirect method)		
Salaries	1250	400
Interests	70	10
Taxes	30	10
Net income	150	80
Value Added	*1500*	*500*
Environmental Item [litre]		
Water use	*150*	*100*
Eco-Efficiency [litre/USD]		
Water Intensity	*0.100*	*0.200*

6.3.4 Consolidating using Approach 2: Adapted application of accounting standards on environmental items

Promoters of an adapted method propose including minority interests in value added rather than net income as the focus of the eco-efficiency indicator lies on value added and not on net income. Therefore, value added is adapted for minority interest as it is normally done in standard financial consolidation with net income. The same procedure is then applied to minority interest in water use. This approach would lead to the results (Table 11).

Using approach 2 the resulting figures for group value added differ substantially from the figures reported in the group's financial report where minority interests in net income is adjusted in the P/L-statement.

Table 11: Calculation of eco-efficiency indicators: Adapted method with focus on minority interests in value added

Eco-Efficiency Indicator: Water Use / Value Added			**Case 1**	**Case 2**	**Case 3**
Consolidation using *Approach 2*		**A's interest in B:**	60%	30%	50%
		Method:	Full	Equity	Proportionate
Step 1: Group Results before adjustments for minority interest					
Financial Item (P/L Statements)	**Company A**	**Company B**	**Group**	**Group**	**Group**
Sales	2000	1000	3000	2000	2500
Purchased goods and services	500	500	1000	500	750
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added (direct method)					
Sales	2000	1000	3000	2000	2500
– purchased goods & services	500	500	1000	500	750
Value Added	1500	500	2000	1500	1750
Value Added (indirect method)					
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added	*1500*	*500*	*2000*	*1500*	*1750*
Step 2: Group Results after adjustments for minority interest					
Value Added			2000	1500	1750
Minority Interests in B's value added			-200 *(=0.4*500)*		
A's share of B's value added				150 *(=0.3*500)*	
Group value added			*1800*	*1650*	*1750*
Environmental Item [litre]					
Water Use	150	100	250	150	200
Minority Interest in B's water use			-40 *(=0.4*100)*		
A's portion of B's water use				30 *(=0.3*100)*	
Group water use			*210*	*180*	*200*
Eco-Efficiency [litre/USD]					
Water intensity	***0.100***	***0.200***	***0.117***	***0.109***	***0.114***

6.3.5 Consolidating using Approach 3: Strict application of account standards on environmental items

Contrary to the adapted approach, the third approach uses the financial data as published in the financial group report. The adjustment for minority interests is done in the same way as in the financial report. Only the minority interest in net income is taken into account, even though the eco-efficiency indicator uses value added as a denominator. The environmental item is then adjusted using the same proportions applied for the adjustment of net income. With this approach the figures for group value added are exactly the same as in the financial report.

This approach avoids the following disadvantage of approach 2: In the case of equity accounting approach 2 adjusts for 30% of B's value added, which means that parts of B's sales and costs implicitly appear in the group account. Value added of USD 150 is composed of 30% of B's sales of USD 1'000 (= USD 300) minus 30% of B's purchases (= USD 150). However, following accounting rules for equity accounting, items like sales and expenses of subsidiaries (associates) should not appear in the consolidated financial accounts.

Therefore, this approach takes the consolidated P/L-statement as the starting point. Group value added is adjusted by minority interest in net income (and not in value added!) Applying the same proportions to the environmental items leads to the following: Company B's value added is USD 500 and the net income is USD 80 (which is 16% of value added). Consequently, only 16% of B's water use should be considered when consolidating the environmental item.

Table 12 shows the results by strictly applying accounting rules on both the financial and environmental items.

The strict application of the financial method has the advantage that the financial data can be used as given in the annual shareholder report. Value added or its components are widely used, not only for the purpose of eco-efficiency calculations. Companies also use value added to report for other purposes such as their contribution to different stakeholders. It should not be that different consolidated value added figures exist depending on the communication target. Consistent data is important. The fact that the denominator is not net income can hardly be seen as a reason to change the rules of consolidation.

Table 12: Calculation of eco-efficiency indicators: Strictly applying financial methods

Eco-Efficiency Indicator: Water Use / Value Added			**Case 1**	**Case 2**	**Case 3**
Consolidation using *Approach 3*		**A's interest in B:**	60%	30%	50%
		Method:	Full	Equity	Proportionate
Step 1: Group Results before adjustments for minority interest					
Financial Item (P/L Statements)	**Company A**	**Company B**	**Group**	**Group**	**Group**
Sales	2000	1000	3000	2000	2500
Purchased goods and services	500	500	1000	500	750
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added (direct method)					
Sales	2000	1000	3000	2000	2500
– purchased goods & services	500	500	1000	500	750
Value Added	1500	500	2000	1500	1750
Value Added (indirect method)					
Salaries	1250	400	1650	1250	1450
Interests	70	10	80	70	75
Taxes	30	10	40	30	35
Net income	150	80	230	150	190
Value Added	*1500*	*500*	*2000*	*1500*	*1750*
Step 2: Group Results after adjustments for minority interest					
Value Added			2000	1500	1750
Minority Interests in B's value added			-32 = (1-0.4)*80		
A's share of B's value added				24 (= 0.3*80)	
Group value added			1968	1524	*1750*
Environmental Item [litre]					
Water Use	150	100	250	150	200
Minority Interest in B's water use			-6.4 = *0.16*100*(1-0.4)*		
A's portion of B's water use				4.8 *(= 0.16*100*0.3)*	
Group water use			243.6	154.8	*200*
Eco-Efficiency [litre/USD]					
Water intensity	***0.100***	***0.200***	***0.124***	***0.102***	***0.114***

6.3.6 Comparing the results of consolidating using approach 2 and 3:

A comparison of the two approaches shows substantial differences in absolute terms (Table 13).

Table 13: Comparison of the two approaches

A's interest in B	60%	30%	50%
Consolidation method	Full	Equity	Proportionate
Approach 2: Adapted application of account standards on environmental items			
Group value added	1800	1650	1750
Group water use	210	180	200
Water intensity	0.117	0.109	0.114
Approach 3: Strict application of account standards on environmental items			
Group value added	1968	1524	1750
Group water use	243.6	154.8	200
Water intensity	0.125	0.100	0.114

6.3.7 Conclusions

At presence there is a consensus on the consolidation of financial statements and the procedure of adjustment for minority interest but there is no consensus when environmental items are included that are used for eco-efficiency calculations. Although the authors strongly support a strict application of accounting standards for both the environmental and financial item, further discussions will be needed to reach the same level of consensus and quality as we have it today with financial accounting. Until that level is reached environmental managers should comprehensively comment on what they do, how they do it and why they do it.

7 Appendices

7.1 Characterisation tables: Global warming and ozone depletion potentials

The tables below give an overview of all substances that are either part of the Kyoto Agreement (Table 14) or the Montreal Protocol (Table 15).

How to use the tables:

- Step1: Assigning (= classification) the emissions of an enterprise to one of the two categories of environmental problems (global warming or ozone depletion).
- Step 2: Multiplying the amount of emission by the factors in Table 15 or results in weighted emissions according to the respective contribution to a problem (characterisation). These weighted emissions are so called global warming or ozone depletion potentials.
- Step 3: Adding up all weighted emissions within the two categories leads to the environmental items „global warming emission" and „ozone depletion emission" respectively expressed in „kg CO_2 -equivalent" or „kg CFC-11-equivalent".

Note: Some of the ozone depleting substances listed in table 18 have a global warming potential too, but are not part of the Kyoto agreement. The decision whether or not to include these substances in the environmental item for the global warming contribution needs further discussion. Besides having a global warming potential nitrous oxide has a significant ozone depleting potential. The exact factor has not been determined yet.

7.2 Global warming potential

Table 14: Characterisation factors for global warming emissions (Kyoto Agreement).

Kyoto Agreement Substance	GWP (1) (time horizon 100 years) [kg CO_2 equivalent per kg substance]
Carbon Dioxide	1
Methane	21
Nitrous Oxide	270
Sulphur Hexafluoride	23,900
Perfluorocarbons (2)	7000-9200
Hydrofluorocarbons (3)	140 - 9800

(1) GWP: Global Warming Potential. For a list of GWPs see IPCC 1996. (2) Depending on the kind of PFCs. The various PFCs and their respective GWPs are listed in IPCC 1996 (3) Depending on the kind of HFC. The various HFCs and their respective GWPs are listed in IPCC 1996

According to the Kyoto Agreement, emissions from the following sources/categories have to be included:

Energy

- Fuel combustion
- Energy industries
- Manufacturing industries and construction
- Transport
- Other sectors
- Other

Fugitive emissions from fuels

- Solid fuels
- Oil and natural gas
- Other

Industrial processes

- Mineral products
- Chemical industry
- Metal production

- Other production
- Production of halocarbons and sulphur hexafluoride
- Consumption of halocarbons and sulphur hexafluoride
- Other

Solvent and other product use

- Agriculture
- Enteric fermentation
- Manure management
- Rice cultivation
- Agricultural soils
- Prescribed burning of savannahs
- Field burning of agricultural residues
- Other

Waste

- Solid waste disposal on land
- Wastewater handling
- Waste incineration
- Other

7.3 Ozone depletion potential

Table 15: Characterisation factors for ozone depleting emissions (Montreal Protocol)

Montreal Protocol Substance	ODP [(1)] [kg CFC-11 equivalent per kg substance]
$CFCl_3$ (CFC-11)	1.0
CF_2Cl_2 (CFC-12)	1.0
$C_2F_3Cl_3$ (CFC-113)	0.8
$C_2F_4Cl_2$ (CFC-114)	1.0
C_2F_5Cl (CFC-115)	0.6
CF_2BrCl (halon-1211)	3.0
CF_3Br (halon-1301)	10.0
$C_2F_4Br_2$ (halon-2402)	6.0
CF_3Cl (CFC-13)	1.0
C_2FCl_5 (CFC-111)	1.0
$C_2F_2Cl_4$ (CFC-112)	1.0
C_3FCl_7 (CFC-211)	1.0
$C_3F_2Cl_6$ (CFC-212)	1.0
$C_3F_3Cl_5$ (CFC-213)	1.0
$C_3F_4Cl_4$ (CFC-214)	1.0
$C_3F_5Cl_3$ (CFC-215)	1.0
$C_3F_6Cl_2$ (CFC-216)	1.0
C_3F_7Cl (CFC-217)	1.0
CCl_4 carbon tetrachloride	1.1
$C_2H_3Cl_3$ 1,1,1-trichloroethane [(2)]	0.1
	Isomer Potential [(3)]
$CHFCl_2$ (HCFC-21) 1 [(4)]	0.04
	continues next page...

Montreal Protocol Substance	ODP [(1)] [kg CFC-11 equivalent per kg substance]
CH_2FCl (HCFC-31) 1	0.02
C_2HFCl_4 (HCFC-121) 2	0.01-0.04
$C_2HF_2Cl_3$ (HCFC-122) 3	0.02-0.08
$C_2HF_3Cl_2$ (HCFC-123) 3	0.02-0.06
$CHCl_2CF_3$ (HCFC-123)	0-0.02
C_2HF_4Cl (HCFC-124) 2	0.02-0.04
$CHFClCF_3$ (HCFC-124) i	0-0.022
$C_2H_2FCl_3$ (HCFC-131) 3	0.007-0.05
$C_2H_2F_2Cl_2$	0.02
C_2HFCl_4 (HCFC-121) 2	0.01-0.04
$C_2HF_2Cl_3$ (HCFC-122) 3	0.02-0.08
$C_2HF_3Cl_2$ (HCGroup IICHFBr2) 1	1.00
CHF_2Br (HBFC-22B1) 1	0.74
CH_2FBr 1	0.73
C_2HFBr_4 2	0.3-0.8
$C_2HF_2Br_3$ 3	0.5-1.8
$C_2HF_3Br_2$ 3	0.4-1.6
C_2HF_4Br 2	0.7-1.2
$C_2H_2FBr_3$ 3	0.1-1.1
$C_2H_2F_2Br_2$ 4	0.2-1.5
$C_2H_2F_3Br$ 3	0.7-1.6
CHF_2Cl_2 (HCFC-22) 1	0.055
$C_2H_3FBr_2$ 3	0.1-1.7
$C_2H_3F_2Br$ 3	0.2-1.1

continues next page...

Montreal Protocol Substance	**ODP [1] [kg CFC-11 equivalent per kg substance]**
C_2H_4FBr 2	0.07-0.1
C_3HFBr_6 5	0.3-1.5
$C_3HF_2Br_5$ 9	0.2-1.9
$C_3HF_3Br_4$ 12	0.3-1.8
$C_3HF_4Br_3$ 12	0.5-2.2
$C_3HF_5Br_2$ 9	0.9-2.0
C_3HF_6Br 5	0.7-3.3
$C_3H_2FBr_5$ 9	0.1-1.9
$C_3H_2F_2Br_4$ 16	0.2-2.1
$C_3H_2F_3Br_3$ 18	0.2-5.6
$C_3H_2F_4Br_2$ 16	0.3-7.5
$C_3H_2F_5Br$ 8	0.9-1.4
$C_3H_3FBr_4$ 12	0.08-1.9
$C_3H_3F_2Br_3$ 18	0.1-3.1
$C_3H_3F_4Br$ 12	0.3-4.4
$C_3H_3F_3Br_2$ 18	0.1-2.5
$C_3H_4FBr_3$ 12	0.03-0.3
$C_3H_4F_2Br_2$ 16	0.1-1.0
$C_3H_4F_3Br$ 12	0.07-0.8
$C_3H_5FBr_2$ 9	0.04-0.4
$C_3H_5F_2Br$ 9	0.07-0.8
C_3H_6FBr 5	0.02-0.7

1) ODP: Ozone Depleting Potential. These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically [MONTREAL 1987]. 2) Methyl chloroform. This formula does not refer to 1,1,2-trichloroethane. 3) Where a range of ODPs is indicated, the highest value in that range shall be used for the purposes of the Protocol. The ODPs listed as a single value have been determined from calculations based on laboratory measurements. Those listed as a range are based on estimates and are less certain. The range pertains to an isomeric group. The upper value is the estimate of the ODP of the isomer with the highest ODP, and the lower value is the estimate of the ODP of the isomer with the lowest ODP.4) Identifies the most commercially viable substances with ODP values listed against them to be used for the purposes of the Protocol.

7.4 Hazardous waste

According to the Basel Convention [BASEL 1986] the categories of waste in the table below have to be controlled (ANNEX I, categories Y1-45) or require special consideration (ANNEX II, category Y47-46).

Table 16: Categories of waste (Basel Convention)

Category	Definition
Basel Convention	
Y1	Clinical wastes from medical care in hospitals, medical centers and clinics
Y2	Wastes from the production and preparation of pharmaceutical products
Y3	Waste pharmaceuticals, drugs and medicines
Y4	Wastes from the production, formulation and use of biocides and phytopharmaceuticals
Y5	Wastes from the manufacture, formulation and use of wood preserving chemicals
Y6	Wastes from the production, formulation and use of organic solvents
Y7	Wastes from heat treatment and tempering operations containing cyanides
Y8	Waste mineral oils unfit for their originally intended use
Y9	Waste oils/water, hydrocarbons/water mixtures, emulsions
Y10	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs) and/or polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBs)
Y11	Waste tarry residues arising from refining, distillation and any pyrolytic treatment
Y12	Wastes from production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish
Y13	Wastes from production, formulation and use of resins, latex, plasticizers, glues/adhesives
Y14	Waste chemical substances arising from research and development or teaching activities which are not identified and/or are new and whose effects on man and/or the environment are not known
Y15	Wastes of an explosive nature not subject to other legislation
Y16	Wastes from production, formulation and use of photographic chemicals and processing materials
	continues next page...

Category	Definition
Basel Convention	
Y17	Wastes resulting from surface treatment of metals and plastics
Y18	Residues arising from industrial waste disposal operations
Y19	Metal carbonyls
Y20	Beryllium; beryllium compounds
Y21	Hexavalent chromium compounds
Y22	Copper compounds
Y23	Zinc compounds
Y24	Arsenic; arsenic compounds
Y25	Selenium, selenium compounds
Y26	Cadmium; cadmium compounds
Y27	Antimony; antimony compounds
Y28	Tellurium; tellurium compounds
Y29	Mercury; mercury compounds
Y30	Thallium; thallium compounds
Y31	Lead, lead compounds
Y32	Inorganic fluorine compounds excluding calcium fluoride
Y33	Inorganic cyanides
Y34	Acidic solutions or acids in solid form
Y35	Basic solutions or bases in solid form
Y36	Asbestos (dust and fibers)
Y37	Organic phosphorous compounds
Y38	Organic cyanides
Y39	Phenols; phenol compounds including chlorophenols
Y40	Ethers

continues next page...

Category	Definition
Basel Convention	
Y41	Halogenated organic solvents
Y42	Organic solvents excluding halogenated solvents
Y43	Any congener of polychlorinated dibenzo-furan
Y44	Any congener of polychlorinated dibenzo-p-dioxin
Y45	Organohalogen compounds other than substances referred to in this Annex (e.g. Y39, Y41, Y42, Y43, Y44).
Y46	Wastes collected from households
Y47	Residues arising from the incineration of household

7.5 Definitions

7.5.1 Environmental performance indicators

There are numerous definitions of environmental performance indicators. Some of the more important are listed below.

Bartolomeo describes environmental performance indicators as:

„… quantitative and qualitative information that allow the evaluation, from an environmental point of view, of enterprise effectiveness and efficiency in the consumption of resources. Environmental performance indicators consist of process, system and eco-financial indicators" [BARTOLOMEO 1995].

According to the Tellus Institute environmental performance indicators

„… provide a metric by which environmental performance may be tracked. Standardized environmental performance indicators allow a comparison of an enterprise's current performance with its earlier performance, with other enterprises in the same sector, or with industry overall.
quantify resource use and environmental impacts.
serve to bridge the gap between environmental stewardship and the bottom line. [WHITE/ZINKL 1997a]

The International Organization for Standardization ISO 14031.5 working draft defines environmental performance indicators as follows:

„Specific expression that is used to provide information about environmental performance"[ISO 1996]

Analogous to the objectives of IASC [IASC framework 1983] it can be said that the objective of environmental performance indicators is to provide information about the environmental performance and changes in the environmental performance of an enterprise that is useful to a wide range of users in making economic and environmental decisions. This information is only useful to users if it is comparable, reliable and understandable.

7.5.2 Definitions of environmental performance indicators

Adams identified six approaches to environmental performance measurement [ADAMS 1997]. They include

- Toxic Release Inventory (TRI)
- Enterprise specific approaches
- Self-selected emission targets
- Compliance with regulations/permits
- Environmental Performance Indicators (EPIs) and Eco-efficiency Measures
- CML method (Centre of Environmental Science, University Leiden)
- Environmental Burden

It can be said that the concept of eco-efficiency is one of the most important in the context of communicating environmental performance. Eco-efficiency has proven to be useful and meaningful for internal management as well as for external communication to investors. Therefore, this report focuses on quantitative environmental performance indicators relating to eco-efficiency measures.

The relevant environmental items do not necessarily originate within the same accounting system. For example, environmental liabilities originate within the financial accounting system while tons of CO_2 -emissions originate within the ecological accounting system.

If the environmental performance is to be disclosed in more useful and meaningful terms for users it should be disclosed in the form of two-item indicators (ratios). Basically, there are three combinations:

- Financial indicator in relation to another financial indicator (e.g. environmental liabilities/shareholders equity).
- Financial indicator in relation to environmental indicator (e.g. tons of CO2 -emissions per USD of sales).
- Environmental indicator in relation to another environmental indicator (e.g. waste in relation to resources used).

Today, while many companies publish information about their environmental performance „...it is entirely up to the enterprise" which indicators they want to report on [ADAMS 1997].

7.5.3 Discretionary use of indicators

In the case of financial/environmental indicators there is no indication of how an indicator is recognised, measured and disclosed. There is no indication of how the financial or environmental indicators were derived (underlying assumptions, qualitative characteristics, scope and method of consolidation).

According to Adams, the solution to these problems depends on various factors: [UNCTAD 1998; ADAMS 1997] „...Various factors will determine the pace of development of environmental performance indicators (both financial and non-financial) as regularly used tools for inter-enterprise comparison. These factors include:

- the speed of take-up of EMAS [the Environmental Management and Audit Scheme by the European Union], ISO 14000 and related environmental standards,
- the willingness of companies to voluntarily enter into a sector-wide public reporting of (potentially substandard or legally embarrassing) environmental performance results,
- the extent to which the financial sector increases pressure on companies to make such disclosures [UNCTAD 1998; ADAMS 1997].

7.6 Other Initiatives

In the introduction other initiatives involving the development of environmental performance and eco-efficiency indicators either at the international level, the NGO level or the business association level are mentioned. The activities of the following key organisations which have major initiatives in this area, are highlighted:

- The International Organisation for Standardisation (ISO)
- The Global Reporting Initiative (GRI)
- The World Business Council for Sustainable Development (WBCSD)
- UNCTAD/UN-ISAR

7.6.1 Global Reporting Initiative (GRI)

The most comprehensive project is the NGO led Global Reporting Initiative (GRI). The GRI was established in 1997 to develop a framework (or guideline) for enterprise-level reporting on sustainable development including environmental, social and economic aspects.

The framework will serve as

- An internal vehicle for checking consistency of sustainability policy with performance;
- A logical structure for applying sustainability concepts to enterprise operations;
- A framework for dialogue between internal and external stakeholders.

The GRI is convened by CERES (Coalition for Environmentally Responsible Economies) and incorporates the active participation of corporations, non-governmental organisations

(NGOs), consultants, accountancy organisations, business associations, universities, and other stakeholders from around the world.

The GRI Sustainability Reporting Guidelines comprise three sections[16]:

1) the preamble describes the rationale and underpinnings of the Guidelines, their value and applicability, general reporting principles, and other information on their continuing evolution.
2) the guidelines recommend specific data related to sustainability performance, along with explanatory notes to assist in interpreting and compiling the recommended information. The guidelines are divided into nine parts: CEO statement; key indicators; profile of reporting entity; policies, organisation and management systems; stakeholder relationships; management performance; operational performance; product performance; and sustainability overview.
3) the Appendices provide additional explanation and illustrations pertaining to various parts of the Guidelines.

These guidelines aim to provide guidance to enterprises preparing sustainability reports. The guidelines do not provide guidance for data collection, information and reporting systems. Nor do they give guidance on the methods to be used for calculating the indicators. The generic indicators identified by GRI correspond to those identified in this report and WBCSD. This report should be viewed as „complementary" to GRI in that it fills in a methodological gap.

Among the indicators recommended by GRI are

- Total energy use
- Total electricity use
- Total fuel use
- Other energy use
- Total materials use other than fuel
- Total water use
- Non-product output (NPO, defined as waste) returned to process or market
- Quantity of non-product output to land by material type
- Emissions to air by type
- Discharges to water by type

[16] www.globalreporting.org

The guidelines are applicable to any size and any type of enterprise that chooses to prepare a sustainability report. The guidelines are not specific to any industry or business sector. That is, they are designed to incorporate information common to most enterprises regardless of business sector.

7.6.2 International Organisation of Standardisation (ISO)

The ISO has 133 member bodies which set technical standards for manufacturing and goods processing in their countries. It has developed ISO 14000 which is a series of international, voluntary environmental management standards. Developed under ISO Technical Committee 207, the 14000 series of standards address the following aspects of environmental management, Environmental Auditing & Related Investigations, Environmental Labels and Declarations, Environmental Performance Evaluation, Life Cycle Assessment and terms and definitions.

ISO (TC 207 subcommittee 4) published ISO 14031.5: on Environmental Management – Environmental Performance Evaluation in 1999. It emphasizes the management process in terms of environmental performance evaluation (EPE). ISO defines EPE as …*a management process which can provide an organization with reliable and verifiable information on an ongoing basis to determine if its performance is meeting the criteria set by its management.* The information generated by EPE may also assist an organization to:

- achieve continual improvement of its environmental performance;
- report and communicate its environmental performance;
- identify opportunities for prevention of pollution;
- increase efficiency and effectiveness and
- identify strategic business opportunities. [ISO 1996]

The standard prescribes the process for evaluating if an enterprise has adopted an environmental management system. It is important to note that working group TC 207 has also identified environmental indicators, which could be used for international environmental management purposes. They were not intended to communicate performance to external stakeholders.

It is important to note for environmental management systems (EMS) in general and ISO in particular, that EMS-standards are process, not performance standards (STURM 1997). In other words these standards do not tell organisations what environmental performance they must achieve (besides compliance with environmental regulations). „Instead, the standards describe a system that will help an organisation to achieve its own objectives and targets. The assumption is that better environmental management will lead indirectly to a better environmental performance." [TIBOR/FELDMANN 1996]

In paragraph 4.1.2 Selecting Indicators.

> *„Indicators help to condense relevant environmental data into compact and useful information about a management's efforts, the organisation's environmental performance, or the condition of the environment. An organisation should select and develop a sufficient number of relevant and understandable indicators to evaluate its environmental performance."*

ISO/WD 14031.5 lists environmental loads, quantitative information on emissions, discharges, climate change and others. The WD lists many types of environmental indicators:

- absolute: (e.g. total tons of SO_2 emitted per year)
- relative: information scaled to, or relative to another parameter such as production (e.g. tons of SO_2 emitted per tone of primary product)
- Indexed: various indices constructed for either absolute or relative information, such as baseline year at 100%; or, weighting of equivalents to consolidate data (e.g. total green house gases emitted expressed as carbon dioxide equivalents).
- Qualitative: data that cannot be quantified by scientific measures, but is placed on a value scale decided by the organization.
- Financial: costs or benefits associated with environmental performance (e.g. waste handling costs, environmental performance improvement investments per ton of release reduction, reduced costs of purchased materials resulting from recycling or reuse).

7.6.3 World Business Council for Sustainable Development (WBCSD)

The WBCSD[17] is a coalition of some 130 transnational corporations united by a shared commitment to the environment and to the principles of economic growth and sustainable development. One essential consequence of this commitment is that most enterprises strive towards more sustainability by increasing their eco-efficiency. The progress achieved is, in many cases, communicated by annual environmental reports. Sometimes, these reports are known as „eco-efficiency reports".

The WBSCD has developed a set of eco-efficiency indicators to help measure progress towards economic and environmental sustainability in business. According to WBSCD eco-efficiency indicators primarily serve as a decision-making tool for internal management to evaluate performance, set targets and initiate improvement measures. They are also an important tool for communicating to internal and external stakeholders. The objective of eco-

[17] The report on eco-efficiency metrics and reporting was released in 2000 and can be downloaded from their web-site http://www.wbcsd.ch/ecoeff1.htm

efficiency is to maximize value while minimising resource use and adverse environmental impacts. In order to calculate eco-efficiency, the WBCSD uses the follow equation:

$$\textit{eco-efficiency} = \frac{\textit{product or service value}}{\textit{environmental influence}}$$

Note: In this report eco-efficiency is defined the other way round; the environmental item is the numerator and the financial item the denominator.

So far, WBSCD has identified the following core indicators to be tested in a pilot application:

- Product/service value
  - Quantity of Goods/Services Produced or Provided to Customers
  - Net sales
- Product/service creation environmental influence
  - Total Energy consumption
  - Materials consumption
  - Water consumption
  - Greenhouse Gas (GHG) Emissions to Air
  - Ozone Depleting Substance (ODS) Emissions to Air

As in the case of GRI these are largely consistent with what is recommended in this report. WBCSD is developing core indicators, which are internationally agreed upon. Although these generic indicators are valid for virtually all businesses, they are not of equal value or importance for a given enterprise nor are they necessarily comparable between different businesses. WBCSD recommends that ISO 14031 Environmental Performance Evaluation be used to guide the selection of relevant supplemental indicators for a specific enterprise or sector[18].

Given the initiatives of all the above mentioned organizations, it can be said that there is much support for standardizing EPIs for external communication: A substantial number of industrial associations in general and companies in particular have created environmental performance and/or eco-efficiency indicators and publish them periodically in environmental reports. They regard their development as being among the most important issues for the next five years (also see findings of UNEP Consultative Meeting with Industry & Trade Associations in Paris on October 1997). Thus, many groups use and want environmental performance and eco-efficiency indicators. All, however, suffer from the lack

[18] WBCSD, Executive Brief, August 1999

of and therefore, should support a standardization of eco-efficiency indicators. Moreover, the knowledge of how to standardise is well established (ISO and IASC). It is much less complicated than it appears.

7.6.4 UNCTAD/UN-ISAR

UNCTAD/UN-ISAR[19] has set up a project on "Standardised Environmental Performance Indicator. At presence there has been no publication. A brief description of the project based on a draft report can be found in a WBCSD publication:

"UN-ISAR is working on an approach to set up Standardized Environmental Per-formance Indicators. The authors of the report distinguish between one-item (absolute) and two-item (relative) indicators, pointing out, that the former are of limited use. A normalization of environmental data with financial figures would allow not only assessment of performance over time, but also comparability with indicators of other entities and other companies in the same industry.

The standard set of indicators is said to be applicable worldwide, by all companies and across all industries. Environmental aspects proposed to be monitored are use of fossil energy, global warming, ozone depletion, solid waste, and water use. The economic counterparts are sales and value added, depending on the boundaries of the environmental data. While sales includes the values summed up in the whole supply chain until the point of sale, "value added" covers only the part of the life cycle, in which the respective company operates itself.

The report finally proposes a process on how to select and install a standard setting body with an EPI Committee, which, in analogy to accounting standards, would define terminology, scope and conditions and therewith guarantee comparability.

UN-ISAR's most recent working group meeting was held on February 18/19 1999 at UNCTAD offices in Geneva." [WBCSD 2000]

[19] United Nations Conference on Trade and Development / Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting

7.7 Eco-efficiency indicator matrix

The objective was to identify eco-efficiency indicators that were meaningful and should be applied to most if not all enterprises. However, this does not mean that other environmental performance and eco-efficiency indicators are inappropriate. Depending on the objective of the user other environmental performance and eco-efficiency indicators can be used.

Generic indicators should always be seen in conjunction with other possible indicators in general and in particular with industry specific environmental performance and eco-efficiency indicators that take into account the specific problems and challenges of that industry. Moreover, every enterprise should try to define environmental performance indicators in general and eco-efficiency indicators in particular for environmental problems of local or regional concerns. Industry specific environmental performance and eco-efficiency indicators already exist for many industries or will be identified in a subsequent step.

In order to show the range of possible generic and industry-specific environmental performance indicators, a matrix is constructed (see Table 17). The matrix can be used as a tool to support the identification of possible environmental performance and eco-efficiency indicators. The following matrix combines different focuses of performance assessment approaches (column 2) with different approaches for reference items (columns 3 and 4). Within this matrix 20 types of different environmental performance indicators can be defined (fields A 1.1 – B 5.2). Assessment indicators 3 (classification) 4 (characterisation), and 5 (valuation) follow the widely accepted concepts and terminology developed for Life-Cycle-Assessment (LCA) under the umbrella of SETAC [SETAC 1993].

Table 17: Eco-efficiency indicator matrix

Eco-Efficiency Indicator Matrix				Reference Item	
	Environmental Performance Assessment Approach		**Focus of Assessment**	**A in physical units**	**B in financial units**
1	Qualitative	1.1	management	A 1.1	B 1.1
		1.2	compliance	A 1.2	B 1.2
2	Financial	2.1	costs	A 2.1	B 2.1
		2.2	benefits	A 2.2	B 2.2
3	Physical classification (1)	3.1	input	A 3.1	B 3.1
		3.2	output	A 3.2	B 3.2
4	Environmental Characterisation (2)	4.1	resource depletion	A 4.1	B 4.1
		4.2	environmental impact	A 4.2	B 4.2
5	Environmental Valuation (3)	5.1	scarcity of resources	A 5.1	B 5.1
		5.2	carrying capacity	A 5.2	B 5.2

1)Classification: The process of assignment and initial aggregation of data from inventory to relatively homogeneous stressor categories (e.g. greenhouse gases, ozone depleting components), within the larger categories like resource depletion or environmental impacts. 2)Characterisation: The analysis and estimation of the magnitude of potential impacts on the environment for each of the stressor categories, derived through application of specific impact tools (e.g. global warming potentials or ozone depletion potentials, see e.g. chapter 7.2 or 7.3) 3)Valuation: The assignment of relative values or weights to different impacts and their aggregation across impact categories. This step is largely based on social and political values, goals and targets.

All proposed eco-efficiency indicators (chapter 5) refer to column B because a financial item is used as the denominator (Table 18).

Table 18: Classification of proposed eco-efficiency indicators

Eco-efficiency Indicators	column in matrix
non-renewable primary energy input / value added	B 3.1
water use / value added	B 3.1
global warming contribution / value added	B 4.2
contribution to ozone depletion / value added	B 4.2
waste disposed / value added	B 3.2

7.8 Selected examples of eco-efficiency indicators used in published environmental reports

7.8.1 Roche[20]

Roche uses an eco-efficiency indicators „CO_2 -equivalents per Mio. CHF of sales“ (Table 19).

Table 19: Eco-efficiency indicators at Roche

	1995	1996	1997	1998	1999
Total CO_2-equivalents in tons	1’211’000	1’347’000	1’277’000	1’308’400	1’276’200
Sales (in Mio. CHF)	14’426	15’966	18’767	24’662	27’567
CO_2-equivalents in tons per 1 Mio. CHF of sales	83.9	84.4	68.0	52.9	46.3

This eco-efficiency indicator would refer to B 4.2 in the matrix because the environmental performance is assessed by the characterisation of environmental impact (contribution to global warming in CO_2-equivalents). As its financial reference item, Roche uses sales.

7.8.2 Sulzer[21]

Sulzer uses eco-efficiency indicators that consist of „water per value added““ and water per employee“ (see Table 20).

The first eco-efficiency indicator (m3/employee) would refer in the matrix to A 3.1 because the environmental performance is assessed by physical classification in terms of input of water. As its reference item, Sulzer uses a physical unit (employee).

The second eco-efficiency indicator (m3/value added in CHF) would refer in the matrix to B 3.1 because the environmental performance is assessed by the physical classification in terms of input of water. As its reference item, Sulzer uses a financial unit (value added).

[20] Group Reports for Safety and Environment 1998 and 1999; p. 30

[21] Environmental Report 1997/1998; page 8

Table 20: Eco-efficiency indicator at Sulzer

Energy consumption	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
kWh/employee	20'800	20'100	21'800	18'600	21'500	21'800
kWh/CHF value added	0.234	0.234	0.265	0.225	0.230	0.232
CO_2 -emissions	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
tonnes/employee	5.6	5.2	4.5	5.1	6.3	6.5
kg/CHF value added	0.063	0.060	0.055	0.061	0.067	0.070
Water consumption	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
m^3/employee	68	74	60	56	63	59
litres/CHF value added	0.720	0.858	0.727	0.679	0.668	0.633
Waste & recycled materials	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
kg/employee	1390	1510	1380	910	1180	1140
kg/CHF value added	0.015	0.017	0.017	0.011	0.013	0.012

8 Reference List

Aspinwall & Company and The Association of Chartered Certified Accountants, Guide to Environment and Energy Reporting and Accounting, London, 1997.

ACHLEITNER A.K., Die Normierung der Rechnungslegung, Schriftenreihe der Treuhand-Kammer Nr. 132, Zürich, 1995.

ADAMS R., „Linking Environmental and Financial Performance: A Survey of Best practice Techniques," in International Accounting and Reporting Issues: 1998 Review, UNCTAD, Geneva,

Earth Summit, United Nations Programme of Action for the Environment, Rio de Janeiro 1992; New York, 1992.

Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal, Basel, 1996.

BAROLOMEO M., About the Usefulness of Environmental Performance Evaluation, http://www.feem.it/feem/notifeem/216/4.html (Milan accessed 15/12/97)

BENNET M. and JAMES P. The Green Bottom Line; Environmental Accounting for Management, Greenleaf Publishing, London, 1998.

DITZ, D., RANGANATHAN J.. Measuring up: Towards a Common Framework for Tracking Corporate Environmental Performance, WRI Washington: 1997.

EFFAS, Eco-Efficiency and Financial Analysis; the Financial Analyst's View, Müller, K. De Frutos. J. Schüssler, C. Haarbosch, H., Randel, Paris: 1996.

EFFAS, Environmental Reporting & Disclosures; the Financial Analyst's View, Müller, K. De Frutos. J. Schüssler, C. Haarbosch, H., EFFAS, Paris, 1994.

ENDS Report, Number 272, London: September 1997.

GEMI, Measuring Environmental Performance: A Primer and Survey of Metrics Use, 1997.

GLOBAL REPORTING INITIATIVE: Sustainability Reporting Guidelines, Exposure Draft March 1999 CERES Boston, 1999.

IAS, International Accounting Standards framework 1983, London: 1999.

IAS, International Accounting Standards Committee. IAS 27, 1994, IASC, London: 1999.

IAS, International Accounting Standards Committee. IAS 28, 1994, IASC, London: 1999.

IAS, International Accounting Standards Committee. IAS, London: 1997, 1998, and 1999.

Intergovernmental Panel on Climate Change - The science of Climate Change, Contribution by Working Group One to the Second Assessment Report of the Intergovernmental Panel on Climate Change, London: 1996.

Inventory of Energy Systems, 3rd Edition, Federal Office for Energy Supplies Basel, 1997.

ISO: Environmental Management – Environmental Performance Evaluation – Guideline: ISO/WD 14031.5, International Organization for Standardization Geneva: 1996.

KPMG International Survey of Environmental Reporting 1996 De Meern, The Netherlands 1996 and 1999

MARSANICH, Environmental Indicators in EMAS Environmental Statements; FEEM (Fondazione Eni Enrico Mattei), Milan: 1997.

Montreal Protocol on Substances that Deplete the Ozone Layer, as revised and amended by the second Meeting of the Parties (London: 27-29 June 1990) fourth (Copenhagen) and seventh (Vienna) Montreal, 1987.

MOORE D., Accounting And Reporting For Environmental Liabilities And Costs Within The Existing Financial Reporting Framework; in International Accounting and Reporting Issues: 1998 Review, UNCTAD, Geneva, 1999.

PIET J. Environmental Performance Indicators; Deloitte Touche Tohmatsu International, Amsterdam, 1994.

RAPPAPORT A., Creating Shareholder Value. The New Standard For Business Performance, The Free Press; New York, 1986.

SCHALTEGGER St., MÜLLER K., HINDRICHSEN H., Corporate Environmental Accounting, Wiley, New York: 1996.

SCHALTEGGER St., STURM A.,. Ökologieinduzierte Entscheidungsinstrumente des Managements, WWZ-Discussion Paper Nr.8914, Basel 1989.

SETAC: A Conceptual Framework for Life-Cycle Impact Assessment, Pensacola: 1993.

SOU: Förbättedrad Miljöinformation No 4/1997:

STURM A. /UPASENA S., ISO 14001, Implementing an Environmental Management System, Asian Institute of Technology/School of Management, Bangkok: 1997

TENNANT T., BELSOM X., THOMAS C., Creating a standard for a corporate global warming indicator, NPI Global Care Investments; London, 1997.

TIBOR, FELDMAN I. ISO 14000, A Guide to the New Environmental Management Standards; Chicago: 1996.

UNCTAD: Environmental Financial Accounting: Guidelines, Position Paper; Geneva: 1998.

UNCTAD Accounting and Financial Reporting for Environmental Costs and Liabilities, UNCTAD. Geneva, 1999.

Conclusions on Accounting and Reporting by Transnational Corporations. The Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting, Geneva: UNCTAD. 1994.

WBCSD: Eco-efficient Leadership for Improved Economic and Environmental Performance, Geneva: 1996.

WBCSD: Eco-efficient indicators & reporting: report on the status of the project. A basis for the final printed report, 2000 (downloaded from www.wbcsd.ch).

WBCSD: Eco-Efficiency Metrics & Reporting: State-of-the-Play report, 2000
downloaded from www.wbcsd.ch/ee/StatePlayReport 20doc.pdf

WHITE A., ZINKL, Corporate Environmental Performance Indicators: A Benchmark Survey of Business Decision-Makers, Tellus Institute, Boston, 1997.

WHITE G., SONDHI A., FRIED D., The Analysis and Use of Financial Statements, John Wiley & Sons, Inc, New York 1994

Green Metrics: A Status Report on Standardized Corporate Environmental Reporting, Working Paper prepared for CERES 1997 Annual Conference, Boston, 1997.

WORLD BANK: Pollution Prevention and Abatement Handbook, Washington, 1998.

WWF Forests for Life Campaign: Sustainable Forestry Pays; New Findings on the Impact of Sustainable Business Strategies, A WWF Research Report, 1999 [www.panda.org/resources/publications/forest/gffi-forestry.html]

ZENHÄUSERN M. BERTSCHINGER P., Konzernrechnungslegung; Verlag SKV; Zurich: 1999